Issue: Caribou and Petroleum Development in Arctic Alaska[1]

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[1] The following is the text of Issue Paper No. 83-03, which was adopted by the Alaska Department of Fish and Game in April 1983 as an official policy statement. As such, it constitutes a general framework for administrative and regulatory actions that address existing and potential conflicts between caribou and resource development. Because petroleum development is the primary industrial undertaking on the Arctic Slope of Alaska, this issue paper examines the implications of oil field activities for caribou and their habitat.

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RH: CARIBOU AND PETROLEUM DEVELOPMENT

I. ISSUE:

Intensive petroleum-related development on Alaska's Arctic Slope is not always compatible with the habitat requirements of barren-ground caribou (Rangifer tarandus granti). Surface alteration can result in displacement of caribou from previously occupied components of range. Although, to date, losses of habitat have been localized, apparently with no adverse effects on herd productivity, uncontrolled or improperly planned future development on State and Federal lands could remove large areas of caribou habitat, with potentially serious consequences to all of the Arctic herds. Caribou represent a valuable recreational and subsistence resource. State and Federal land management agencies must fully acknowledge the potential conflicts associated with industrial activity and adopt conservative policies of subsurface leasing and surface development.

II. BACKGROUND:

Virtually the entire Arctic Slope may be considered caribou habitat. The Western Arctic, Teshekpuk, Central Arctic, and Porcupine herds (totaling nearly 300 000 caribou) all occupy this region during two or more phases of their annual cycle (Hemming, 1971; Davis, 1980). Currently, only the Central Arctic Herd is in contact with intensive

industrial activity. However, considering the potential for rapidly expanding resource development, it is conceivable that all four herds will be affected simultaneously on various portions of their respective ranges. Primary concerns are based on studies in the Central Arctic region, other reports on caribou behavior, nutritional requirements, and theoretical considerations regarding the value of various habitats.

Parturient and postpartum caribou accompanied by calves appear to be generally intolerant of stressful surroundings and seek areas of little or no disturbance. In fact, intensive oilfield development may result in virtual abandonment of areas previously occupied during calving. Such displacement apparently has occurred in response to industrial growth near Prudhoe Bay (Cameron, et al. 1979; Cameron and Whitten, 1980; Smith and Cameron, 1983). Numerous other reports cite the heightened sensitivity of female caribou immediately before, during, and following parturition (de Vos, 1960; Lent, 1964, 1966a; Kelsall, 1968; Bergerud, 1974; Roby, 1978).

The possible consequences of displacing female caribou from preferred calving areas have been the subject of considerable debate and speculation. Although there is no precedent involving industrial activity on calving grounds, various concerns regarding increased neonatal mortality have a firm basis in evolutionary theory. From a

natural selection point of view, it is illogical that female caribou in relatively poor condition would undertake early spring migration to such areas if no net advantage were to be realized. Early snow melt, advanced emergence of new vegetation, scarcity of predators, and/or proximity to insect relief habitat have been cited as advantages related to the selection and repeated use of specific calving areas (Lent, 1964, 1966b; Kelsall, 1968; Skoog, 1968). The calving grounds of all four Arctic herds are each characterized by at least two of these attributes.

Under some circumstances, the calving environment may be crucial to calf production and/or subsequent survival. Thus, if caribou attain maximum fat stores by fall and encounter ideal winter conditions, use of suboptimal calving habitat may be little more than an inconvenience. However, given nutrient deficiencies in summer or during a winter of heavy snowfall, surviving female Rangifer enter the spring season in poor condition (Cameron and Luick, 1972; Dauphiné, 1976), yet are faced with the stresses of late pregnancy, parturition, and lactation. Loss of access to favorable calving areas might then be catastrophic to calving caribou, their offspring (Miller, 1974a), and, ultimately, to the herd itself. Displacement to an area of abundant predators would have more direct, and potentially more severe, consequences. Considering the fundamental importance of the calving process itself and the distinctive physical characteristics of

traditional calving grounds, free access of parturient caribou to these areas should be maintained to the greatest extent possible.

Avoidance of intensively developed areas by cows and calves also extends through the summer months. Calf percentages observed from road systems within the Prudhoe Bay Complex and the Trans-Alaska Pipeline (TAP) Corridor have been substantially lower than comparable regional values determined by aerial survey (Cameron et al., 1979; Cameron and Whitten, 1980, 1982). Again, such displacement may be a matter for concern, depending on the size and character of the area in question. Postpartum female caribou, in particular, must consume adequate amounts of high-quality forage to replenish body reserves and to meet the increased metabolic demands of lactation (White and Luick, 1976; Luick et al., 1980; Kuropat and Bryant, 1980). Similarly, calves must maximize forage intake during this period; adequate summer growth is critical to subsequent survival (Haukioja and Salovaara, 1978).

Insects are a strong force in the summer ecology of caribou. Daily movements are closely related to the emergence and activity of mosquitos and Oestrid flies (Curatolo, 1975; Roby, 1978). Insect activity varies directly with temperature and inversely with wind velocity (White et al., 1975). On warm, calm days Central Arctic caribou move rapidly to coastal sand dunes, river deltas, and offshore

islands; typically, such areas are sparsely vegetated and exposed to cool breezes. With an abatement of insect attack, caribou drift inland. Thus, oscillatory movements occur between coastal habitat and inland feeding sites (White et al., 1975; Cameron and Whitten, 1982). The Teshekpuk Herd responds similarly to insect harassment, occupying areas near the barren beaches of Harrison Bay (P. Reynolds, unpubl. observ.). The Western Arctic Herd, however, utilizes primarily altitudinal relief areas in the western foothills of the Brooks Range (Skoog, 1968; J. Davis, unpubl. observ.). Porcupine Herd caribou combine coastal-inland oscillations with altitudinal movements during postcalving migrations between Alaska and the Yukon Territory (Whitten and Cameron, unpubl. observ.).

Despite topographic differences in insect relief habitat, use of such areas is consistently beneficial. The ecological strategy is maximum intake of the highest quality forage available and minimum expenditure of energy. Apparently the energy cost of moving to insect relief habitat, where forage may be less abundant, is more than offset by the energy savings associated with reduced insect harassment (White et al., 1981); a decline in insect activity is accompanied by a prompt return to grazing areas (Cameron and Whitten, 1982).

Considered collectively, caribou summer movements and the related changes in habitat use (Roby, 1978) are closely linked to forage

preference (Skogland, 1980; White et al., 1981) and, ultimately, to the success of summer growth and fattening (Reimers, 1972; Dauphiné, 1976). The nutritional status of caribou entering the fall season may, under some circumstances, be an important determinant of overwinter survival (White et al., 1981). In addition, females in poor condition tend to be characterized by low reproductive performance (Dauphiné, 1976; Parker, 1981; E. Reimers, unpubl.). Therefore, preserving free movements of caribou between the various components of summer range is highly desirable. As insect relief sites, coastal deltas warrant special attention because of their limited size and occurrence.

Displacement of cows and calves by industrial activity also occurs in fall (Cameron and Whitten, 1980, unpubl.), and similar problems during winter and early spring are possible. However, these conflicts are ostensibly less important than those on calving and summer habitats, principally because options for suitable winter ranges are generally numerous; indeed, caribou winter distribution itself is extremely variable. Nevertheless, petroleum or other resource development, if of sufficient overall magnitude, could reduce the usable amount of any seasonal habitat below the minimum required to support a given caribou herd.

Regardless of seasonal differences in the nature or level of conflict with industrial activity, concerns for the future status of caribou on

the Arctic Slope are based on one fundamental assumption: access to various habitats has survival value to caribou. Traditional movements and overall patterns of range occupancy are consistent with forage phenology and availability (Klein, 1970; Chapin et al., 1975; White et al., 1981; Whitten and Cameron, 1980), and are sustained further by dominant individuals and social facilitation (Espmark, 1970; Miller et al., 1972; Klein, 1980). The phases of the caribou annual cycle, and the specific concerns applicable to each, cannot be viewed in isolation, but rather as an interdependent sequence of events. Substantial perturbation of one phase will likely result in reduced success of another.

Numerous reports have dealt with the responses of caribou to man-made linear structures (Child, 1974, 1975; Miller et al., 1972; Banfield, 1974; Hanson, 1981; Johnson and Todd, 1977), sensory disturbances (de Vos, 1960; Lent, 1964, 1966a; Bergerud, 1974; Calef et al., 1976; Miller and Gunn, 1979; Horejsi, 1981), and various combinations of stimuli that typify petroleum-related development (Klein, 1971, 1980; Miller, 1974b; Cameron et al., 1979; Kelsall and Klein, 1979; Cameron and Whitten, 1980; Whitten and Cameron, 1982). Despite these and a plethora of unpublished studies, analyses and literature reviews, our understanding of caribou disturbance behavior remains largely incomplete. However, some general criteria for pipeline design, special crossing structures, and seasonal disturbance limitations have

been developed and are routinely recommended for incorporation into various permit stipulations. Several additional studies are now in progress, and the results should enable a refinement of the current guidelines.

Although site-specific conflicts can be mitigated to a certain degree, concerns involving the cumulative effects of large-scale surface development have not been addressed. Unfortunately, combinations of physical and sensory disturbance are extremely difficult to quantify, and, consequently, there is not yet a rational basis for specifying the precise nature and level of regional development permissible within caribou range.

Major oilfields are among the principal threats to caribou habitat. Within these complexes the proximity of processing centers, camps, and support facilities may be extremely important in terms of disturbance effect; that is, whether caribou perceive various oilfield components as separate entities or as related structures which together constitute a single larger stimulus. Certainly, connecting roads, pipelines, and associated traffic would further intensify the disturbance effect. On a regional level, proximate complexes with connecting transportation networks may preclude or reduce caribou occupancy of, or movements through, large areas of otherwise usable habitat. In the extreme case, special use areas (e.g., calving

grounds, insect relief habitat) might be lost, effectively reducing carrying capacity of the range.

Retaining adequate size and diversity of caribou habitat is the most important goal. Acceptable productivity of the Central Arctic herd (Whitten and Cameron, 1983), despite local displacement, suggests that suitable alternate habitats remain. Preserving such options, both locally and regionally, is essential to the continued well-being of this as well as the other Arctic herds.

III. CURRENT SITUATION:

At present, only State lands in the mid-Beaufort region are affected by petroleum development. Virtually all subsurface rights between the Colville and Canning Rivers, south to about 69°40'N latitude, have been leased or are scheduled to be leased within the next 4 years. This constitutes a band of the Arctic Coastal Plain approximately 150 km long and 80-100 km in width. Until recently, major development has occurred only between the Kuparuk and Sagavanirktok Rivers, from the coastline inland to Deadhorse airport. This Prudhoe Bay Industrial Complex (PBC) lies within the Prudhoe Bay Production Unit (PBU). The complex is the site of intensive activity and consists of a maze of roads, several support/processing facilities, a complex of above-ground pipelines, two major airports, and numerous private

businesses. West of the Kuparuk River, widespread construction is underway in ARCO's three-phase Kuparuk Development Area (KDA); Phase I production commenced in early 1982.

There are a number of imminent development scenarios on the central Arctic Slope. Within the PBU, ARCO's oilfield network has expanded across the west channel of the Sagavanirktok River, and SOHIO's production facilities now extend west of the Kuparuk River. In addition, SOHIO/EXXON's man-made islands off the Sagavanirktok Delta are rapidly approaching the production phase. Farther to the east, ARCO, SOHIO, EXXON, Chevron, Mobil, and Shell are actively engaged in exploration. Development of EXXON's Point Thomson field is anticipated.

Impending development west of the Kuparuk River includes major expansion of KDA production facilities, smaller SOHIO and Mobil projects, and a separate CONOCO unit at Milne Point. As a further complication, KDA expansion will include construction of a large airport, a new dock at Oliktok Point, and a North Slope Borough "industrial park." Eventual development of offshore reserves will contribute further to the expanding infrastructure onshore, with a corresponding increase in the level of associated activity. In summary, it appears likely that regional petroleum development will

continue to expand and intensify, encompassing the majority of existing and proposed State lease tracts, some 1.4 million ha.

Considerable petroleum development on adjacent Federal lands also appears probable. National Petroleum Reserve-Alaska (NPR-A) lease sales in 1982 consisted of 400 000 ha of subsurface rights. An additional 800 000 ha will be offered for sale annually. Within the Central Arctic Management Area (CAMA) 1 million ha or more will be available for leasing in the near future. The Federal mandate to explore the coastal portion of the Arctic National Wildlife Refuge (ANWR) may ultimately open an additional 650 000 ha to development.

If all lands identified as having oil and gas potential are eventually developed, approximately 12.5 million ha, nearly 60% of the Arctic Slope, would be involved. Although simultaneous exploitation of such a vast area is improbable, it is unrealistic to presume that the distribution, intensity, and timing of future surface development will be fortuitously in harmony with caribou.

To some extent, lack of development foresight is a reflection of limited geotechnical data and economic unknowns. Preliminary exploratory data are neither entirely conclusive nor adequate for meaningful projections; detailed seismic testing and confirmation drilling are required to delineate and characterize each reservoir.

Ultimately, crude oil prices, which are notoriously variable, dictate the feasibility of developing a given reserve.

Because of these uncertainties, exploration and production have often occurred simultaneously in adjacent areas, each proceeding independently. Hence, the oilfield complex near Prudhoe Bay has emerged as a seemingly haphazard matrix of roads, pipelines, and facilities. Access is frequently redundant, production lines pose physical impediments to caribou movement, and support and production activities have not been consolidated and centralized. Widespread disturbance within the PBC has resulted in losses of caribou habitat (Smith and Cameron, 1983). Future planning and coordination must deal more effectively with all aspects of development, from leasing to termination.

Many of the undesirable effects of industrial activity can be successfully mitigated. Others clearly cannot. Direct harassment (e.g., helicopter overflights, ATV activity) can presumably be minimized through appropriate regulations, stipulations, and company operating policies. Similarly, improved pipeline design will hopefully minimize <u>physical</u> impediments to caribou movement. In contrast, there is little control over the character of an emerging oilfield complex in terms of access/transport routes, construction activity, traffic, and the design/placement of various facilities.

Most importantly, experience suggests that strategic planning at the regional level will be extremely difficult, as inadequate coordination exists between State, Federal, and private landowners. In reality, site-specific restrictions are of limited value if development is not planned in a regional context. Nevertheless, until a comprehensive land use plan is established and implemented through the leasing process, the conduct of individual developments should continue to be modified, as necessary, to minimize local conflicts with caribou. Through continued studies of the disturbance behavior and habitat requirements of caribou, as well as improved planning efforts, perhaps caribou can be protected in a manner that is consistent with orderly--and economically sound--development of Alaska's petroleum resources.

IV. RECOMMENDATIONS

The Department of Fish and Game should:

A. Finalize management plans for the various arctic caribou herds; establish minimum population sizes and use priorities.

B. Initiate programs of habitat assessment and in so doing establish broad development criteria for various important, sensitive, and critical habitats.

C. Encourage land managers to conduct comprehensive surface planning for their lands on the Arctic slope and to do so in a coordinated manner.

D. Establish a Memorandum of Understanding with the Alaska Department of Natural Resources, and seek Cooperative Agreements with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the U.S. Geological Survey, and the North Slope Borough. Such interagency agreements should:

1. acknowledge the necessity for a cooperative approach to land use that will maintain an adequate caribou population and yet permit orderly development of petroleum resources.
2. provide for the best possible definition of the location, size, and characteristics of petroleum reservoirs prior to leasing.
3. provide for a multi-agency review process for tract nomination, considering:
    a. the relative value of each area as caribou habitat and the availability of suitable alternate habitats;
    b. projections of the size and intensity of related surface development, probable transportation

routes, and estimated requirements for extraction/processing facilities; and

c. the proximity to existing proposed industrial/urban development, and the probable scope of regional development.

4. establish and implement a strategic leasing plan that will ensure the continued availability of adequate critical, alternate, and total caribou habitat on State, Federal, and private lands.
5. require industry to formulate a surface unit plan that is coincident with, and approved as part of, the subsurface production unit agreement; development standards would be specified for each surface unit.
6. establish a mechanism to expedite decisions, technical input, revision of development standards, and conflict resolution.
7. provide for long-term support of relevant research on the disturbance behavior and habitat requirements of caribou so that mitigation measures can be effective.

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