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EFFECTS OF THE TRANS-ALASKA PIPELINE ON THE DISTRIBUTION AND MOVEMENTS OF CARIBOU

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Job No.: 3.18R Job Title: Effects of the Trans-Alaska Pipeline Corridor on the Distribution and Movements of Caribou

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SUMMARY

During summer, fall, and spring, 1975-76 through 1981-82, caribou (Rangifer tarandus granti) surveys were conducted from a light truck along the Arctic Slope route of the Trans-Alaska Pipeline and within the oil field complex near Prudhoe Bay. Also, systematic aerial surveys of caribou were conducted periodically within the surrounding region of the central Arctic Slope. In general, seasonal changes in the distribution of caribou along the road system reflected the north-south seasonal movements of the Central Arctic Herd. Crossings of the road and/or pipeline were predominantly by bulls; calves composed only 3% of the caribou in crossing groups. Comparisons of calf percentages obtained by corresponding road and aerial surveys indicate cow-calf avoidance of the corridor during summer (Jul/Aug) between 1977 and 1979, and during spring (Apr/May) between 1977 and 1982. No consistent differences in calf percentage were apparent during fall (Oct/Nov), but sighting rates for all caribou were lower than in either summer or spring. We conclude that parturient and maternal cows are sensitive to human activities in developed areas on the Arctic Slope. This sensitivity is already

apparent in spring at least 2 months before calving, and extends through the summer and probably through fall.

Key words: Caribou, disturbance, industrial development, pipeline.

CONTENTS

BACKGROUND

Studies of the relationship between Central Arctic Herd (CAH) caribou (Rangifer tarandus granti) (Cameron and Whitten 1979, Whitten and Cameron 1983a) and the Arctic Slope portion of the Trans-Alaska Pipeline (TAP) began in summer 1975. The Dalton Highway (previously known as the North Slope Haul Road) had been built the previous year, and pipeline construction was in progress. A comparison of the percentages of calves among caribou observed during systematic surveys of the central Arctic region with those determined by ground surveys along a corresponding road segment indicated that during summer calves were underrepresented along the TAP and within the associated Prudhoe Bay oil field complex (PBC); in fall, however, no differences in calf percentage were noted (Cameron et al. 1979). It was concluded that structural complexity and construction-related human activity elicited "avoidance" of the corridor by maternal cows and their calves during summer. The apparent absence of a negative response in fall was attributed in part to a decline in maternal sensitivity, perhaps a function of the more advanced age of calves.

Similar comparisons of caribou composition data obtained through 1978 confirmed the earlier summer findings and, in addition, indicated an avoidance response in fall after 1975 (Cameron and Whitten 1980). Supplemental ground surveillance conducted from the PBC road network in summer 1978 yielded low relative numbers of calves (Smith and Cameron 1983), verifying the specific influence of the oil field complex on the local distribution of cow-calf pairs. Sexual differences in the occurrence of collared caribou along the road system and the dissimilar frequencies of corridor crossings by collared bulls and cows (Whitten and Cameron 1983b) were entirely consistent with earlier findings, as were data on the relative paucity of calving caribou in the vicinity of the PBC (Whitten and Cameron 1985). These studies, together with numerous reports on the sensitivity of maternal cows to disturbance (see Cameron 1983), constitute strong evidence for a cow-calf avoidance response.

In this report, we highlight the comparative results of caribou surveys conducted by air and along the Dalton Highway between 1975 and 1982.

OBJECTIVES

In accordance with stipulations 2.5.4.1* and 2.5.3.1 of the Grant of Right-of-Way for the TAP, this project is designed to accomplish the following principal objectives:

1. To determine seasonal/annual changes in the distribution and group sex/age composition of caribou in the vicinity of the TAP corridor.

2. To determine the locations of corridor crossings by caribou.

3. To characterize the responses of caribou to the Dalton Highway, pipeline(s), traffic, and human activity.

PROCEDURES

A. Road Surveys

1. Between June 1975 and May 1982, 179 caribou surveys were conducted by light truck along the road system between Pump Station 4 and the ARCO West Dock (Fig. 1) (Cameron et al. 1979).

2. The following data were recorded for each caribou sighting and entered into computer files:

   a. date
   b. group size
   c. sex/age composition (bull, cow, calf, yearling, adult, unknown sex/age)
   d. road location (km from known point)
   e. observation distance (estimated)
   f. any observed road and/or pipeline crossing

3. Pooled data on caribou numbers and sex/age composition were compiled on the basis of year, season, observation distance, crossing activity, and/or group characteristics.

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* "Lessees shall construct and maintain the pipeline, both buried and above-ground sections, so as to assure free passage and movement of big game animals."

B. Aerial Surveys

1. Between June 1975 and May 1982, 20 systematic aerial surveys were conducted in the central Arctic region (Fig. 2) (Cameron and Whitten 1979).

2. The following data were recorded for each caribou sighting and entered into computer files:

   a. date
   b. group size
   c. sex/age composition (bull, cow, calf, yearling, adult, unknown sex/age)
   d. map location

3. Pooled data on caribou numbers and sex/age composition were compiled on the basis of year, season, group characteristics, and/or location.

C. Statistical Methods

1. Standard errors of mean calf percentages were computed according to Cochran's (1977) ratio formula.

2. Mean calf percentages were compared using Student's *t* test, 95% confidence interval.

RESULTS

A. Composition of Caribou Along the TAP/PBC Road System

1. Observations by road survey each year between 1975 and 1982 (Tables 1 and 2) indicate that:

   a. calf percentages were consistently higher, and bull percentages generally lower, in fall than in either summer or spring

   b. calf percentages were less variable among groups with calves than among all groups combined

   c. in most cases, the majority of caribou observed were in groups without calves

   d. bull percentages were consistently high in groups without calves

2. Caribou sighting rates varied considerably on a regional basis (Fig. 1) among both seasons and years (Tables 3 and 4), but some consistencies are apparent:

   a. summer rates were highest along the northern half of the road (i.e., Regions 3 and 4)

   b. fall and spring rates in Regions 3 and 4 were lower than the corresponding summer rates, and usually lower than those for other regions

   c. fall rates for the entire road (i.e., Regions 1-4) were consistently lower than in summer and spring

B. Caribou Crossings of the TAP/PBC Corridor

1. Observations of road and/or pipeline crossings by caribou (Table 5) indicate that:

   a. crossings were predominantly by bulls

   b. calves composed only 3% of the total caribou in crossing groups

   c. most crossings occurred near the coast (i.e., Region 4) and involved groups that were generally larger than in other areas

2. Individual and combined crossing rates (Tables 6 and 7) show the same basic pattern as sighting rates (Tables 3 and 4), but were generally more variable.

C. Composition of Caribou in the Central Arctic Region

1. The results of aerial surveys conducted between 1975 and 1982 (Tables 8 and 9) indicate that:

   a. seasonal calf percentages based on areawide observations were far less variable than those based on road survey observations

   b. without exception, calf percentages based on aerial survey observations were higher than corresponding percentages based on road survey observations

   c. in contrast to road survey results, the majority of caribou observed during aerial surveys were in groups with calves

d. as for road survey observations, bull percentages were consistently high in groups without calves

D. Composition of Caribou Along the Road System vs. Areawide Estimates

1. A comparison of adjusted calf percentages obtained by road and aerial surveys for each of 5 periods (Table 10; Fig. 3) indicates that:

a. in most cases where comparative road/air data are available, calf percentages along the road were lower than those determined by aerial survey

b. differences were significant during June in both 1975 and 1976; no subsequent aerial data are available, but mean calf percentages along the road remained low through 1981 (<3%), suggesting that the differences persisted

c. differences in calf percentages were not significant during July/August in either 1975 or 1976; however, the means diverged thereafter, and were significantly different in 1977, 1978, and 1979

d. with 1 exception, calf percentages along the road in September and October/November were not significantly different from corresponding percentages obtained by aerial survey

e. in April/May 1977-82, calf percentages based on road surveys were consistently and significantly lower than those determined by air

2. Seasonal differences in local calf representation, expressed as a ratio of the calf percentages obtained by road and air (Fig. 4), indicate that:

a. in July/August 1975 and 1976, calf representation along the corridor approached areawide estimates, but declined abruptly in 1977 and remained low through 1979

b. in October/November 1975, 1977, and 1980, local calf representation along the road system was at or near areawide estimates

c. in March/April 1977 through 1982, calf representation along the road system was consistently lower than expected values

DISCUSSION

The foregoing comparisons of calf percentages determined by road and aerial survey procedures clearly indicate cow-calf avoidance of the corridor during the summer months. The limited comparative data obtained in June 1975 and 1976 (Fig. 3a) suggest that cows accompanied by neonates are extremely sensitive to disturbance, as an effect was apparent shortly after onset of TAP construction activity and during a period of relatively little development within the PBC. Comparisons of the available road and aerial survey data for July/August represent the most convincing evidence for an avoidance response. Data sets based on each of the 2 survey procedures show clear chronological trends in calf percentage: an increasing trend in areawide values and a gradual decline along the road (Fig. 3b). As a result, local calf representation along the road system declined precipitously after 1976 (Fig. 4).

In contrast, fall comparisons suggest little, if any, local avoidance (Figs. 3c, d; 4). Perhaps the older age of calves (3-6 months), together with the distractions of the rut, contribute to a reduction in maternal sensitivity. However, the generally lower sighting rates along the road during fall (Table 4) suggest that cows remain sensitive to disturbance, and that bulls from the road join female groups (i.e., groups with calves) in off-road areas during the breeding season (Table 9). A general avoidance of riparian areas by both sexes is unlikely, as the numbers of caribou observed by aerial survey in fall were usually higher than during other seasons (Table 8).

Patterns during spring were similar to those in summer. Areawide calf percentages increased somewhat over the study period, while calf percentages along the road were stable at appreciably lower values (Fig. 3e); thus, local calf representation during April/May was highest in 1977, but declined in 1978 and remained generally low through 1982. It seems likely that, in spring, maternal avoidance does not result from the presence of a previous year's calf, but is more a function of imminent parturition. The local paucity of short yearlings is a reflection of their close association with parturient cows, and likely not due to any heightened sensitivity on their own part.

It should be emphasized that the above road/air comparisons of calf percentage are extremely conservative. In particular, observations within the nonriparian coastal portion of aerial coverage were deleted from consideration in our estimates of areawide calf percentages. This eliminated any possible bias associated with oversampling coastal areas which tend to

support more cows and calves, especially during the summer months. In reality, however, we believe that some additional coverage of the near-coastal zone is warranted, as north-south transects along rivers do not adequately sample caribou that are concentrated adjacent to the coast. A further consequence of deleting coastal observations was that aerial coverage oversampled riparian habitats relative to ground coverage within 1,000 m of the road system. Therefore, any disturbance-unrelated avoidance of riparian habitat by cows and calves would tend to decrease the differences between calf percentages determined by visual and aerial survey, which nevertheless were significant over much of the study period (Table 10).

Two other refinements in survey data were made for the comparisons of calf percentages. First, aerial observations of caribou along the Sagavanirktok River were not included in the various computations, thereby eliminating overlap of coverage with road surveys. Secondly, sampling of caribou along the corridor was limited to those within 1,000 m of the road, virtually guaranteeing complete coverage and constant sightability.

The detailed publication of these data will incorporate additional estimates of regional calf percentages for comparison with road survey observations. These may include estimates based on partial surveys as well as productivity/survival data for the CAH. We will also attempt to categorize various segments of the corridor in terms of the avoidance responses of caribou. Finally, we will describe the 1977-82 disturbance levels within the corridor by evaluating trends in traffic, structural complexity, and human activity.

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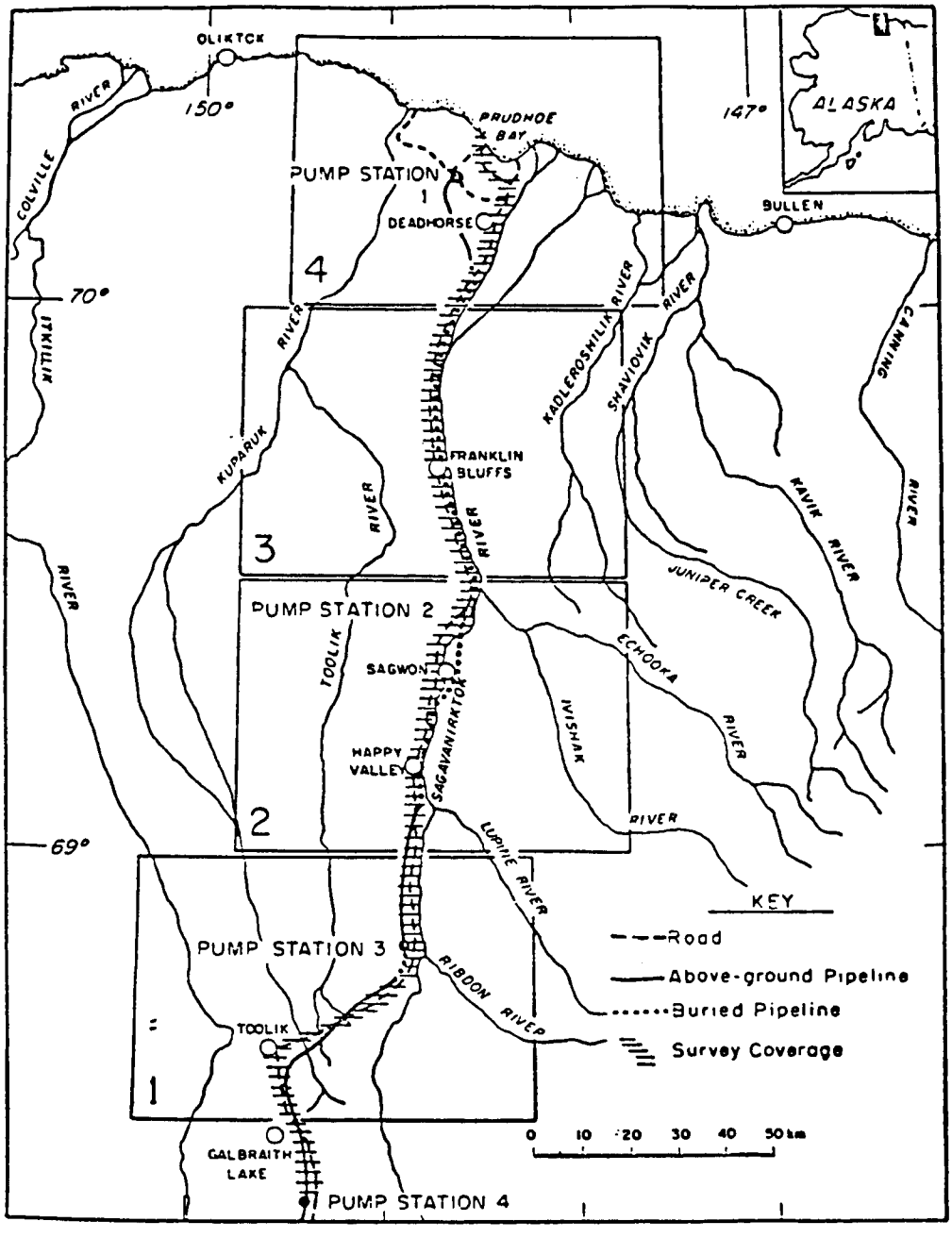

Fig. 1. Road survey coverage within the Trans-Alaska Pipeline corridor/Prudhoe Bay oil field complex, and regional boundaries established for evaluation of seasonal/annual changes in caribou distribution, 1975-82.

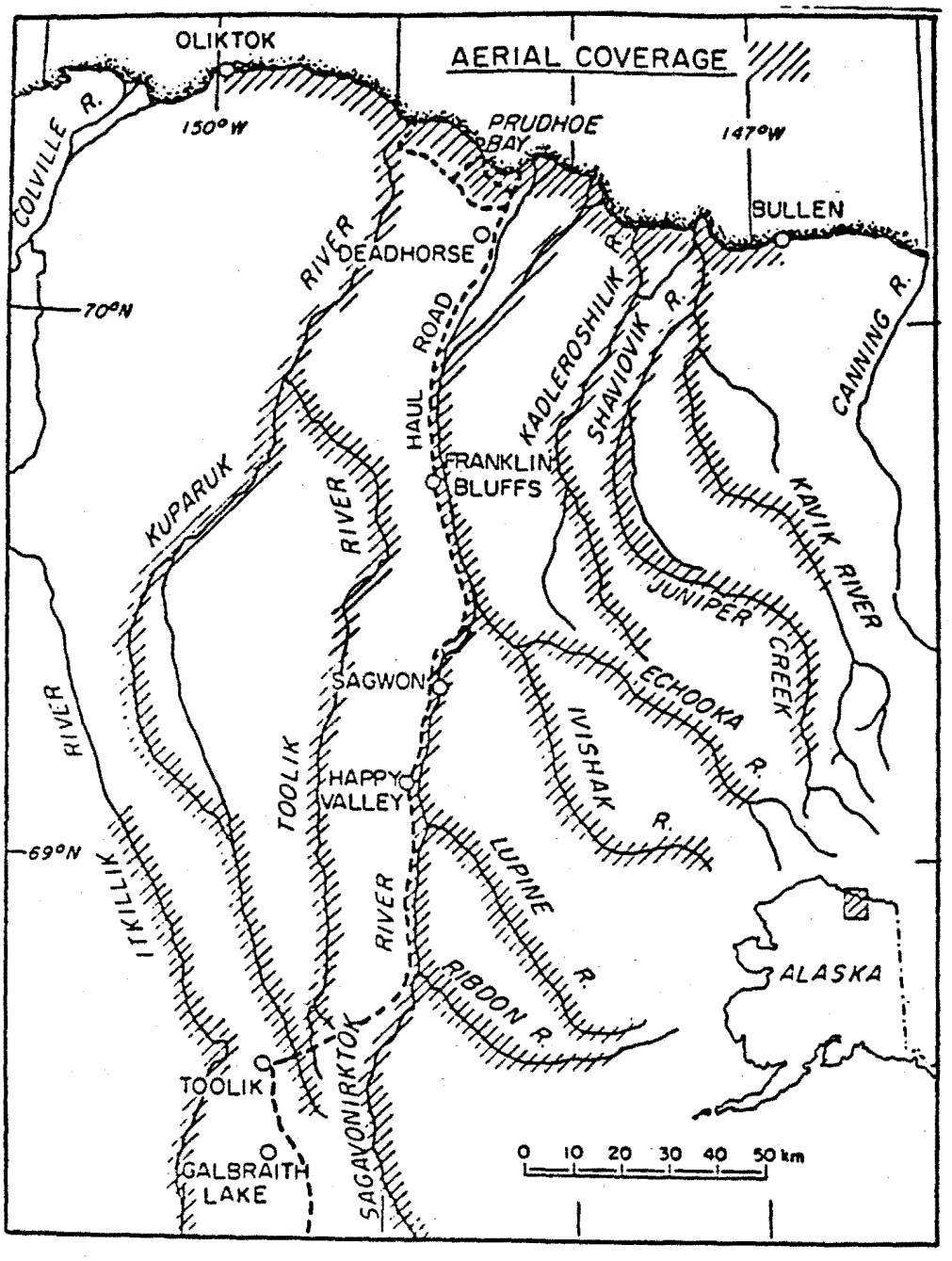

Fig. 2. Aerial survey coverage of the Central Arctic region, 1975-82.

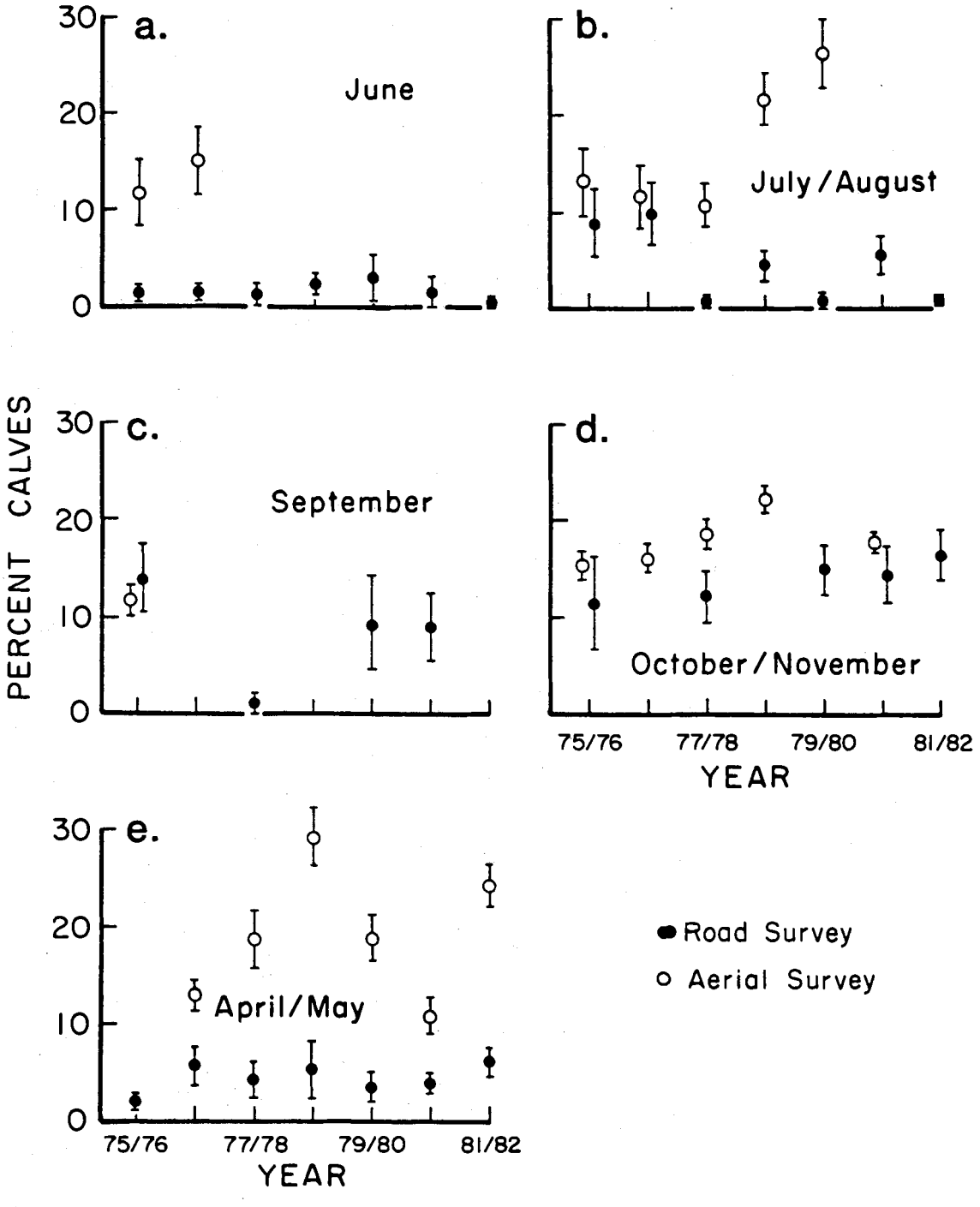

Fig. 3. Comparison of calf percentages among caribou observed during road surveys (Fig. 1) with those determined from systematic aerial surveys of the Central Arctic region (Fig. 2; footnote d, Table 10), a. June, b. July/August, c. September, d. October/November, e. April/May, 1975-82.

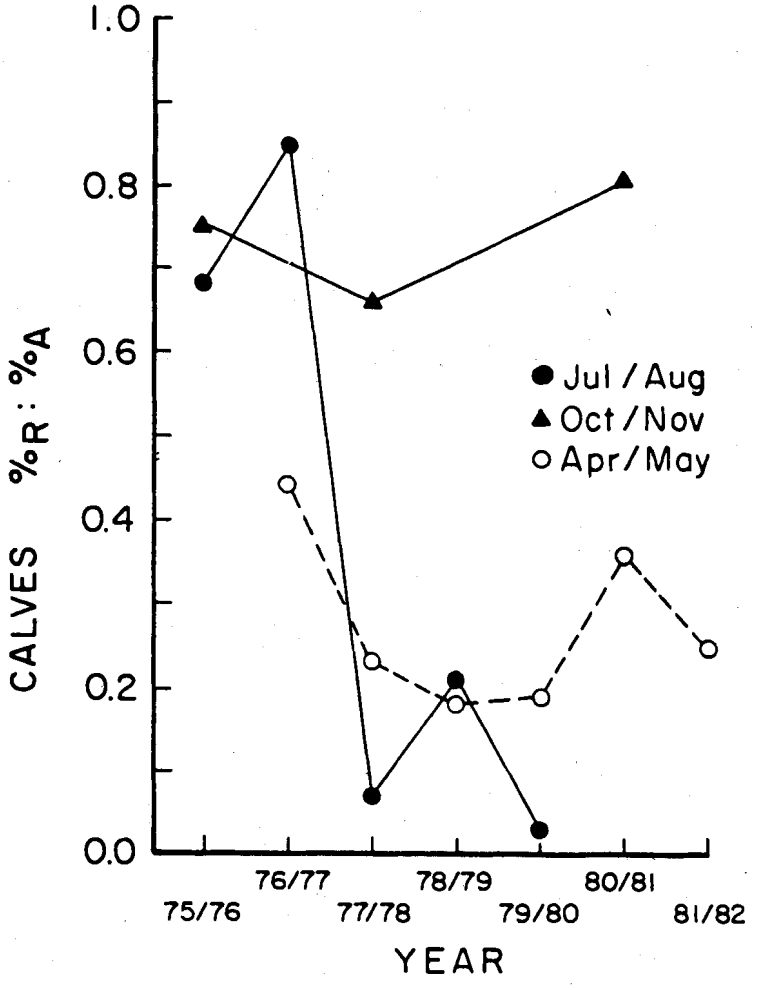

Fig. 4. Seasonal changes in relative calf representation along the Trans-Alaska Pipeline corridor/Prudhoe Bay oil field complex, 1975-82. Note: $\%_R : \%_A$ = ratio of mean calf percentages observed from the road system to those determined by aerial survey (from Table 10, Fig. 3).

Table 1. Schedule of caribou surveys along the Dalton Highway, Alaska, and the numbers of caribou observed within 1,000 m of the road, 1975-82.

Year	Season	Incl. dates	No. of surveys[a]	Observed	
				No. of groups	No. of caribou
1975-76	Summer	11 Jun-24 Aug	12	266	1611
	Fall	3 Sep-22 Nov	7	41	278
	Spring	3 Mar-28 May	9	87	766
1976-77	Summer	8 Jun-26 Aug	12	176	681
	Fall	9 Sep-28 Oct	3	7	33
	Spring	15 Mar-25 May	3	36	351
1977-78	Summer	8 Jun-28 Aug	11	178	746
	Fall	9 Sep-26 Nov	7	61	246
	Spring	26 May-27 May	2	39	284
1978-79	Summer	10 Jun-26 Aug	12	202	861
	Fall	13 Sep-13 Oct	3	9	35
	Spring	11 Mar-30 May	4	41	147
1979-80	Summer	13 Jun-27 Aug	12	279	1553
	Fall	11 Sep-27 Nov	7	71	376
	Spring	10 Apr-29 May	6	68	524
1980-81	Summer	10 Jun-25 Aug	10	166	452
	Fall	9 Sep-25 Nov	11	45	275
	Spring	10 Mar-28 May	12	169	1165
1981-82	Summer	9 Jun-29 Aug	12	132	625
	Fall	13 Sep-24 Nov	12	60	278
	Spring	8 Mar-27 May	12	224	1422

[a] One-way surveys between the southern boundary of Region 1 and the ARCO West Dock (see Fig. 1).

Table 2. Seasonal and annual changes in the composition of caribou within 1,000 m of the Dalton Highway, Alaska, 1975-82.

		Total groups classified[a]				Groups with calves[b]				Groups without calves		
Year	Season	No. of groups	No. of caribou	Bulls[c] %	Calves %	No. of groups	No. of caribou	Bulls[c] %	Calves %	No. of groups	No. of caribou	Bulls[c] %
1975-76	Summer	257	1573	71	7	20	578	33	19	237	995	94
	Fall	36	227	55	13	13	130	27	23	23	97	93
	Spring	82	685	77	3	10	113	33	20	72	572	86
1976-77	Summer	171	665	79	6	16	119	9[d]	34[d]	155	546	94
	Fall	7	33	55[d]	12[d]	2	14	21[d]	29[d]	5	19	79[d]
	Spring	33	330	59	7	7	139	14	17	26	191	92
1977-78	Summer	175	729	89	1	4	21	5[d]	33[d]	171	708	92
	Fall	60	237	70	8	17	84	35	23	43	153	90
	Spring	38	278	83	4	6	56	27	21	32	222	97
1978-79	Summer	202	861	86	4	17	99	13[d]	32[d]	185	762	95
	Fall	9	35	66[d]	9[d]	3	11	9[d]	27[d]	6	24	92[d]
	Spring	41	147	74	5	5	19	16[d]	42[d]	36	128	83
1979-80	Summer	278	1534	91	1	11	60	8	35	267	1474	94
	Fall	68	348	45	14	27	163	22	29	41	185	65
	Spring	68	524	74	4	8	111	51	17	60	413	81
1980-81	Summer	166	452	76	4	10	56	9	32	156	396	86
	Fall	45	275	51	12	18	156	20	21	27	119	92
	Spring	169	1165	45	5	26	265	8	22	143	900	56

Table 2. Continued.

Year	Season	Total groups: No. of groups	Total groups: No. of caribou	Total groups: Bulls[c] %	Total groups: Calves %	Groups with calves[b]: No. of groups	Groups with calves[b]: No. of caribou	Groups with calves[b]: Bulls[c] %	Groups with calves[b]: Calves %	Groups without calves: No. of groups	Groups without calves: No. of caribou	Groups without calves: Bulls[c] %
1981-82	Summer	132	625	91	1	6	22	41[d]	23[d]	126	603	93
	Fall	60	278	46	17	21	170	23	27	39	108	83
	Spring	224	1422	42	7	50	530	21	20	174	892	54

[a] No unknowns present.

[b] One or more calves present.

[c] Minimum percentage of bulls, i.e., excludes younger bulls that were indistinguishable from cows.

[d] Unreliable percentage; computed from small sample.

Table 3. Rates of caribou sightings within 1,000 m of the Dalton Highway, Alaska, (no. of caribou/100 km coverage) by season and region, 1975-82.

Year	Season	Region(s)[a]				
		1	2	3	4	1-4
1975-76	Summer	4	29	72	126	51
	Fall	11	29	18	2	15
	Spring	75	33	2	1	32
1976-77	Summer	2	25	38	30	22
	Fall	<1	5	8	4	4
	Spring	106	24	13	9	44
1977-78	Summer	9	9	71	17	26
	Fall	13	17	14	9	13
	Spring	115	67	1	6	54
1978-79	Summer	10	21	58	25	27
	Fall	7	3	1	7	4
	Spring	7	32	14	4	14
1979-80	Summer	7	22	51	147	49
	Fall	29	8	24	17	20
	Spring	71	34	10	0	33
1980-81	Summer	5	19	15	36	17
	Fall	4	10	23	1	9
	Spring	63	58	10	3	37
1981-82	Summer	5	12	39	30	20
	Fall	20	4	2	4	9
	Spring	119	25	4	<1	45

[a] See Fig. 1.

Table 4. Summary of seasonal and regional mean (±SD) rates of caribou sightings within 1,000 m of the Dalton Highway, Alaska, (no. of caribou/100 km coverage), 1975-82[a].

Season	Region(s)[b]				
	1	2	3	4	1-4
Summer	6 ± 3	20 ± 7	49 ± 20	59 ± 54	30 ± 14
Fall	12 ± 10	11 ± 9	13 ± 9	6 ± 5	11 ± 6
Spring	79 ± 39	39 ± 17	8 ± 5	3 ± 3	37 ± 13

[a] Computed across years (n = 7) using the respective seasonal means for each region and among regions (from Table 3).

[b] See Fig. 1.

Table 5. Distribution and sex/age composition of caribou observed crossing the Dalton Highway and/or Trans-Alaska Pipeline during road surveys, summer-spring 1975-82.

Region[a]	No. of groups	No. of caribou	No. (%)				
			Bulls	Cows	Calves	Yearlings	Adults
1	38	142	126 (89)	1 (1)	0 (0)	1 (1)	14 (10)
2	26	128	95 (76)	7 (5)	3 (2)	12 (9)	11 (8)
3	37	216	170 (79)	17 (8)	9 (4)	6 (3)	14 (6)
4	22	617	554 (90)	28 (5)	20 (3)	8 (1)	7 (1)
Totals	123	1,103	945 (85)	53 (5)	32 (3)	27 (2)	46 (4)

[a] See Fig. 1.

Table 6. Rates of caribou crossings of the Dalton Highway and/or Trans-Alaska Pipeline, Alaska, (no. of crossings/100 km coverage) by season and region, 1975-82.

Year	Season	Region(s)[a]				
		1	2	3	4	1-4
1975-76	Summer	0.3	0.4	2.6	3.5	1.5
	Fall	0	0	0	0	0
	Spring	0.9	0.4	0.3	0.6	0.6
1976-77	Summer	0.2	0.1	0.6	5.7	1.4
	Fall	0	0	0	0	0
	Spring	0	0	0	0	0
1977-78	Summer	0.9	0.1	0	0.2	0.3
	Fall	1.2	2.0	1.1	1.9	1.5
	Spring	6.0	6.3	0	0	3.4
1978-79	Summer	0.3	0.9	1.9	0.2	0.8
	Fall	0	0	0	0	0
	Spring	0	5.9	1.6	0.5	1.9
1979-80	Summer	1.2	0.8	2.3	86.4	18.3
	Fall	2.0	0	1.1	0	0.9
	Spring	2.4	0	0.5	0	0.9
1980-81	Summer	0.4	0.5	1.4	0.2	0.6
	Fall	0	1.0	1.3	0	0.6
	Spring	0	3.8	0.9	0	1.1
1981-82	Summer	0.9	1.1	14.9	0.5	4.3
	Fall	1.2	0.5	0	0	0.5
	Spring	4.2	3.3	0	0	2.1

[a] See Fig. 1.

Table 7. Summary of seasonal and regional mean (±SD) rates of caribou crossings of the Dalton Highway and/or Trans-Alaska Pipeline (no. of crossings/100 km coverage), 1975-82[a].

Season	Region(s)[b]				
	1	2	3	4	1-4
Summer	0.6 ± 0.4	0.6 ± 0.4	3.4 ± 5.2	13.8 ± 32.1	3.9 ± 6.5
Fall	0.6 ± 0.8	0.5 ± 0.8	0.5 ± 0.6	0.3 ± 0.7	0.5 ± 0.6
Spring	1.9 ± 2.4	2.8 ± 2.7	0.5 ± 0.6	0.2 ± 0.3	1.4 ± 1.1

[a] Computed across years (n = 7) using the respective seasonal means for each region and among regions (from Table 6).

[b] See Fig. 1.

Table 8. Schedule of systematic aerial surveys[a] in the central Arctic region, and the numbers of caribou observed, 1975-82.

Year	Season	Incl. dates	Aircraft[b]	Observations	
				Number of groups	Number of caribou
1975-76	Summer	25-27 Jun	F	102	852
	Summer	7-11 Aug	F	81	555
	Fall	22-25 Sep	F	29	675
	Fall	18-24 Nov	F	131	1007
1976-77	Summer	30 Jun-2 Jul	F	92	843
	Summer	11-12 Aug	F	92	293
	Fall	12-15 Oct	H	200	1275
	Spring	3-7 May	H	114	757
1977-78	Summer	11-16 Aug	F	187	517
	Fall	10-16 Oct	H	152	696
	Spring	20 Apr-11 May	H	75	350
1978-79	Summer	9-10 Aug	F	81	311
	Fall	22-26 Oct	H	170	801
	Spring	11-12 May	H	82	499
1979-80	Summer	25 Aug	F	44	134
	Spring	24 Apr-1 May	H	139	1336
1980-81	Fall	30-31 Oct	H	147	1728
	Spring	27-30 Apr	H	141	998
1981-82	Fall	25 Oct-7 Nov	H	145	1712
	Spring	27 Apr-1 May	H	100	1674

[a] See Cameron and Whitten 1979.

[b] F = fixed-wing (C-180 or C-185), H = helicopter (Bell 206B).

Table 9. Seasonal and annual changes in the composition of caribou observed during aerial surveys of the central Arctic region, 1975-82.

Year	Season	Total groups classified[a]				Groups with calves[b]				Groups without calves		
		No. of groups	No. of caribou	% Bulls[c]	% Calves	No. of groups	No. of caribou	% Bulls[c]	% Calves	No. of groups	No. of caribou	% Bulls
1975-76	Summer	77	668	37	17	23	364	1	31	54	304	81[c]
	Summer	72	525	35	23	28	334	2	37	44	191	93[c]
	Fall	23	398	43	15	19	354	37	17	4	44	91[c,d]
	Fall	121	899	22	17	80	639	6	24	41	260	60[c]
1976-77	Summer	91	842	29	17	22	437	0	33	69	405	60[c]
	Summer	92	293	24	15	25	132	2	34	67	161	42[c]
	Fall	200	1275	45	17	92	1007	35	21	108	268	81
	Spring	114	757	33	16	71	490	14	25	43	267	69
1977-78	Summer	186	509	44	15	41	233	10	33	145	276	73[c]
	Fall	151	664	38	20	72	528	28	25	79	136	76
	Spring	75	350	21	23	54	262	13	30	21	88	43
1978-79	Summer	80	287	27	22	32	191	6	34	48	96	69[c]
	Fall	170	801	34	23	102	667	24	28	68	134	81
	Spring	82	499	36	24	50	346	17	34	32	153	80
1979-80	Summer	44	134	20	20	18	85	2	32	26	49	51[c,d]
	Spring	137	1302	45	19	62	877	29	28	75	425	79
1980-81	Fall	147	1728	44	18	93	1471	36	21	54	257	92
	Spring	141	998	50	13	56	506	21	25	85	492	81
1981-82	Fall	145	1712	33	26	119	1639	31	27	26	73	88
	Spring	100	1674	40	22	58	1380	29	27	42	294	94

Table 9. Continued.

[a] No unknowns present.

[b] One or more calves present.

[c] Minimum percentage of bulls (i.e., excludes young bulls that were indistinguishable from cows during fixed-wing surveys).

[d] Unreliable percentage; computed from small sample.

Table 10. Comparision of caribou calf percentages determined by surveys along the Dalton Highway with those determined by aerial surveys of the central Arctic region, 1975-82.

Year	Month(s)	% Calves,[a] $\bar{x}$ ± SE(N[b]) Road[c]	Air[d]	t test[e]
1975-76	Jun	1.2 ± 0.8 (81)	11.7 ± 3.4 (53)	S
	Jul/Aug	8.9 ± 3.5 (181)	13.1 ± 3.5 (48)	NS
	Sep	13.9 ± 3.6 (22)	11.7 ± 1.6 (13)	NS
	Oct/Nov	11.5 ± 4.7 (14)	15.4 ± 1.5 (91)	NS
1976-77	Jun	1.3 ± 0.7 (69)	15.0 ± 3.4 (59)	S
	Jul/Aug	9.9 ± 3.2 (102)	11.6 ± 3.3 (73)	NS
	Apr/May	5.8 ± 2.0 (31)	13.1 ± 1.7 (80)	S
1977-78	Jul/Aug	0.8 ± 0.5 (111)	10.7 ± 2.2 (123)	S
	Oct/Nov	12.2 ± 2.6 (33)	18.6 ± 1.4 (97)	S
	Apr/May	4.3 ± 1.8 (38)	18.9 ± 3.0 (38)	S
1978-79	Jul/Aug	4.5 ± 1.5 (129)	21.7 ± 2.6 (76)	S
	Apr/May	5.4 ± 2.9 (41)	29.3 ± 3.0 (35)	S
1979-80	Jul/Aug	0.8 ± 0.5 (194)	26.4 ± 3.6 (19)	S
	Apr/May	3.6 ± 1.5 (68)	19.0 ± 2.2 (120)	S
1980-81	Oct/Nov	14.5 ± 2.9 (21)	17.8 ± 1.0 (126)	NS
	Apr/May	4.0 ± 1.0 (134)	11.0 ± 1.9 (86)	S
1981-82	Apr/May	6.1 ± 1.4 (186)	24.4 ± 2.1 (57)	S

[a] Based on groups with no unclassified (unknown) caribou.

[b] Number of groups.

[c] Road survey observations of caribou within an estimated 1,000 m of the Dalton Highway, Regions 1-4 (Fig. 1).

[d] Aerial survey observations of caribou (Fig. 2); excludes nonriparian coastal coverage and that portion of the Sagavanirktok River south of Region 4 (see Fig. 2).

[e] At the 95% confidence interval.