

WOLVES

Wolves were observed by a minimum of 7% (1991) to 13% (1989) of passengers on an annual basis (Table 87). Percentage of passengers who observed wolves varied by month from a low of 0 in September, 1988, 1990 May, 1989, to a high of 23% in September of 1989. There was no one month when wolf observations were consistently highest or lowest, nor was a seasonal pattern of increase or decrease detectable. There was no advantage in bus type, as one month shuttle passengers would report more wolves, and the next month, tour passengers would report more observations.

Wolves made up less than 2% of all stops to observe wildlife on an annual basis (Fig.176). On a monthly basis, wolves made up from 0% to a high of 3% of all stops. No month showed a consistent highest or lowest level for stops to observe wolves (Fig. 176). Stops for wolves were more opportunistic than for other species.

Young wolves were rarely observed. Only one of the 191 records was of young wolves, when on August 28, 1989, a group of seven was observed.

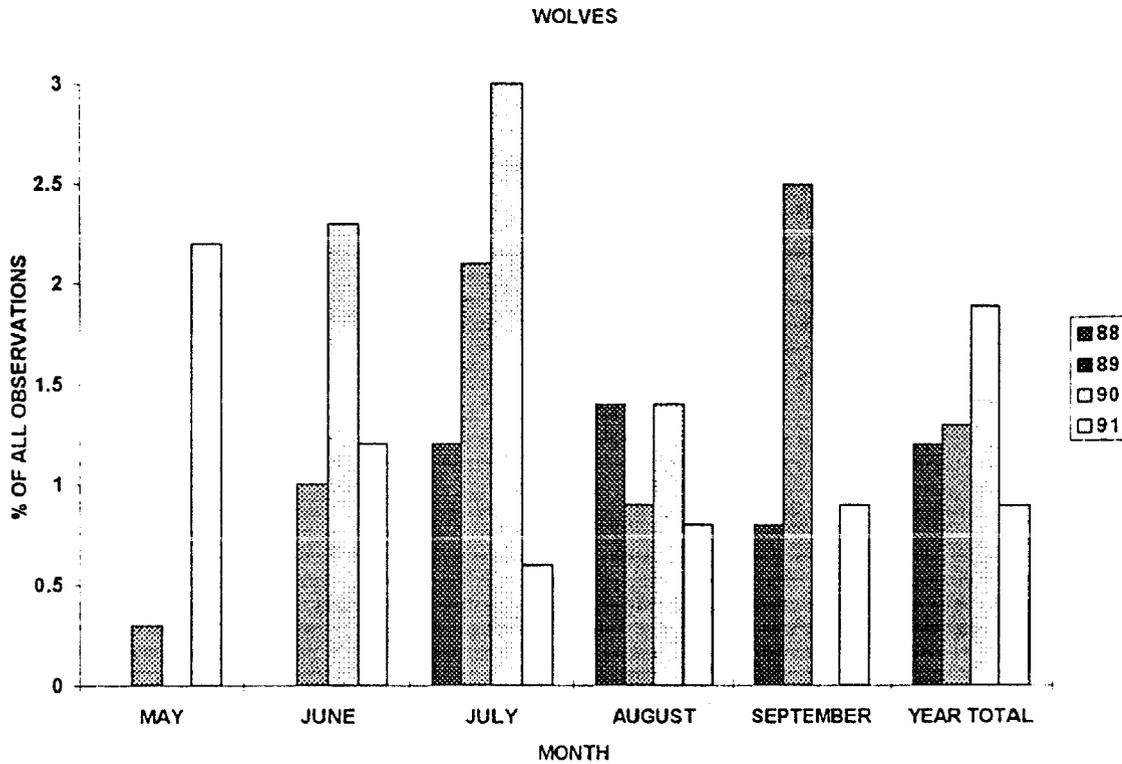
Table 87. Percentage of passengers who observed wolves by month and year.

SPECIES	YEAR	MONTH	PASSENGER OBSERVERS	TOTAL PASSENGERS	PERCENT WHO OBSERVED
WOLF	1988 SHUTTLE	JULY	385	2781	13.84
		AUGUST	362	2469	14.66
		SEPTEMBER	107	1045	10.24
		TOTAL	854	6295	13.57
	TOUR	JULY	488	5494	8.88
		AUGUST	480	5250	9.14
		SEPTEMBER	0	1496	0
		TOTAL	968	12240	7.91
	TOTAL	JULY	873	8275	10.55
		AUGUST	842	7719	10.91
		SEPTEMBER	107	2541	4.21
		TOTAL	1822	18535	9.80

Table 87. Concluded.

1989					
SHUTTLE	MAY	0	439	0	
	JUNE	224	2224	10.55	
	JULY	198	1807	10.07	
	AUGUST	184	1886	9.76	
	SEPTEMBER	105	433	24.25	
	TOTAL	711	6789	10.47	
	TOUR	MAY	48	414	11.59
		JUNE	428	2705	15.82
		JULY	586	3568	16.42
		AUGUST	228	3393	6.72
		SEPTEMBER	359	1548	23.19
		TOTAL	1649	11628	14.18
	TOTAL	MAY	48	853	5.63
		JUNE	652	4929	13.23
		JULY	784	5415	14.48
		AUGUST	412	5279	7.80
		SEPTEMBER	464	1981	23.42
		TOTAL	2360	18457	12.79
.....					
1990	MAY	74	715	10.35	
	JUNE	497	3231	15.38	
	JULY	609	3691	16.50	
	AUGUST	290	3508	8.27	
	SEPTEMBER	0	1108	0	
	TOTAL	1470	12253	12.00	
.....					
1991	MAY	125	688	18.17	
	JUNE	325	2576	12.62	
	JULY	176	4025	4.37	
	AUGUST	191	3534	5.40	
	SEPTEMBER	48	849	5.65	
	TOTAL	865	11672	7.40	

FIG. 176. Percent of total observations of caribou, Dall's sheep, grizzly bears, moose, and wolves that were of wolves during four years.



Wolves were observed from milepost 20-82 in 1988, and from milepost 30-65, with one observation at milepost 4 in 1989 (Figs. 176 & 177). Wolf groups of 2 or more were confined between mileposts 35 to 58.

FIG. 177. NUMBER OF WOLVES PER OBSERVATION BY MILEPOST, 1988.

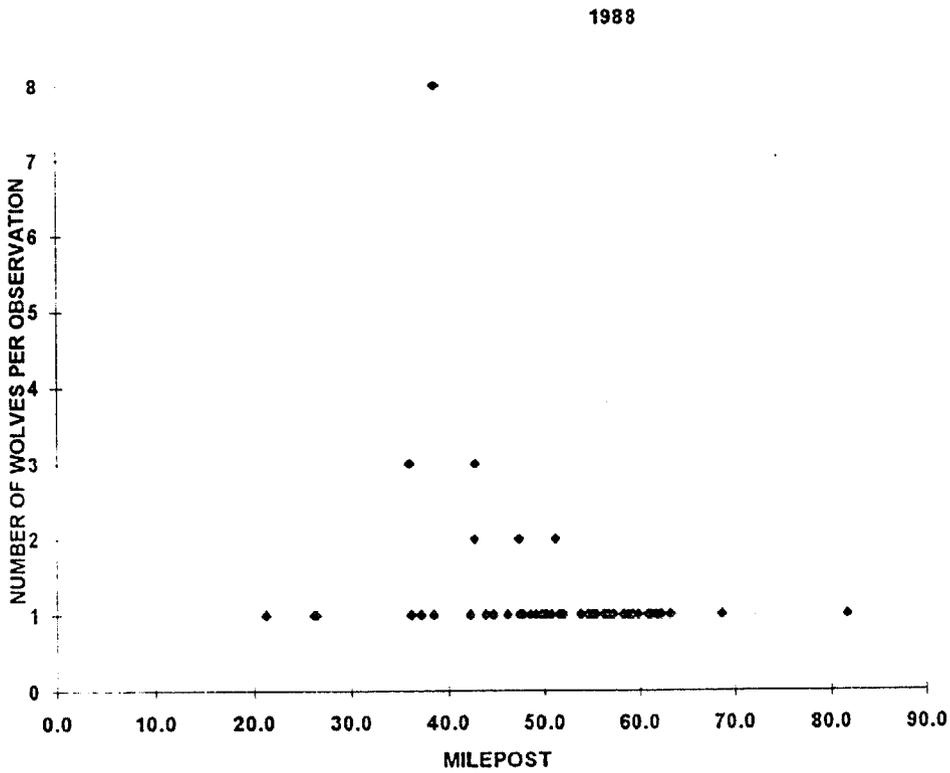
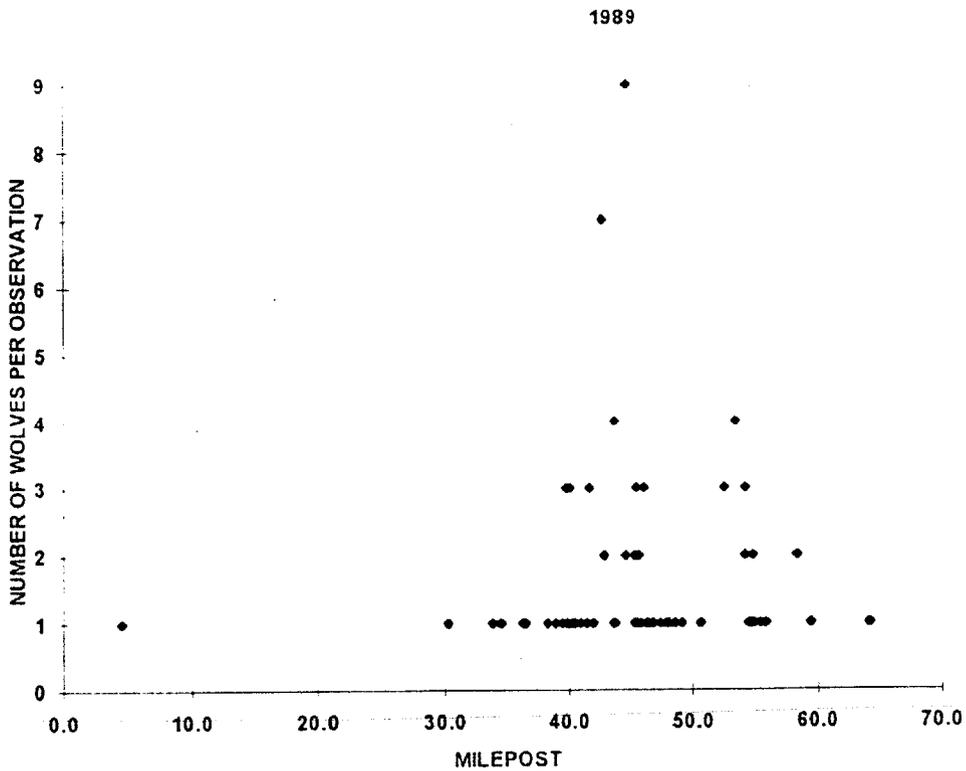


FIG. 178. NUMBER OF WOLVES PER OBSERVATION BY MILEPOST, 1989.



Mean number of wolves per milepost per bus trip was plotted for each month of 1989, and for the 1989 season to show areas of primary wolf habitat(Figs. 179-184). During May, no wolves were observed (Fig. 179). During other months, wolves were reported from mileposts between 39 and 65 (Figs. 180-183). A mean of .03 wolf per bus trip per milepost was the highest level recorded. That number was during July at milepost 55 (Fig. 181).

Combined annual observations show wolves occurring from mileposts 38-65. An annual mean of .04 wolf per bus trip was recorded at milepost 55 (Fig. 184).

FIG. 179. MEAN NUMBER OF WOLVES PER MILEPOST PER BUS TRIP, MAY, 1989

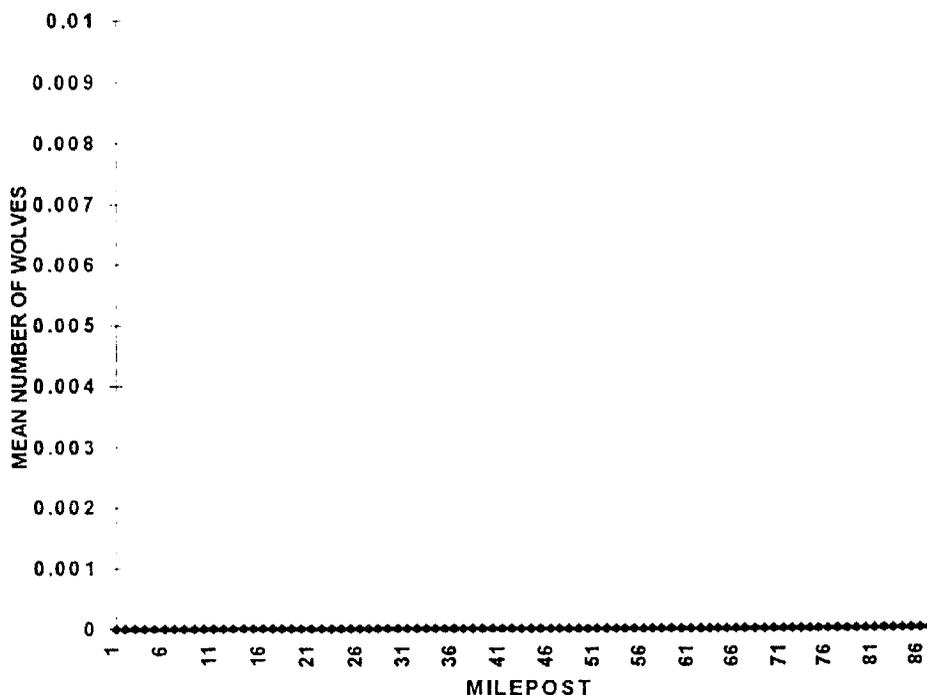


FIG. 180. MEAN NUMBER OF WOLVES OBSERVED PER MILEPOST PER BUS TRIP, JUNE, 1989

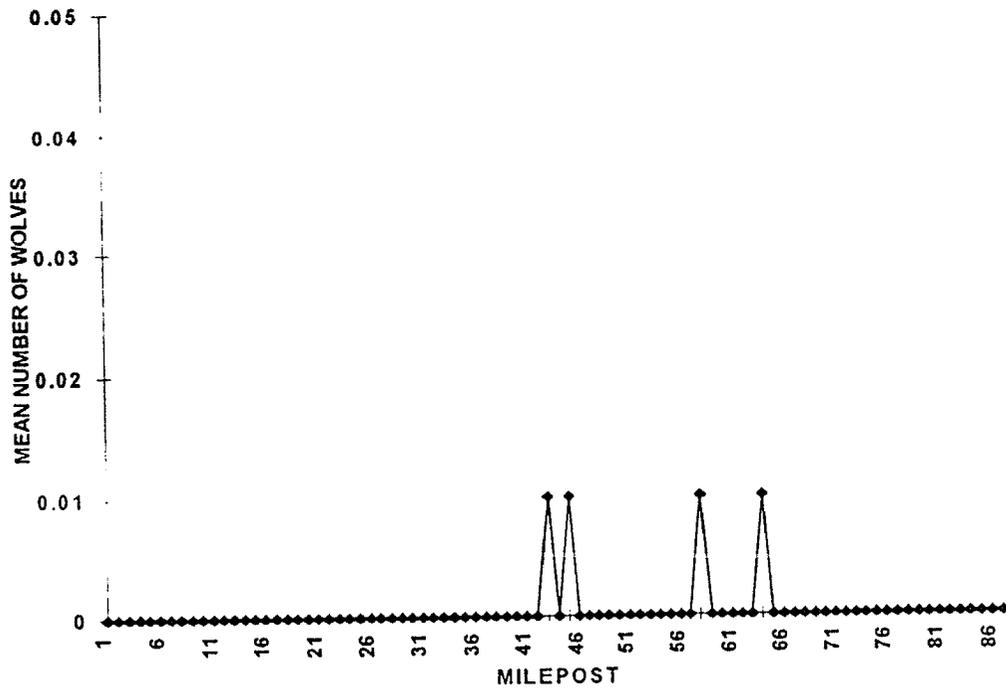


FIG. 181. MEAN NUMBER OF WOLVES OBSERVED PER MILEPOST PER BUS TRIP, JULY, 1989

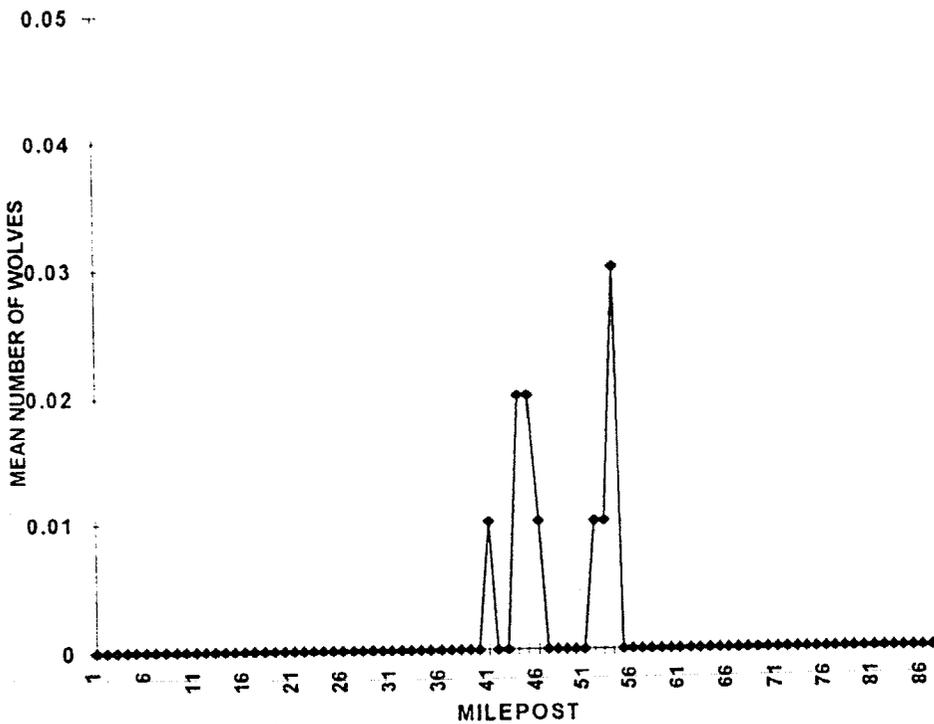


FIG. 182. MEAN NUMBER OF WOLVES OBSERVED PER MILEPOST PER BUS TRIP, AUGUST, 1989

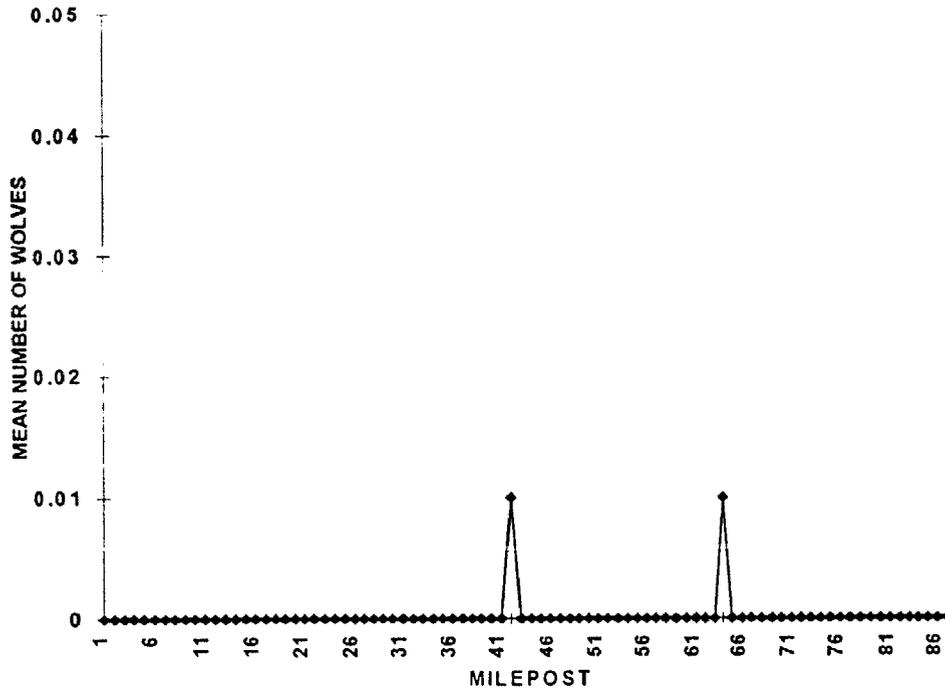


FIG. 183. MEAN NUMBER OF WOLVES OBSERVED PER MILEPOST PER BUS TRIP, SEPTEMBER, 1989

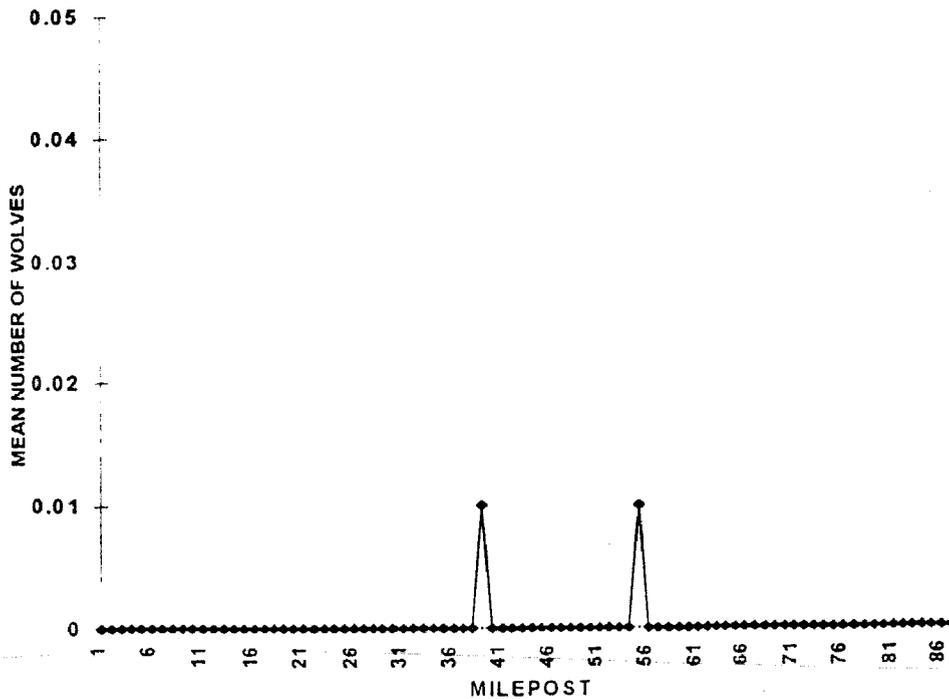


FIG. 184. MEAN NUMBER OF WOLVES OBSERVED PER MILEPOST PER BUS TRIP-1989

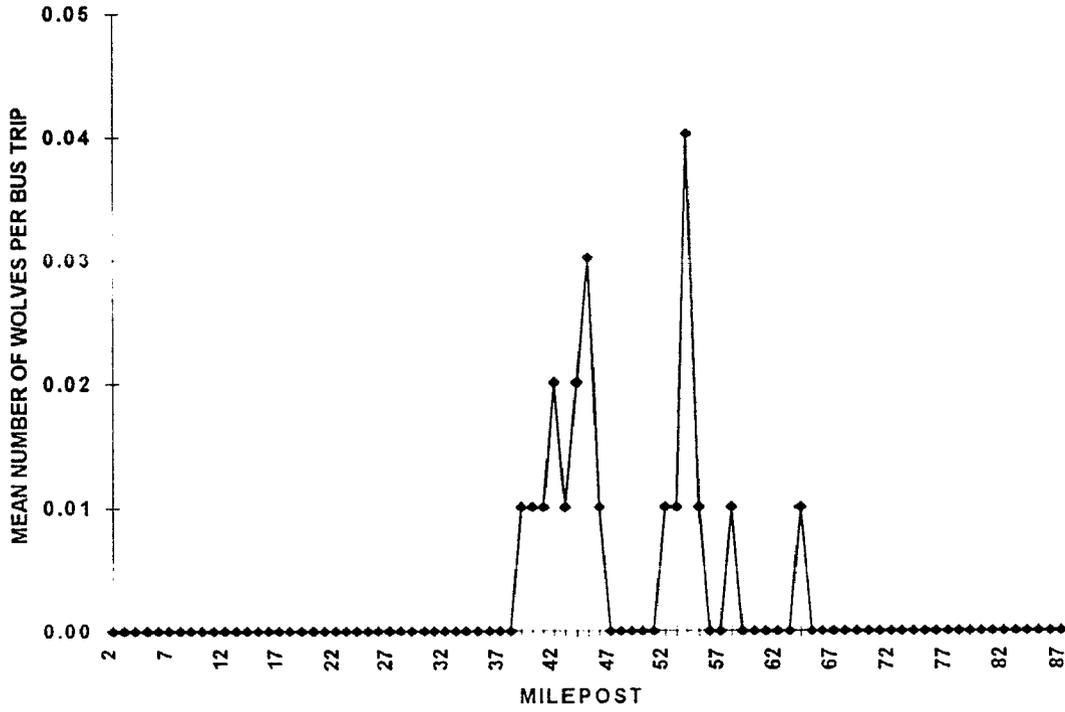


FIG. 185. NUMBER OF WOLVES PER OBSERVATION BY JULIAN DATE, 1988

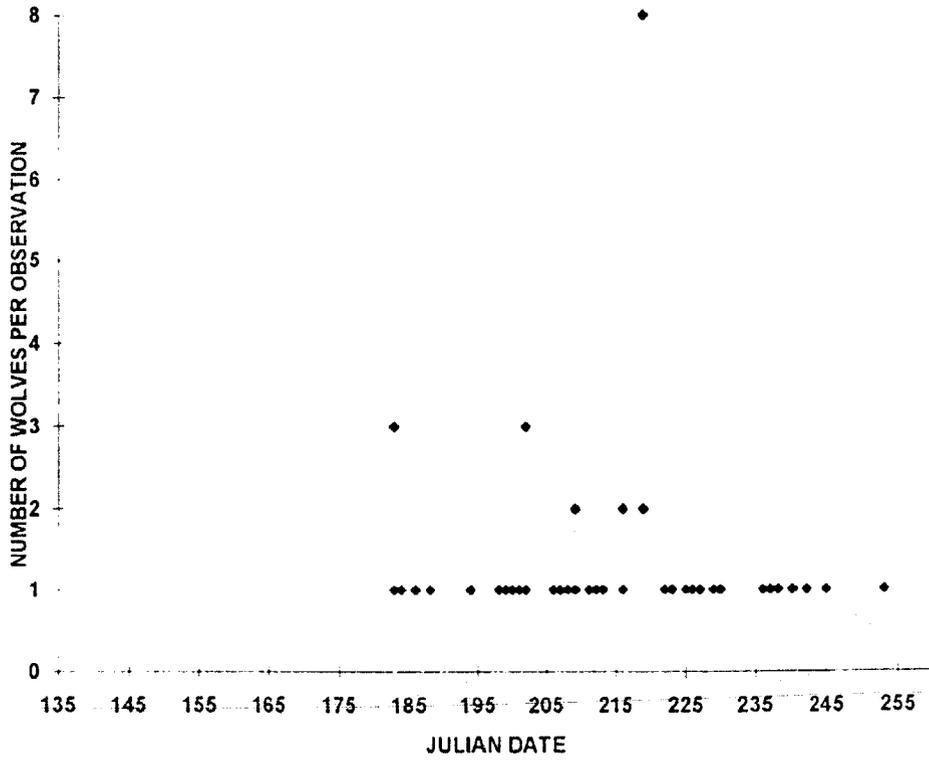
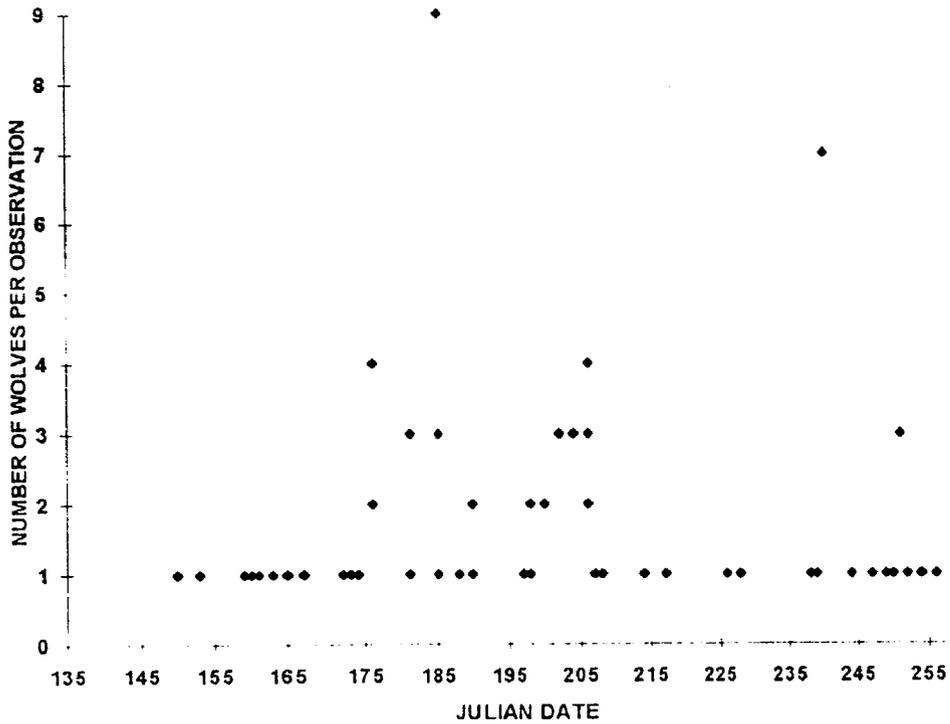


FIG. 186. NUMBER OF WOLVES PER OBSERVATION BY JULIAN DATE, 1989



Wolves were observed from the beginning of the observation season to the end (Figs. 185 & 186). Largest group size was typically observed just prior to or during mid-season.

Distance categories graphed by date showed wolves present in approximately the same distance categories throughout the season (Figs. 187 & 188). Most observations were of wolves near, or on the road, or at 100 m or > distance.

FIG. 187. WOLF OCCURRENCE BY DISTANCE CATEGORY AND JULIAN DATE, 1988

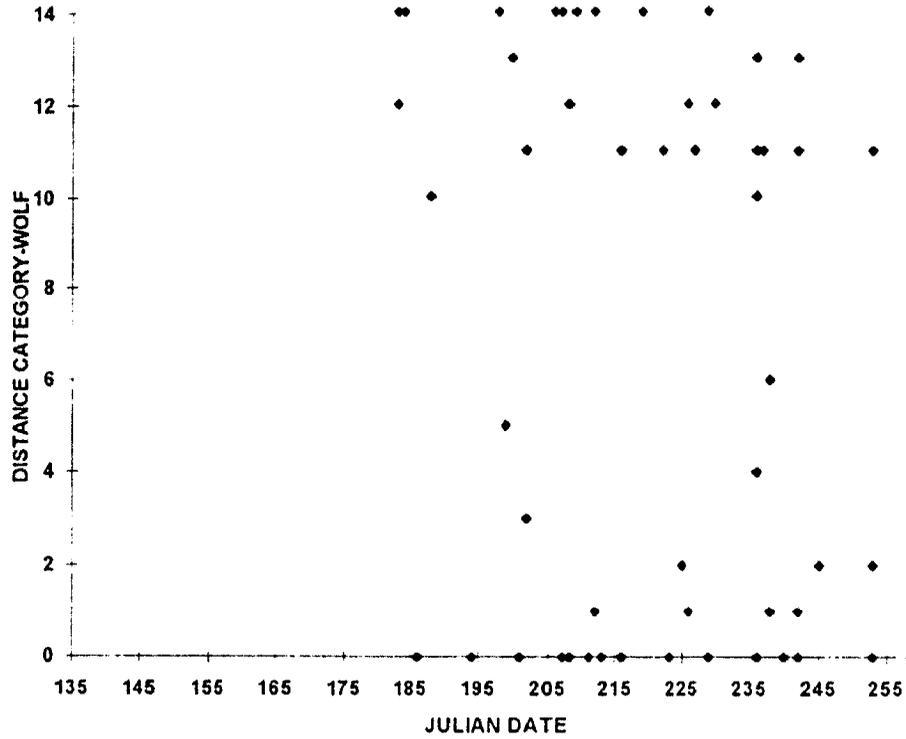
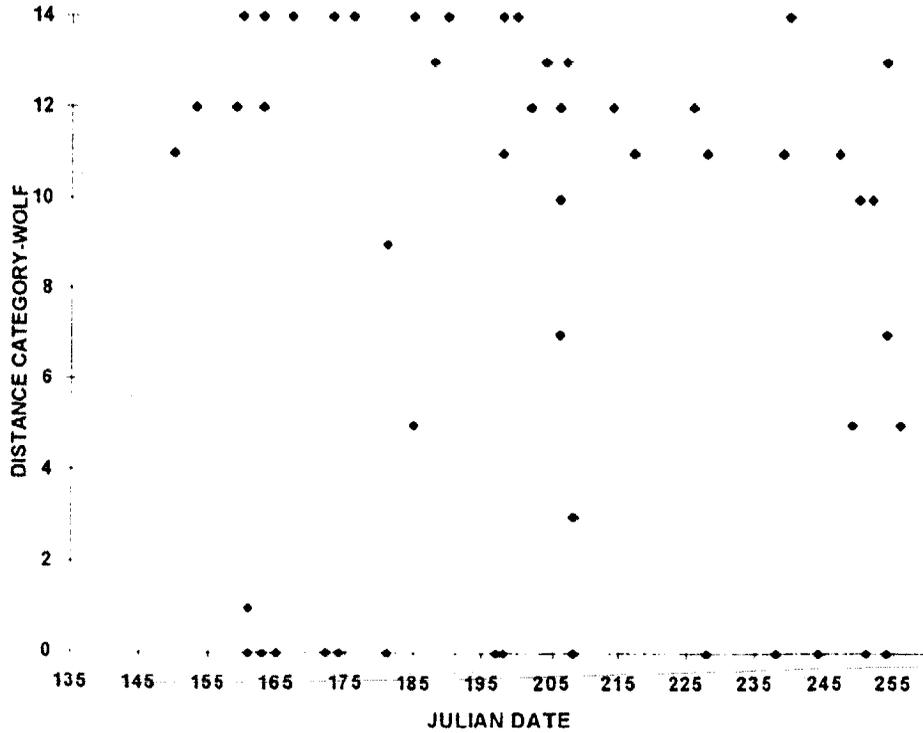


FIG. 188. WOLF OCCURRENCE BY DISTANCE CATEGORY AND JULIAN DATE, 1989.



Per cent occurrence of wolf observations by distance categories is shown in Figs.189-192 for years 1988-1991. Twenty-eight per cent of the observations for 1988 and 1989 are of wolves on the road (Figs.189 & 190. Note: the category was not used in 1990 and 1991). Distance categories 4-9 (40 to 90 m from the road) had the fewest observations. Distance categories show the majority of wolves were on, or within a few meters of the road, or > 100 m from the road.

FIG. 189. PERCENT OCCURRENCE OF WOLF OBSERVATIONS BY DISTANCE CATEGORY, 1988.

WOLF-1988

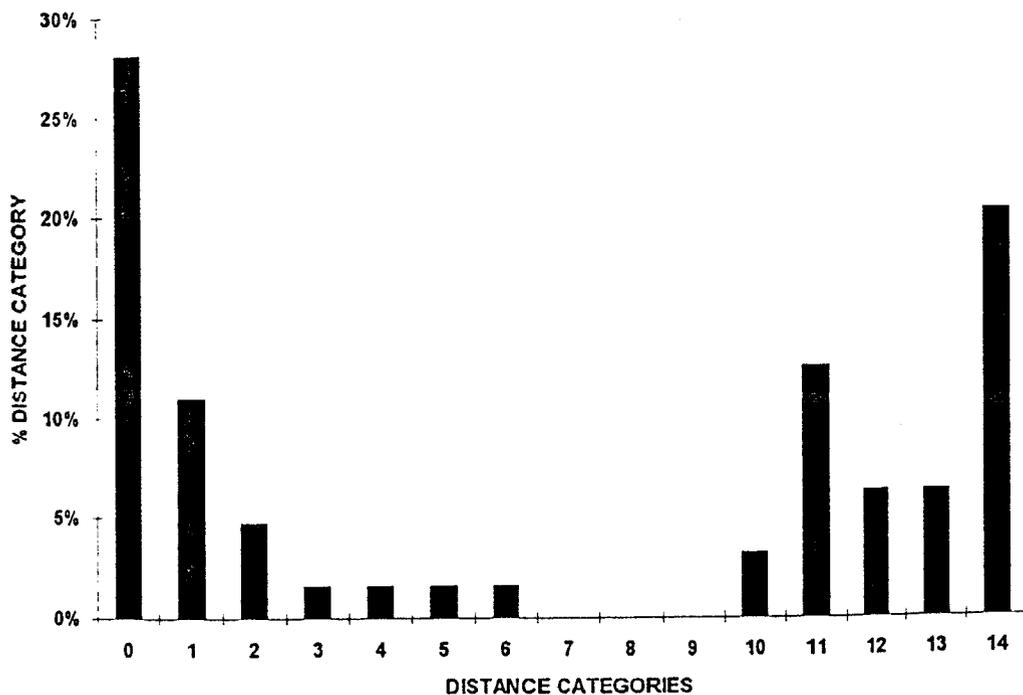


FIG. 190. PERCENT OCCURRENCE OF WOLF OBSERVATIONS BY DISTANCE CATEGORIES, 1989.

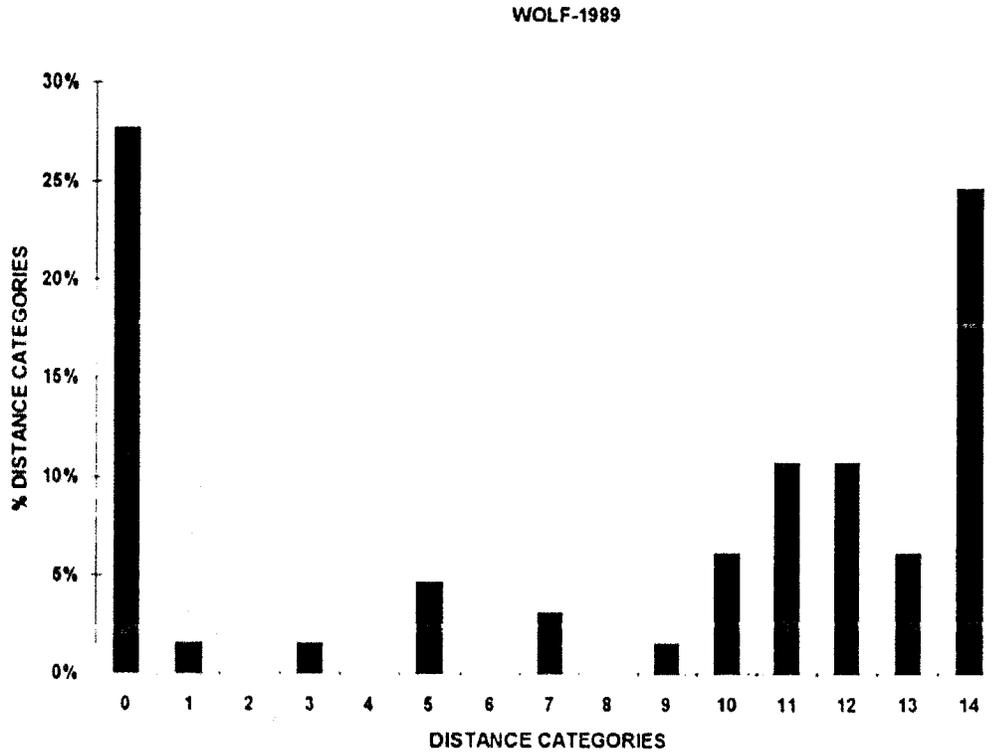


FIG. 191. PERCENT OCCURRENCE OF WOLF OBSERVATIONS BY DISTANCE CATEGORIES, 1990.

WOLF-1990

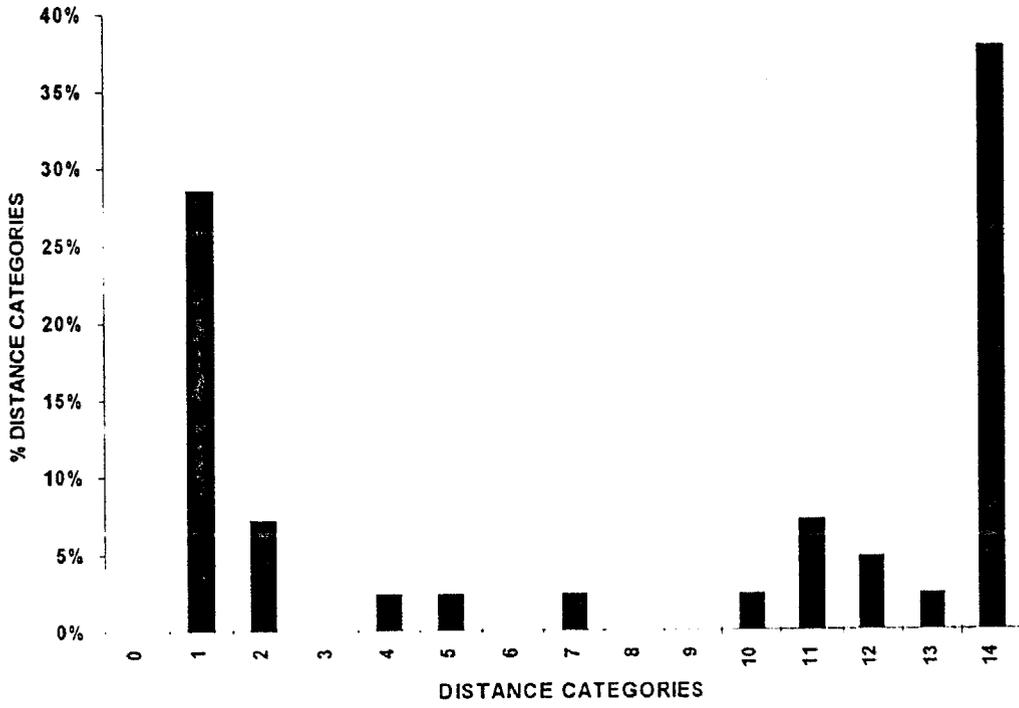


FIG. 192. PERCENT OCCURRENCE OF WOLF OBSERVATIONS BY DISTANCE CATEGORY, 1991.

WOLF-1991

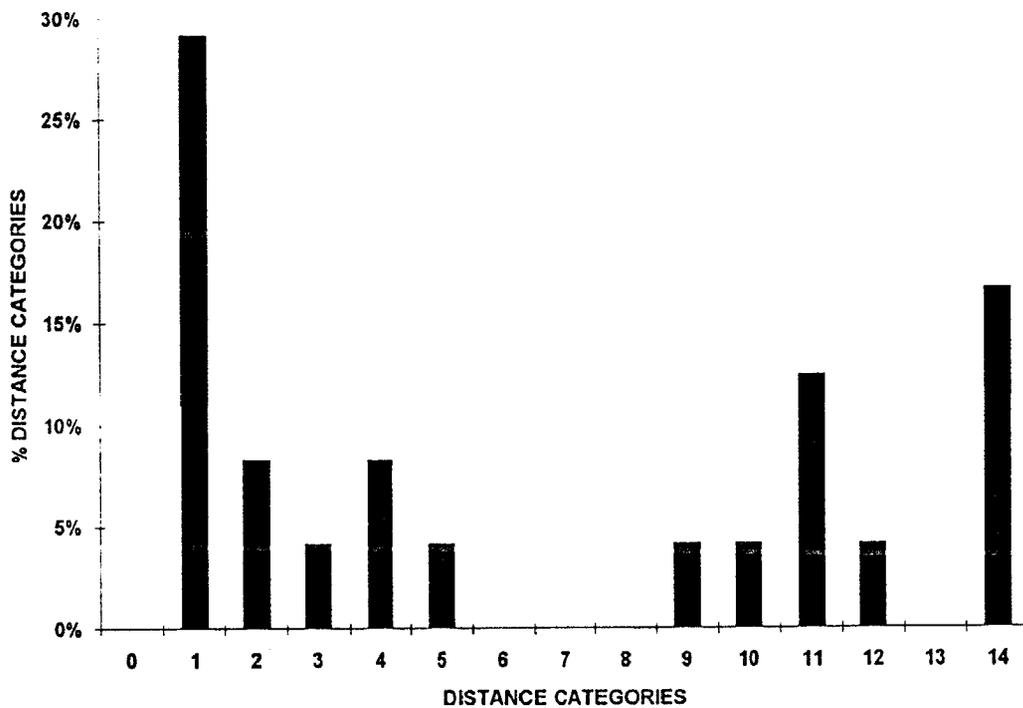
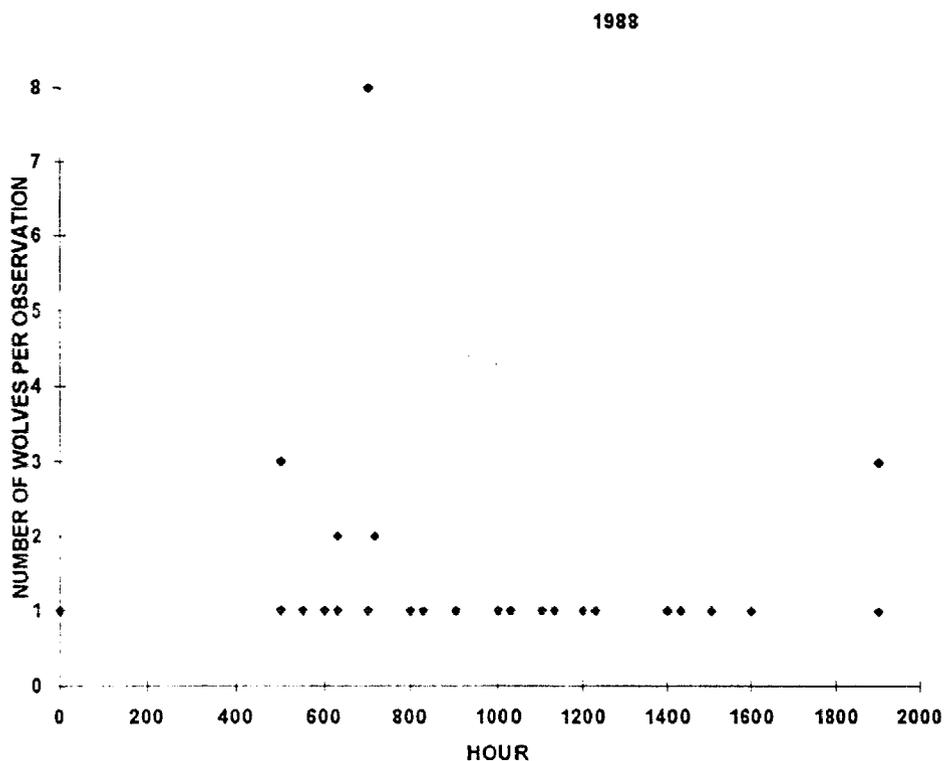


FIG. 193. NUMBER OF WOLVES PER OBSERVATION AND TIME OF BUS DEPARTURE, 1988.



Observations by time of bus departure were relatively constant throughout the hours of record, indicating wolves were as likely to be observed at one hour as at any other (Figs. 193 & 194). The occasional record of a group of 4 or more was in the early hours, however.

Plots of distance from the road by hour of the day of bus departure showed no relative changes in distance from the road as the day progressed (Figs. 195 & 196). Wolves were present on the road with approximately equal frequencies during all hours recorded.

FIG. 194. NUMBER OF WOLVES PER OBSERVATION AND TIME OF BUS DEPARTURE, 1989.

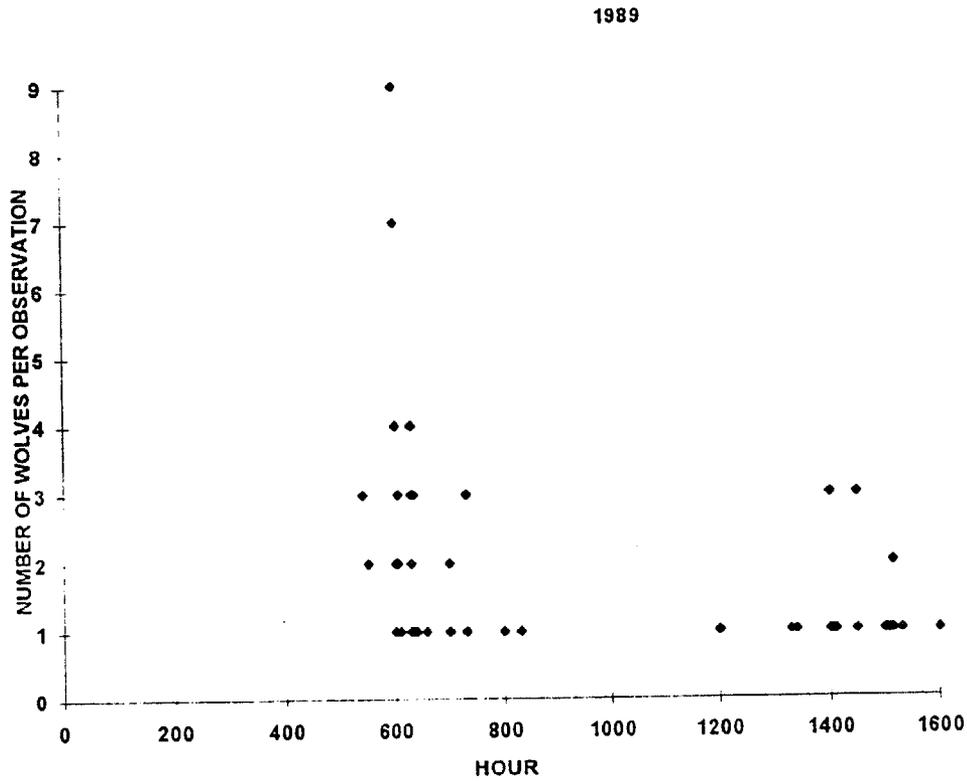


FIG. 195. WOLF OBSERVATIONS AT DISTANCE CATEGORY BY HOUR OF BUS DEPARTURE, 1988.

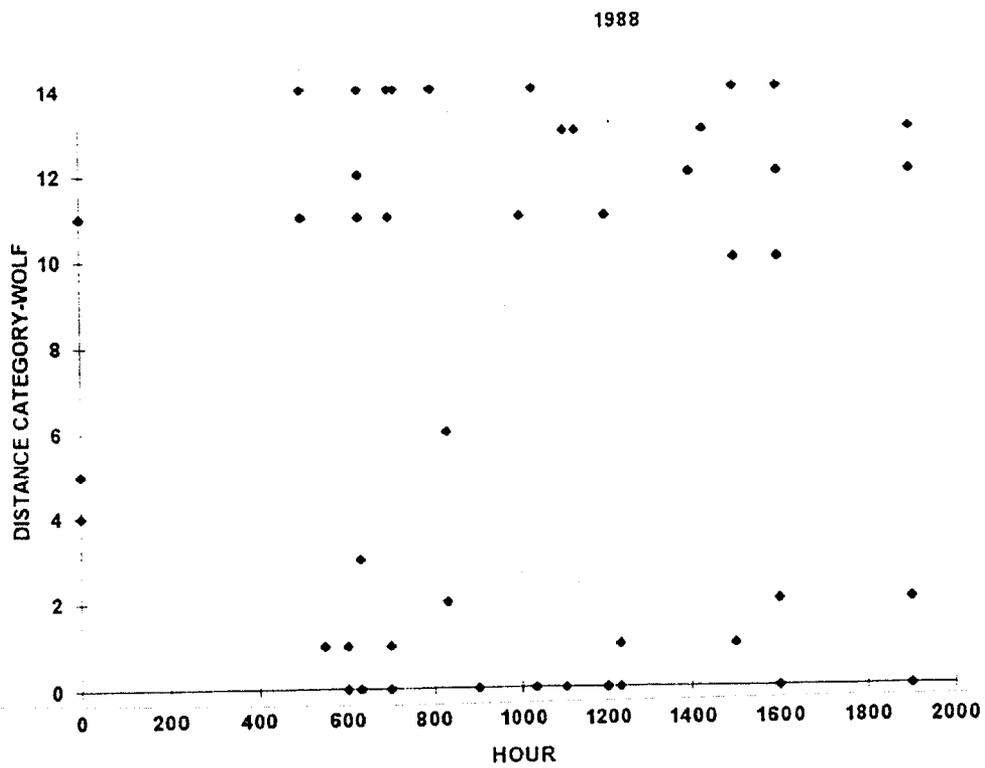


FIG. 196. WOLF OBSERVATIONS AT DISTANCE CATEGORY BY HOUR OF BUS DEPARTURE, 1989.

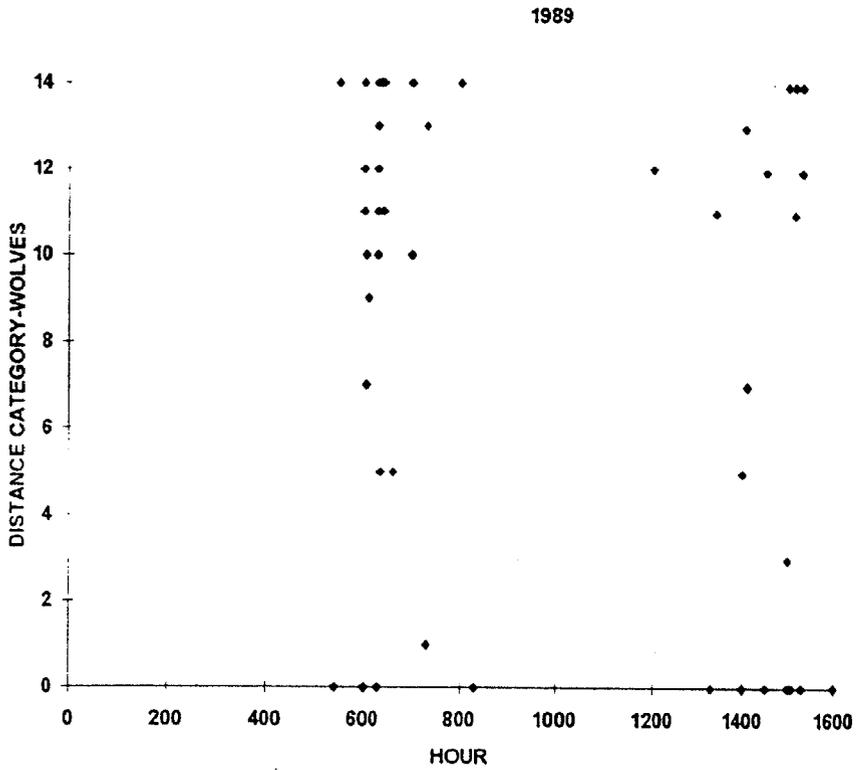


FIG. 197. NUMBER OF WOLVES PER OBSERVATION AT ELEVATION, 1988.

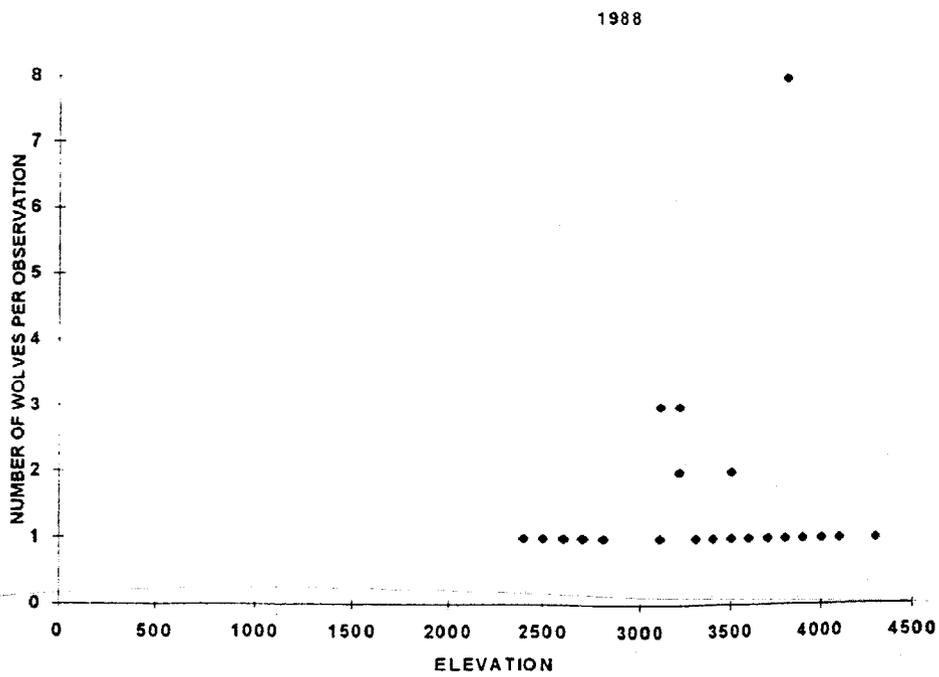
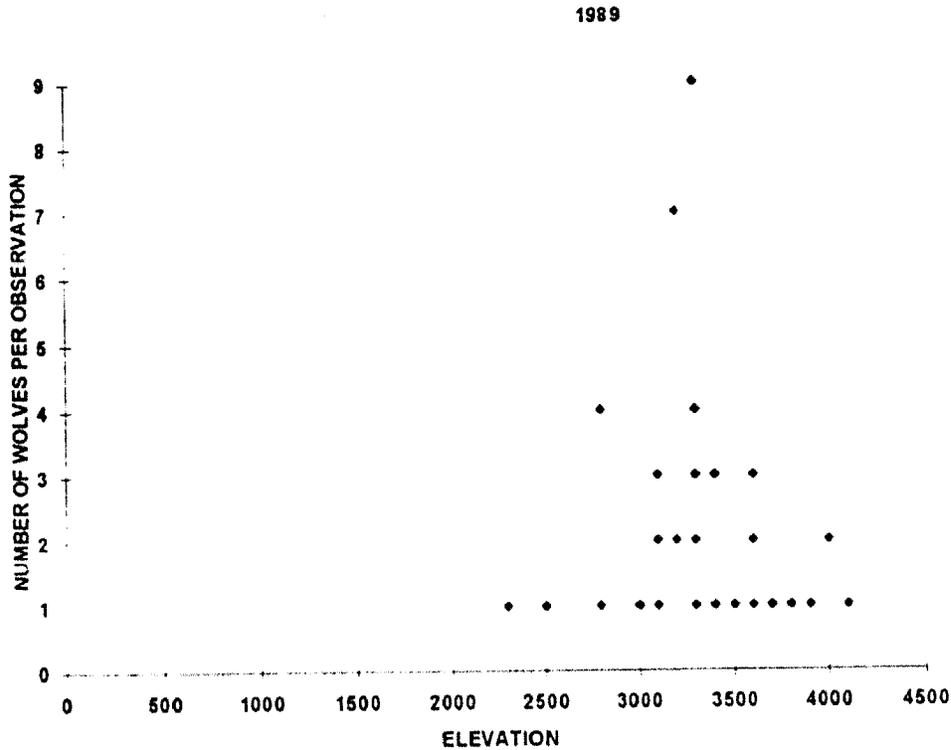


FIG. 198. NUMBER OF WOLVES PER OBSERVATION AT ELEVATION, 1989.



Wolves were observed at elevations of 2300 ft. (701 m) to 4300 ft. (1311 m) (Figs. 197 & 198). Largest groups were typically at elevations of 3000 ft. (914 m) to 3600 ft. (1097 m).

Wolf group size varied from 1 to 9 animals (Tables 88-105 and Figs. 199-202). Wolves were not recorded 2 of the 18 months of record (May and September 1990, the year with the fewest bus trips). Single animals comprised from 44% to 100% of the total wolf observations. The 44% level was during July 1989 when groups of 2 and 3 animals were present in higher numbers than typical (Table 93). During all other months, single animals made up a minimum of 63% of all observations.

Stops for 2 animals occurred from 0% to 35% of the time (Tables 88-105). Animals in groups of 2 were observed at stops 25% or > during June (two times), July (one time), and August (one time). No groups of 2 were observed during May or September of any year.

Groups with 3 wolves were observed during 6 of the 18 months measured. During those months, from 8% to 22% (July 1989) of all stops for wolves were for groups of 3. Stops for groups larger than 3 animals were rare.

Annually, from 69% to 90% of all stops were to observe single wolves (Figs. 199-202). Stops to observe 2 and 3 animals occurred 10% of the time during 1989 and 1991. Stops for groups larger than 3 occurred less than 5% of the time any year.

Table 88. Group size, number and percentage of stops for observation of wolves, July, 1988.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	2157	98.8%	other animals
1	23	1.1%	88.5%
2	1	0.0%	3.8%
3	2	0.1%	7.7%
4	0	0.0%	0.0%
TOTALS	2183	100.0%	100.0%

Table 89. Group size, number and percentage of stops for observation of wolves, August, 1988.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	2270	98.6%	other animals
1	29	1.3%	90.6%
2	2	0.1%	6.3%
3	0	0.0%	0.0%
4	0	0.0%	0.0%
5	0	0.0%	0.0%
6	0	0.0%	0.0%
7	0	0.0%	0.0%
8	1	0.0%	3.1%
TOTALS	2302	100.0%	100.0%

Table 90. Group size, number and percentage of stops for observation of
of wolves, September, 1988.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	610	99.2%	other animals
1	5	0.8%	100.0%
TOTALS	615	100.0%	100.0%

FIG. 199. WOLF GROUP SIZE, JULY-SEPTEMBER, 1988.

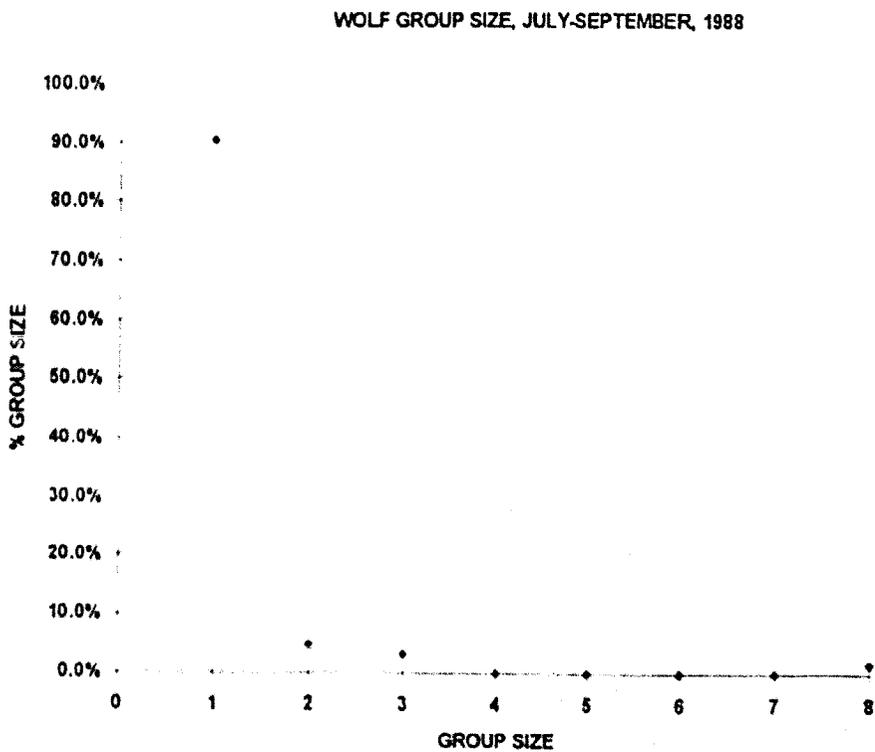


Table 91. Group size, number and percentage of stops for wolves, May, 1989.

Group Size	Number of Stops	% Stops	% Observations by Group Size
0	337	99.7	other animals
1	1	0.3	100
Totals	338	100	100

338-337=1 stop to observe wolves during May, 1989.

Table 92. Group size, number and percentage of stops for wolves, June, 1989.

Group Size	Number of Stops	% Stops	% Observations by Group Size
0	1809	99.0	other animals
1	16	0.9	84.2
2	2	0.1	10.5
4	1	0.1	5.3
Totals	1828	100	100

1828-1809=19 stops to observe wolves during June, 1989.

Table 93. Group size, number and percentage of stops for wolves, July, 1989.

Group Size	Number of Stops	% Stops	% Observations by Group Size
0	1089	97.9	other animals
1	10	0.9	43.5
2	6	0.5	26.1
3	5	0.4	21.7
4	1	0.1	4.3
9	1	0.1	4.3
Totals	1112	100	99.9

1112-1089=23 stops to observe wolves during July, 1989.

Table 94. Group size, number and percentage of stops
for wolves, August, 1989.

Group Size	Number of Stops	% Stops	% Observations by Group Size
0	1147	99.1	other animals
1	9	0.8	90.0
7	1	0.1	10.0
Totals	1157	100	100

1157-1147=10 stops to observe wolves during August, 1989.

Table 95. Group size, number and percentage of stops
for wolves, September, 1989.

Group Size	Number of Stops	% Stops	% Observations by Group Size
0	434	97.5	other animals
1	10	2.2	91.9
3	1	0.2	9.1
Totals	445	100	100

445-434=11 stops to observe wolves during September, 1989.

FIG. 200. WOLF GROUP SIZES, SUMMER SEASON, 1989.

FIG. WOLF GROUP SIZE SUMMER, 1989

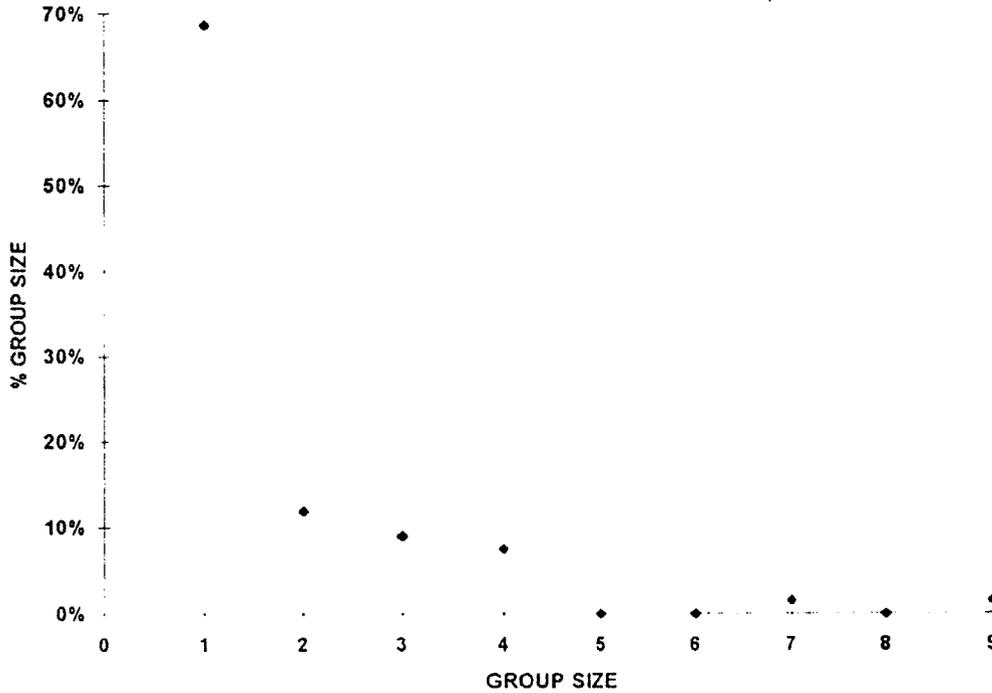


Table 96. Group size, number and percentage of stops for observation of wolves, May, 1990.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	151	100.0%	other animals
TOTAL	151	100.0%	0.0%

Table 97. Group size, number and percentage of stops for observation of wolves, June, 1990.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	595	97.7%	other animals
1	9	1.5%	64.3%
2	5	0.8%	35.7%
TOTAL	609	100.0%	100.0%

Table 98. Group size, number and percentage of stops for observation of wolves, July, 1990.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	509	97.0%	other animals
1	15	2.9%	93.8%
2	0	0.0%	0.0%
4	1	0.2%	6.3%
TOTAL	525	100.0%	100.0%

Table 99. Group size, number and percentage of stops for observation of wolves, August, 1990.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	582	98.6%	other animals
1	6	1.0%	75.0%
2	2	0.3%	25.0%
TOTAL	590	100.0%	100.0%

Table 100. Group size, number and percentage of stops for observation of wolves, September, 1990.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	148	100.0%	other animals
TOTAL	148	100.0%	0.0%

FIG. 201. WOLF GROUP SIZE, SUMMER SEASON, 1990.

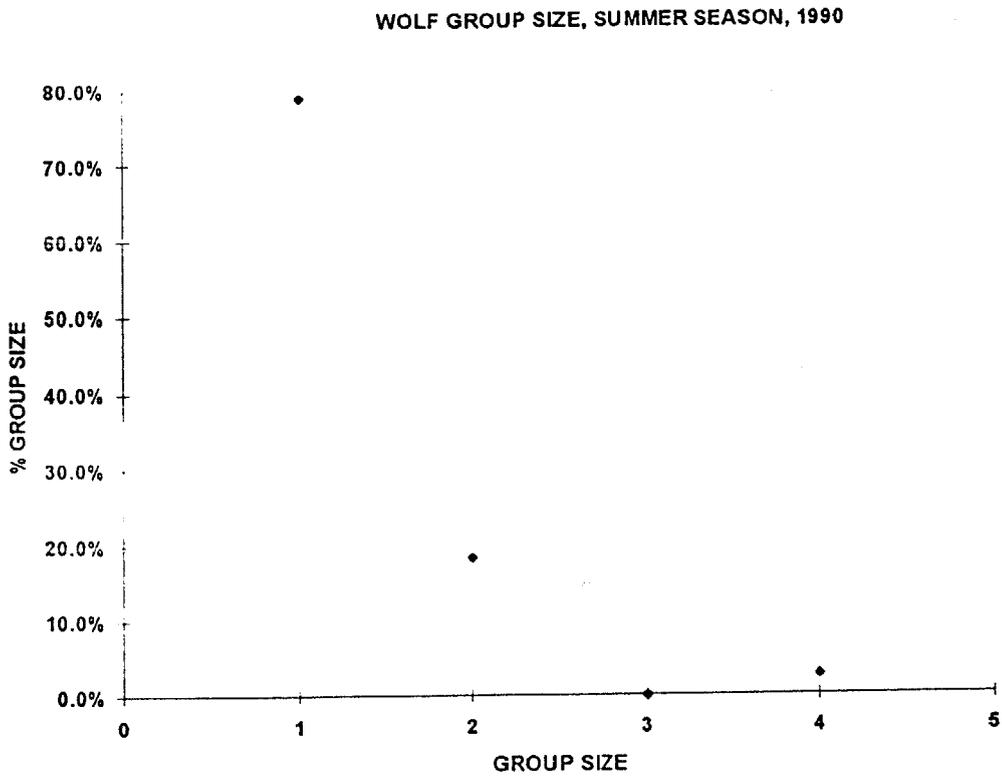


Table 101. Group size, number and percentage of stops for observation of wolves, May, 1991.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	134	97.8%	other animals
1	3	2.2%	100.0%
TOTAL	137	100.0%	100.0%

Table 102. Group size, number and percentage of stops for observation of wolves, June, 1991.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	684	98.8%	other animals
1	5	0.7%	62.5%
2	2	0.3%	25.0%
3	1	0.1%	12.5%
TOTAL	692	100.0%	100.0%

Table 103. Group size, number and percentage of stops for observation of wolves, July, 1991.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	718	99.2%	other animals
1	5	0.7%	83.3%
3	1	0.1%	16.7%
TOTAL	724	100.0%	100.0%

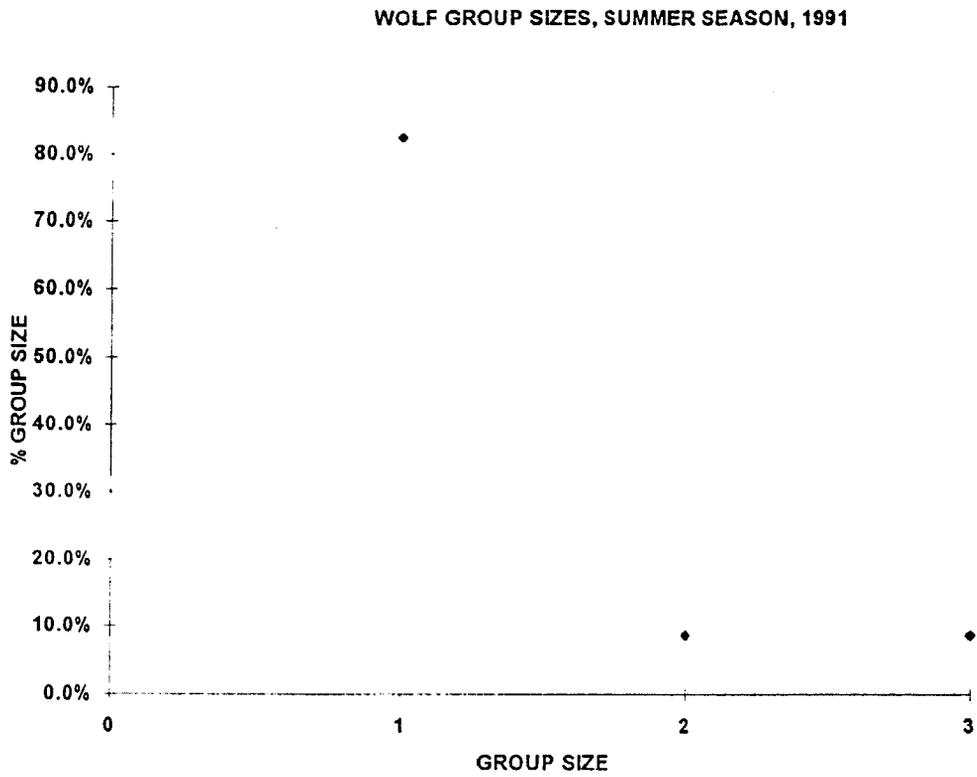
Table 104. Group size, number and percentage of stops for observation of wolves, August, 1991.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	718	99.2%	other animals
1	5	0.7%	83.3%
3	1	0.1%	16.7%
TOTAL	724	100.0%	100.0%

Table 105. Group size, number and percentage of stops for observation of wolves, September 1991.

GROUP SIZE	NUMBER OF STOPS	% STOPS	% OBSERVATIONS BY GROUP SIZE
0	107	99.1%	other animals
1	1	0.9%	100.0%
TOTAL	108	100.0%	100.0%

FIG. 202. WOLF GROUP SIZES, SUMMER SEASON, 1991.



DISCUSSION

Population Estimates

This study was done during a period of relative population stability for moose, caribou, and wolves near the park road (Table 106). Data for Dall's sheep and grizzly bear populations are not available.

The parkwide caribou population varied from a low of 2660 animals to a high of 3210 from 1988 to 1991 (Table 106). Percentage of passengers who observed caribou varied from 83% to 96%, with percentage increasing with total population estimates for all years except 1990 (Table 107 & Fig. 203). Shuttle drivers did not participate in the study during 1990, consequently, no buses were present for records past Stony Hill (milepost 62). As noted in numerous places in this text, 30% of all caribou observations occur past that point, so the result is not unexpected.

Observations of caribou calves decreased in 1990 and 1991 (Fig. 48). These data suggest caribou suffered poor reproductive success during the 2 years. Adams (1996) found caribou reproductive success was 55% in 1988, 40% in 1989, and dropped to 11% and 7%, respectively, in 1990 and 1991 (Fig. 203a).

Moose counts did not differ greatly from 1986 through 1991 (No count was made in 1990; Table 106). Percentage of passengers who observed moose varied from 51% to 62% for the years measured (Table 107, Fig. 204). A test of the hypothesis that percentage of passengers who observe moose varies directly with moose population could have been done during 1992 when moose counts along the eastern part of the road dropped by 54% (Table 106). Unfortunately, the study was not continued during that year.

Percentage of passengers who observed wolves appears to track numbers of animals in the Headquarters and East Fork packs. The 2 packs utilize the park road corridor east of Eielson Visitors Center (milepost 66) (Fig. 205; Table 106). The highest wolf count was in 1990, a year when no shuttle drivers participated in the study for observations past milepost 62. Few wolves are observed past milepost 62, however (Table 108). Looney (1992) notes "no visitor observation of any species has changed so dramatically in this decade as that of the wolf in Denali." In 1980, he recorded 1 wolf during 72 round trips to Eielson, but in 1990, he recorded 50 wolves in 78 shorter round trips to Stony Hill or Toklat.

Table 106. Population Estimates of Moose, Caribou, and Wolves

MOOSE				
YEAR	EASTERN UNIT	PARK	SOURCE	
1986	380±138	1582±318	Meier, et al. 1991	
1991	272±43	1564±123	Meier, et al. 1991	
Mlle 7-18				
1988	153		Van Ballenberghe, 1996	
1989	144		Van Ballenberghe, 1996	
1990	no count			
1991	125		Van Ballenberghe, 1996	
1992	67		Van Ballenberghe, 1996	
CARIBOU				
1986		2470	Adams, 1996	
1987		2540	Adams, 1996	
1988		2950	Adams, 1996	
1989		3210	Adams, 1996	
1990		3180	Adams, 1996	
1991		2660	Adams, 1996	
WOLVES				
YEAR	HEADQUARTERS PACK	EAST FORK PACK	TOTAL	SOURCE
1987	2	8	10	Looney, 1992
1988	7	19	26	Looney, 1992
1989	14	27	41	Looney, 1992
1990	15	33	48	Looney, 1992
1991	10	16	26	Stahnecker, 1996

Table 107. Annual percentage of passengers who observed caribou, Dall's sheep, grizzly bears, moose, and wolves.*

YEAR	CARIBOU	DALL'S SHEEP	GRIZZLY BEAR	MOOSE	WOLF
1988	91	91	86	56	10
1989	96	92	83	62	14
1990	83	86	64	51	12
1991	86	82	65	59	7

*From tables 11, 30, 49, 68, and 87.

FIG. 203. PERCENTAGE OF PASSENGERS WHO OBSERVED CARIBOU COMPARED TO CARIBOU POPULATION

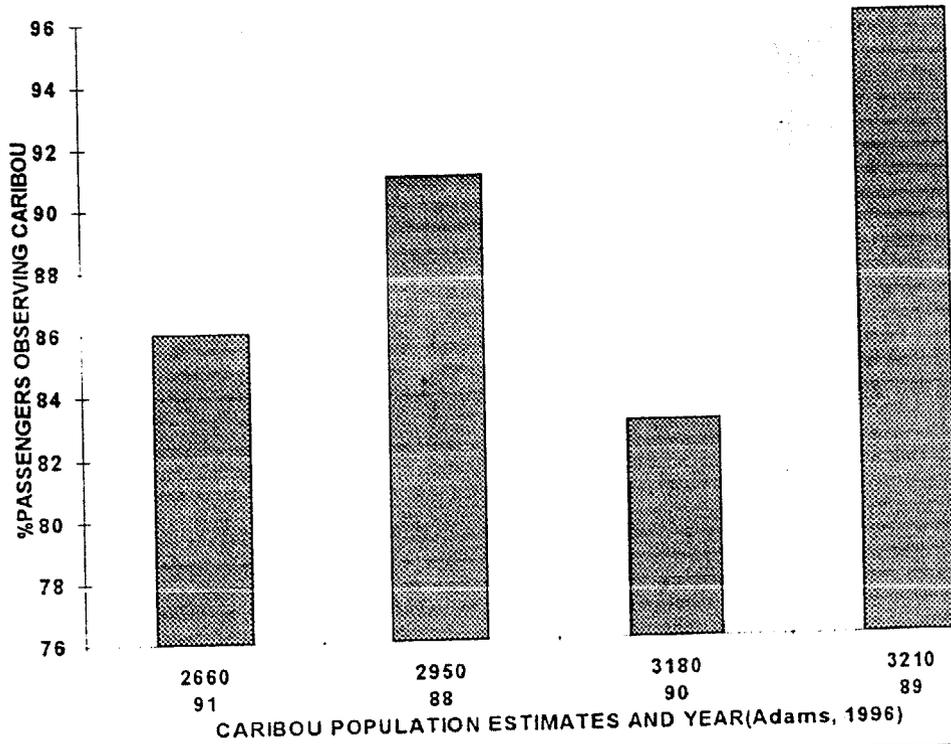


FIG. 203a. % OF OBSERVED CARIBOU THAT WERE CALVES EACH YEAR COMPARED TO YEARLY CALF SURVIVAL RATES (SURVIVAL RATES FROM Adams, 1996)

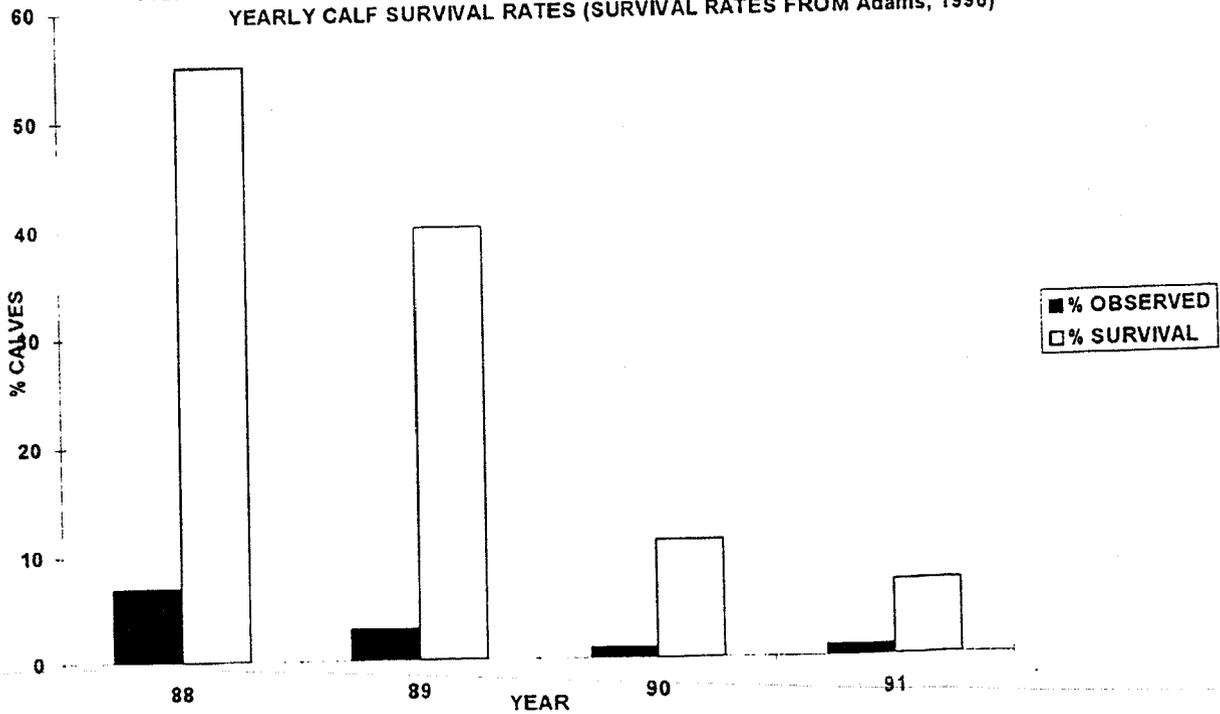


FIG. 204. % OF PASSENGERS WHO OBSERVED MOOSE AT VARIOUS POPULATION LEVELS

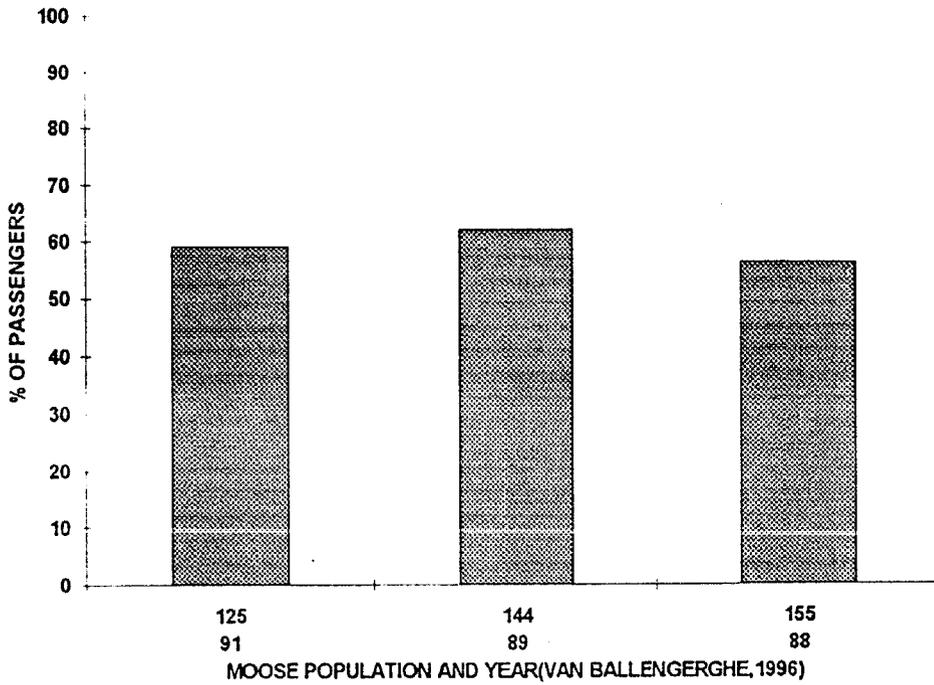
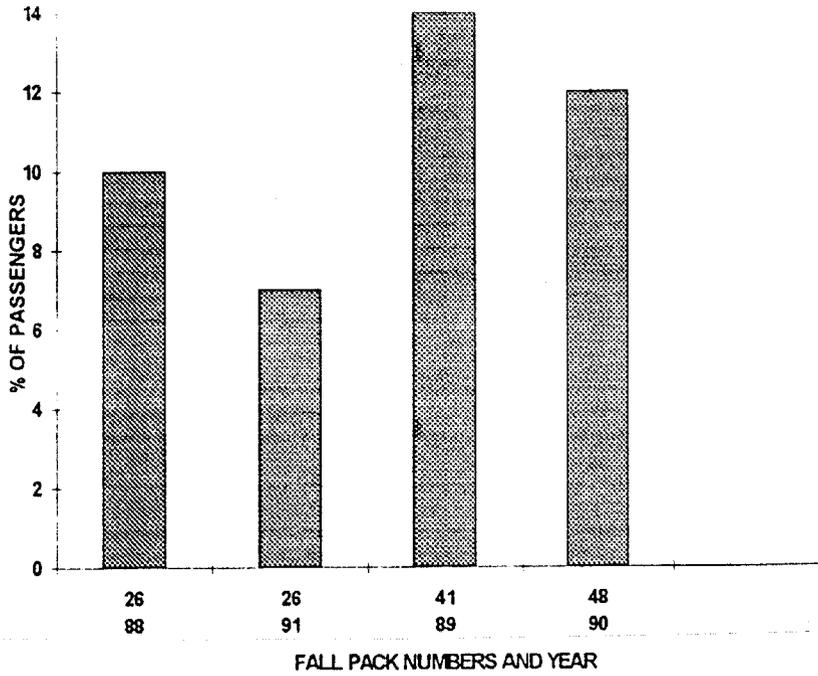


FIG. 205. % OF PASSENGERS WHO OBSERVED WOLVES AT VARIOUS POPULATION LEVELS



Management Unit

Management unit analysis, requested by Denali Park Resources Management, is shown in Tables 108-109. The 6 proposed management units begin, and end, at approximate bus turn around locations as follows:

Milepost	15..Savage River Bridge
	30..Rest Stop
	54..Toklat River
	62..Stony Hill Overlook
	66..Eielson Visitor's Center
	87..Wonder Lake Ranger Station

Of particular interest was the number of animals observed between potential turnaround areas at Stony Hill and Eielson. These data show the number of animals forgone by turning around at Stony Hill versus Eielson Visitor's Center would be a mean of 8 caribou, and one bear per bus trip (Table 108). Dall's sheep, moose, or wolves should not be expected here as they are observed infrequently in this management unit (>62-66).

The following analysis evaluates mean number of animals observed per bus trip within the management units.

Caribou Highest mean number of caribou per bus trip occurred in unit >62-87. Lowest mean number was in unit 0-15 (Table 108). Over 64% of all caribou observations occurred in units from >54 through 87, thus illustrating the importance of having buses available to take passengers to these distances (Table 109; see also Fig. 23). Caribou were the most widely distributed of the five reported species, being observed at every milepost, on average, per bus trip (Fig.23).

Dall's Sheep A mean of 18.9 Dall's sheep were observed per bus trip in unit >30-54 (Table 108). 81% of all sheep observations occurred in this management unit (Table 109). Over 92% of all sheep observations occurred in units >30-54 and >54-62 on average. Less than one sheep per bus trip was observed in units 0-15, >15-30, >62-66, and >62-87 (see also Fig. 72).

Grizzly Bears were most common in management unit >30-54 where over 50% of all bears observations occurred (Tables 108 & 109). Only 4% of all bears observations occurred in units 0-15 and >15-30 (see also Fig. 113).

Moose observations were most common in the 0-15 mile management unit where 39% of all observations occurred (Tables 108 & 109).

Management unit >30-54 followed with 33% of all observations. Only 4% of all moose were observed in units >54-62 and >62-87. Moose were sufficiently dispersed to have a record of .01 moose per milepost per bus trip for 64 of the 87 mileposts.

Wolves Wolves were most commonly observed in unit >30-54 where 86% of all observations occurred. Few wolves were recorded in units >54-62 and >62-87. No wolves were recorded in units 0-15 and >15-30 (Tables 108 & 109, and see also Fig. 184).

Table 108. Mean number and standard deviation of caribou, Dall's sheep, grizzly bears, moose, and wolf observed per bus trip by management unit, 1989.

Species	UN IT					
	0-15	>15-30	>30-54	>54-62	>62-87	>62-66
Caribou	1.76+-.015	2.88+-.018	4.81+-.041	8.9+-.142	10.5+-.618	8.04+-.299
Dall's sheep	0.92+-.026	0.68+-.021	19.84+-.083	2.62+-.060	0.41+-.021	0.37+-.026
Grizzly bear	0.07+-.003	0.18+-.004	3.07+-.004	1.21+-.013	1.55+-.015	1.06+-.01
Moose	0.59+-.003	0.35+0	0.5+-.008	0.05+0	0.26+-.005	0.02+0
Wolf	0	0	0.18+-.012	0.02	0.01	0.01

Table 109. Percent occurrence of each species by Management Unit.

Species	0-15	>15-30	>30-54	>54-62	>62-87	TOTAL
Caribou	7%	11%	18%	34%	30%	100%
Dall's sheep	4%	3%	81%	11%	2%	100%
Grizzly Bear	1%	3%	55%	22%	19%	100%
Moose	39%	23%	33%	3%	1%	100%
Wolf	0%	0%	86%	10%	5%	100%

Comparison with Looney's (1992) Observations

During a 10 year period, 1980-1990, Looney (1992) recorded wildlife observed during 556 tour bus trips. His summary of observations by road section for 69 of those bus trips are compared with results from this study for the year 1989 where we have a full season of data from 533 bus trips (Table 110). Although the milepost sections requested for analysis by Denali Resources Management differed slightly from those of Looney, there is an overall similarity of high and low findings for Dall's sheep, grizzly bears, moose, and wolf by road section. The major difference was results for caribou in all units past milepost 15.

Table 110. Comparison of per cent occurrence of observations in Management Units with those of Looney (1992). Data from this study were recalculated to exclude Management Unit >62-87, a unit not covered by Looney.

CARIBOU									
YEAR	LOONEY	TAYLOR	LOONEY	TAYLOR	LOONEY	LOONEY	TAYLOR	LOONEY	TAYLOR
	0-14.8	0-15	14.8-31.3	>15-30	31.3-43.4	43.4-53.1	>30-54	53.1-62	>54-62
1989	8	10	30	16	9	41	26	12	48
DALL'S SHEEP									
YEAR	LOONEY	TAYLOR	LOONEY	TAYLOR	LOONEY	LOONEY	TAYLOR	LOONEY	TAYLOR
	0-14.8	0-15	14.8-31.3	>15-30	31.3-43.4	43.4-53.1	>30-54	53.1-62	>54-62
1989	1	4	2	3	75	20	83	2	10
GRIZZLY BEARS									
YEAR	LOONEY	TAYLOR	LOONEY	TAYLOR	LOONEY	LOONEY	TAYLOR	LOONEY	TAYLOR
	0-14.8	0-15	14.8-31.3	>15-30	31.3-43.4	43.4-53.1	>30-54	53.1-62	>54-62
1989	2	2	1	4	53	25	68	19	27
MOOSE									
YEAR	LOONEY	TAYLOR	LOONEY	TAYLOR	LOONEY	LOONEY	TAYLOR	LOONEY	TAYLOR
	0-14.8	0-15	14.8-31.3	>15-30	31.3-43.4	43.4-53.1	>30-54	53.1-62	>54-62
1989	50	40	23	23	22	5	34	0	3
WOLF									
YEAR	LOONEY	TAYLOR	LOONEY	TAYLOR	LOONEY	LOONEY	TAYLOR	LOONEY	TAYLOR
	0-14.8	0-15	14.8-31.3	>15-30	31.3-43.4	43.4-53.1	>30-54	53.1-62	>54-62
1987,89,90	0		8		14	66		12	
1989		0		0			90		10

Multivariate Analysis of Covariance (MANCOVA)

Multivariate analysis of covariance (MANCOVA) tests were conducted to determine effects of month, year, management unit, number of private vehicles, "other traffic," and on the number of caribou, Dall's sheep, grizzly bears, moose, and wolves that were observed. Through an understanding of the biology of the five species, we know there are predator-prey, herbivore-herbivore, predator-predator, and other interactions. The MANCOVA accounts for this covariance, or lack of independence between the dependent variables (Manley 1989). Covariates for traffic included all National Park Service vehicles, tour buses, and shuttle buses lumped together as "other traffic." Data for July, August, and September, 1988 and 1989, were tested (Tables 111 & 112).

Year, month, and management unit observations all showed highly significant levels of effect. Two way interactions between year and month, month and management unit, and the three way interaction between year, month, and management unit were significant. This indicates there were changes in numbers of animals observed between years, months and management units (Table 111).

In the multivariate analysis, the number of private vehicles had a highly significant effect on observations of animals (Table 111). The effect of photographers, and other vehicles was not measurably different from 0 (Table 111).

Individual species tests separated effects identified in the multivariate tests (Table 112). As individual species, caribou, grizzly bears, Dall's sheep, moose, and wolves showed overall significant differences in year and month and location, and interactions of year and month and location. Numbers of caribou, grizzly bears, moose, and wolves varied from year to year and within months between years.

Following the study by Singer & Beattie (1986), private vehicles were reduced due to their impacts on bears (DENA 1986). Even though private vehicle numbers were reduced from 6662 in 1984 (Singer and Beattie study period) to 3516 in 1988 and 4454 in 1989 (this study period, see Table 2), private vehicles resulted in a negative impact on numbers of moose and wolves reported in this study. Moose showed a highly significant response to private vehicles, and wolves showed a significant response (Table 112).

There were no measurable effects from private vehicles, photographers, and "other traffic" for caribou, Dall's sheep, and grizzly bears (Table 112). The effect of private vehicles on

Dall's sheep and effect of photographers on Dall's sheep and moose indicate additional information is needed, specifically, more detailed location of where photographers spend their time. The data used here are simply a test of the number of photographers on the road at any one time, and has no relationship to where they spend their time photographing animals.

"Other traffic" had no detectable effect on moose and wolves (Table 112).

Table 111. Multivariate Analysis of Covariance (MANCOVA), including all Species and Interactions

EFFECT	DF	SIG
YEAR	5	.00**
MONTH	10	.00**
MANAGEMENT UNIT	25	.00**
YEAR*MONTH	10	.00**
YEAR*MANAGEMENT UNIT	25	.00**
MONTH*MANAGEMENT UNIT	50	.00**
YEAR*MONTH*MANGEMENTUNIT	50	.00**
PRIVATE VEHICLES	5	.00**
PHOTOGRAPHERS	5	.25 ns
OTHER VEHICLES	5	.27 ns

Table 112. Multivariate Analysis of Variance, Univariate Tests

SOURCE	CARIBOU		DALL'S SHEEP		GRIZZLY BEAR		MOOSE		WOLF	
	DF	SIG	DF	SIG	DF	SIG	DF	SIG	DF	SIG
OVERALL	38	.00**	38	.00**	38	.00**	38	.00**	38	.00**
YEAR	1	.00**	1	.01**	1	.00**	1	.01**	1	.00**
MONTH	2	.00**	2	.00**	2	.00**	2	.00**	2	.00**
MANAGEMENT UNIT	5	.00**	5	.00**	5	.00**	5	.00**	5	.00**
YEAR*MONTH	2	.00**	2	.59ns	2	.00**	2	.00**	2	.02*
YEAR*MANAGEMENT UNIT	5	.00**	5	.01**	5	.00**	5	.00**	5	.01**
MONTH*MANAGEMENT UNIT	10	.00**	10	.00**	10	.00**	10	.00**	10	.02*
YEAR*MONTH*MANAGEMENT UNIT	10	.00**	10	.00**	10	.00**	10	.00**	10	.01**
PRIVATE VEHICLES	1	.41ns	1	.07ns	1	.59ns	1	.00**	1	.02*
PHOTOGRAPHERS	1	.74ns	1	.08ns	1	.57ns	1	.06ns	1	.74ns
OTHER TRAFFIC	1	.41ns	1	.15ns	1	.15ns	1	.16ns	1	.66ns

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APPENDIX 1. MILEPOST LOG OF ROADSIDE FEATURES

<u>Mile</u>	<u>Remarks</u> (8-6-82)
0.00	Junction SR-3 (SR-3 MP 237.30)
0.10	Appr Lt. and Rt.
0.35	Appr Lt. to Riley Creek Campground
0.60	Sign - Rough road
1.15	Airport Appr Lt.
1.18	Alaska Railroad Crossing
1.45	Store Rt.
1.50	RR Spur line to McKinley Lodge
1.52	Appr Rt. to McKinley Lodge and Lt. to RR Station
1.59	Trail X-ing (Morino Loop)
1.75	Trail X-ing
1.85	Sign - 35 MPH
2.00	Sign - Pedestrian X-ing
2.05	Trail X-ing (Morino Loop)
2.10+	Begin ascending grade
3.10	C-Camp Appr Rt. (Employee residences)
3.22	Appr Rt. for service road
3.31	Rock Creek Bridge (Elev. 2030) (Mile 3.0)
3.35	Appr Lt. to residential area

3.42 DNP Headquarters Appr Lt.
3.45 Appr Lt. and Rt. Parking for Dog Sled Exhibit
3.63 Appr Lt. - Service road to Headquarters
5.00 Creek - Large culvert
5.65 Appr Lt. - Service road
5.69 Creek - Treated timber bridge (dry)
7.05 Creek (dry w/culvert)
7.05 Appr Rt. to Old Borrow (Chips stockpiled)
7.12 Culvert at live stream
7.25 Parking area Lt. (paved)
7.67 Sign - 35 MPH
7.75 Parking area Lt. (paved)
8.30 Begin Sealed Surface
9.00 Parking area Lt. (paved)
9.45 Creek (live) Treated timber bridge
10.09 Creek (dry) Treated timber bridge
10.20 Parking area Rt. (paved)
10.60 Parking area Lt. (paved)
10.85 Parking area Rt.
11.75 Creek (dry w/culvert)
11.82 Parking area Lt. (paved)
12.39 Creek (dry w/culvert)

12.56 Creek (nearly dry) Twin culverts - gabions

12.80 DNP Entrance Station

12.82 Appr Lt. to Savage River Campground

13.00 Parking area Rt. (paved)

13.92 Creek Culvert 60"+

13.95 Begin Road Construction

14.80 Begin new Savage River Bridge (under construction)

14.83 Center new bridge

14.86 End new bridge

15.01 End project under construction

17.20 Parking area Lt. Entrance Appr (near top ridge)

17.63 Culvert at live stream, sharp curve to Lt.

20.40 Live stream, sharp curve to Lt.

20.42 Live stream, sharp curve to Lt.

21.15 Sign - One Lane Bridge

21-25 Hogan Creek (One-lane treated timber bridge)

22.70 Appr Rt. to Old Borrow Pit along river

22.70 Sanctuary Campground Appr Lt.

22.77 Begin Sanctuary River Bridge (Concrete)

22.80 Center Sanctuary River Bridge 24' Curb to Curb;
28-51 Out to Out

22.82 End Sanctuary River Bridge

22.83 Approach Rt. to Borrow

24.39 Approx. Summit

25.91 Parking area Rt.

26.16 Parking area Lt.

27.26 Teklanika Borrow Pit Appr Lt. (1st. Pit)

27.28 Creek - Culvert (large fill)

27.42 Teklanika Borrow Pit Appr Lt. (2nd. Pit)

27.45 Creek - (Culvert)

28.34 Curves

28.91 Sign - 20 MPH

29-14 Teklanika Campground Appr Rt.

29.40 Sign - 35 MPH

30.13 Small Pond Lt.

30.28 Entrance - Bus Rest Stop

30.32 Parking area Rt. - Bus Rest Stop

30.36 Exit - Bus Rest Stop

30.36 Gate

30.83 Creek (sharp curve)

31.28 to 31.34 Teklanika River Bridge (Concrete)

34.07 Igloo Creek Ranger Station Rt.

34.09 Igloo Creek Campground Lt.

34.12 Igloo Creek Bridge (Concrete)

35.30 Sign - Dall Sheep Exhibit

37.05	Igloo Creek Bridge (Concrete)
37.53	Tattler Creek (culvert)
38.62	Sign - Grizzly Bear Exhibit
39.12	Sable Pass
42.05	Ghiglione Creek Bridge (Concrete)
43.03	Aprr to Borrow Source Lt.
43.35to 43.40	East Fork Toklat River Bridge (Concrete)
45.93	Polychrome Pass - Rest Stop and Parking
52.56	Old Borrow Site Rt.
52.63	Old Borrow Site Rt.
52.98 to 53.15	Sheet pile retaining wall Lt.
53.15 to 53.23	Toklat River Bridge (Pile, H-beam - timber)
53.23 to 53.46	Sheet pile retaining wall Lt.
53.46 to 53.55	Toklat River Bridge (Pile, H-beam - timber)
53.57	NPS Maintenance Camp Rt.
53.69	Toklat River Ranger Station
58.35	Sign - Long Tailed Jaeger (Hawk) Exhibit
58.47	Highway Pass
59.31	Branch of Stony Creek (culvert)
60.53	Borrow Pit Rt.
60.60	Stony Creek Bridge (Concrete)
60.81	Bottom of Stony Hill grade
61.20	Switchback curve Lt.

61.87	Summit - Stony Hill
62.09	Stony Hill overlook
62.36	Switchback curve Rt.
62.75	Switchback curve Lt.
62.96	Bottom of Stony Hill grade
62.99	Culvert (36")
63.14	Little Stony Creek (Culvert/gabions)
63.46	Culvert at live stream (48")
63.50	Bottom of grade (Ascending ahead)
64.62	Thoroughfare Pass
65.77	Sign - Curve
65.93	Stream at sharp curve Lt.
66.03	Entrance to Eielson Visitor Center
66.10	Exit to Eielson Visitor Center
67.58	Timber Crib Wall
67.82	Stream
68.09	Slide in sharp draw and curve Lt.
68.24	Shoulder slump (Slide below road)
68.55	Small Saddle (End rugged terrain)
70.38	Borrow Pit Lt.
72.15	Borrow Pit Rt. (Small)
72.41	Borrow Pit Rt.
73.18	Borrow Pit Lt.
74.58	Sign-Muldrow Glacier Exhibit

74.82	Barrow Pit Rt.
76.82	Barrow Pit
77.40	Sign-Beaver Exhibit-Pond Rt.
77.70	Borrow Pit Lt.
79.40	Borrow Pit Rt
81.82	Small stream X-ing
84.61	Junction, Wonder Lake campground Road
84.80	NPS Tent Camp (temporary)
86.70	Wonder Lake Ranger Station
87.40	Stream (culvert) Outlet Wonder Lake
88.00	DNP Wilderness/Reserve Boundary
88.2.5	Approach Rt.
89.01	Northface Lodge Rt.
89.20	Moose Creek Bridge (Pony Truss)
89.30	Camp Denali Rt
89.48	Gravel Pit Rt.
91.00	Approach Lt.
91.10	Kantishna Lt.
91.20	Eureka Creek (Road ford)
92.30	Friday Creek (Road ford)
92.56	Air Strip - END DNP ROUTE 1

DIRECTIONS: (Record only on trip cut).

1. Fill in day/month.
2. Observer last name.
3. Show bus number and time bus leaves on tour.
4. Show start location and start odometer (last 4 digits, i.e., 100.5).
5. Check clr (clear), pcldy (partly cloudy), cldy (cloudy), rain, snow.
6. Show end location and end -odometer reading.
7. Show arrival time at points indicated.
8. Odometer- record reading at point perpendicular to the road.
9. Species- record species by writing C for (Caribou), S (Sheep), B (Bear), M (Moose), F (Fox), W (Wolf).
10. Number- record the number of adult (a), number of young of this years cubs or calves (yg), and number of unknown (u).
11. Distance- record in meters from the road. If a range-finder is unavailable, estimate:

<10	51-60	100-200
11-20	61-70	200-300
21-30	71-80	300-400
31-40	81-90	>400
41-50	91-100	
12. Side of road- show N for north, S for south.
13. Remarks- add as necessary.

DENA ROAD CORRIDOR WILDLIFE SURVEY CODES

Field Name

*Day

*Month

*Year

*Observer

- Lindfors -1
- Nowak -2
- Reidinger -3
- Lindgard -4
- Hawkins -5
- Hannah -6
- Dunne -7
- Tourtlot -8
- Showler -9
- Soileau -10
- Canale -11
- Trumbull -12
- Pederson -13
- Dungan -14

*Bus Run

*Bus Number

- *Start Location
- Village -1 (-6.6)
 - Chalet -2 (-1.8)
 - Harper -3 (-1.5)
 - Riley Cr-4 (+0.4)
 - DENA Pad -5 (+1.5)
 - Hotel -6 (+1.6)
 - Depot -7 (+1.7)

*Start Odometer

*Start Weather

- clear -1
- pcldy -2
- cldy -3
- rain -4
- snow -5

*End Location

- Toklat -1
- Stony Hill -2
- WL -3
- EVC -4
- Camp Denali -5
- Polychrome -6
- Teklanika -7

*End Odometer
 *End Weather
 *Arrive Igloo
 *Igloo Weather
 *Arrive Polychrome
 *Polychrome Weather
 *Arrive Stony Hill

*Stony Hill Weather
 *Arrive Eielson VC
 *Eielson Weather
 *Odometer
 *Species

c=caribou	-1
d=Dall sheep	-2
b=grizz bear	-3
m=moose	-4
f=fox	-5
w=wolf	-6
beaver	-7
wolverine	-8
eagle	-9
marmot	-10
snowshoe hare	-11
porcupine	-12
goose	-13
falcon	-14

*a=adult

*yg=young

*u=unknown age

*Distance

0	-0
1-10	-1
>10-20	-2
>20-30	-3
>30-40	-4
>40-50	-5
>50-60	-6
>60-70	-7
>70-80	-8
>80-90	-9
>90-100	-10
>100-200	-11
>20-300	-12
>300-400	-13
>400	-14

*Side of Road

N	-1
S	-2
On Road	-3

*Remarks

*Maxtemp

*Mintemp

*Precipitation

*Cloud Cover

*Number of Passengers

JULIAN DATE CALENDAR

(PERPETUAL)

Day	Jan	Feb	Mar	Apr	May	June	July	<u>Aug</u>	Sep	Oct	Nov	Dec	Day
1	001	032	060	091	121	152	182	213	244	274	305	335	1
2	002	033	061	092	122	153	183	214	245	275	306	336	2
3	1003	034	062	093	123	154	184	215	246	276	307	337	3
4	004	035	063	094	124	155	185	216	247	277	308	338	4
5	005	036	064	095	125	156	186	217	248	278	309	339	5
6	006	037	065	096	126	1157	187	218	249	279	310	340	6
7	007	038	066	097	127	158	188	219	250	280	311	341	7
8	008	039	067	098	128	159	189	220	251	281	312	342	8
9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	1164	194	225	256	286	317	347	13
14	014	045	073	104	134	165	195	226	257	287	318	348	14
15	015	046	074	105	135	166	196	227	258	288	319	349	15
16	016	047	075	106	136	167	197	228	259	289	320	350	16
17	017	048	076	107	137	168	198	229	260	290	321	351	17
18	018	049	077	108	138	169	199	230	261	291	322	352	18
19	019	050	078	109	139	170	200	231	262	292	323	353	19
20	020	051	079	110	140	171	201	232	263	293	324	354	20
21	021	052	080	111	141	172	202	233	264	294	325	355	21
22	022	053	081	112	142	173	203	234	265	295	326	356	22

23	023	054	082	113	143	174	204	235	266	296	327	357	23
24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
27	027	058	086	117	147	178	208	239	270	300	331	361	27
28	028	059	087	118	148	179	209	240	271	301	332	362	28
29	029	060	088	119	149	180	210	241	272	302	333	363	29
30	030	061	089	120	150	181	211	242	273	303	334	364	30
31	031	062	090	121	151	182	212	243	274	304	335	365	31

FOR LEAP YEAR USE REVERSE SIDE

JULIAN DATE CALENDAR

FOR LEAP YEARS ONLY

Day	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	061	092	122	153	183	214	245	275	306	336	1
2	002	033	062	093	123	154	184	215	246	276	307	337	2
3	003	034	063	094	124	155	185	216	247	277	308	338	3
4	004	035	064	095	125	156	186	217	248	278	309	339	4
5	005	036	065	096	126	157	187	218	249	279	310	340	5
6	006	037	066	097	127	158	188	219	250	280	311	341	6
7	007	038	067	098	128	159	189	220	251	281	312	342	7
8	008	039	068	099	129	160	190	221	252	282	313	343	8
9	009	040	069	100	130	161	191	222	253	283	314	344	9
10	010	041	070	101	131	162	192	223	254	284	315	345	10
11	011	042	071	102	132	163	193	224	255	285	316	346	11

12	012	043	072	103	133	164	194	225	256	286	317 347	12
13	013	044	073	104	134	165	195	226	257	287	318 348	13
14	014	045	074	105	135	166	196	227	258	288	319 349	14
15	015	046	075	106	136	167	197	228	259	289	320 350	15
16	016	047	076	107	137	168	198	229	260	290	321 351	16
17	017	048	077	108	138	169	199	230	261	291	322 352	17
18	018	049	078	109	139	170	200	231	262	292	323 353	18
19	019	050	079	110	140	171	201	232	263	293	324 354	19
20	020	051	080	111	141	172	202	233	264	294	325 355	20
21	021	052	081	112	142	173	203	234	265	295	32 356	21
22	022	053	082	113	143	174	204	235	266	296	327 357	22
23	023	054	083	114	144	175	205	236	267	297	328 358	23
24	024	055	084	115	145	176	206	237	268	298	329 359	24
25	025	056	085	116	146	177	207	238	269	299	330 360	25
26	026	057	086	117	147	178	208	239	270	300	331 361	26
27	027	058	087	118	148	179	209	240	271	301	332 362	27
28	028	059	088	119	149	180	210	241	272	302	333 363	28
29	029	060	089	120	150	181	211	242	273	303	334 364	29
30	030	061	090	121	151	182	212	243	274	304	335 365	30
31	031	062	091	213	152	183	213	244	275	305	336 366	31

(USE IN 1964, 1968, 1972, etc)

DENALI ROAD CORRIDOR WILDLIFE SURVEY CODES, 1990-91

Observer

- 1 Canale
- 2 Irinaga
- 3 Soileau
- 4 Trumbull
- 5 Barker
- 6 Butler

Starting Location

- 1 McKinley Village
- 2 Chalets
- 3 Harper/Princess Lodge
- 4 Riley Creek
- 5 Mayflower Pad
- 6 Park Hotel
- 7 Railway Depot
- 8 Visitor Access Center

Ending Location

- 1 Toklat
- 2 Stony Hill
- 3 Wonder Lake
- 4 Eielson Visitor Center
- 5 Camp Denali
- 6 Polychrome Rest Stop
- 7 Teklanika Rest Stop
- 8 Savage Box

Weather

- 1 Clear
- 2 Partly Cloudy
- 3 Cloudy
- 4 Raining
- 5 Snowing

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- 3 Cloudy
- 4 Raining
- 5 Snowing

Animal Species

- 1 Caribou (C)
- 2 Dall's Sheep (S)
- 3 Grizzly Bear (B)
- 4 Moose (M)
- 5 Fox (F)
- 6 Wolf (W)
- 7 Beaver
- 8 Wolverine
- 9 Golden Eagle
- 10 Marmot
- 11 Snowshoe Hare
- 12 Porcupine
- 13 Geese
- 14 Falcon
- 15 Other

Distance

- 0 on the road
- 1 1-10 meters
- 2 11-20
- 3 21-30
- 4 31-40
- 5 41-50
- 6 51-60
- 7 61-70
- 8 71-80
- 9 81-90
- 10 91-100
- 11 101-200
- 12 201-300
- 13 301-400
- 14 >400 meters

Side of Road

- 1 North
 - 2 South
 - 3 On Road
-

Data Entry Information:

All data were entered into dBASE III+ database files by Stephen Salisbury, Jack Thach and Paul Atkinson in 1993 and 1995.

Files: ROAD90.DBF (1990 road survey data), ROAD91.DBF (1991 road survey data)

Field names and numerical codes used were the same as those used by Taylor in his 1988 and 1989 road survey databases.

Data were entered using a data entry screen that permitted entry of only the specific numerical range used for each field (thus preventing meaningless outliers).

Incomplete or illegible data sheets were not entered into the databases.

All data entries were checked by Stephen Salisbury and Paul Atkinson. Printouts of all database records were manually checked against the original data sheets, and errors were then corrected in the database files.

Actual park road mileage for sighting locations (ROADMILE field) was automatically calculated after all data were entered by adding or subtracting the appropriate mileages from the starting location:

McKinley Village	- 6.6 mi
Chalets	- 1.8 mi
Harper/Princess	- 1.5 mi
Mayflower Bus Pad	- 1.5 mi
Visitor Center	+ 0.7 mi
Park Hotel	+ 1.6 mi
Railway Depot	+ 1.7 mi

All times were converted to 24-hour format (military time).

Unusual sightings not listed in species list above (least weasels, etc.) were noted in the REMARKS field.

Animals observed crossing the road were recorded as on road in SIDEOFROAD field with "Crossing Road" noted in the REMARKS field.

Those bus runs that ended at non-standard points (Giglione Bridge, Polychrome Rest Stop, etc.) were recorded as ending at the next farthest standard ending location, with the actual ending location noted in the REMARKS field.