SMITH

COMPARATIVE MOVEMENTS OF SATELLITE-COLLARED CARIBOU NEAR AND DISTANT FROM OIL DEVELOPMENT IN ARCTIC ALASKA

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Abstract: Between 1987 and 1989, 15 adult female caribou (Rangifer tarandus granti) of the Central Arctic Herd were equipped with satellite transmitters and located at least once daily for 1-3 summers (May-August). Of the 23 caribou-summers, 11 apply to an area outside oil development east of the Prudhoe Bay, and 12 are for areas within or near the Kaparuk Oilfield. We compared movement rates and activity patterns of parturient and nonparturient cows within, and distant from, oil development during the calving and insect periods. For example, during the 1988 insect period (July and August), satellite-collared cows within the Kuparuk Oilfield more than doubled their daily rate of movement as compared with the preceding calving period (May and June). Also, cows with calves crossed the major road/pipeline system less frequently than one cow without a calf.

We are currently using satellite collars on Central Arctic Herd (CAH) caribou to determine daily movement rates and activity patterns of caribou influenced by oil development. As with many new methods, we have had to modify our original objectives to fit the

strengths and weaknesses of the data generated by this application of space technology.

Transmitters on collared CAH caribou send ultra high-frequency signals to sun-synchronous polar-orbiting Tiros-N weather satellites which transfer the signals to facilities in Maryland and France (Fancy et al. 1988). The data are analyzed for a Doppler shift in the carrier frequency to determine the geographical location of the transmitter. The transmitter collars also contain mercury tip switches to measure activity. For each 1-min period a microprocessor sums the number of 1-sec intervals during which the switch was activated by neck movements, and then sums all 1-min counts for each 24-h period. This total is then relayed as part of the transmitter signal.

Between 1987 and 1989, 12 adult female caribou of the CAH were fitted with satellite transmitters and located at least once daily for 1-3 summers (May-Aug). Data were collected for 16 caribou summers; 12 are for the Kuparuk Oilfield area west of Prudhoe Bay, and 4 apply to an undisturbed control area east of oil development at Prudhoe Bay. In 1987, there was a strong correlation between mean daily distance traveled and daily activity counts for collared cows both east and west of Prudhoe Bay (Fig. 1); the mean distance traveled was similar in the 2 areas, but activity comparisons were inconclusive because of a large variance in summer activity counts. Unfortunately, transmitter failures, movements of collared cows 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.

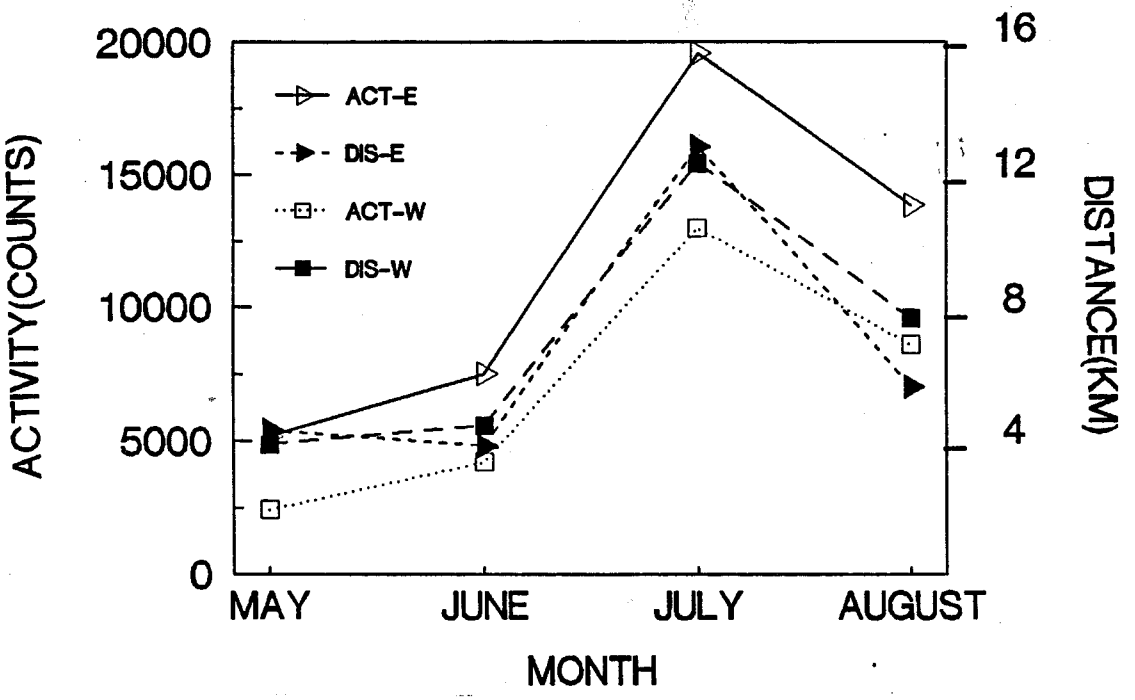

Fig. 1. Mean daily activity counts (ACT) and mean daily distance traveled by satellite-collared female caribou east (E) and west (W) of oilfield development, Prudhoe Bay Region, summer 1987.

In most years, parturient cows are near calving areas on the coastal plain by the beginning of May, and daily movements for the month are limited and localized (Figs. 2 and 3). In contrast, most cows were still 150 km south of the calving grounds in mid-May 1989, and collared cows moved significantly farther before calving. These longer movements may have affected calf viability. For example, in 1989, caribou S23 moved 150 km north in May and early June to calve near her 1987 calving site, but her calf died within a day, whereas

in 1987 her calf survived at least through the following spring. Movements in June were also localized, and cows selected sites away from oil facilities for calving.

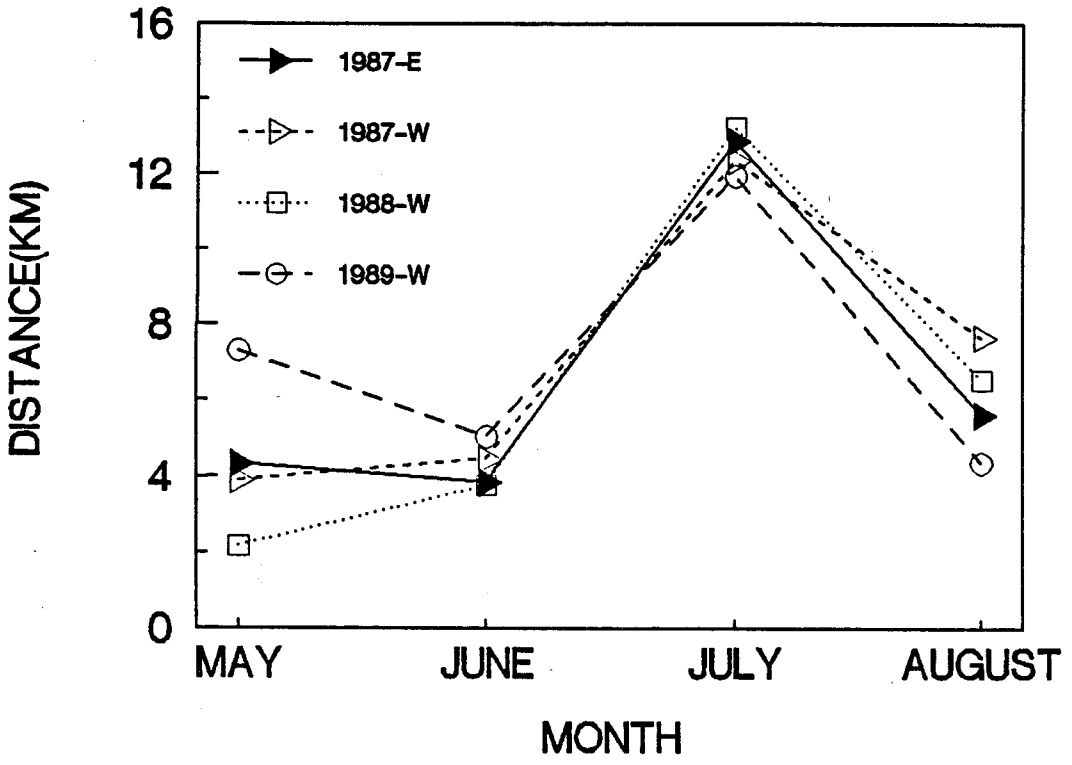

Fig. 2. Mean daily distance traveled by satellite-collared female caribou east (E) and west (W) of oilfield development, Prudhoe Bay region, summer 1987-89.

Mean distances traveled within eastern and western areas in July were similar but appreciably greater than in May and June; caribou moved between coastal insect relief habitat and inland feeding areas and along the coast in response to mosquitoes and oestrid flies (Figs 2 and 4). Movements in August were localized and nondirectional, primarily in response to oestrid flies; daily distances traveled were intermediate between those in June and July.

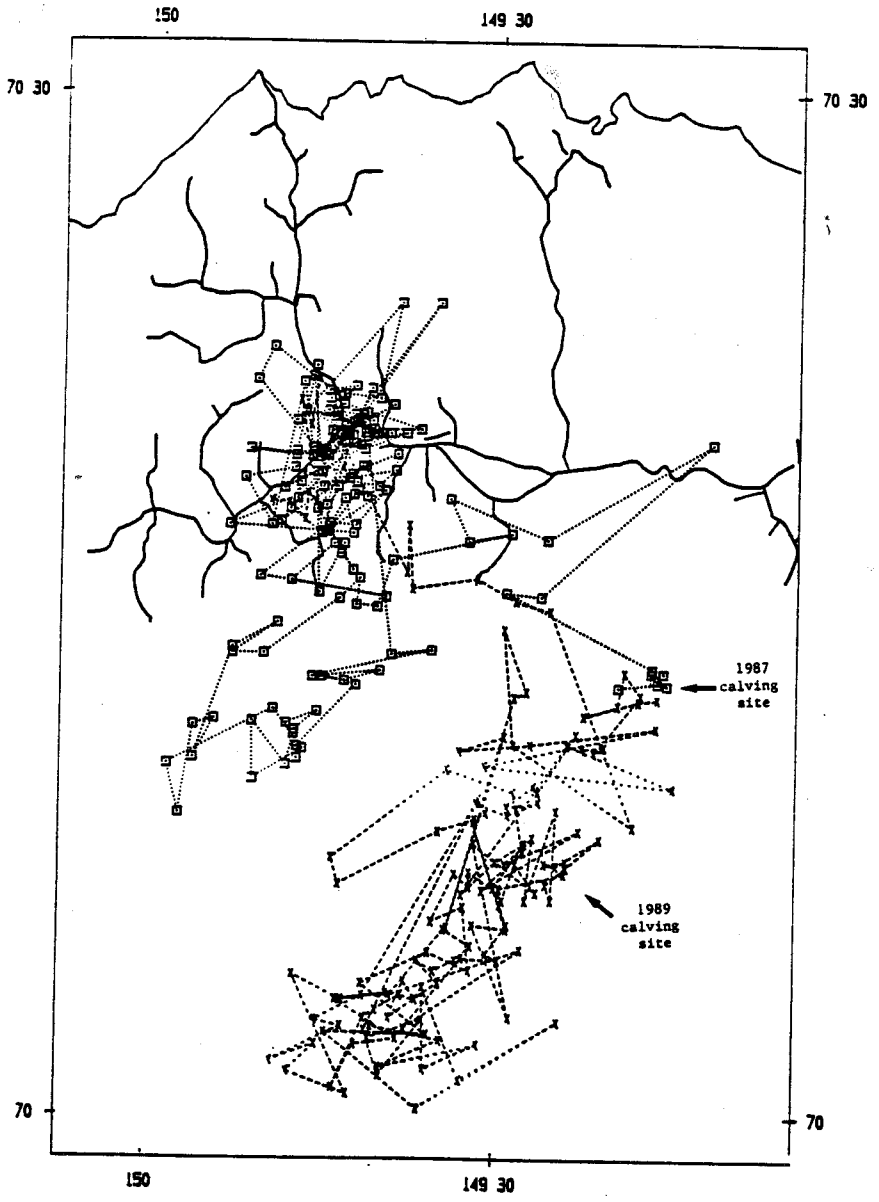

Fig. 3. Satellite locations of cow caribou S23 near the Kuparuk Oilfield, May (..□..) and June (--x--).

We also used plots of satellite locations to examine the frequency with which cows with and without calves crossed the main road/pipeline corridor in the Kuparuk Oilfield (Fig. 4). During the 1988 mosquito season, 1 cow without a calf crossed 8 times, compared with 3.7 crossings for 3 cows with new calves, thereby supporting other reports of increased sensitivity of parturient and maternal cows to disturbance (Smith and Cameron 1985, Dau and Cameron 1986, Johnson and Lawhead 1988).

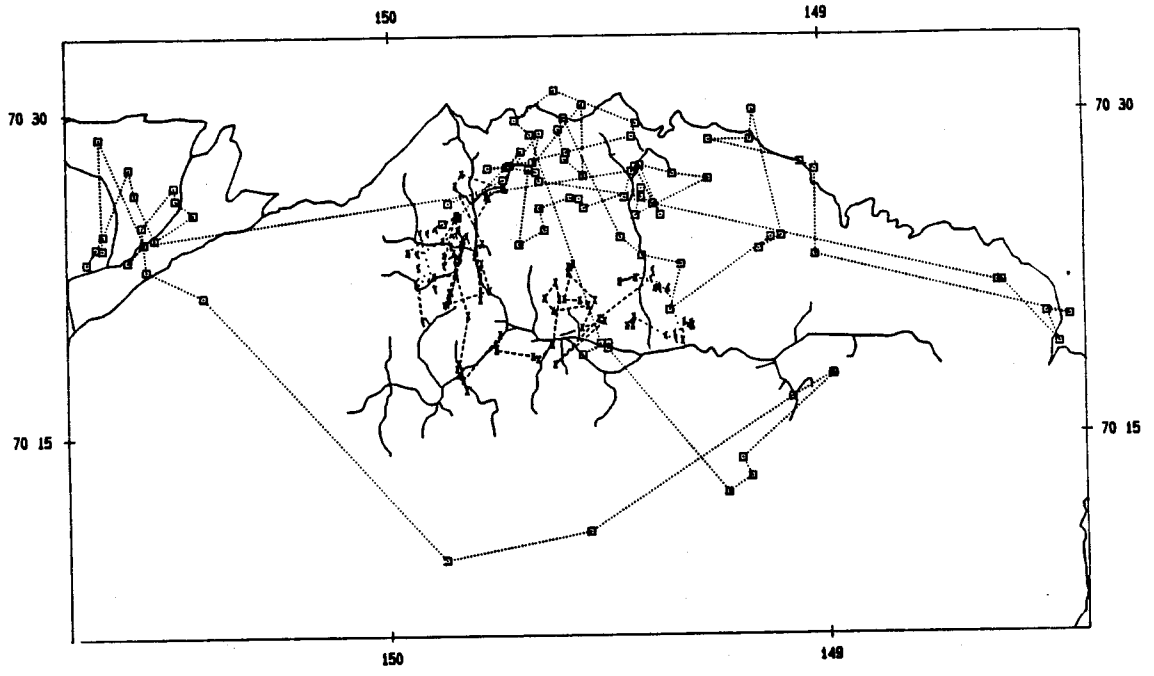

Fig. 4. Satellite locations of cow caribou S24 near the Duparuk Oilfield, July (...□...) and August (--x--) 1988.

Although satellite tracking is a useful tool for wildlife researchers and managers, study objectives must be formulated carefully to ensure scientific validity and cost efficiency. Although the cost per location is low, collars remain expensive ($3,500), and the 12-month data processing cost for 1 collar is $3,500. Even though new generation collars can be programmed to transmit for shorter periods during selected seasons, batteries limit the total transmission time to 3 months. These limitations mean that sample size can be quite small. We had planned to compare the movement data from collared cows over 3 summers to evaluate the sensitivity of cows to pipeline corridors during the July insect period (see above); however, in 1987, all 4 cows produced calves, whereas in 1989, none of the 4 cows produced viable calves. As differences in the level of insect harassment precluded lumping the 3 years' data, we were left with the limited efficacy of the 1988 data reported above.

Another problem involves location error. The mean error is 839 m (26 SE, n = 1,265), and the maximum error may approach 9 km (Fancy 1988). Although such errors may be inconsequential when tracking long, straightline movements (e.g., during migration or mosquito-related movements along the coast), the inaccuracy of locations within the Kuparuk Oilfield in May and June complicates the determination of both mean daily movements and crossings of specific linear structures (Fig. 3). An alternative objective, such as comparing distances to the nearest road, pipeline, or facility, might be more feasible.

Originally we had hoped to compare activity budgets of caribou near and away from oil development. The 1-min counts can distinguish between running and walking but not between feeding and lying (Harris et al., in press), precluding an estimate of a total activity budget. Although much of the variance in activity counts among collars can be attributed to the position and snugness of the collar on the caribou's neck and to the angle of the mercury tip-switch within the satellite collar, more research must be done before we can delineate all specific activities with confidence.

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4th NORTH AMERICAN CARIBOU WORKSHOP

ST. JOHN'S, NEWFOUNDLAND

OCTOBER 31 - NOVEMBER 3, 1989

PROCEEDINGS

Edited by: Charlie Butler and Shane P. Mahoney

Technical Editors: John Blake, Margo Hoban and Brian Tucker

Artist: Frank LaPointe

Newfoundland and Labrador Wildlife Division

February 1991

Citation example:

Eastland, W.G. 1991. Correlations of weather and autumn caribou movements in Butler, C.E. and Mahoney, S.P. (eds.). Proceedings 4th North American Caribou Workshop. St. John's, Newfoundland. pp 143 - 145.