ALASKA DEPARTMENT OF FISH AND GAME
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CHARACTERISTICS OF EXPLOITED WOLF POPULATIONS

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SUMMARY

The effectiveness of aerial wolf survey techniques was evaluated in Game Management Units (GMU's) 20A and 13. Results indicated that under certain conditions, aerial wolf surveys can provide reasonably accurate estimates of wolf numbers in the types of habitat typical of Southcentral and Interior Alaska. Most important of these conditions are the presence of an adequate amount of fresh snow and sunlight, and the use of pilots and observers possessing the ability to identify, interpret, and follow wolf tracks observed from the air. In relatively level terrain, flight transects about six miles (10km) apart appear to be adequate to detect the presence of wolf packs under present ecological conditions in Alaska. In more broken terrain, waterways and ridge systems should be followed most closely with the average distance between flight lines also being about six miles (10km) or less. Results of an extensive survey and control effort in subunit 20A during early 1976 suggested that previous survey estimates tended to be slightly conservative. It appears that the wolf population in subunit 20A has been relatively stable since 1973, numbering about 200 individuals in late winter.

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BACKGROUND

The general background of wolf *(Canis lupus)* studies in Alaska has been presented in previous reports (Rausch 1966, 1967, 1969; Stephenson and Johnson 1972; Stephenson 1975). The need for reliable estimates of wolf numbers in Alaska in general, as well as in specific areas, has increased in recent years due to drastic declines in various moose *(Alces alces)* and caribou *(Rangifer tarandus)* populations, and the heightened national concern over the status and wellbeing of wolves in Alaska.

In 1973 the Department intensified efforts to develop and refine techniques for aerial wolf surveys and to apply these techniques to quantify wolf abundance in certain Game Management Units (GMU's). Extensive population surveys were conducted during late winter in GMU's 20 (1973, 1974, 1975) and 13 (1974). Previously, estimates of wolf abundance, based on various kinds of information, had been made in Southeastern Alaska (Atwell et al. 1963), Southcentral Alaska (Rausch 1967, 1968, 1969) and Arctic Alaska (Stephenson 1975).

Success of recent surveys has varied, depending on the experience of personnel conducting the work and on snow conditions. Also, the reliability of population estimates was unmeasurable because of a lack of replicate survey coverage within years. Nevertheless, wolf and moose population estimates for GMU 20 strongly suggested that predator/prey ratios were high. In 1973 the Board of Fish and Game authorized the Department to remove up to 80 percent of the wolves in subunit 20A to decrease predation on ungulates. This program necessitated reconnaissance flying over a prolonged period which provided extensive data on wolf distribution and abundance. Removal of wolves during the program, when viewed in relation to previous population estimates, also provided a measure of the reliability of those estimates.

Another effort to evaluate the effectiveness of aerial surveys was undertaken in connection with ecological studies of radio-collared wolves in GMU 13 in Southcentral Alaska. In this area a relatively precise knowledge of the numbers and distribution of radio-marked packs provided the opportunity to test the ability of a pilot and observer to detect and accurately enumerate wolves based on the occurrence of tracks following a fresh snowfall. This report discusses the results of these studies.

OBJECTIVES

To assess wolf population levels and determine the characteristics of exploited wolf populations in Southcentral, Interior and Arctic Alaska.

PROCEDURES

In January 1974 a memorandum outlining basic procedures for conducting wolf surveys was distributed to Department biologists involved in wolf surveys. Procedures, based upon the extensive experience of biologist Peter E.K. Shepherd, were developed around the following points:

1) Fresh snow is essential for an accurate wolf survey. "Reading" tracks becomes increasingly difficult with the increasing density of animal tracks following a fresh snow. Ideally, aircraft and personnel should be available on a day's notice beginning in mid-February so the maximum amount of flying can be done the first two or three days following a snowfall. A few inches of fresh snow are sufficient to enable biologists to distinguish new tracks from old. The best survey conditions are encountered during clear weather following a fresh snowfall, since sunlight enhances track definition.

2) Selection of a pilot experienced in tracking wolves from the air and familiar with the survey area is critical to the success of these surveys. The best aircraft for these surveys are ski-equipped Super Cubs (PA-18). Two or more aircraft may be used simultaneously in adjoining areas.

3) Inherent errors resulting from chance occurrence of "resident" wolves outside the survey area become less important with increasing size of the survey area. Survey area boundaries are arbitrary and do not necessarily conform to the "territorial" boundaries of wolf packs. Wolf packs in Alaska may range over an area of from 300 to 2000 mi^2 (777 to 5180km^2), with most "territories" being in the lower end of that range. Each survey should cover at least 1500 mi^2 (4350km^2). This area can be covered adequately in most terrain with a Super Cub in one day (4 to 7 hours of flying).

4) Differences in prey species density and predator-prey associations should be considered when selecting survey areas. Wolves are highly mobile and can concentrate quickly in areas with high prey densities. This could result in grossly inaccurate estimates of wolf numbers if survey results from a limited area were extrapolated to a larger area without considering wolf and prey distribution.

5) Entire drainages, or large parts of drainages, may be selected as survey areas to facilitate navigation. Flight routes should follow terrain on which tracks are visible and over which wolves are likely to travel. Drainage systems offer the greatest opportunity to locate and follow wolf tracks from the air in most areas. Flight routes may follow drainages with deviations to view lakes, trails, open ridges, knolls and promontories; wolves tend to travel and rest on ridgetops. In areas where the habitat is generally homogenous, parallel transects approximately six miles (10km) apart should be flown. If such areas are small (20 mi^2 or less) and bordered by streams or other open areas in which tracks are visible, flying along the periphery is recommended since wolves will rarely remain in heavy cover for long periods when snow cover is heavy.

6) When wolf tracks are sighted, the direction of travel and number of wolves should be determined. Tracks should be followed as long as possible or until the wolves are located. If wolves are not located, the number of wolves should be determined by landing at a place where pack members have diverged briefly. Larger packs warrant more careful attention than packs of only two or three animals, and counting tracks from the ground may help to avoid confusion and error in determining numbers. When wolves are located they should be circled widely at an altitude of about 500 feet (150m) until a count and description of the animals can be obtained. The location of wolves and their tracks, the direction of travel and travel routes should be indicated on 1:250,000 maps. When there is a possibility of duplication in the enumeration of wolves based on the occurrence of tracks they should be followed and/or intervening areas searched.

7) Results of wolf surveys should be expressed either as the number of wolves/mi^2 or km^2, or as the number of mi^2 or km^2/ wolf. The area covered by each survey should be determined using a planimeter or by enumerating townships. Determination of density provides a basis for comparing results with those from other studies in Alaska and elsewhere.

In addition to the above, the memorandum outlining proposed survey techniques included information on how to differentiate other large mammal tracks from those of wolves, general habits of wolves, ways to determine direction of travel of wolves based on tracks, characteristics of wolf den sites, and a description of physical and behavioral characteristics which can be used to differentiate pup from adult wolves during early winter.

The techniques outlined above were used in the 1976 survey work in both GMU 13 and subunit 20A.

Subunit 20A Study, 1977

In subunit 20A, 325 hours were flown between 13 January and 19 April 1977. A lack of fresh snow prior to mid-March made surveys difficult because recent tracks were difficult to locate and because wolf movement patterns were unlike those in normal winters with heavier snowfall. During February and March, snow depth on the Tanana flats averaged only about 1.5 feet (46cm). Wolves were not restricted to waterways and wind-packed areas as they are when snow depths are greater. As a consequence wolves tended to remain in heavy cover for long periods, and flight patterns were modified to survey these areas.

The lack of snow also allowed wolves to disperse quickly when approached by aircraft, thereby making enumeration difficult. In deep snow wolves will remain in a single track until an aircraft is very close and even then scattering is slowed, thereby allowing a more accurate count of pack numbers. Sightability of wolves was also much reduced by patchy snow and exposed low brush. Wolves and wolf tracks were most effectively located by flying a "crisscross" pattern over large areas while generally following a discernible drainage from the Tanana River to the foothills or mountains of the Alaska Range. Fresh trails were followed until lost or the wolves were located. Landings were made whenever possible to better determine direction of travel and number of wolves. Trails of single wolves were followed for only short distances.

Effectiveness of Aerial Surveys Evaluated - GMU 13 - 1975-76

The effectiveness of aerial surveys was evaluated during ecological studies of radio-collared wolves in GMU 13 in Southcentral Alaska. A relatively precise knowledge of the numbers and distribution of radio-marked packs in an area of about 7000 mi^2 ($18,130km^2$) provided wolf density figures to which the results of an aerial survey could be compared. Originally, the boundaries of the survey area included the Denali Highway on the north, the Richardson Highway on the east, the Glenn Highway on the south and the Maclaren, Susitna and Tyone Rivers, Lake Louise and the Lake Louise Road on the west. This area includes about 2600 mi^2 ($6734km^2$) of various types of terrain.

Winter 1975-76 in GMU 13 was characterized by shallow snow depths and infrequent, light snowfalls. Survey conditions were not adequate until mid-March when a heavy snowfall with drifting occurred. It stopped snowing 17 March leaving as much as 36 cm of snow in parts of the study area and providing excellent survey conditions.

The survey team selected to take part in the evaluation consisted of Ed King (pilot) of King Salmon and Nick Steen, assistant area biologist in King Salmon and former assistant area biologist in Glennallen. Both individuals were experienced in aerially tracking wolves and were familiar with the Nelchina area, but neither had prior knowledge of the location and composition of radio-marked packs. Unfortunately, the survey team was delayed by weather from leaving King Salmon and did not arrive in Glennallen until the afternoon of 21 March, four days after snow had ceased. Part of the proposed survey area was covered 22 and 23 March, although availability of direct sunlight limited flying on 23 March to late afternoon. Deteriorating survey conditions 24 March terminated the survey effort prematurely with about two-thirds of the proposed area covered. Because of the delay in survey initiation and the forested nature of most of the terrain which made tracking slow, the survey team followed tracks only long enough to determine direction of travel and obtain what they thought was a good estimate of numbers based on tracks. This team covered approximately 1800 mi^2 ($4612km^2$) in 7.75 hours of survey flying.

FINDINGS

GMU-20A

Aerial survey coverage in late February 1976 of subunit 20A and the small portion of subunit 20C lying east of the Nenana River resulted in an estimate of 183 wolves in 23 packs (Table 1). Fig. 1 shows the general locations of packs based on surveys prior to the initiation of control efforts, the location and number of wolves removed during control work by the Department, and the approximate locations of wolves taken by private individuals during 1975-76. Actual sightings of wolves during 1976 are detailed in Table 2. Comparison of pack sizes estimated from tracks with those actually observed during later control efforts suggests that track estimates were overestimated by a factor of 8.7 percent. Single wolves constituted 11 of 113 wolves (8.9%) observed during aerial surveys and control efforts (Table 2). This is comparable to data on Alaskan wolf population composition presented by Mech (1970) in which about 9.0 percent of wolves seen were singles. Thus, it appears that the error in pack size estimation may have been compensated for by a number of lone wolves which were not included in the February population estimate because their pack affiliation was unknown.

Prior to initiation of aerial surveys in late January, trappers took 56 wolves in subunit 20A and a small portion of 20C adjoining 20A (Table 3). These wolves plus the estimated late February population yield a calculated autumn 1975 (pre-hunting season) population of 239 wolves, which is a population density of one wolf per 29 mi^2 ($75km^2$) in the 7000 mi^2 ($18,130km^2$) area.

The number of wolves (94) remaining in subunit 20A following the cessation of control efforts on 25 April was estimated by subtracting 67 wolves taken by the Department and 78 wolves taken by hunters and trappers (Table 4) from the total estimated late February population. Individuals conducting the 1976 reconnaissance and control efforts in 20A considered this calculated number to be slightly high based on their observations which indicated that as few as 75 wolves remained.

Aerial surveys to determine wolf abundance in subunit 20A have been conducted each winter since 1973 with variable success. These surveys are described in detail in a previous report (Stephenson 1975) and are reviewed below.

In March 1973, 37 hours of aerial surveys were conducted in 9030 mi^2 ($23,388km^2$) of subunit 20A and portions of the remainder of GMU 20. Wolf density was estimated to range from about one wolf per 33 mi^2 ($85km^2$) on the Tanana flats to one per 140 mi^2 ($363km^2$) in the higher elevations of the Charley, Salcha and Birch Creek drainages. A minimum of 20 different packs totaling 101 wolves were present in the area surveyed. Based on track observations, the average pack size for 17 groups of 2 or more wolves was 5.8 wolves. Survey conditions were relatively poor during this period with only one snowfall occurring that was sufficient to cover old tracks.

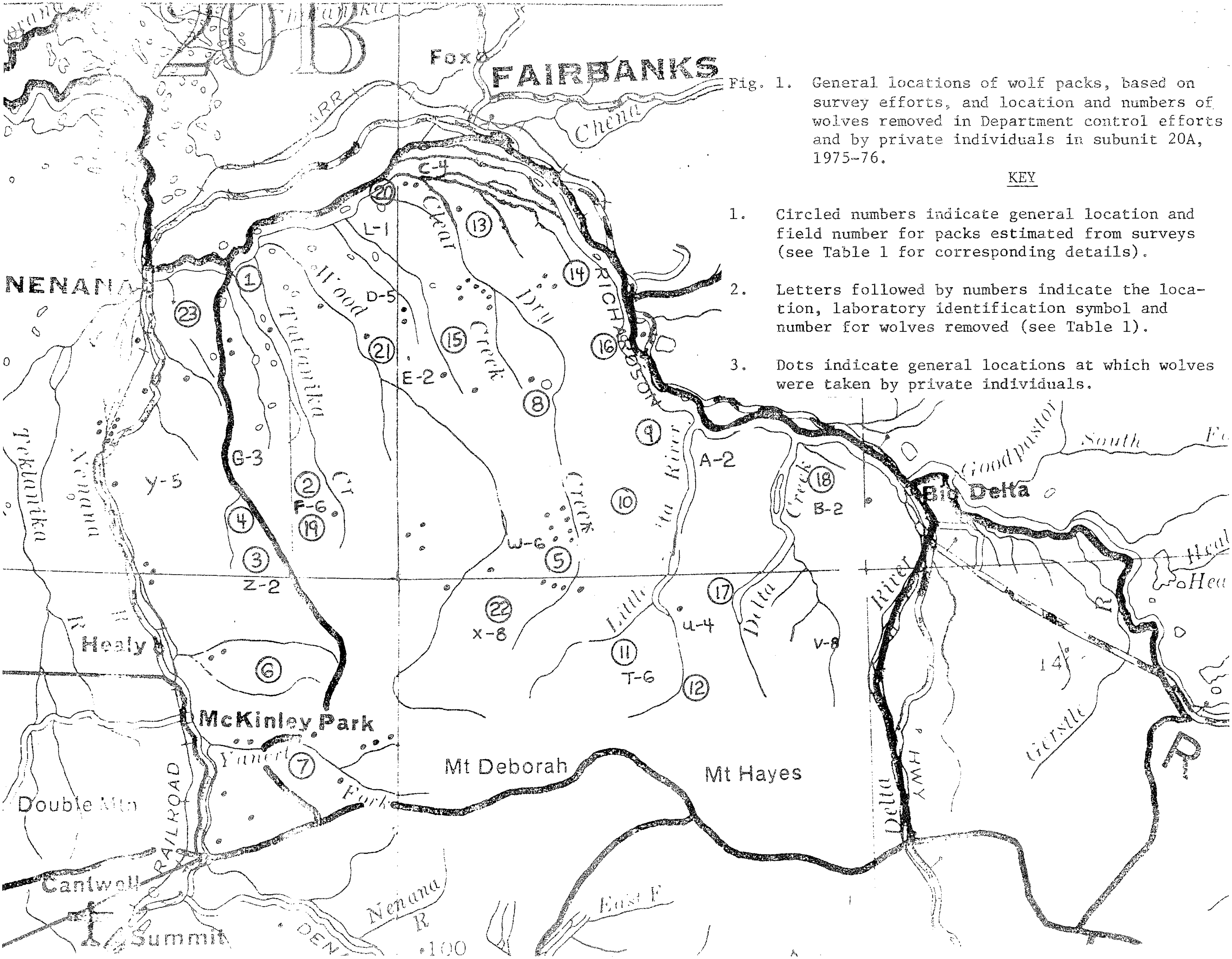

Fig. 1. General locations of wolf packs, based on survey efforts, and location and numbers of wolves removed in Department control efforts and by private individuals in subunit 20A, 1975-76.

KEY

1. Circled numbers indicate general location and field number for packs estimated from surveys (see Table 1 for corresponding details).

2. Letters followed by numbers indicate the location, laboratory identification symbol and number for wolves removed (see Table 1).

3. Dots indicate general locations at which wolves were taken by private individuals.

Table 1. Estimated wolf pack[a] sizes in Unit 20A, January through March 1976.

Field Pack No.	Lab Pack Id.	Location	Estimated Size	Actual Size	Known No. Removed[b]	Remaining
1	-	Tanana River-NW Flats	12	?	?	12
2	F	Tatlanika Flats-Foothills	10	9	6	4
3	Z	Jumbo Dome	7	6	3	4
4	Y	Totatlanika-Rex Dome	12	11	5	6
5	W	Slide Creek-Jap Hills	18	14	8	6
6	-	Healy-Moody Creeks	8	?	?	8
7	-	Yanert	16	?	?	16
8	-	Blair Lakes	5	?	?	5
9	A	Little Delta-Tanana River	6	?	2	4
10	-	Little Delta-Flats	5	?	?	5
11	T	Little Delta-Buchanan Creek	6	6	6	0
12	U	Little Delta-East Fork	6	5	4	2
13[c]	-	Clear Creek Buttes	7	?	?	7
14	C	Salchaket Slough	5	5	4	1
15	D	Crooked and Willow Creeks	5	5	5	0
16	?	Nelson Clearwater-Salchaket	7	?	1	6
17	V	Delta Creek-100 Mile Creek	14	14	8	6
18	B	Delta Creek-Tanana River	6	4	2	2
19	-	Fish Creek	5	?	?	5
20	-	Rosie Creek	6	?	?	6[d]
21	E	Wood River Buttes	6	4	2	2
22	X	Dry Creek-Upper Wood River	8	10	8	2
23	G	Totatlanika-Lower	3	4	3	1
		Totals	183[e]	97[f]	67[g]	110[h]

a. Some may represent parts of larger packs.
b. Aerial control - trapper catches are deducted from remaining population.
c. Packs or sub-packs from Nos. 13-16 were heavily trapped in addition to aerial control.
d. Remaining wolf estimate is known to be high for this pack and others.
e. Overestimate of 8.7 percent (compared to estimate of actual pack size). Essentially equals number of singles (9.0%); fall population equals 183 + 54 trapped = 239 wolves.
f. Actual count of 13 packs.
g. In addition, one wolf was found dead at Slide Creek.
h. Less 24 trapped = 86.

Table 2. Wolf pack sightings, Subunits 20A and 20C, 1976.

Area	Date	Fixed Wing Aircraft	Pack Size	No. Removed
Wood River	1/14	B	1	0
Slide Creek	2/24	B	14	4
Clear Creek Buttes	2/27	A	5	0
Dry Creek	2/28	A	10	8
East Fork Little Delta	3/8	A	4	2
Slide Creek	3/9	A	5	2
Little Delta	3/10	B	2	2
Tanana	3/11	B	1	1
Wood River Buttes	3/11	B	3	1
Clear Creek	3/14	A	2	2
Wood River	3/14	A	2	1
Tatlanika River	3/19	A	2	2
Tatlanika River	3/19	A	3	3
Salchaket Slough	3/17	A	2	2
Tatlanika River	3/19	A	2	2
Tatlanika River	3/20	A	2	0
Salchaket Slough	3/20	A	1	1
Crooked Creek	3/20	A	2	2
100 Mile Creek	3/20	C	3	3
Buchanan Creek	3/21	A	6	6
Tatlanika River	3/22	A	1	1
Salchaket Slough	3/22	A	1	1
Dry Delta	3/23	A	1	1
East Fork	3/23	A	1	1
Tatlanika River	3/25	A	3	3
Jumbo Dome	3/26	A	6	3
Rex Dome	3/26	B	2	1
Jap Hills	3/26	B	1	1
Dry Delta	3/28	A	2	0
Dry Delta	3/28	C	4	2
Clear Creek	3/29	A	1	1
Rex Dome	3/30	A	8	3
Rex Dome	3/30	C	2	1
Tatlanika River	4/5	A	1	0
100 Mile Creek	4/15	C	1	0
100 Mile Creek	4/17	A	6	3
			Total = 66	

A - PA-18
B - Bellanca Scout
C - PA-18

Table 3. Sex and age data for wolves taken in Subunit 20A by Department personnel during February, March and April 1976.

Number Taken	Sex		Age		Color	
	M	F	P	A	Black	Gray
66*	43	22	12	52	9	55

* Age data not available for 2 wolves; sex not available for one.

Table 4. Wolf harvest by hunters and trappers in Subunit 20A based on sealing data.

Year	No. Wolves Taken
1973	42
1974	51
1975	59
1976	78

The following year, March 1974, 8.2 hours of aerial surveys were flown in subunit 20A, covering 2100 mi^2 (5439km^2) of the 7000 mi^2 (18,130km^2) area. A heavy snowfall accompanied by high winds provided good survey conditions. In addition, two trappers with long experience in the area were consulted for information on wolf occurrence in the foothills and mountains of the Alaska Range adjacent to the areas in the Tanana flats which were surveyed. Data reflecting wolf abundance were obtained for a total area of 3400 mi^2 (8806km^2) with an estimated minimum of 92 wolves occupying this area. This indicated a density of one wolf per 37 mi^2 (95.8km^2), with an average pack size (excluding two observations of lone wolves) for 17 groups of 2 or more wolves, of 5.3 wolves. Applied to the total 7000 mi^2 (18,130 km^2) area, this density would indicate a population of 189 wolves. Based on data from wolf sealing forms, 51 wolves were taken by hunters and trappers in 20A during 1973-74. This indicates that the autumn 1973 population was in excess of 200 animals and may have been as high as 240.

In March and April 1975, 53.5 hours of aerial surveys were flown in subunit 20A. A 2-inch snowfall on 5 March and a lighter snowfall on 22 March provided relatively good survey conditions. An area of 4700 mi^2 (12,173km^2) was surveyed including the mountainous portions of the subunit west of the Little Delta River and the Tanana flats and foothills from Dry Creek west to the Totatlanika River. The latter area received the most intensive coverage. Six large packs were observed during this period and an accurate count of another pack was obtained by tracking from the ground. The average pack size for these 7 packs was 9.4 wolves. The 66 wolves known to be present in this area represented a density of one wolf per 71 mi^2 (184km^2). Indications of a minimum of 20 other wolves in small packs in other parts of the area were also obtained from track sightings. Adding these figures raises the density to one wolf per 55 mi^2 (142km^2) which when applied to the entire unit suggested a population of 127 wolves. Wolf sealing data indicated that 59 wolves were taken legally by hunters and trappers during the 1974-75 season. In addition, evidence of illegal aerial hunting was noted, and the illegal kill could have amounted to 20 or 30 wolves. Combining the known human-caused mortality and the estimated late winter population of wolves yields a minimum autumn population of 186 wolves or a density of one wolf per 38 mi^2 (98km^2). Because of the unknown effects of natural mortality and illegal harvest this estimate of wolf density is considered minimal.

The population estimates made in 1973, 1974 and 1975 indicated a population level slightly lower than first suggested by the more extensive 1976 data. This difference probably was the result of differential survey intensity, although an actual increase in wolf numbers over that period was possible. Both immigration from surrounding areas and reproduction by resident wolves could contribute to an increase.

Of 131 wolves of known age status (pup or adult) taken in subunits 20A and 20C in 1976 (Tables 3 & 5), 39 or 29.7 percent were pups. This is an

Table 5. Sex and age data for wolves taken in Subunit 20A and 20C[a] by hunters and trappers during the 1975-76 season.

Month	Number Taken	Sex* M	Sex* F	Age** P	Age** A	Black	Gray	Brown	White
September	7	5	2	2	4	2	3	1	1
October	-	-	-	-	-	-	-	-	-
November	11	4	7	4	3	4	6	-	-
December	20	10	9	7	11	6	14	-	-
January	16	5	11	6	10	2	13	1	-
February	14	7	7	4	9	6	6	1	1
March	10	4	6	4	3	5	2	-	-
	78	35	42	27	40	25	44	3	2
Totals	144	78	64	39	92	34	99	3	2

* Sex not available for one wolf.

** Age data not available for 11 wolves.

a That portion of Subunit 20C lying between the Nenana River and the western boundary of 20A.

unexpectedly low proportion of pups for an Alaskan wolf population. Based on the examination of 4150 wolves between 1959 and 1966, Rausch (1967) reported that pups constituted from 37 percent to 48 percent (average 44 percent) of wolf populations in the state. Condition of females two or more years old was another indication of lowered reproductive success in this wolf population. There was a higher percentage of nonbreeders and average litter size was lower than for the females reported by Rausch (Stephenson 1977). In view of the lowered fecundity and/or survival suggested by these data, and the considerable harvest of wolves in 20A by humans during recent years (Table 4), a significant increase in the population is not likely.

Estimates of wolf numbers in subunit 20A prior to 1976 were probably conservative because of the less intensive survey efforts. These previous surveys were accomplished in a relatively short period of time, whereas the 1976 survey spanned a period of two months. This increased the chance of finding wolves in subunit 20A whose home range only partially or temporarily included a portion of the subunit. In 1976 several packs were found very near the border of the 20A area and one pack was tracked out of the area.

It appears that previous surveys may have underestimated wolf numbers slightly while results of long-term survey-control effort may have overestimated the number of resident wolves slightly. I believe that wolf numbers in subunit 20A have been relatively constant since 1973, numbering about 200 individuals in late winter, an average density of one wolf per 35mi^2 (91km^2).

GMU-13

On 22 March 1976 the survey team flew four north-south transects across the Lake Louise Flats between Lake Louise and the Richardson Highway. Transects extended from the Glenn Highway on the south to the West Fork of the Gulkana River on the north, and the distance between transects ranged from 4 to 10 miles (5 to 16km) and averaged about 6 miles (10km). On 23 March the team surveyed the Alphabet Hills, flying contours near timberline (900 to 1200m elevation). These flight lines were much closer together than those on the flats to the south, separated by an average of 3 miles (5km). The lower elevations of the West Fork drainage south of the Alphabet Hills were avoided because of the presence of aircraft involved in a radio collaring effort in this area. The survey in the Alphabet Hills was intensive relative to previous wolf surveys undertaken by the Department. That on the Lake Louise Flats was less intensive.

The survey team determined what they considered to be the minimum and maximum numbers of wolves represented by each track sighting. Table 6 presents the location and nature of each wolf track sighting made by the survey team and the minimum, maximum and estimated numbers are given below for each day of flying and in total.

Table 6. Observations of wolf tracks during aerial survey evaluation in GMU 13, 23 and 24 March, 1976.

Obs. No.	Estimated No. of Wolves	Direction of Travel[1]	Estimated Age of Tracks[2]	Location	Remarks
1	4	NW then circling SE to Deep Lake	Recent	North of Y Lake	Observations 1 thru 4 made on 22 March
2	1	Unknown	Recent	In timber along Moose Creek	Identity of this wolf unknown
3	1	SW	Recent	Dog Creek	Tracks in Nos. 1, 3 and 4 were made by members of the "Deep Lake" pack, 2 members of a group of 3 were radio-collared on this date
4	2	E	Recent	Fish Lake	
5	3	E	Old	North of Middle Lake	Observations 5 thru 27 made on 23 March
6	3	E	Recent	Gulkana R. north of Poplar Grove	
7	2	Unknown	Old	Ridge 5 mi. south of Monsoon Lake	
8	4	E and SE	Recent	5 mi. west of #7	
9	1	W	Recent	3 mi. west of #8	
10	2	N	Recent	3 mi. west of #9	
11	1	NW	Recent	3 mi. southwest of #10	
12	2	Unknown	Old	On slope north of Laren Benchmark	
13	3-4	NW	Recent	In narrow valley NW of Monsoon Lake	
14	2	NE	Recent	Northeast of #13	
15	2	E	Recent	On Monsoon Lake	
16	-	-	-	-	Wolverine at what appeared to be an old kill

Table 6. Continued.

Obs. No.	Estimated No. of Wolves	Direction of Travel[1]	Estimated Age of Tracks[2]	Location	Remarks
17	2	NE	Recent	South of Dickey Lake on hills	
18	2-5	Unknown	Recent	East of #17	
19	3	W	Old	2 mi. south of Dickey Lake	
20	3	Unknown	Recent	Middle Fk. of Gulkana R. below Hungry Hollow	
21	6	W-Upstream	Recent	Upstream from #20	
22	2	W	Recent	On slope south of Middle Fk. of Gulkana below Flat Top Mountain	
23	4-6	S	Recent	Mouth of Middle Fork	
24	7	Unknown	Old	In vicinity of #23	
25	1	SE	Recent	2 mi. north above 20 Mile	
26	4	Unknown	Old	On ridge west of Twin Lakes	
27	-	Unknown	Old	On ridge above lake 2477	

1 Direction of travel was in all cases interpreted from the characteristics of wolf tracks and trails.

2 "Old" indicates tracks were made before or during snowfall ending on 17 March while "Recent" indicates tracks were made following snowfall.

Number of wolves enumerated during aerial survey evaluation, GMU 13, 1976.

	March 22	March 23	Total
Minimum	8	15	23
Maximum	16	36	52
Accepted Estimate	8	15	23

Table 7 presents the general location and size of discrete groups of wolves designated by the survey team, and the number of wolves known to inhabit these areas based on telemetery studies and associated work conducted during previous months. The close agreement between the estimated population size determined from aerial surveys and from radio-tracking suggests that an experienced wolf survey team can obtain relatively accurate estimates of wolf populations under favorable snow and light conditions. Although a few additional wolves were later found in some of the packs detected in the survey, the survey team was successful in detecting those wolves inhabiting areas traversed during the survey. However, under less favorable survey conditions the team may not have detected the Deep Lake and Middle Fork packs which were near the eastern and southern portions, respectively, of their territories at the time of the survey.

Survey results in subunit 20A and Unit 13 suggest that wolf track count surveys can provide reasonably accurate estimates of wolf numbers in the habitat types typical of Southcentral and Interior Alaska. There are, however, a number of factors that increase the reliability of survey results. The most important are adequate snow and sunlight, and an experienced pilot and observer.

A comparison of the efficiency of three pilot/observer teams which were involved in 20A survey-control efforts during 1976 is given in Table 8. Both pilot and observer in aircraft A were experienced in aerially tracking wolves while the pilot of aircraft B had some experience but was accompanied by several relatively inexperienced observers. Aircraft C was piloted by a person with some experience in hunting and tracking wolves, but the observer had little experience tracking wolves. The figures for each aircraft suggest a nearly three-fold difference in efficiency in locating wolves which reflects, to some extent, general ability in interpreting tracks from the air.

Results of the Unit 13 evaluation suggest that in relatively level terrain flight transects about 6 miles (10km) apart are adequate for detecting the presence of wolves. In most cases, wolf surveys by the Department cover a much larger area than covered in Unit 13, which lessens the potential for underestimating wolf numbers because resident wolves are outside of the area surveyed. The relatively high level of experience of the people involved probably contributed to the accuracy of their estimate. As with fresh snow and sunlight, skilled observers with a good general understanding of the natural history of wolves and the ability to read tracks are basic requisites for accurate and efficient surveys.

Table 7. A comparison of known and estimated wolf pack sizes during Unit 13 wolf survey evaluation, March 1976.

General Location	Estimated No. of Wolves	Known No. of Wolves	Radioed Pack Designation	Comments
North of Crosswind Lake	4	3	Deep Lake	3 wolves located in same area in radio-collaring effort on same day. Pack later found to include a total of 7 wolves. Apparently only part of the pack was in survey area at the time of the evaluation.
South of Ewan Lake	1	?	Ewan Lake?	A pack of 10 wolves inhabited this area in early winter but at least several members including all radioed members either perished or dispersed by late winter and no sign of the pack had been detected for several weeks. The identity of this wolf is unknown.
East of Ewan Lake	3	3	None	During radio-collaring efforts on same day this trail was followed out and 3 wolves were located.
Middle Fk. of Gulkana River	7	9	Middle Fork	9 wolves were located in this area during radio-collaring efforts one day prior to survey effort.
Western Alphabet Hills	4	5	Keg Creek	
Eastern Alphabet Hills	4	4	Hogan Hill	In early winter this pack was composed of 8 members but the whereabouts of only 4 were known at the time of the survey. Two additional members were relocated in following weeks, however.
Totals:	23	24		

Table 8. A comparison of the efficiency of three pilot/observer teams.

Aircraft	No. Hours Flown	No. Wolves Sighted	Wolves/hr.
A	157.6	79	.50
B	101.4	24	.23
C	64.5	10	.15
	323.5	113	.35

The intensity of aerial coverage used in wolf surveys in Alaska is low compared to that of most other types of bg game surveys. Nevertheless, this technique appears to be effective under conditions found in much of central and northern Alaska and is practical in terms of the personnel requirements and cost. This "relatively extensive" type of survey is permissable because the traveling habits and normal distribution of wolf packs create discrete, extensive, and, to the practiced eye, distinctive trails in suitable snow cover. These factors minimize the intensity of surveys necessary to locate a large portion of the packs inhabiting an area, but it must be remembered that within a few days following a snowfall cumulative track patterns can confound such a survey.

Although this technique appears to be effective in enumerating wolves at levels of abundance currently found in much of Alaska, it would probably be less useful for censusing wolves at much higher densities, The trails of discrete packs would tend to intermingle more rapidly along territory edges, thus creating confusion. Miller and Russell (1977) evaluated the usefulness of aerial transect surveys and ground observation in determining wolf numbers on the western Queen Elizabeth Islands, Northwest Territories, and concluded that estimates based on aerial surveys were usually misleading. These estimates were based on wolves actually seen along transects, a technique much different than that employed in aerial wolf surveys in Alaska where wolf tracks are located and followed.

Aerial wolf surveys in Alaska have usually been conducted during late winter because of the more favorable snow and light conditions during this season. For the following reasons early winter surveys should be considered and undertaken when conditions allow:

1) Wolf packs are more cohesive in early winter than in late winter when the increased mobility of pups and the effects of mating activities increase the tendency for packs to split temporarily.

2) Estimating wolf populations at this time of year would preclude the necessity of having to take into account human-caused and natural mortality which has reduced numbers by some indeterminant and variable percentage.

3) For the above reason, and because pups are more easily distinguished from adults in the early winter, an early-winter census effort could provide some insight into pup survival.

4) During late winter, when snow depths are greatest, the tendency of wolves to travel in existing game trails complicates efforts to determine wolf numbers from track observations.

5) Maximum concentration of moose in lowland habitats occurs during late winter. This could alter the distribution of wolf packs somewhat making the data of little value in determining the summer distribution of active dens. Knowledge of summer distribution is valuable in assessing the potential impact of wolves on the young of prey species.

6) Combining wolf survey efforts with fall moose surveys currently conducted in most areas of the Interior and Arctic would increase the efficiency of these surveys.

Overcast skies which are prevalent over much of Alaska during this season and diminished day length are the greatest obstacles to conducting wolf surveys in early winter.

RECOMMENDATIONS

The most experienced observers and pilots should be used in large-scale, one-time-only wolf surveys. Inexperienced people should be trained during smaller scale, continuing survey efforts.

When weather conditions allow, wolf surveys should be attempted in early winter when pack cohesiveness is greatest. Poor light conditions and inadequate snow cover during this season often preclude wolf surveys, however. In the northern third of the state acceptable conditions often occur only during late March and April.

The observations and opinions of area residents should be used to augment wolf survey data whenever possible.

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