AFWRC Annual Progress Report - 1989

WORK UNIT II: Habitat requirements and potential impacts of oil development on caribou.

Work subunit IIb: Caribou responses to development infrastructures and mitigation measures implemented in the Central Arctic Region.

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INTRODUCTION

The Central Arctic Caribou (*Rangifer tarandus granti*) Herd (CAH) has been exposed to petroleum development in the Prudhoe Bay region for more than a decade. Findings to date indicate that oilfield complexes directly influence the distribution and movements of CAH caribou (for review, see Shideler 1986). Parturient and post-partum females are particularly sensitive to disturbance and tend to avoid areas of human activity, resulting in losses of CAH calving habitat (Whitten and Cameron 1985; Dau and Cameron 1986). In addition, access to portions of summer range has been impaired, either through avoidance of disturbed areas (Smith and Cameron 1983; Whitten and Cameron 1983; Johnson and Lawhead 1988) or because of the impediments to movement posed by roads and pipelines (Smith and Cameron 1985a,b; Curatolo and Murphy 1986). Thus far, habitat losses have been limited to areas occupied by industrial complexes near Prudhoe Bay and within the Kuparuk Development Area (KDA), and it appears that sufficient habitat remains available to parturient and maternal females. However, continued expansion and intensification of oil development within the central Arctic region could result in large-scale displacement of caribou with the potential for major impacts on herd productivity.

Studies of CAH calving distribution and summer movements in relation to petroleum development were initiated in 1978 and have continued on an annual basis. Specific objectives are to:

(1). Compare the distribution and movements of caribou in the KDA with those of caribou in undeveloped areas.

(2). Determine the frequency with which CAH caribou in the KDA encounter development infrastructures.

(3). Evaluate the effectiveness of caribou mitigation measures implemented to date within the Prudhoe Bay, Kuparuk, Lisburne, and Endicott production units.

Results herein pertain to Objectives 1 and 2. Objective 3 will be addressed through a cooperative industry/agency team beginning in 1990.

METHODS

On 11-15 June 1989, low-level surveys were conducted by helicopter (Cameron et al. 1985; Whitten and Cameron 1985) between the Colville and Canning Rivers. Caribou were counted and classified within 25 north-south strip transects, each 3.2km wide and extending 35-73km inland from the coast (Smith and Cameron 1988).

On 2-17 June and again on 2-31 July, systematic surveys (Smith and Cameron 1985a) were conducted once daily along the Kuparuk Spine Road (SR) and Oliktok Road (OR) (Fig. 1). Each SR/OR survey began on the east bank of the Kuparuk floodplain (km0.0), continued through CPF-1 (km 29.3) near the SR/OR junction, and terminated at Oliktok Point (km56.0).

From 1987 through 1989, 12 CAH adult female caribou were fitted with satellite transmitters and located at least once daily (Fancy et al. 1988) for 1 to 3 summers (May-August) Each collar contains a mercury tip switch to measure caribou activity patterns. A microprocessor sums the number of 1-sec intervals during which the switch is activated by neck movements and then sums all 1-min counts for each 24-hr period. This total is relayed to the satellite as part of the transmitter signal.

RESULTS

Aerial Surveys

During strip transect surveys in June 1989, we classified 2,520 caribou, approximately one-half the totals for 1987 and 1988 (Lawhead and Cameron 1988; Smith and Cameron 1988). The overall distribution of caribou was similar to the 2 previous years, with concentrations south of Bullen Point, east of Franklin Bluffs, and in the vicinity of Milne Point (Fig. 2). Essentially no caribou were seen in the central portion of the study area, an apparent avoidance of the Dalton Highway and the road system within the Prudhoe Bay industrial complex (Whitten and Cameron 1985). Unlike 1987 and 1988, however, few caribou were seen in the Mileveach and Ugnavarik uplands south of the Kuparuk Oilfield.

The overall calf:cow ratio was 51:100, considerably lower than ratios obtained in 1987 and 1988 (Table 1). Furthermore, the calf:cow ratio west of the Sagavanirktok River was lower than the ratio east of the Sagavanirktok River (29:100 vs. 63:100). The parturition rate among radio-collared cows also was lower on the west side (50% vs. 63%), but the difference was not significant (Chi-square, n = 25, P > 0.3).

Intensive strip transect surveys encompassing the KDA (Fig.2) yielded a ratio of 40 calves:100 cows, significantly

Table 1. Sex/age composition and sighting rates of caribou within strip transects[a] during helicopter surveys of the Central Arctic Herd calving grounds, June 1987-89.

	West of Sagavanirktok River (transects 3-10)				East of Sagavanirktok River (transects 11-20)				Total (transects 3-20)			
Year	Calves :100 cows	Yrlgs :100 cows	Bulls :100 cows	Sighting rate caribou/km	Calves :100 cows	Yrlgs :100 cows	Bulls :100 cows	Sighting rate caribou/km	Calves :100 cows	Yrlgs :100 cows	Bulls :100 cows	Sighting rate caribou/km
1987	77	16	3	4.0	71	23	4	4.0	74	21	4	4.0
1988	68	33	6	3.8	66	34	7	4.1	67	34	7	4.0
1989	29	29	12	1.6	63	12	3	2.6	51	18	4	2.1

[a] Only transects at 9.6-km intervals (see Smith and Cameron 1988).

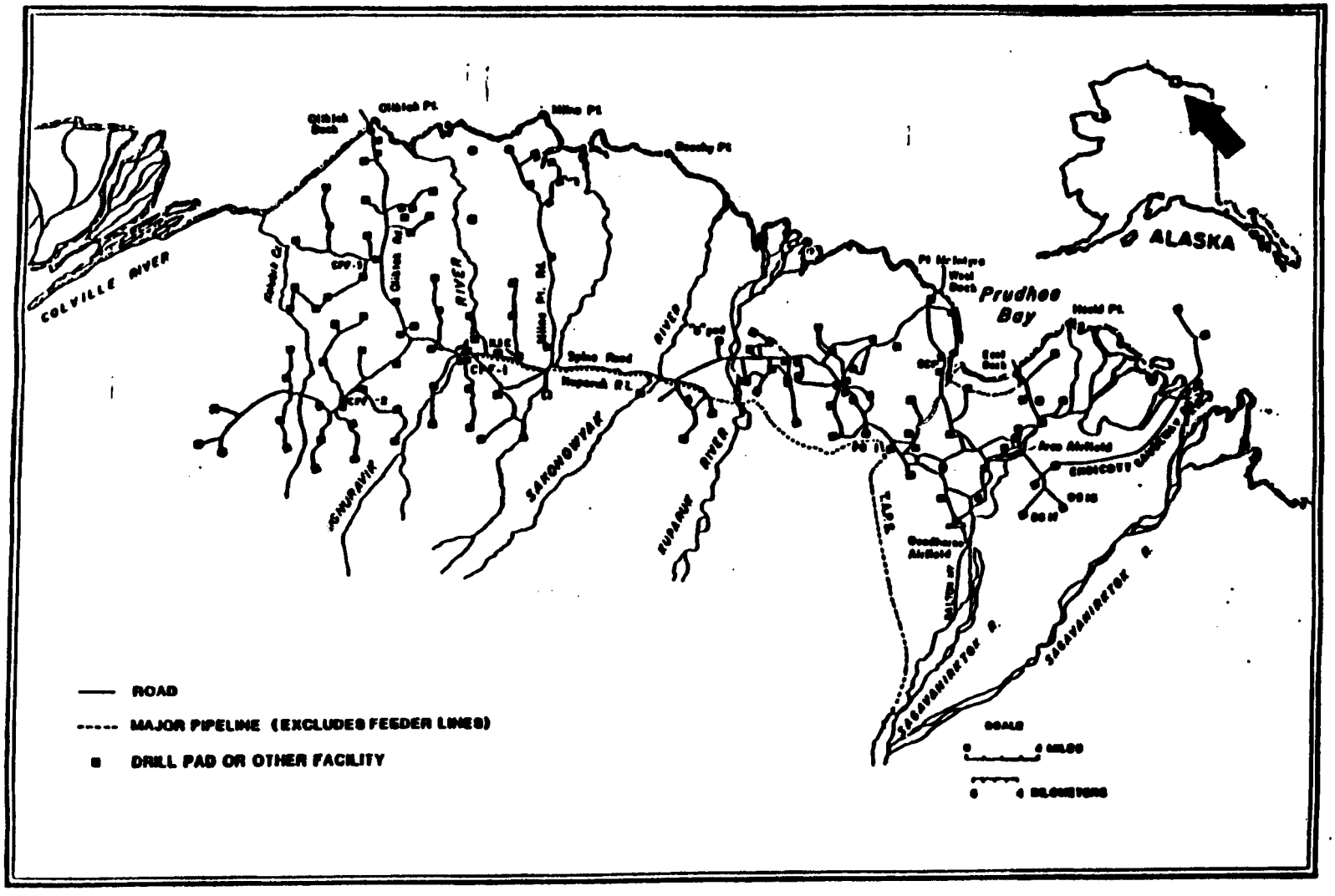

Figure 1. Oilfield development schematic of the Prudhoe Bay area, 1989. (Revised from Shidler 1986).

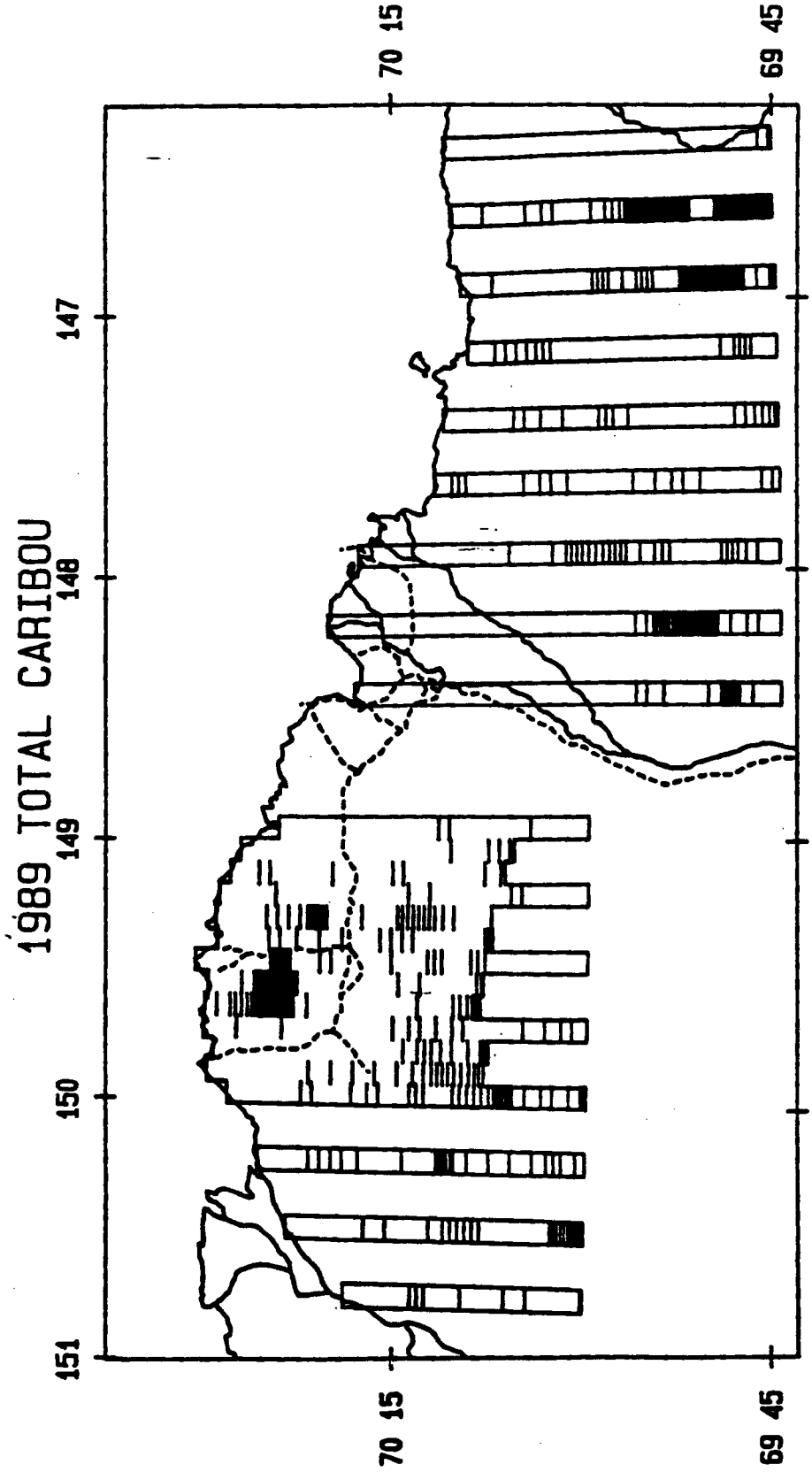

Figure 2. Distribution and relative density of all caribou observed on helicopter surveys of the Central Arctic herd calving grounds, 11-15 June 1989. Graduations in shading depict average densities in 10.4 km^2 transect segments from -0.4/km^2 (open) to -7.7/km^2 (solid).

lower than the mean of for the previous 11 years (t-test, P < 0.05) (Cameron et al. , unpubl. data). Calves were most abundant between the O ok and Milne Point Roads (Fig. 3). Few calves were within transect segments near roads, an observation consistent with avoidance responses reported previously (Dau and Cameron 1986).

Road Surveys

On 14 road surveys conducted during the calving period (2-17 June), we observed 901 caribou (Table 2), less than one-half the number seen in 1988. Caribou sighting rates along the SR and OR were similar, unlike previous years when caribou were more numerous along the OR. Only 3 caribou were observed crossing roads and/or pipelines, compared with a previous range of 4-142. Most caribou were seen in the middle segments of the SR and OR, apparently avoiding the Kuparuk floodplain, CPF-1 area, and Oliktok Point (Fig. 4). Only 5 calves were observed from the road.

During the summer insect period (2-31 July) we observed 24,533 caribou along the SR and OR (Table 2). Unlike all previous years, few caribou were seen near the Kuparuk River; most were observed in insect-harassed groups at Oliktok Point and immediately east of CPF-1 (Fig. 5). A total of 10,223 caribou in 151 groups attempted to cross roads and/or pipelines, again mostly at Oliktok Point and east of CPF-1 (Fig. 6).

Satellite Telemetry

Data from satellite-collared cows were collected for 16 caribou-summers; of these, 12 are for the vicinity of the KDA and 4 apply to an undisturbed portion of range east of Prudhoe Bay. In 1987, mean daily distance traveled and daily activity counts were closely related for satellite-collared cows both east and west of Prudhoe Bay (Fig. 7). The mean distance traveled was similar for cows in the 2 areas, but activity comparisons were inconclusive because of large variances in activity counts. Unfortunately, transmitter failures, movements from the CAH range for all or part of the summer, and some mortality of cows east of Prudhoe Bay precluded similar comparisons in 1988 and 1989.

In 1987 and 1988, as in most years, parturient cows were in or near calving areas on the coastal plain by early May, and daily movements for the month were localized (Fig. 8). In 1989, however, most collared cows were still 150km south of the calving grounds as late as mid-May; consequently, they moved farther during the 2-3 weeks before calving. Movement activity was low in June but increased approximately 3-fold during the July insect season as caribou alternately occupied coastal insect relief habitat and inland feeding areas; mean distances traveled within eastern and western areas were similar. Movements in August were

Table 2. Population characteristics of caribou observed along the Spine and Oliktok Roads, Kuparuk Development Area, 2 June-31 July 1989.

	Calving (2 -17 June)					Summer (2 -31 July)				
Category	No. groups	No. caribou	Mean group size	Sighting rate (caribou/km)	% calves	No. groups	No. caribou	Mean group size	Sighting rate (caribou/km)	% calves
Kuparuk Spine Road (0.0-32.0km)	174	507	2.9	1.1	1.0	498	11,151	22.4	13.9	11.9
Oliktok Road (32.1-56.0km)	140	394	2.8	1.2	0.3	335	13,382	39.9	22.3	11.0
Total (Road) (0.0-56.0km)	314	901	2.9	1.2	0.7	833	24,533	29.5	17.5	11.5
0-1,000 m	196	527	2.7	0.7	0.8	720	17,213	23.9	12.3	11.5
0-2,000 m	245	674	2.8	0.8	0.6	813	20,873	25.7	14.9	11.6
Pipe crossings	--	--	--	--	--	67	562	8.4	0.4	8.5
Road crossings	--	--	--	--	--	30	332	11.1	0.2	10.8
Road/Pipe crossings	2	3	1.5	<0.1	0.0	54	9,329	172.7	6.7	11.4
Total (crossings)	2	3	1.5	<0.1	0.0	151	10,223	67.7	7.3	11.2
On insect days	--	--	--	--	--	206	15,938	77.4	31.6	10.3

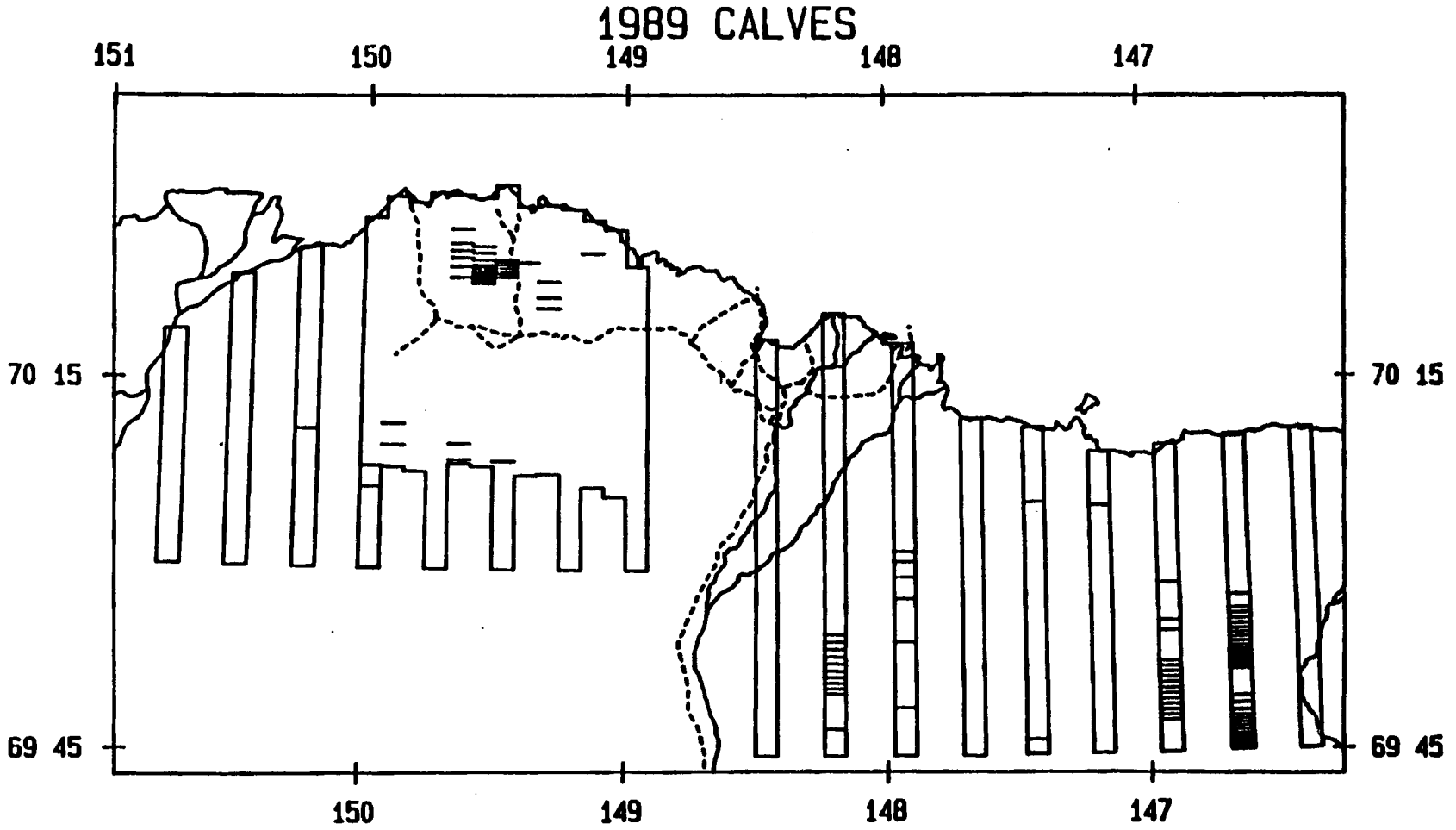

Figure 3. Distribution and relative density of caribou calves observed on helicopter surveys of the Central Arctic herd calving grounds, 11-15 June 1989. Graduations in shading depict average densities in 10.4 km^2 transect segments from -0.4/km^2 (open) to -7.7/km^2 (solid).

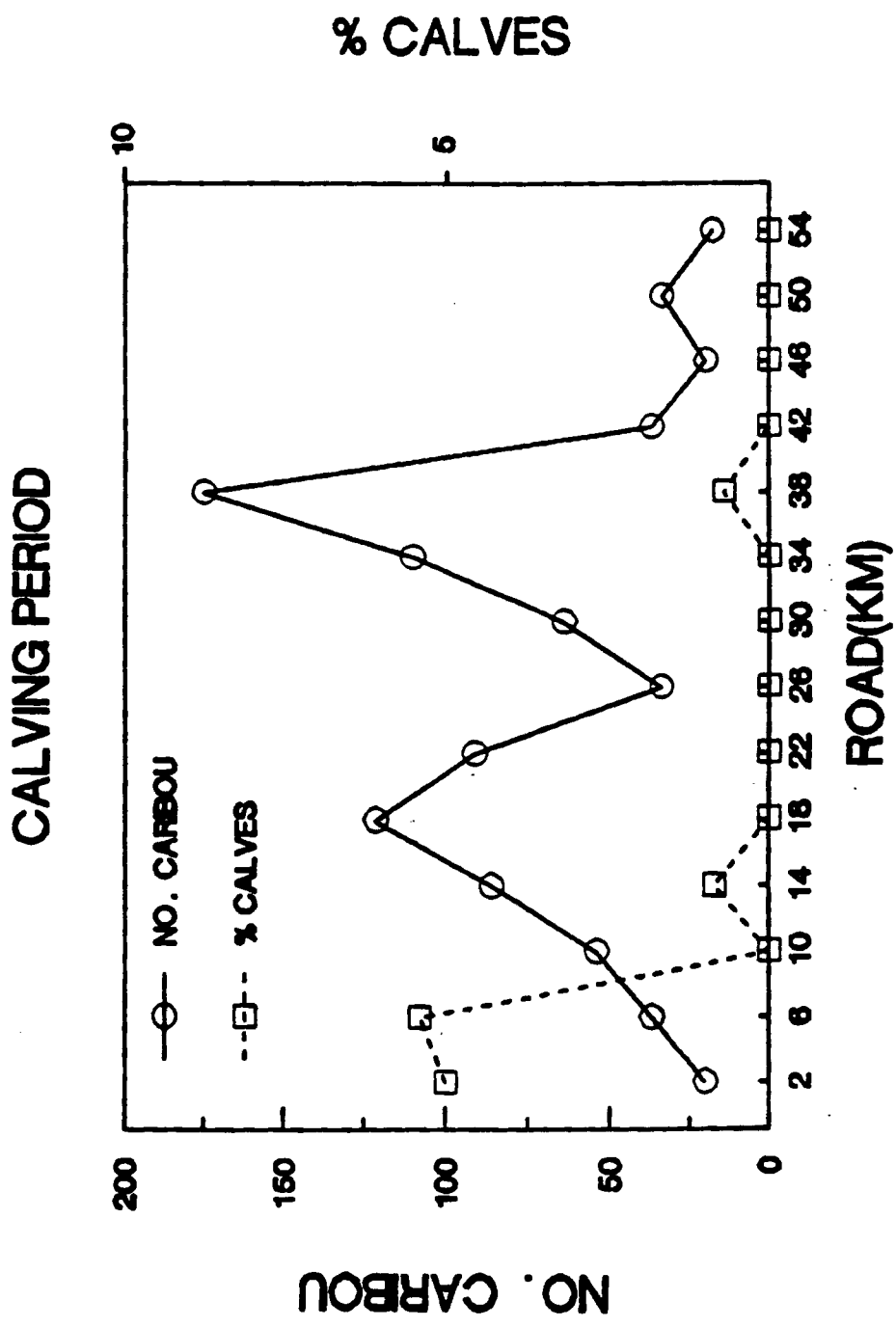

Figure 4. Number of caribou and calf percentages observed within 4 km segments of the Spine and Oliktok roads, Kuparuk Development Area, 2-17 June 1989.

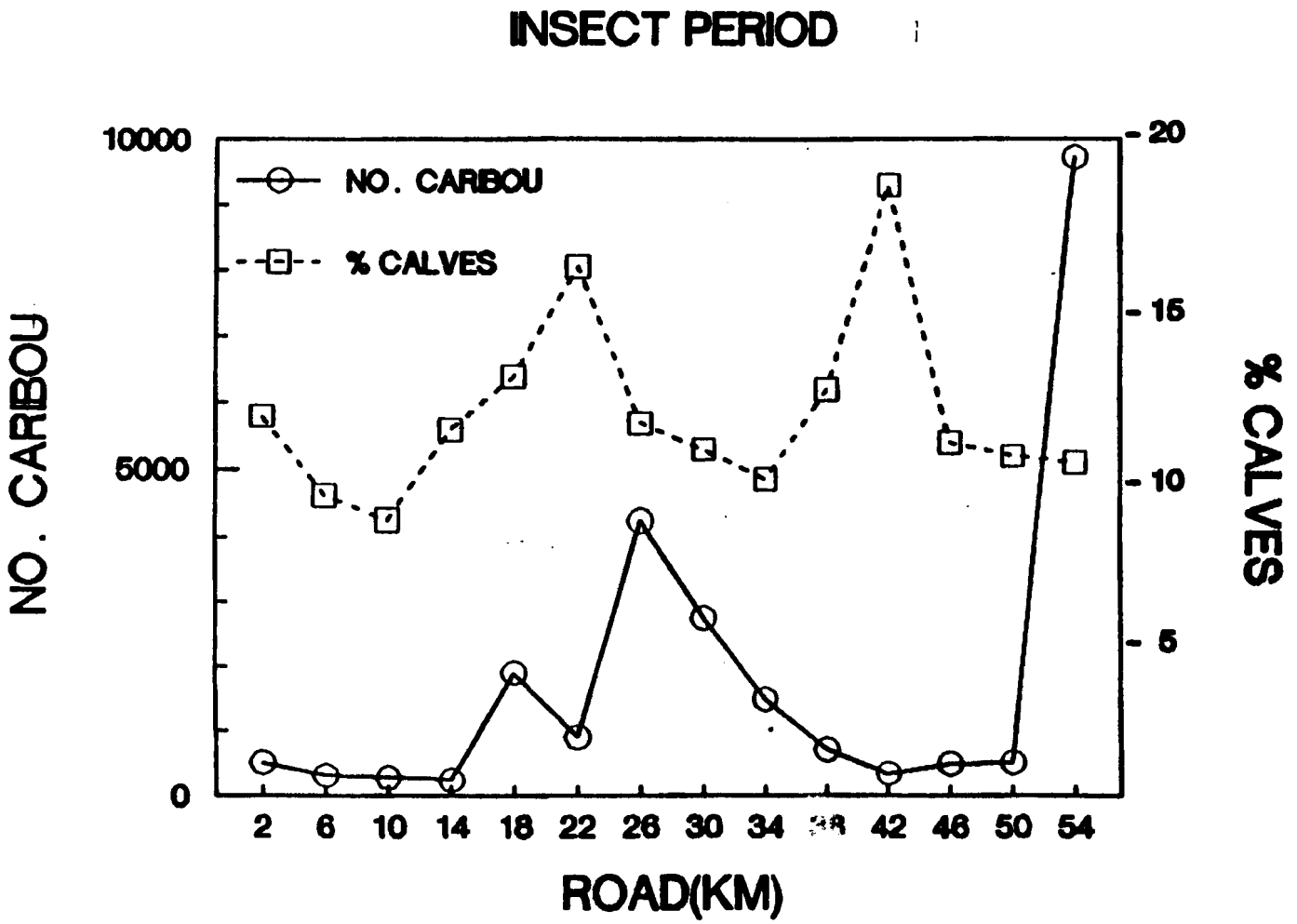

Figure 5. Number of caribou and calf percentages observed within 4 km segments of the Spine and Oliktok roads, Kuparuk Development Area, 2-31 July 1989.

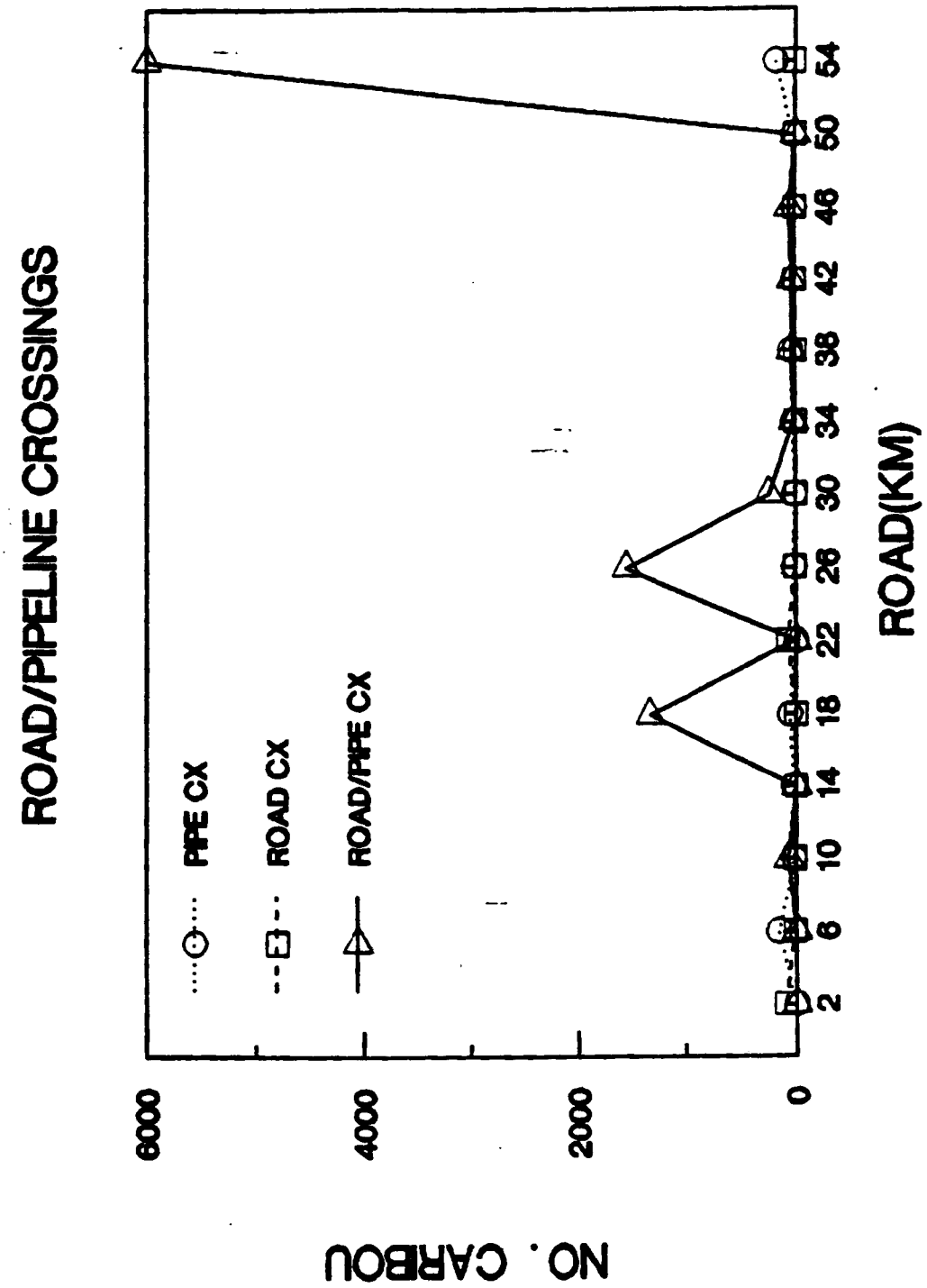

Figure 6. Number of caribou attempting to cross pipelines, roads, and road/pipeline complexes within 4 km segments of the Spine and Oliktok Roads, Kuparuk development Area, 2-31 July 1989.

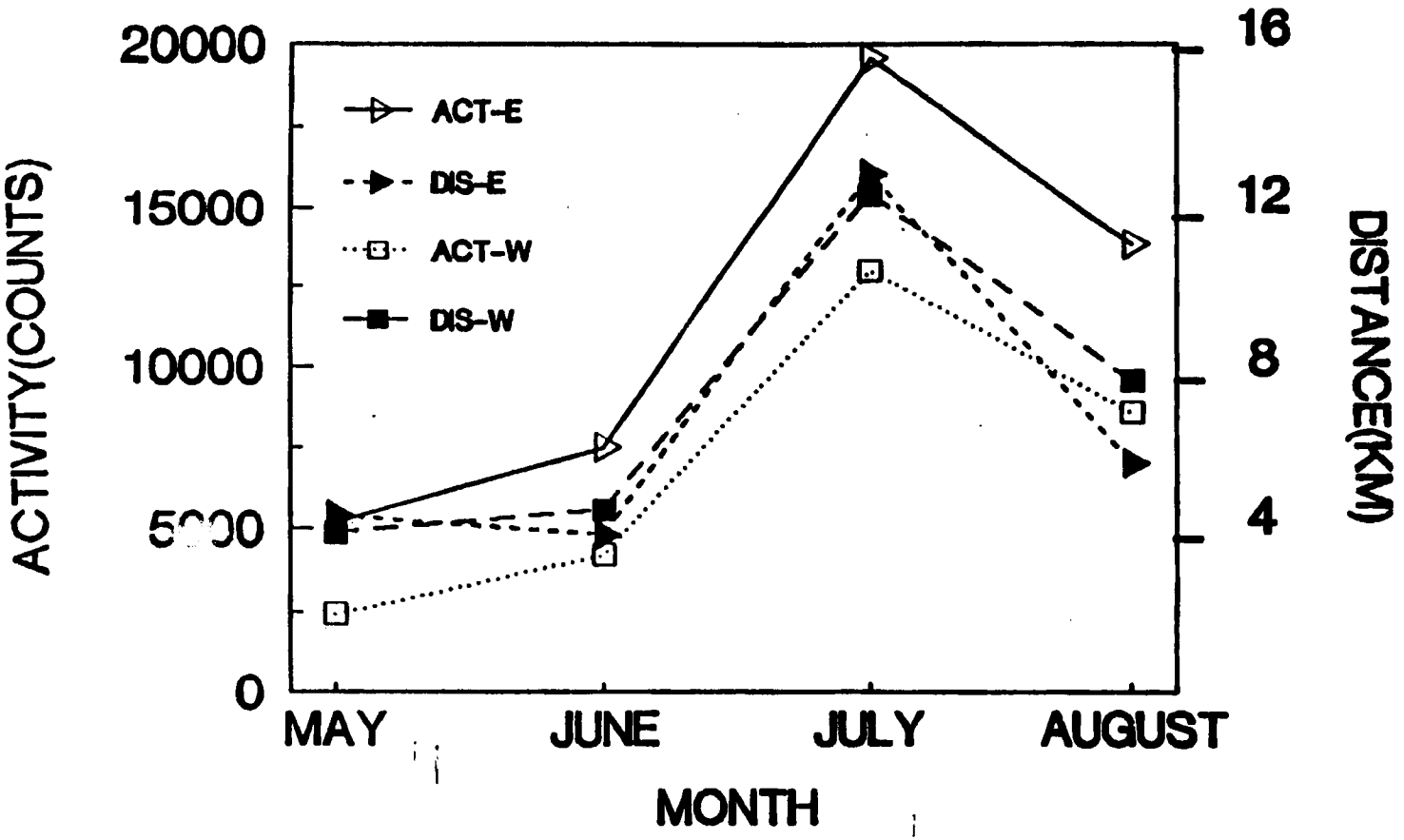

Figure 7. Mean daily activity counts (ACT) and mean daily distance traveled (DIS) by satellite-collared female caribou east (E) and west (W) of oilfield development, Prudhoe Bay Region, summer 1987.

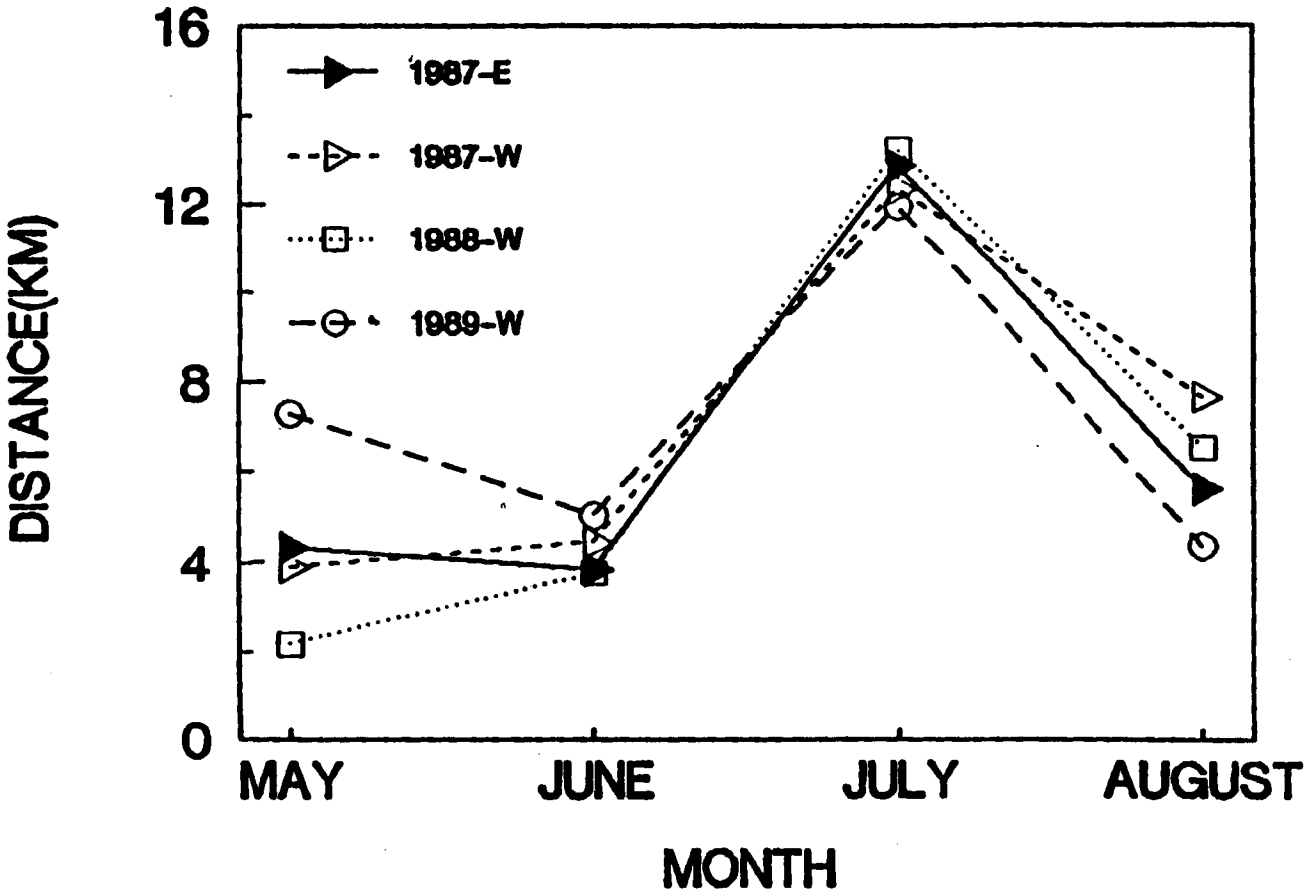

Figure 8. Mean daily distance traveled by satellite-collared female caribou east (E) and west (W) of oilfield development, Prudhoe Bay Region, summer 1987-89.

localized and nondirectional, a typical response to oestrid flies.

DISCUSSION

When road survey data from the 1989 calving period (Table 2) are compared with data from 1981-85 and 1988 (Smith and Cameron 1986, 1988), we noted the following: (1) the overall sighting rate of 1.2 caribou/km was within the previous range of 0.8-2.8; (2) sighting rates of 0.7 and 0.8 caribou/km within 1,000m and 2,000m, respectively, of the road also were within the previous ranges of 0.2-2.4 and 0.4-2.7; (3) mean group size was 2.9, within the range of 2.6-5.6; and (4) the overall calf percentage was the lowest ever recorded, 0.7 vs. the previous range of 1.2-7.4. The road survey results, like the strip transect data, indicate that few calves were in the vicinity of oilfield structures during the calving period.

We noted the following trends when comparing results of July 1989 road surveys (Table 2) with those obtained in 1981-85 and 1988 (Smith and Cameron 1986, 1988): (1) the overall sighting rate was higher--17.5 caribou/km vs. the previous range of 4.6-16.4; (2) sighting rates of 12.3 and 14.9 caribou/km within 1,000 and 2,000m, respectively, of the road are near the upper end of the previous ranges of 1.9-13 and 3.4-15.8; (3) the mean group size of 29.5 fell within the previous range of 16.9-42.5; (4) the overall calf percentage was the lowest ever recorded, 11.5 vs. the previous range of 16.2-23.2; and (5) as in previous years, more caribou were sighted along the OR portion of the survey.

For the first time since we began road surveys in 1978, few caribou were seen in the Kuparuk floodplain in (Fig. 5). Rather, inland movements were primarily to areas east of the OR and south of the SR (Table 3). More than 60% of the caribou were seen on 3 days: on 6 and 15 July when large groups were observed at Oliktok Point under moderate mosquito harassment, and on 24 July, when caribou moved north into the CPF-1 area in response to moderate mosquito and oestrid fly harassment.

In July 1989, more than 150 groups were observed crossing the road and/or pipelines (Table 2), of which 80% were seen on moderate-to-severe insect harassment days. As most caribou were seen during crossing episodes, the distribution of crossings and sightings are similar (Figs. 5, 6). Eighty-six percent of the groups crossed successfully (i.e., >50% crossed), and 64% of the individuals within those groups were successful. Crossing success by large groups (>100 individuals) continued to be markedly higher along the OR and SR than observed in the early 1980's (Smith and Cameron 1985a,b; Smith and Cameron 1986); 12 of 14 large groups observed and 60% of the individuals crossed roads

Table 3. Summary of July movements of the Central Arctic Herd within the Kuparuk Development Area, July 1989.

Date	Location and movements	Wind direction	Avg. high temp. oC[a]	Insect harassment	No. caribou seen from road
1-4	Moved to coast, north of Spine road	N, NE	13.0	Moderate	1,079
5-7	Moved west along coast, crossing road at Oliktok Point	W	17.5	Light-moderate	3,284
8-13	Local movements west of Oliktok Point and in Colville Delta	W	18.0	Light-moderate	374
14-15	Moved east along coast, crossing road at Oliktok Point	N, W	20.5	Moderate-severe	6,002
16-18	Moved south and crossed Spine Road east of CPF-1	VAR	13.5	Light-moderate	4,713
19-22	Local movements south of Spine Road	NE	9.5	Light	680
23-24	Moved north to Spine Road east of CPF-1	VAR	17.5	Moderate	4,107
25-31	East and south of Spine Road; some movement to Prudhoe Bay Oilfield	NE	13.5	Light-	4,294

[a] Summarized from hourly weather observations, Deadhorse Airport, Alaska.

and/or pipelines. The 2 largest groups, totaling 6,746 caribou, were delayed in crossing, during which time insect activity decreased because of higher winds and lower temperatures. With impetus to move gone, the caribou began feeding and lying. The individuals that did not cross constituted 80% of all caribou in the unsuccessful category for July. Thus, many of these unsuccessful crossings can be attributed to changes in weather rather than to the presence of roads and pipelines.

RESEARCH PROSPECTUS

Plans for the 1990 field season are to continue the same basic program of aerial and road surveys. However, additional emphasis will be placed on determining the responses of caribou to oilfield infrastructures using satellite telemetry.

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LITERATURE CITED

Cameron, R. D., W. T. Smith, and R. T. Shideler. 1988. Variations in initial calf production of the Central Arctic Herd. Pages 1-7 in R. D. Cameron and J. L. Davis, eds. Proc. 3rd North Am. Caribou Workshop. Alaska Dep. Fish and Game. Wildl. Tech. Bull. No. 8. Juneau.

_____, K. R. Whitten, W. T. Smith, and D. J. Reed. 1985. Sampling errors associated with aerial transect surveys of caribou. Proc. 2nd North Am. Caribou Workshop, Val Morin, Quebec, 17-20 October 1984. McGill Subarctic Res. Pap. No. 40:273-283.

Curatolo, J. A., and S. M. Murphy. 1986. The effects of pipelines, roads, and traffic on the movement of caribou, Rangifer tarandus. Can. Field-Nat. 100:218-224.

Dau, J. R., and R. D. Cameron. 1986. Effects of a road system on caribou distribution during calving. Rangifer, Spec. Issue No. 1:95-101.

Fancy, S. G., L. F. Pank, D. C. Douglas, C. H. Curby, G. W. Garner, S. C. Amstrup, and W. L. Regelin. 1988. Satellite telemetry: a new tool for wildlife research and management. U.S. Fish and Wildl. Serv. Resour. Publ. No. 172.

Johnson, C. B., and B. E. Lawhead. 1988. Distribution, movements, and behavior of caribou in the Kuparuk Oilfield, summer 1988. Final report prepared for ARCO Alaska, Inc., Anchorage by Alaska Biological Research, Fairbanks. 71pp.

Lawhead, B. E., and R. D. Cameron. 1988. Caribou distribution and abundance on the calving grounds of the Central Arctic Herd, Alaska, 1987. Final Rep. prepared for ARCO Alaska, Inc. and the Kuparuk River Unit, Anchorage, by Alaska Biological Research, Inc. and Alaska Dep. Fish and Game, Fairbanks. 59pp.

Shideler, R. T. 1986. Impacts of human developments and land use on caribou: A literature review. Vol. II. Impacts of Oil and Gas Development on the Central Arctic Herd. Tech. Rep. No. 86-3. Alaska Dep. Fish and Game. Juneau. 128pp.

Smith, W. T., and R. D. Cameron. 1983. Responses of caribou to industrial development on Alaska's Arctic Slope. Acta Zool. Fenn. 175:43-45.

_____, and _____. 1985a. Factors affecting pipeline crossing success of caribou. Pages 40-46 in A. M. Martell and D. E. Russell, eds. Proc. 1st North Am. Caribou Workshop, Whitehorse, 1983. Can. Wildl. Serv. Spec. Publ., Ottawa.

_____, and _____. 1985b. Reactions of large groups of caribou to a pipeline corridor on the Arctic Coastal Plain of Alaska. Arctic 38:53-57.

_____, and _____. 1986. Distribution and movements of caribou in relation to the Kuparuk Development Area. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Final Rep. Proj. W-21-2, W-22-1, W-22-2, W-22-3, W-22-4, and W-22-5. Juneau. 47pp.

_____, and _____. 1988. Distribution and movement of caribou in relation to petroleum development. Appendix A in R. D. Cameron, W. T. Smith, and S. G. Fancy. Distribution and productivity of the Central Arctic Caribou Herd in relation to petroleum development: case history studies with a nutritional perspective. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-23-1 and W-23-2. Juneau. 32pp.

Whitten, K. R., and R. D. Cameron. 1983. Movements of collared caribou, Rangifer tarandus, in relation to petroleum development on the Arctic Slope of Alaska. Can. Field-Nat. 97:143-146.

_____, and _____. 1985. Distribution of caribou calving in relation to the Prudhoe Bay oilfield. Pages 35-39 in A. M. Martell and D. E. Russell, eds. Proc. 1st North Am. Caribou Workshop, Whitehorse, 1983. Can. Wildl. Serv. Spec. Publ., Ottawa.

TERRESTRIAL RESEARCH

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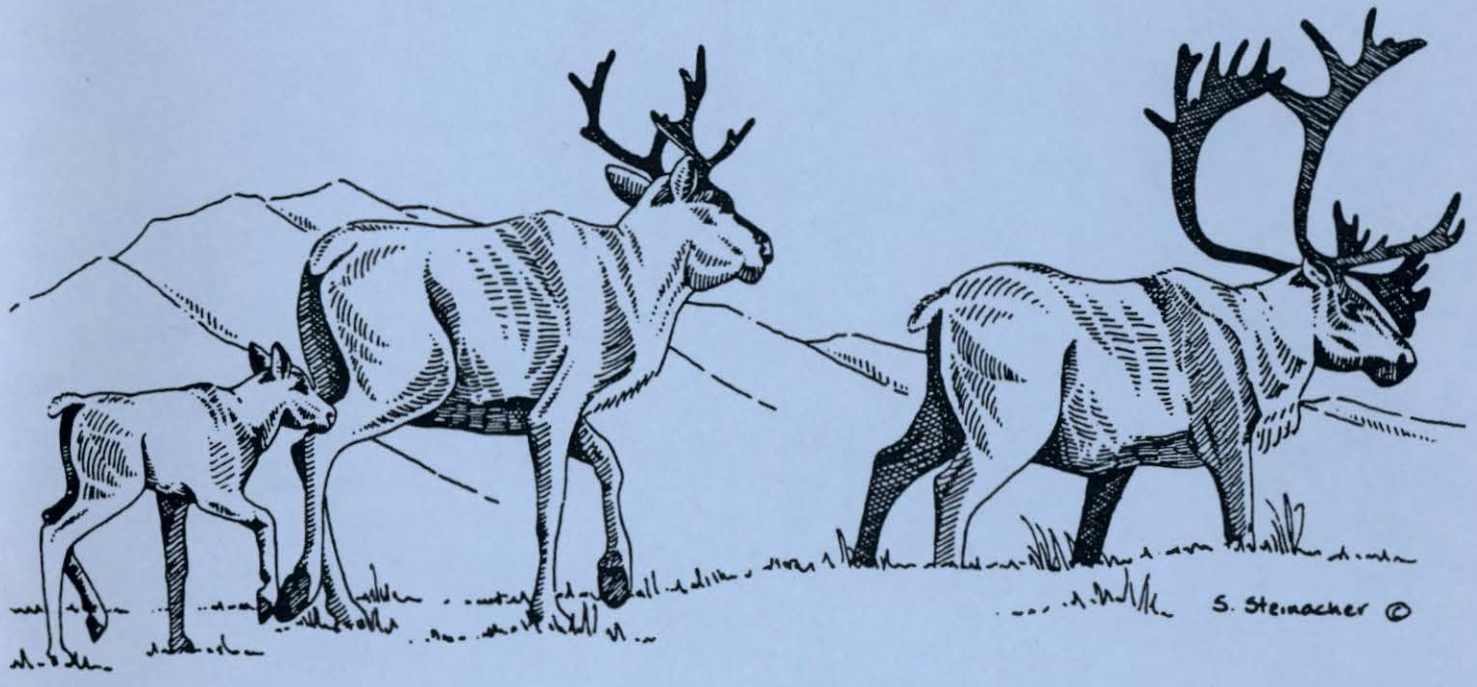

Annual Progress Report

Field Season - 1989

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