REPORTING TEMPLATE

- **Discipline/Subject Area: Caribou**

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- **What do we need to know and why regarding subjects?**

  The purposes of the Arctic National Wildlife Refuge, as established by the Alaska National Interest Lands Conservation Act include:

  - "to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, the Porcupine caribou herd (including participation in coordinated ecological studies and management of this herd …);
  - "to fulfill the international fish and wildlife treaty obligations of the United States";
  - "to provide the opportunity for continued subsistence uses by local residents";

  In addition, the International Agreement for the Conservation of the Porcupine Caribou Herd (1987) obligates the governments of the United States and Canada to:

  - "conserve the Porcupine Caribou Herd and its habitat through international co-operation and coordination so that the risk of irreversible damage or long-term adverse effects as a result of use of caribou or their habitat is minimized";
  - "ensure opportunities for customary and traditional uses of the Porcupine Caribou Herd" by rural Alaska residents and members of Canadian First Nations;

Conservation of the Porcupine caribou herd in association with the exploration, development, and production of oil and gas resources on the coastal plain of the Arctic Refuge will require information regarding:

- Importance of the 1002 Area relative to caribou birth rates, calf survival, and overall herd health;
- Likelihood and consequences of disturbance or displacement of caribou from the 1002 Area (or portions thereof) during calving and post-calving seasons;
- Potential impacts of development on access to caribou by hunters and on viewing opportunities of other Refuge visitors;

- **What information is currently available to address the information needs for subjects?**

- The Porcupine caribou herd occupies a range of approximately 130,000 square mi (337,000 square km) spanning the border between Alaska and Canada. The herd is an important cultural and economic resource utilized by local and indigenous people in Alaska and the Yukon and Northwest Territories of Canada. Approximately 2,000 – 3,000 caribou are harvested annually, mostly by subsistence users. In addition, viewing the large aggregations of caribou that occur during summer is a unique experience valued by visitors from across the U.S. and around the world.
- Telemetry data from collared adult female caribou from the Porcupine herd have been collected since 1982. These data indicate that this herd migrates to the Arctic coastal plain of northeastern Alaska and northwestern Canada for calving during early June. The area used for calving for all years combined extends approximately from the Canning River in Alaska to the Babbage River in Yukon Territory, Canada and includes the 1002 Area of the Arctic Refuge. Additional aerial surveys conducted over the coastal plain beginning in the 1960s, and surveys of relative abundance of bone and antler specimens on the tundra dating back to the early 20th century confirm that this area has been used for calving for many decades, and likely for millennia. Annual distributions of caribou during the calving season have varied among years; however, the highest densities of calving caribou were within the central coastal plain of the Arctic Refuge, including the 1002 Area, during many years.
- Predator densities are lower within areas of the coastal plain used for calving compared to neighboring areas in the foothills of the Brooks Range.
- Availability of high-quality food plants consumed by caribou during the calving season is greater within the calving range than in neighboring areas to the south and east.
- Modeling the potential effects of displacement of the caribou calving range from the coastal plain suggested that this would expose caribou calves to higher rates of predation and lower quality forage.

- During 1982-1998, caribou from the Porcupine herd used the 1002 Area and neighboring coastal areas of the Arctic Refuge for insect relief habitat during late June and early July of most years. From 1999-2017 caribou moved through this area after calving but the duration of use was variable and generally shorter than during the previous period, and most caribou moved south into the Brooks Range or east into Canada during early July.
- All arctic caribou herds fluctuate in size over periods of several decades. However, the rate of change (both increase and decline) of the Porcupine herd has been slower than other herds in arctic Alaska. The herd increased slowly during the 1980s, reached a peak of 178,000 in 1989, declined to approximately 123,000 in 2001, then increased to its current population of 218,000 in 2017.
- Studies of the Central Arctic caribou herd in developed areas west of the Arctic Refuge suggested that pregnant female caribou avoided roads and other oil field infrastructure during the calving period. Avoidance of infrastructure was less evident or absent among non-pregnant females and males. Caribou were more tolerant of human disturbance during mid to late summer, when caribou movements are largely driven by insect harassment. When human activity is low, caribou may even seek out raised gravel pads, roads, or structures to escape insect harassment.
- Prior to development, the area surrounding Prudhoe Bay was used by Central Arctic caribou for both calving and as insect relief habitat. The intensive development that occurred in this area apparently caused caribou to shift their calving distribution southward, and to cease using the developed area for forming the large aggregations that occur in response to insect harassment. Caribou seem to be more tolerant of the lower density of infrastructure associated with more recent installations west of Prudhoe Bay and have continued to use developed areas near the Kuparuk and Milne Point oil fields for insect relief.
- Displacement of Central Arctic caribou from preferred calving areas near Prudhoe Bay was associated with reduced calf size at birth, but the difference was not sufficient to cause a statistically detectable reduction in calf survival.
- Elevating pipelines to a minimum of seven feet above ground and separating roads and pipelines by at least 300 feet reduced the impact of linear features that might obstruct caribou movements.
- Despite any negative impacts that might have occurred during the period of development, the Central Arctic caribou herd grew from approximately 10,000 caribou in the late 1970s to a peak population of 70,000 in 2010. The herd subsequently declined to 22,000 in 2016.

➢ **What are key information gaps?**

Much of the available information regarding effects of oil field development on caribou came from studies of the Central Arctic herd during the 1980s and 1990s. These studies did not utilize the sophisticated analytical methods that have been developed since then, and most were limited to documenting large-scale distribution

patterns, comparing density of caribou at varying distances from infrastructure, and observing changes in caribou numbers over time. In addition, many studies were of limited duration and had low statistical power to detect differences in demographic rates (survival, reproduction, and population change). Because of the variety of natural factors that drive caribou demographics (e.g., variation in climate, weather, forage quality, predator abundance) and the general tendency of caribou herds to fluctuate in abundance, these studies provide only limited information to evaluate the potential impacts of development on the Porcupine caribou herd. Furthermore, there are significant geographic differences between the ranges of the Central Arctic and the Porcupine herds. For example, the coastal plain used for calving by the Central Arctic herd extends up to 100 mi (160 km) inland from the Arctic coast to the foothills of the Brooks Range; whereas, the coastal plain used by the Porcupine herd is only 10-40 mi (16-64 km) wide and contains a much smaller proportion of moist and wet sedge tundra habitat used by caribou for feeding during early summer. These differences suggest that impacts on the Porcupine herd could be greater due to the relative scarcity of alternative calving and post-calving habitat within the range of that herd. Key information gaps include:

- Estimated rates of survival and recruitment are not sufficiently precise to detect biologically significant differences among years;
- Lack of understanding of what drives the variation in calving site selection by caribou;
- Little empirical data are available concerning the potential physiological and demographic effects of displacement of caribou from preferred calving and insect relief habitats (e.g., evaluate the value of the 1002 Area in providing higher nutrition, reduced predation, and access to insect relief habitat in comparison to other areas).
- Data are needed to assess effectiveness of existing measures used to mitigate effects of disturbance on caribou and to develop more cost-effective measures;
- Research is needed to differentiate the effects of disturbance from natural variation in caribou distribution, abundance, and demographic parameters;.
- Limited understanding of how interchange of caribou between neighboring herds might affect population dynamics of those herds.

What studies/surveys need to be conducted to fill those information gaps?

Exploration phase:

- <u>Increase demographic/behavior monitoring</u>: To improve precision of estimates of survival, birth rates, and recruitment so that changes in important demographic parameters can be detected, monitoring intensity should be increased (number of radiocollared caribou and monitoring effort). This monitoring should use GPS collar technology so that fine-scale behavior data can simultaneously be collected, increasing the ability to understand the influence of habitat conditions on demography. Such data would also reveal emigration rates to neighboring

herds. Increased field monitoring would also facilitate the following proposed studies (potential cost: $75,000-$100,000 annually);

- Assess factors associated with calving site selection: Identify and evaluate the relative importance of climate, predator abundance, forage quality, insect harassment, population density, and anthropogenic disturbance on calving site selection using a combination of long-term and newly collected data; Estimated cost: $75,000 annually for 5 years. Should be done during exploration period so that impacts of future development can be differentiated from natural drivers.
- Investigate characteristics associated with post-calving distribution: Use long-term and newly collected data to understand the influence of weather, forage conditions, insect harassment and population density on caribou movement and resource-selection patterns during the post-calving period. Estimated cost: $150,000 annually for 5 years. This information will be needed during the development phase to guide design and placement of infrastructure.
- Analyze existing telemetry data to quantify seasonal ranges and migration routes: A large database of telemetry data exists that could provide valuable baseline information on caribou movements. These data need to be formally analyzed to update the report "Sensitive Habitats of the Porcupine Caribou Herd" (International Porcupine Caribou Board, 1993). Estimated cost: $25,000 (seasonal salary; no costs other than staff time); this information is needed to identify sensitive areas that may require special management during development and production.
- Monitor body condition and survival: Existing long-term monitoring programs should be continued to predict population trends and evaluate the roles of natural vs. anthropogenic factors. These data will be needed to evaluate causes of future changes in population size that are likely to occur during the development and production periods.

Development and production phase:

- Continue monitoring caribou movements: Monitoring data are needed to identify calving areas and seasonal ranges and to quantify caribou recruitment and survival; Estimated cost: $250,000 annually, collaboration with state, federal, and Canadian agencies, cost sharing to be determined.
- Identify drivers of caribou fitness traits (body condition, survival and recruitment): Use long-term and newly collected data on collared individuals to quantify the effects of annual variation in summer and winter forage conditions (vegetation type, nutritional condition), weather (phenology, snow depth and density, icing events), predator abundance, population density, insect harassment and human activity on caribou body condition, survival and recruitment; Estimated cost: $200,000 annually for 5 years. This information will be needed to differentiate potential effects of displacement from variation due to natural causes, to evaluate mitigation measures that are applied, and to develop improved mitigation strategies.
- Monitor body condition and survival: Long-term monitoring of basic physiological and demographic traits is necessary to predict population trends and evaluate

the roles of natural vs. anthropogenic factors. These data will be needed to evaluate causes of future changes in population size that are likely to occur during the development and production periods.

- Project future changes in distribution and demography: With an improved understanding of the factors that influence the behavior and demography of Porcupine caribou (see previous needed studies), the influence of development within the 1002 Area on the herd can be projected, along with expected future changes in other key factors (i.e., climate, insect harassment, forage conditions). Estimated Cost: Analysis time after the other studies have been completed.