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Mary V. Hicks, Editor

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STATE OF ALASKA
Walter J. Hickel, Governor

DEPARTMENT OF FISH AND GAME
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LOCATION

Game Management Units: 1A and 2- (8,900 mi^2)

Geographic Description: Unit 1A - That portion of Unit 1 lying south of Lemesurier Point, including all drainages into Behm Canal and excluding all drainages into Ernest Sound

Unit 2 - Prince of Wales Island and all adjacent islands bounded by a line drawn from Dixon Entrance in the center of Clarence Strait, Kashevarof Passage, and Sumner Strait to and including Warren Island

BACKGROUND

Wolves inhabit the islands and mainland of Game Management Units 1A and 2. Accomplished swimmers, wolves may move between adjacent land masses separated by several miles of open water.

Deer are the primary food source for wolves in southern Southeast Alaska. On mainland portions of Subunit 1A, however, where deer numbers are generally lower, mountain goats are a larger portion of the diet (Smith et al. 1986). Beavers constitute a portion of some packs' diets, and many wolves feed on spawning salmon during August and September.

The colors of Southeast Alaska wolves vary widely. The brown/gray color is most common, but white and black wolves also inhabit this area. During the past decade, white or near-white wolves composed less than 1% of the harvest, while black wolves have accounted for about 21% of the harvest in Unit 1A and 17% in Unit 2.

Wolf research is being conducted in Unit 2 by a University of Alaska, Fairbanks graduate student. Objectives of the research are to: 1) assess and determine wolf distribution and abundance; 2) determine wolf home ranges, movements, and habitat use; and 3) evaluate feeding ecology of wolves (Person 1992). To date, over 20 wolves have been captured throughout the unit and 16 have been radiocollared. Over 460 relocations have been recorded and infrared monitoring systems used to estimate pack sizes (Person 1993). Wolf scats collected during the study will be analyzed to determine seasonal diets.

MANAGEMENT DIRECTION

Management Objectives

Maintain an average annual harvest of at least 20 wolves from Unit 1A and 39 from Unit 2. These numbers reflect the average harvests for these units during 1984-1990.

METHODS

Harvest data are collected from hunters and trappers when sealing wolves. Data collected include number and sex of harvested wolves, date and location of harvest, method of take, transportation used, and pelt color. An annual trapper survey supplies additional information from trappers.

RESULTS AND DISCUSSION

Population Status and Trend

Wolf numbers in Units 1A and 2 have increased during the past two decades, responding to increasing deer numbers after harsh winters in the early 1970s. Increased harvests also reflect increases in wolf numbers (Table 1). Responses to our past 2 trapper surveys indicate wolf trappers and hunters believe the wolf populations in both Units 1A and 2 are abundant. In Subunit 1A, the Index of Abundance (I_A) (Brand and Keith 1979) was calculated as 86 in 1991-92 and 65 in 1992-93. The I_A for Unit 2 was 59 in 1991-92 and 60 in 1992-93. According to Brand and Keith (1979), populations with values over 50 are considered abundant, those with values between 20 and 50 are intermediate, and those with values less than 20 scarce.

Population Size: Quantitative information about wolf populations is weak for Southeast Alaska. During the mid 1980s, Smith et al. (1986) researched wolf population on Revillagigedo Island and estimated that population at 39-51 early winter and 26-37 late winter. They further estimated at least 9 wolf packs inhabited the island at that time.

Recent research in Unit 2 has resulted in a preliminary estimate of 350-400 wolves (D. Person, pers. commun.). This estimate represents the first quantitative, data-based estimate ever for Unit 2 and is nearly twice as high as subjective departmental estimates made in the past (Wood 1990). Although estimates for Unit 1A will remain uncertain, Unit 2 estimates should become increasingly precise as information from the ongoing research becomes available.

Mortality

Harvest:

Season and Bag Limits.

Regulatory years 1990 & 1991

Hunting: No Closed Season; no bag limit
Trapping: November 10-April 30; no bag limit

Regulatory year 1992

Hunting: August 1 - April 30; five wolves.
Trapping: November 10 - April 30; no limit.

Board of Game Actions and Emergency Orders. Following the discontinuance of the wolf bounty program in the late 1970s, no changes to wolf seasons or bag limits were made until 1992. The Board of Game then implemented an August 1-April 30 wolf hunting season and a 5 wolf bag limit. No additional changes are recommended at this time.

Hunter/Trapper Harvest. The 1992-93 harvests in both 1A and 2 were the highest recorded during the past decade (Table 1). We believe the increased harvests during the past 2 to 3 seasons result primarily from an increase in wolf numbers and secondarily from localized increases in trapper effort, particularly on northern Prince of Wales Island.

Harvest Chronology. Wolf harvests are generally affected by local weather conditions. Persistent freezing often makes intertidal sets inoperative and ineffective. Deep snow can bury snares, making them useless. During the past two seasons, the highest number of Subunit 1A wolves were taken during March (Table 3). In Unit 2 the highest take in 1991-92 occurred during November and December when mild conditions kept traps ice-free and operative. In 1992-93, on the other hand, Unit 2 icing conditions in November and December reduced the overall catch; the highest harvest occurred late in the season when weather conditions favored trapping (Table 3). Numbers of trappers and hunters harvesting wolves have recently remained stable (Table 4). However, the average take per person has increased during the past 2 seasons in both Subunit 1A and Unit 2.

Transport Methods. Boats continue to be the most popular transport method of Unit 1A wolf trappers and hunters (Table 2). In both 1991 and 1992 61% of the successful Unit 2 trappers and hunters accessed harvest areas with highway vehicles. However, during the following 2 seasons, highway vehicles were used by only 32-37% of the successful Unit 2 wolf trappers and hunters (Table 2). Boats were used by 62-65% of those sealing wolves. This is believed to be due to the success of a new trapper from north P.O.W. who accessed his trapline using a boat, trapping 45% of the wolves in Unit 2 during the two seasons.

Habitat

As reported previously (Wood 1990, Larsen 1991), we believe increasing both the road system and human population will continue to directly affect wolves in Unit 1A and Unit 2. Long-term decreases in wolf numbers can be expected indirectly through loss of deer habitat. As the uneven-aged, old-growth forest is logged, deer carrying capacity will be reduced. Wolf populations, supported by fewer deer, will likely be reduced, and while fluctuations in wolf numbers will occur, the overall potential for the land to support wolves is expected to decline.

Concerns about future wolf declines on the Tongass National Forest were recently addressed by the Biodiversity Legal Foundation who petitioned the U. S. Fish and Wildlife Service to list the Alexander Archipelago wolf as a threatened species. The Service, examining available information, has not issued a decision on the petition.

CONCLUSIONS AND RECOMMENDATIONS

Wolf populations are stable or increasing in Subunit 1A and Unit 2. Recent high harvests reflect high wolf densities and additional effort among trappers. Habitat changes created by clearcut logging raise concerns about the long-term viability of Southeast Alaska wolves and has prompted the Biodiversity Legal Foundation to petition the U. S. Fish and Wildlife Service to list the Alexander Archipelago wolf as threatened. We continue to believe the

ability of the land to support wolves in southern Southeast will decrease as a result of deer habitat loss caused by logging. It is unknown, however, how this expected decrease will affect overall viability of Southeast wolves.

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Table 1. Subunit 1A and Unit 2, Wolf harvests 1984-1993.

Season	Males	Females	Unknown	Total	Method of take			Pelt Color			
					Shot	Trapped	Unk	White	Grey	Black	Unk
Unit 1A											
1984-85	6	9	0	15	3	12	0	1	12	2	0
1985-86	6	5	0	11	1	10	0	0	7	4	0
1986-87	11	10	0	21	3	18	0	0	16	5	0
1987-88	14	9	0	23	9	14	0	0	16	7	0
1988-89	13	8	0	21	10	11	0	0	14	7	0
1989-90	12	19	2	33[a]	14	19	0	0	25	8	0
1990-91	9	6	0	15	9	6	0	0	11	4	0
1991-92	15	16	0	31	12	19	0	0	29	2	0
1992-93	26	16	0	42	11	31	0	0	36	6	0
Totals	112	98	2	212	72	140	0	1	166	45	0
Unit 2											
1984-85	26	16	1	43	21	22	0	0	29	14	0
1985-86	7	11	0	18	9	9	0	1	14	3	0
1986-87	22	16	1	39	16	23	0	0	32	7	0
1987-88	27	24	4	55	26	29	0	1	39	15	0
1988-89	27	16	2	45	31	14	0	0	41	4	0
1989-90	20	11	1	32	23	8	1	0	20	9	3
1990-91	36	29	1	66	44	21	1	0	50	15	1
1991-92	42	40	4	86	41	45	0	0	80	6	0
1992-93	59	46	0	105	26	79	0	0	93	11	1
Totals	266	209	14	489	237	250	2	2	398	84	5

[a] Does not include 1 gray female killed by a car on South Tongass Highway, Ketchikan.

Table 2. Subunit 1A and Unit 2, Wolf trapper transport methods, 1985-1993

Season	Air	Boat	Highway vehicle	Walked	Unknown
Unit 1A					
1985-86	0	5	3	0	3
1986-87	10	11	0	0	0
1987-88	0	21	2	0	0
1988-89	0	16	5	0	0
1989-90	2	26	5	0	0
1990-91	1	10	2	0	2
1991-92	1	24	1	5	0
1992-93	2	30	3	3	4
Totals	16	143	21	8	9
Unit 2					
1985-86	0	4	5	0	9
1986-87	0	14	25	0	0
1987-88	0	31	20	0	4
1988-89	3	25	14	0	5
1989-90	0	12	15	0	5
1990-91	2	15	40	1	8
1991-92	2	53	31	0	0
1992-93	1	68	32	0	4
Totals	8	222	182	1	33

Table 3. Subunit 1A and Unit 2 wolf harvest chronology, 1984-1993.

Season	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Unit 1A												
1984-85	0	0	2	0	0	1	4	4	3	1	0	0
1985-86	0	0	0	0	0	1	4	3	2	1	0	0
1986-87	0	1	0	0	1	2	3	11	2	1	0	0
1987-88	0	0	1	1	0	4	6	3	1	1	3	3
1988-89	0	1	2	1	3	2	4	0	3	4	1	0
1989-90	0	1	1	4	4	5	3	3	6	5	1	0
1990-91	0	0	2	1	4	0	2	2	0	2	2	0
1991-92	0	0	0	4	3	2	2	4	9	6	1	0
1992-93	0	1	1	2	5	6	1	4	15	7	0	0
Totals	0	4	9	13	20	23	29	34	41	28	8	3
Unit 2												
1984-85	0	1	2	2	2	7	9	11	4	5	0	0
1985-86	0	0	4	1	2	2	3	4	1	1	0	0
1986-87	0	1	1	1	2	11	6	9	5	2	1	0
1987-88	0	1	1	7	7	11	3	11	8	1	4	1
1988-89	0	0	5	8	5	8	5	4	0	3	4	3
1989-90	0	2	3	3	2	5	3	2	2	2	4	4
1990-91	0	4	4	8	7	6	7	12	12	6	0	0
1991-92	1	2	7	1	8	20	18	7	7	11	2	2
1992-93	0	1	3	8	10	19	15	16	28	4	1	0
Totals	1	12	30	39	45	89	69	76	67	35	16	10

Table 4. Numbers of trappers who caught wolves in Subunit 1A and Unit 2 and average catch per trapper, 1985-1993.

Season	Number of people that harvested wolves		Average catch/person	
	1A	2	1A	2
1985-86	7	14	1.6	1.3
1986-87	10	27	2.1	1.4
1987-88	12	34	1.9	1.6
1988-89	15	31	1.4	1.4
1989-90	18	28	1.8	1.1
1990-91	13	42	1.1	1.6
1991-92	17	37	1.8	2.3
1992-93	19	35	2.2	3.0

LOCATION

Game Management Unit: 1B and 3 (6,000 mi^2)

Geographical Description: Southeast Mainland from Cape Fanshaw to Lemesurier Point and adjacent Islands

BACKGROUND

Wolves are endemic to the Alexander Archipelago south of Frederick Sound and to the Southeast Alaska mainland. Wolves probably immigrated into this region relatively late after the postglacial immigration and establishment of deer populations. Because Subunit 1B and Unit 3 are heavily forested, wolves are infrequently seen. Viewing opportunities are very limited.

Wolf trapping is a well-established pursuit by a few individuals. There is less interest in trapping now than in the past because pelt prices are generally low and trappers in this area are not dependent upon trapping as a primary income.

Government-funded trapping and poisoning programs were used in the past to reduce wolf numbers to increase deer numbers. No control programs are in effect now, and none are planned.

MANAGEMENT DIRECTION

Management Objectives

Maintain viable populations in all areas of historic wolf range.

METHODS

We monitored the harvest through mandatory pelt sealing. We collected data on the number of wolves killed, sex, date and method of take, and method of transportation. Trappers and hunters shared field observations and opinions about wolf numbers.

We recorded incidental observations of wolves by department personnel and the public. Air taxi pilots reported wolf sightings, especially when wolves were in close proximity to other game animals.

RESULTS AND DISCUSSION

Population Status and Trend

Pupulation Size We did not collect sufficient data to allow meaningful estimates of wolf populations. At best we can only make a reasoned assumption that the population is stable or increasing. Wolf numbers fluctuate more on individual islands than for the combined area of Unit 1B and Unit 3. These two management areas should probably be considered as a single unit because wolves cross the narrow waters between the mainland and islands. At low tide wolves can walk across Dry Straits, the boundary between Subunit 1B and Unit 3.

Mortality

Harvest:

Season and Bag Limit.

Regulatory years 1990 & 1991

Hunting: No closed season; no bag limit
Trapping: November 10-April 30; no bag limit

Regulatory year 1992

Hunting: August 1-April 30; five wolves
Trapping: November 10-April 30; no bag limit

Board of Game Actions and Emergency Orders. The Board of Game instituted a hunting bag limit of 5 wolves and an open season from August 1 to April 30, effective July 1, 1992. The Board did not change the trapping season or bag limit. Before this action wolf hunters had no closed season or bag limit.

Hunter/Trapper Harvest. The average annual harvest of wolves for the past 5 seasons was 38 for the combined areas (Table 1). In 1989-90, the first year of substantially increased kill, the take was 41 wolves. Wolf harvest fluctuates widely between years, and we cannot determine a primary reason. The fur market is a strong influence; trappers are less likely to invest in costly equipment when prices are low. The measure of individual expertise and number of trappers are also important factors affecting harvest.

One trapper, of the 31 people taking wolves, took 10 wolves in 1991-92. Different individuals took 6, 5, and 4 wolves each. In 1992-93 a trapper took 12 wolves, another took 4, and the other 12 trappers took less than 4 each. Trappers and hunters combined averaged about 2 wolves each for 1991-92 and over 2 for 1992-93. The fewer number of trappers caused the difference in harvest between 1991-92 and 1992-93.

Trapping continues to be the primary method of take. One or two trappers use calls to attract wolves. Deer hunters, and occasionally moose hunters, are generally responsible for shot wolves.

Harvest Chronology. Most wolves are taken in December, January, and February. Hunters taking wolves incidentally account for most of the other times (Table 2).

Transport Methods. Most of the wolf harvest in Unit 3 is by trappers using small boats (Table 3). Some trapping occurs from the road system on Mitkof and Wrangell islands. Other forms of transportation are rarely used.

CONCLUSIONS AND RECOMMENDATIONS

Wolf populations have increased in the past 5 years. There has been no real change in harvest other than small annual fluctuations that may be explained by the number of trappers. I recommend no change in regulations.

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Table 1. Subunit 1B and Unit 3 wolf harvest, 1985-93.

Regulatory year	UNIT	Reported harvest				Method of take		Successful
		M	F	Unk.	Tot.	Trap/snare	Shot	Total trappers/hunters
1985-86	1B	6	3		9	6	3	4
	3	5	4		9	7	2	4
1986-87	1B	7	4		11	10	1	6
	3	6	3	1	10	9	1	7
1987-88	1B	8	6		14	11	3	6
	3	6	3		9	5	4	6
1988-89	1B	4	5		9	6	3	6
	3	5	5		10	5	5	6
1989-90	1B	12	7		19	14	5	8
	3	12	10		22	12	10	13
1990-91	1B	7	8		15	10	5	3
	3	11	7		18	15	3	10
1991-92	1B	4	6		10	7	3	7
	3	26	25		51	33	16	25
1992-93	1B	3	5		8	7	1	2
	3	12	14		26	19	7	13

Table 2. Subunit 1B and Unit 3 wolf harvest chronology percent by time period, 1985-93.

Regulatory year	Unit	Harvest periods													
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Unk	*n*
1985-86	1B					33		66							9
	3							33	11	22		11		22	9
1986-87	1B			9		9	9	18	9	27	18				11
	3			10	10				70	10					10
1987-88	1B			7	7	50			29				7		14
	3				11		22		11		22	11	22		9
1988-89	1B		11		11	11	56	11							9
	3	10		10					50		20	10			10
1989-90	1B			11	11	16	32	26			15				19
	3		9	16	16		32	16	5	16	5				22
1990-91	1B				2		1	6	2	4					15
	3		1		1		2	5	4	3	2				18
1991-92	1B		1			1	2	6							10
	3			4	4	7	4	8	8	6	5	3	2		51
1992-93	1B					1	4	2			1				8
	3			4	1		3	9		4	5				26

Table 3. Subunit 1B and Unit 3 wolf harvest percent by transport method. 1985-93.

Regulatory year	Unit	Percent of harvest								*n*
		Airplane	Horse or Dog team	Boat	3 or 4 wheeler	Snow machine	ORV	Highway vehicle	Other	
1985-86	1B	NA								
	3	NA								
1986-87	1B			82	18					11
	3			60				10	30	10
1987-88	1B			93					7	14
	3			89				11		9
1988-89	1B	11		78		11				9
	3	10		70				20		10
1989-90	1B			89		11				19
	3			77	5			18		22
1990-91	1B			73	7	13			7	15
	3			72		17		11		18
1991-92	1B			90		10				10
	3	4		69				22	6	51
1992-93	1B			100						8
	3	4		85				12		26

LOCATION

Game Management Unit: 1C - (7,600 mi^2)

Geographical Description: That portion of the Southeast Alaska mainland from Cape Fanshaw to the latitude of Eldred Rock

BACKGROUND

Wolves are throughout the mainland portion of Unit 1C. They may be numerous in Glacier Bay National Park. No wolves have been reported from Douglas, Shelter, Lincoln or the smaller islands within the subunit.

MANAGEMENT DIRECTION

Management Objectives

No formal management goals have been established for this area. A wolf management planning effort by the Division of Wildlife Conservation in 1992 was not adopted by the Board of Game. General management objectives should be to maintain wolf harvest at a level similar to the average over the past 5 seasons (i.e., 7 wolves annually) while monitoring the population through anecdotal reports, aerial survey sightings, and trapper interviews. No wolf control methods are planned for this area.

METHODS

The mandatory sealing of wolf hides taken by successful trappers provided information on date and method of take, sex, and transportation means. Discussions with hunters and trappers during sealing and with hikers and other observers provided additional population data.

RESULTS AND DISCUSSION

Population Status and Trend

Based on harvest data, discussions with trappers and other observers, and incidental sightings during various field duties, I believe the population is stable or slowly increasing throughout the subunit. Public reports of packs in the Berners Bay, Nugget Creek, Taku River, St. James Bay, and Endicott Arm areas were received during the reporting period.

Population Size: No quantitative data on wolf numbers in Subunit 1C is available. Based on available habitats and locations where wolves have been sighted, approximately 70 wolves in 10 packs use the area.

Mortality

Harvest:

Seasons and Bag Limits.

Regulatory Years 1990-1991

Hunting:	No Closed Season	No Limit
Trapping:	Nov. 10 - April 30	No Limit

Regulatory Year 1992

Hunting:	Aug. 1 - April 30	Five Wolves
Trapping:	Nov. 10 - April 30	No Limit

Game Board Actions and Emergency Orders. Board of Game actions in June 1992 changed wolf hunting seasons to eliminate hunting during the summer and to limit take to 5 wolves per hunter.

Hunter/Trapper Harvest. A total of 6 wolves (4 males and 2 females) were taken in Unit 1C in 1990/91 (Table 1). This compares to the 5-year mean of 7 wolves (range 5 to 12). Four gray and 2 black wolves were taken. Three wolves were shot; 3 were trapped.

In 1991 5 wolves (1 male and 4 females) were killed. Four animals were gray and 1 was black. All of these wolves were taken by shooting.

In 1992 5 wolves (3 males and 2 females) were harvested. Three were gray and the remaining 2 were black. One was shot,1 was trapped, and the remaining 3 were taken with snares.

Hunter/Trapper Residency and Success. In 1990 3 local residents took wolves within the subunit and 1 nonlocal state resident was successful. In 1991 successful wolf hunters included 3 local residents and 1 nonresident. In 1992 4 local residents took the entire harvest.

Throughout the period the take of wolves was scattered throughout the subunit with no particular area dominating.

Harvest Chronology. Trapping harvest is spread throughout the year, with the exception of summer months, and is not consistent from year to year (Table 2). In general, wolves are harvested opportunistically, and recent years reflect little directed effort to take these animals.

Transport Methods. Boats were the primary access for wolf hunters and trappers, although aircraft and highway vehicles were also used (Table 3).

Other Mortality:

No natural mortality was documented during the report period.

CONCLUSIONS AND RECOMMENDATIONS

Little is known about wolf populations within Unit 1C. Reports from public afield as well as incidental observations by departmental staff indicate wolves are common in some areas and may be more plentiful than thought previously. Because mountain goats are the most common big game prey species in the mainland portion of Unit 1C, wolves may affect goat populations considerably in some areas (e.g., Endicott Arm). Low deer densities on the mainland portions of the subunit are probably due in part to pressure from wolves.

No changes in seasons or bag limits are recommended.

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Table 1. Subunit 1C. Wolf harvest, 1988-1992.

Year	Males	Females	Unknown	Total
1988/89	3	2	0	5
1989/90	4	7	1	12
1990/91	4	2	0	6
1991/92	1	4	0	5
1992/93	3	2	0	5

Table 2. Subnit 1C. Wolf harvest chronology, 1988-1992.

Regulatory Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1988/89									5			
1989/90				1	1	5	3	1		1		
1990/91			1			3				1	1	
1991/92			2							2	1	
1992/93					1		1		2	1		

Table 3. Subunit 1C. Harvest by transport method, 1988-1992.

Regulatory Year	Airplane	Dogsled Skiis Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown
1988/89			1		2	2		
1989/90			10		1	1		
1990/91			5			1		
1991/92	2		3					
1992/93			4			1		

LOCATION

Game Management Unit: 1D - (2,700 mi^2)

Geographical Description: That portion of the Southeast Alaska mainland lying north of the latitude of Eldred Rock, excluding Sullivan Island and the drainages of Berners Bay

BACKGROUND

The most recent wolf population estimate for the subunit was made in 1985 when 20-25 wolves in 4 packs were thought to inhabit the area. This estimate was based on sightings, hunter and trapper interviews, and sealing data. No wolf-prey investigations have been conducted in the area.

MANAGEMENT DIRECTION

Management Objectives

No formal management goals have been established for this area. A wolf management planning effort by the Division of Wildlife Conservation in 1992 was not adopted by the Board of Game. General management objectives should be to maintain wolf harvest at a level similar to the average over the past 5 seasons (i.e., 2 wolves annually) while monitoring the population through anecdotal reports, aerial survey sightings, and trapper interviews. No wolf control methods are contemplated for this area.

METHODS

Wolves were sealed by ADF&G and Fish and Wildlife Protection staff in Haines.

RESULTS AND DISCUSSION

Population Status and Trend

Based on harvest reports and limited trapper and hunter interviews, the population of wolves in the subunit is moderately low. Numbers may rise temporarily when packs from Canada cross the border and seek prey in the Chilkat Valley. Because moose numbers have declined since the mid 1980s, perhaps fewer than 25 wolves use the subunit.

Mortality

Harvest:

Seasons and Bag Limits.

Regulatory Years 1990-1991

Hunting:		
Subunit 1D	No Closed Season	No Limit
Trapping:		
Subunit 1D	Nov. 10 - April 30	No Limit

Regulatory Year 1992

Hunting:		
Subunit 1D	Aug. 1 - April 30	5 Wolves
Trapping:		
Subunit 1D	Nov. 10 - April 30	No Limit

Game Board Actions and Emergency Orders. Board of Game actions in June 1992 changed wolf hunting seasons to eliminate hunting during the summer and to limit take to 5 wolves per hunter.

Hunter/Trapper Harvest. One gray female comprised the entire wolf harvest in Subunit 1D in 1990/91 (Table 1). This compares to the 5-year mean of 2 (range 0-5). This wolf was shot by a hunter using a highway vehicle for access.

In 1991 no wolves were reported killed. In 1992 3 females wolves were harvested. Two were shot and 1 was snared. One trapper took 2 of the animals using an aircraft for access. The other wolf was taken by a trapper using a highway vehicle.

Hunter/Trapper Residency and Success. The wolf taken in 1990 was taken by a nonresident. Two local residents took the 3 wolves harvested in 1992.

Harvest Chronology. Most harvest occurred midwinter (Table 2).

Transport Methods. Access methods used by successful trappers and hunters during the report period show little consistency year to year (Table 3). This is not surprising.since the harvest is small and few hunters/trappers are represented in more than a single year.

Other Mortality:

No natural mortality was documented during the report period.

CONCLUSIONS AND RECOMMENDATIONS

The current status of the Subunit 1D wolf population is uncertain. Little hunting and trapping effort is applied to wolves in the area, but with low moose numbers in the Chilkat Valley, any visable predation raises the public's concern. Balanced against this is the nonconsumptive values wolves have to ecotourism in the subunit and to a sizeable proportion of local residents. The wolf management planning effort conducted in 1991 and 1992 showed most local respondents felt there should be no effort to control wolf populations. Some recommended no harvest of wolves be allowed. No changes in seasons or bag limits are recommended.

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Table 1. Unit 1D. Wolf harvest, 1988-1992.

Year	Males	Females	Unknown	Total
1988/89	0	1	0	1
1989/90	3	1	1	5
1990/91	0	1	0	1
1991/92	0	0	0	0
1992/93	0	3	0	3

Table 2. Subunit 1D. Wolf harvest chronology, 1988-1992.

Regulatory Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1988/89						1						
1989/90				3		1			1			
1990/91					1							
1991/92												
1992/93						1	2					

Table 3. Subunit 1D. Harvest by transport method, 1988-1992.

Regulatory Year	Airplane	Dogsled, Skis, Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown
1988/89			1					
1989/90				1	1		3	
1990/91							1	
1991/92								
1992/93	2						1	

LOCATION

Game Management Unit: 5 (6,200 mi^2)

Geographical Description: Cape Fairweather to Icy Bay, Eastern Gulf Coast

BACKGROUND

Lifelong residents of Yakutat indicate wolves were present in the Yakutat Forelands area before the immigration of moose in the early 1930s (ADF&G files). No reports of wolves exist for the west side of Yakutat Bay (Unit 5B) before 1971 (well after moose were established), and viable wolf populations were probably established by 1976. Klein (1965) suggests that wolves gained access to the area via the Alsek/Tatshenshini River valley.

In 1964, area biologist L. Johnson commented on an increase in wolf numbers since he began moose surveys. By 1967, up to 23 different animals were documented during moose surveys. Area biologist D. Johnson documented 44-50 wolves during 1973-74 aerial efforts to count moose. In the winter of 1977, area biologist R. Quimby estimated a minimum of 6 discrete packs in Unit 5A: Situk, Ahrnklin, Dangerous/Italio, Akwe, Tanis Mesa/East Alsek, and Doame/Clear. Minimum pack sizes were estimated at 9, 7, 6, 3, 5, and 6, respectively, for a total of 36. Quimby extrapolated this to a minimum of 45-50 animals (prepupping), at a density of 1 wolf/15 square miles. The presence of a breeding population of wolves in Unit 5B was undetermined at that time. In winter of 1979 area biologist R. Ball estimated the minimum Unit 5A and 5B populations at 35 and 10, respectively. By 1980 he felt wolf numbers were stable or increasing in 5A, with a population estimate of 50 animals. By 1982 he suggested there might be a minimum of 12 wolves in 5B in 2 packs. Beginning about 1985, B. Dinneford reported an increased number of reports from local residents of moose mortality in winter months. These reports have reflected an increasing wolf population responding to a larger moose population. In 1983 he documented wolf harvests were up, over the long-term average.

Wolves subsisted on mountain goats and salmon before moose inhabited the area. Salmon, especially as a late fall/early winter food source, is very important for wolf maintenance. Sitka black-tailed deer, a mainstay in wolves' diets elsewhere in Southeast Alaska, are scarce in Unit 5.

Wolves played a role in the reduction of moose, especially in Unit 5A, in the mid 1970s. Severe winter weather was the most important factor depressing the moose population then, but wolves, hunting, and reduced browse quality caused by overbrowsing contributed to the decline. An attempt to reduce wolves from 1974 to 1976 resulted in 1 wolf taken in about 31 hours of aerial effort. Bad weather, rough terrain, and dense forest prevented a higher take.

In recent years wolf harvest in the subunit has declined. A high proportion of the animals taken have been shot by guided nonresident hunters. New wolf hunting seasons restrict harvest during spring brown bear hunts.

MANAGEMENT DIRECTION

Management Objectives

No formal management goals have been established for this area. A wolf management planning effort by the Division of Wildlife Conservation in 1992 was not adopted by the Board of Game. General management objectives should maintain wolf harvest at a level similar to the average of the past 5 seasons (i.e., 9 wolves annually) while monitoring the population through anecdotal reports, aerial survey sightings, and trapper interviews. No wolf control methods are planned for this area.

METHODS

Wolves were sealed by ADF&G and Fish and Wildlife Protection staff in Yakutat.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

An estimated minimum wolf population of at least 50 (prepupping), in 5 to 7 packs, inhabits the Yakutat and Malaspina Forelands. No quantitative data is available, but from anecdotal reports wolf numbers are increasing. The Unit 5A moose herd is probably no longer increasing, but moose still represent a reliable food source for wolves. Reports of increased sightings of wolves indicate wolf numbers may still be climbing.

Mortality

Harvest:

Seasons and Bag Limits.

Regulatory Years 1990-1991

Hunting:

Unit 5	No Closed Season	No Limit

Trapping:

Unit 5	Nov. 10 - April 30	No Limit

Regulatory Year 1992

Hunting:

Unit 5	Aug. 1 - April 30	Five Wolves

Trapping:

Unit 5	Nov. 10 - April 30	No Limit

Game Board Actions and Emergency Orders. In Regulatory Year 1992 wolf-hunting seasons during summer were eliminated and take was limited to 5 wolves per hunter.

Hunter/Trapper Harvest. A total of 7 wolves (4 males, 3 females) were taken in Unit 5 in 1990/91 (Table 1). This compares to the 5-year mean of 9(range 4-13). Four wolves came from the Alsek/Doame/East River area, 2 from the Situk area, and 1 from the Akwe River. One black and 6 gray wolves were taken. Five wolves were shot and 2 were trapped or snared.

In 1991 11 wolves (8 males and 3 females) were killed. Four were taken along the Alsek River, 5 near Yakutat or along the Situk River, 1 at the Akwe River, and 1 from Unit 5B. Eight animals were gray and 3 black. Seven were shot and 4 snared.

In 1992 4 gray wolves (2 males and 2 females) were harvested. All were shot in the Alsek/Doame River area.

Hunter/Trapper Residency and Success. Two local residents, 1 nonlocal Alaska resident, and 4 nonresidents took wolves in Unit 5A in 1990. The following year 3 local residents, 1 nonlocal Alaskan and 5 nonresidents were successful. In 1992 no local residents reported taking wolves, while 2 nonlocal residents and 2 nonresidents reported success.

Harvest Chronology. Trapping harvest is concentrated in early winter months (Table 2), while some trapping also occurs near the end of the season. Hunting harvest of wolves is heaviest during spring bear seasons, with a few additional animals taken in the fall.

Transport Methods. Access methods used by successful trappers and hunters during the report period varied, having little consistency year to year (Table 3). Since a high proportion of harvested wolves were taken opportunistically in the course of other big game hunts, it is not surprising transportation methods vary. One or two trappers using consistent transport methods could dominate this category.

Other Mortality:

No natural mortality was documented during the report period. In 1992 the Yakutat Fish and Wildlife protection officer responded to a report of an injured wolf and destroyed the animal. The wolf's original injury is unknown.

CONCLUSIONS AND RECOMMENDATIONS

Because of no recent surveys, the current trend of the Unit 5A moose herd is uncertain. However, even if the herd is no longer increasing, the moose population provides a reliable food source for wolves, and wolves are probably at least as numerous as at the beginning of the reporting period. Hunters report seeing wolves near groups of moose at the Italio and Alsek rivers during fall hunting seasons, and a pack was observed during an aerial survey for moose near the Doame River in 1992. Some local residents believe wolf numbers are still increasing on the Yakutat Forelands. At present the wolf population can easily support the current low levels of harvest, which may decline further since spring bear hunters can no longer take wolves in May and June.

No changes in seasons or bag limits are recommended.

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Table 1. Unit 5. Wolf harvest, 1988-1992.

Year	Harvest
1988-89	8
1989-90	13
1990-91	7
1991-92	11
1992-93	4

Table 2. Unit 5. Wolf harvest chronology, 1988-1992.

Regulatory Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1988/89			2	1	1	1		2			1	
1989/90			4	1	1				1	2	4	
1990/91			1	1	1		1			1	2	
1991/92		2	1			1		3	3	1	2	
1992/93			1	1						2		

Table 3. Unit 5. Harvest by transport method, 1988-1992.

Regulatory Year	Airplane	Dogsled Skiis Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk
1988/89	7			1				
1989/90	5		1	2		1	4	
1990/91	3		3		1			
1991/92	6	1		5			1	
1992/93	3		1					

LOCATION

Game Management Unit: 6 (10,140 mi^2)

Geographical Description: Prince William Sound and North Gulf Coast

BACKGROUND

The wolf population in Unit 6 was low during the early and mid 20th century (Griese 1989). Heller (1910) reported tracks in Nelson Bay in Unit 6D, and locals indicated wolves were present east of Nelson Bay. Significant ungulate prey became available in the mid 1900s as a result of successful Sitka black-tailed deer and moose introductions. However, increases in the wolf population may have been prevented by federal control efforts in the 1940s and 1950s. By the 1970s, numbers began to increase, particularly in Units 6A, 6B, and 6C, where moose were well established. Goat numbers in those Units may have declined due to predation from increasing numbers of wolves (Reynolds 1981).

Wolves are found on the mainland throughout Unit 6. However, they have not become established on the major islands in Unit 6D, where deer would be adequate prey.

MANAGEMENT OBJECTIVES

To maintain a wolf population in a minimum of 5 packs that will sustain an annual harvest of 10 wolves.

METHODS

The public provided observations of wolves or their tracks, noting date, location and pack size. Similar information was recorded from observations during staff field activities. Also, the U.S. Forest Service (USFS) provided radiotelemetry data on pack dynamics and movements (Stephenson et al. 1993).

We collected harvest data by sealing hides of wolves taken by trappers and hunters. We recorded location and date of harvest, method of take, transportation, sex, and pack size.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The wolf population during 1990-91 was perhaps 60-80 animals in 10 packs (Table 1). In 1991-92 and 1992-93 there were an estimated 40-60 wolves in 9 packs. This was fewer animals than estimated during previous years. Numbers may have declined; however, the lower estimate was due to refined information by radiotelemetry (Stephenson et al. 1993), rather than a change in the population. Earlier estimates were based primarily on incidental observations.

Distribution and Movements: Wolf packs of different sizes were distributed throughout mainland portions of Unit 6. Unit 6A contained 2 packs of 14-22 wolves, while Unit 6B probably had 2 packs with 7-14 animals. Unit 6C had 2 packs of 7-14 wolves, and an estimated 10-15 wolves in 3 packs inhabited Unit 6D.

Mortality

Harvest:

Season and Bag Limit. The hunting season was from 10 August to 30 April, with a bag limit of 5 wolves. The trapping season was 10 November to 31 March; there was not a bag limit.

Board of Game Actions and Emergency Orders. The only Board of Game action over the last 5 years was a change in bag limit from 2 to 5 wolves. This change took effect in 1992-93 to standardize bag limits in Southcentral Alaska.

Hunter/Trapper Harvest. The reported harvest during this period ranged from 3-6 wolves, with unreported and illegal harvest taking an estimated 3-4 wolves annually (Table 2). Females composed 1-4 of the annual harvest. The number of successful hunters and trappers ranged from 3-4. There was not a noticeable change in harvest characteristics in the past 5 years.

Harvest Chronology. Wolves were taken throughout the open season, with the exception of August (Table 3). There was not a month when kill was concentrated during the reporting period or during the previous 2 years.

Transport Methods. Highway vehicles were the most important means of transportation (50%-67%) during this reporting period. They were also most important (100%) in 1988-89. However, in 1989-90 most (50%) wolves were taken by individuals using aircraft. The heavy reliance on highway vehicles occurred because most of the wolves taken in Unit 6 were harvested in Unit 6C where access was by the Copper River highway.

CONCLUSIONS AND RECOMMENDATIONS

The population objective was achieved. Pack numbers exceeded the minimum of 5 packs. The 40-60 wolves in the population were lightly harvested and could easily sustain the take of 10 animals specified in the objective. Regulatory changes were not indicated.

Additional refinement of the wolf population estimate is needed. Also, the importance of wolf predation as a limiting factor on mountain goat and moose populations in Unit 6 should be investigated. Cooperation with the USFS on studies of wolf ecology offers the best opportunity to develop this information.

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Table 1. Unit 6 fall wolf population estimates,[a] 1988-92.

Year	Population estimate	Number of packs	Basis of estimate
1988/89	106-125	15	b
1989/90	83-125	18	b
1990/91	60-80	10	b
1991/92	40-60	9	b,c
1992/93	40-60	9	b,c

[a] Fall estimate = pretrapping season population.
[b] Estimate from incidental observations and sealing records.
[c] Estimate based upon radio telemetry.

Table 2. Unit 6 wolf harvest, 1988-92.

Regulatory year	Reported harvest			Estimated harvest			Method of take		Successful	
	M	F (%)	Unk.	Total	Unreported	Illegal	Trap/snare (%)	Shot	Total	Trap/hunters
1988/89	3	1 (25)	0	4	5	6	3 (75)	1	4	
1989/90	3	2 (40)	1	6	4	1	3 (50)	3	6	
1990/91	0	4 (100)	0	4	3	1	2 (50)	2	3	
1991/92	2	4 (67)	0	6	1	1	3 (50)	3	4	
1992/93	2	1 (33)	0	3	1	2	1 (33)	2	3	

Table 3. Unit 6 wolf harvest chronology percent by time period, 1988-92.

Regulatory year	Harvest periods								n
	September	October	November	December	January	February	March	April	
1988/89	0	0	25	25	25	0	25	0	4
1989/90	17	0	0	50	0	17	0	17	6
1990/91	25	0	0	25	25	0	0	25	4
1991/92	33	17	0	0	17	33	0	0	6
1992/93	0	33	0	0	0	33	33	0	3

Table 4. Unit 6 wolf harvest percent by transport method.

Regulatory year	Percent of harvest								n
	Airplane	Dogsled Skiis Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
1988/89	0	0	0	0	0	0	100	0	4
1989/90	50	17	0	0	0	0	33	0	6
1990/91	25	0	0	0	0	0	50	25	4
1991/92	0	17	0	0	0	17	67	0	6
1992/93	0	0	0	0	0	33	67	0	3

LOCATION

Game Management Units: 7 and 15 (10,637 mi^2)

Geographic Description: Kenai Peninsula

BACKGROUND

Following a half-century absence, wolves recolonized the Kenai Peninsula during the 1960s. The first recent documentation was in 1961 when Jack Didrickson (ADF&G) observed a single wolf between Skilak and Tustumena Lakes. Observations increased throughout the 1960s, with the first pack sighting (10 wolves) in 1968 by Dimitri Bader (ADF&G).

Moose were easily available prey because of their high density and severe winters from 1971 through 1975. In less than 15 years, wolves repopulated most suitable habitat. Peterson and Woolington (1981) estimated wolves annually killed 9-15% of the moose calves produced and 5-7% of the adult moose on the Kenai Peninsula.

Aerial track counts from 1975 to 1992 indicated the Kenai Peninsula wolf population increased rapidly during the early 1970s, then remained relatively stable at about 200 animals. According to Peterson and Woolington (1981), annual mortality of radiocollared wolves in Unit 15A was 38%. Pups composed 37% of the early winter population, reflecting the relative stability of the population in the northern portion of the Kenai Peninsula from 1976 to 1981. Considering the growth rate of the wolf population during the 1970s, natural mortality rates were low. However, now they may be increasing due to the dense population of wolves and declining prey.

Regulated wolf harvests on the Kenai Peninsula began with a permit hunt during the winter of 1973-74; 2 wolves were harvested. During the winter of 1974-75, 6 were harvested. Hunting and trapping were allowed the following season (1975-76), and the harvest increased to 19; 12 by trappers and 7 by hunters. Although the 9-month season was liberal, the harvest of wolves increased slowly until 1978-79, when 55 wolves were taken. The harvest from 1978-79 to 1988-89 ranged from 25 to 64 wolves, averaging 49. This mean annual harvest indicated 25% of the estimated population was removed annually from 1978-79 to 1988-89.

In 1987, the Kenai National Wildlife Refuge imposed a 4-day trap check for trappers using refuge-managed lands and the season was reduced by 15 days. These restrictions resulted in a reduction in harvest. The harvest over the next 5 years ranged from 9 to 21 wolves and averaged 17 animals which was 9% of the estimated population.

Historically, most of the wolf harvest occurred during the trapping season, while most nonconsumptive uses probably were in the summer and early fall. Almost all wolves have

been taken for recreational purposes; the dollar value received for pelts has been a secondary benefit. Most wolves have been killed by trappers and hunters operating from the road system, although some aircraft were used. In the spring of 1986, the Board of Game prohibited the use of aircraft to locate wolves for the purpose of landing and shooting them. This land-and-shoot method was responsible for only 6% of the annual harvests from 1973 to 1985, occurring in only 5 of the 12 years. The low harvest was attributable to poor tracking and landing conditions in heavily forested areas and closure of the refuge to aircraft.

An infestation of biting lice (*Trichodectes canis*) was identified from 2 packs of wolves during 1982-83. Wolves from these packs in Unit 15A were brought in for sealing by local trappers, and department and refuge personnel initiated a control program to treat all infested wolves. Wolves were either captured and treated or a medication (Ivermectin) was injected into moose recently killed by wolves or placed in treated bait near kills. Both methods proved unsuccessful, and the incidence of infestation spread rapidly across the Kenai. Infected wolves are common, and there seems little chance to control the parasite.

MANAGEMENT DIRECTION

Management Objectives

To maintain a postseason population of 25-35 wolves in Unit 15A, excluding the Indian and Quartz Creek/Mystery Creek packs.

To maintain the spring wolf population at a maximum ratio of 1 wolf:50 moose in Units 15B, 15C, and Unit 7.

METHODS

Experienced pilots and observers conducted aerial surveys during November and December, only after snow and tracking conditions proved suitable. Local trappers provided additional information concerning wolf pack distribution and size for unsurveyed areas. Harvest was monitored by sealing the pelts of harvested wolves.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Wolf surveys were not conducted over the entire Kenai Peninsula because of unfavorable snow conditions during early winter. Harvest data, observations by department staff, and reports from trappers indicated the number of wolves had not changed from previous years. The estimated population for Units 7 and 15 was 200 wolves in 20 packs (Tables 1 and 2).

Mortality

Harvest:

Season and Bag Limits. The hunting season in Units 7 and 15 was 10 August to 30 April. The bag limit was 1 wolf in 1990-91 and 1991-92; this was increased to 5 in 1992-93, except on the Kenai National Wildlife Refuge where the bag limit was 2 wolves.

The wolf trapping season in Units 7 and 15 was 10 November to 28 February; there was no bag limit.

Game Board Actions and Emergency Orders. The Board of Game increased the hunting bag limit to 5 in 1992-93. The Board did not take any action on trapping seasons or bag limits during this reporting period.

Hunter/Trapper Harvest. Nine wolves were killed during the hunting and trapping seasons in 1990-91, 9 in 1991-92 and 19 in 1992-93, in Units 7 and 15 (Table 3). The sex ratio was 5 (57%) males and 4 (43%) females in 1990-91, 6 (67%) males and 3 (33%) females in 1991-92, and 10 (53%) males and 9 (47%) females in 1992-93 (Tables 4 and 5). The mean annual harvest (12) for these 3 years represented an annual harvest rate of 6% of the estimated population and a 76% decline in harvest, compared to the period prior to the 4-day trap check on the refuge.

The combined harvest for 1990-91 through 1992-93 was 37 wolves, comprised of 20 (54%) taken by trapping or snaring and 17 (46%) by ground shooting.

Harvest Chronology. The harvest chronology for 1990-91 to 1992-93 was August, 0; September, 4 (11%); October, 3 (8%); November, 7 (19%); December, 5 (14%); January, 6 (16%); February, 7 (19%); March, 2 (5%) and April, 3 (8%). Thirty-two percent (12) of the harvest occurred before or after trapping season.

Transport Methods. Transportation methods used to access traplines varied each year depending upon snow and ice conditions. Combined methods for 1990-91 to 1992-93 were aircraft 6 (16%), horse/dog team 3 (8%), boat 2 (5%), ATV 3 (8%), snowmachine 13 (35%), and highway vehicle 10 (27%).

CONCLUSIONS AND RECOMMENDATIONS

A mean harvest of 12 wolves during the past 3 years represents 6% of the early winter population estimate of 200 for Units 7 and 15. With this low rate of harvest, the wolf population will probably be controlled by prey abundance, increased dispersal, and natural mortality.

The department and US Fish and Wildlife Service (USFWS) signed an agreement in 1988 to manage wolves in Unit 15A using a harvest quota system. Terms of this agreement were based on continuing the current level of harvest opportunity while protecting the wolf population from overharvest. In addition to this agreement the USFWS implemented several new restrictions on trappers using the refuge. These restrictions included a mandatory trapper orientation course before receiving a permit, closures to trapping (except mink and muskrat) within 1 mile of any road and 2 miles from any trailhead or campground, prohibited use of toothed traps and the requirement traps be tagged by the owner. These new permit conditions to trap on the refuge, a complete closure on lynx harvest by the Board of Game, and the poor quality of lice-infested wolf pelts have reduced trapper effort and opportunity. Additionally, wolves taken in Unit 15A had to be sealed within 5 days to maintain an early harvest record for the quota system.

To maintain reliable counts, the department and refuge staff have maintained radiocollared wolves in each pack in Unit 15A since the early 1980s. Maintaining collared wolves has been expensive. Although useful management data has been collected, I recommend we discontinue the collaring program in Unit 15A and request the Board to repeal the 5-day sealing requirement because it does not serve a useful purpose. I also recommend we discontinue the quota system for Unit 15A. With the current low effort and harvest, it is not warranted or cost-effective. The management strategy for Unit 15A essentially mandates we manage wolves pack by pack. I recommend we consider the entire wolf population on the Kenai Peninsula as 1 population. Allowable harvest should not exceed 35% or 70 wolves annually.

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Table 1. Unit 7 fall wolf population estimate[a], 1988-1992.

Year	Population estimate	Number of packs	Basis of estimate
1988/89	45	6	b
1989/90	45	6	b
1990/91	45	6	b
1991/92	45	6	b
1992/93	45	6	b

[a] Fall estimate = pretrapping season population.
[b] Estimates were generated from information gathered from incidental observtions of staff, sealing records, and reports from public.

Table 2. Unit 15 fall wolf population estimates[a], 1988-1992.

Year	Population estimate	Number of packs	Basis of estimate
1988/89	146	14	c
1989/90	147	14	c
1990/91	155	14	c
1991/92	155	14	c
1992/93	155	14	c

[a] Fall estimate = pretrapping season population.
[b] Information gathered from incidental observtions of staff, and reports from public.
[c] Results of research and management studies in addition to incidental observations and trapper reports.

Table 3. Known wolf mortality in Units 7 and 15, 1988-1992.

Year	Unit/Units 7	15A	15B	15C	Total
1988/89[a]	2	6	6	3	17
1989/90[ab]	3	6	10	2	21
1990/91[ab]	3	4	2	0	21
1991/92[a]	2	2	0	5	9
1992/93[a]	3	8	2	6	19

a Trapping season 10 November-28 February.
b Trapping season extended by EO in 15A to 31 March.

Table 4. Unit 7 wolf harvest, 1988-92.

Regulatory year	Reported harvest M	F (%)	Unk.	Method of take Trap/snare (%)	Shot	Unk.	Successful Trappers/hunters
1988/89	0	2 (100)	0	1 (50)	1	0	2
1989/90	0	3 (100)	0	3 (100)	0	0	2
1990/91	2	1 (33)	0	3 (100)	0	0	2
1991/92	1	1 (50)	0	2 (100)	0	0	2
1992/93	0	3 (100)	0	3 (100)	0	0	3

Table 5. Unit 15 wolf harvest, 1988-92.

Regulatory year	Reported harvest			Method of take			Successful	
	M	F (%)	Unk.	Trap/snare (%)	Shot	Unk.	Total	Trappers/hunters
1988/89	9	6 (40)	1	9 (56)	7	0	11	
1989/90	9	6 (40)	0	8 (53)	7	0	11	
1990/91	3	3 (50)	0	3 (50)	3	0	6	
1991/92	5	2 (29)	0	2 (29)	5	0	5	
1992/93	10	6 (38)	0	7 (44)	9	0	13	

LOCATION

Game Management Units: 9 (33,638 mi^2) and 10 (1,586 mi^2)

Geographical Description: Alaska Peninsula and Unimak Island

BACKGROUND

Wolves are throughout the Alaska Peninsula (Unit 9) and on Unimak Island (Unit 10) in low-to-moderate densities. Specific data on historic wolf abundance are lacking, but the population was probably reduced by wolf control work during the 1950s. Prey abundance has varied during the past 20 years. Moose densities decreased during the 1970s in all areas north of Port Moller but have stabilized during the past 10 years. The Mulchatna Caribou Herd increased from about 14,000 in 1974 to over 110,000 in 1992. The Northern Alaska Peninsula Caribou Herd increased from about 13,000 in the mid 1970s to about 20,000 in 1984. During the past 8 years, it has remained relatively stable at 16,000-18,000. Caribou decreased dramatically on Unimak Island from a peak of 5,000 in 1975 to only a few hundred by 1977. No change in caribou numbers on Unimak Island has been noted in the past 10 years. The mainland segment of the Southern Alaska Peninsula Caribou Herd peaked at over 10,000 in 1983 and then declined to 3,000 by 1992.

MANAGEMENT DIRECTION

Management Objectives

To maintain a wolf population that will sustain a 3-year-average annual harvest of 50 wolves.

METHODS

Specific data were not collected on wolf densities in Units 9 or 10. Trends were monitored through observations made during other fieldwork, reports from hunters and guides, and responses to the annual trapper questionnaire. Harvests were monitored from mandatory pelt-sealing reports.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: By piecing together miscellaneous observations of wolf packs and general knowledge of territory size, I estimate at least 250 wolves inhabit Units 9 and 10. This is a

conservative estimate, but it cannot be refined without considerable expense and abnormally good snow and flying conditions.

Wolf numbers generally parallel changes in prey populations; overall, numbers seem stable or increasing in all areas except Unit 9D and Unimak Island. There were not apparent differences in the results of the 1991-92 and 1992-93 trapper questionnaires, so they were combined. In total, 10 trappers classified wolves as scarce; 22 indicated they were common; and 3 rated them as abundant. Compared to the previous year, 5 said there were fewer wolves; 14 said there were about the same number; and 10 said there were more wolves.

Mortality

Harvest:

Season and Bag Limits. The hunting season in Units 9 and 10 was 10 August to 30 April. The bag limit in Unit 9 was 10 wolves, while the bag limit for wolves in Unit 10 was 2. The trapping season in Units 9 and 10 was 10 November to 31 March, and there was not a bag limit.

Game Board Actions and Emergency Orders. During the 1987 fall meeting, the Board of Game prohibited the harvesting of wolves on the same day a hunter was airborne in most areas of the state, including Unimak Island; however, it was not prohibited in Unit 9. For 1990-91, same-day-airborne hunting of wolves was put under a registration permit system with numbered locking tags issued to each permittee. Hunting regulations on Unimak Island remained unchanged. For the 1993-94 season, trappers were permitted to take wolves on the same day they were airborne, providing they were at least 300 feet away from the aircraft before they shot.

Hunter/Trapper Harvest. The wolf harvest for 1990-91, 1991-92, and 1992-93 were 29, 91 and 33 in Unit 9, and 3, 3, and 0 on Unimak Island (Table 1). The 1991-92 harvest was exceptionally high, primarily due to good snow conditions in Unit 9E during the winter.

Harvest Chronology. Harvest chronology for the past 5 years is shown in Table 2.

Transport Method. Inaccurate reporting of the method of transportation used for harvesting wolves hampers analysis; however, the majority involved the use of aircraft or snowmobile (Table 3).

CONCLUSIONS AND RECOMMENDATIONS

The wolf harvest in Unit 9 varies widely, depending on weather conditions and the activity of several individuals who use aircraft. Harvest has had little effect on the wolf populations in

Units 9 and 10. For practical and budgetary reasons, it is unlikely that more accurate estimates of population size will be possible. Sealing data on sex composition of harvest, methods of take, and transportation do not seem reliable; analyses using these data are not recommended. No regulatory changes are recommended.

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Table 1. Units 9 and 10 wolf harvest, 1988-92.

Regulatory year	Reported harvest				Method of take			Successful	
	M	F	Unk.	Total	Trap/snare	Shot	Unk.	Total	Trappers/hunters
1988/89	35	25	3	63	10	52	1	28	
1989/90	20	19	0	39	1	38	0	31	
1990/91	7	13	9	29	3	26	0	17	
1991/92	36	32	26	94	45	49	0	38	
1992/93	8	12	13	33	17	16	0	18	

Table 2. Units 9 and 10 wolf harvest chronology percent by time period, 1988-92.

Regulatory year	Harvest periods									
	August	September	October	November	December	January	February	March	April	n
1988/89	0	0	10	2	24	24	32	8	2	63
1989/90	0	3	18	8	8	5	38	15	5	39
1990/91	3	7	17	0	21	3	28	21	0	29
1991/92	2	0	5	2	32	5	39	14	0	93
1992/93	0	9	0	3	3	39	6	39	0	33

Table 3. Units 9 and 10 wolf harvest percent by transport method, 1988-92.

Regulatory year	Airplane	Dogsled Skis Snowshoes	Boat	3-or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n
1988/89	59	5	2	16	14	0	3	2	63
1989/90	49	0	5	18	21	0	3	5	39
1990/91	90	10	0	0	0	0	0	0	29
1991/92	32	0	0	6	45	0	4	13	94
1992/93	9	0	3	6	73	0	9	0	33

LOCATION

Game Management Unit: 11 (13,257 mi^2)

Geographical Description: Wrangell Mountains

BACKGROUND

Wolf population estimates and trends are unavailable for Unit 11 prior to the 1950s. Skoog (1968) assessed that wolf numbers were low from 1900 to the 1930s, then increased somewhat, based on settlers' written accounts. In 1948 the U. S. Fish and Wildlife Service initiated an extensive wolf control program, lasting until 1953. Following termination of the control program, wolf numbers increased and probably peaked during the mid 1960s. In the early 1970s, wolves were still abundant (McIlroy 1974) with 1 wolf/80 mi^2, a unitwide population of 100-125 animals. Population estimates were not made during the late 1970s and early 1980s; in fact, population estimates were not made until 1985.

Although the size of wolf harvests prior to mandatory sealing are unknown, they were probably similar to harvest levels reported during the early 1970s because trapping seasons were comparable and there were no bag limits. Wolf harvests since 1972 have averaged 25 wolves per year, ranging widely from 6 to 51 wolves per year.

MANAGEMENT DIRECTION

Management Objectives

To maintain a minimum posthunting and trapping season population of 75 wolves.

The human-use objective is to allow limited human harvests when they do not conflict with unit management goals or population objectives.

METHODS

The annual wolf harvest is monitored by sealing the hides of all wolves harvested in the unit. Information on wolf numbers and distribution is collected by interviews with hunters and trappers when pelts are sealed and from wolves observed incidentally during surveys for other species.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The spring 1993 population estimate for Unit 11 was 58-78 wolves, down from the 1992 estimate of 85-95 wolves (Table 1). Wolf numbers were below the 5-year (1988-92) mean population estimate of 98 wolves in Unit 11. Survival rates for exploited wolf populations (Ballard et al. 1987) reflect fall 1993 wolf population in Unit 11 was between 91 and 110 wolves.

Distribution and Movements: Wolf numbers were higher in the northern portions of the unit, especially from the Dadina River northeast to the Copper River. Caribou were available to wolves at least part of the year in this area, and moose were more abundant than in the southern portions of the unit. Wolf numbers in the lower Chitina River valley have increased in recent years, but densities will probably remain lower than in the northern portion of the unit because caribou were absent and moose were less abundant. Although sheep and mountain goats were wolves' primary prey in the lower Chitina Valley, they did not support as large a wolf population because of their small body size and the area's difficult terrain.

In Unit 11, wolves frequently travel the larger rivers flowing out of the steep mountains as a route to higher elevations to hunt sheep; they use lower elevation riparian areas to hunt wintering moose. This contrasts with movement patterns in Unit 13 where wolves are not as restricted to riparian habitat. Moose densities are much higher in Unit 13, and moose are more dispersed throughout the winter.

Mortality

Harvest:

Season and Bag Limit. The hunting season in Unit 11 was from 10 August to 30 April and the bag limit was 5 wolves. Trapping season was from 10 November to 31 March; there was no bag limit.

Game Board Actions and Emergency Orders. In 1986, the Board of Game prohibited the land-and-shoot method of harvesting wolves, unless a wolf had first been caught in a trap or snare. Effective with the 1990-91 season, the Board opened Unit 11 to same-day-airborne (SDA) hunting of wolves with a bag limit of 10 wolves. However, all National Park/Preserve lands within Unit 11 were subsequently closed to same-day-airborne hunting of wolves to align state and federal regulations. In 1992, the Board closed same-day-airborne hunting for wolves in Unit 11 and reduced the hunting bag limit to 5 wolves.

Hunter/Trapper Harvest. Hunters and trappers harvested 33 wolves from Unit 11 during the 1992-93 season (Table 2). Harvest has been high in Unit 11 for the past 3 years, averaging 33 wolves per year, compared to an average of 25 during the 5-year period between 1985 and 1989. Males composed 52% of the take in 1992-93, which is lower than earlier percentages. Since 1987, males have composed 54% of the harvest. The 1992-93 harvest was not distributed evenly throughout the unit. Hunters and trappers reported taking most of the wolves from either the Nabesna Road or the lower Chitina Valley. This harvest pattern was similar to past years when harvests were near developed areas with access.

The harvest methods for wolves killed in Unit 11 over the past 5 years are provided in Table 2. Over the period 1988-92, trapping and snaring accounted for 90% of the harvest for which the method of take was known. Prior to 1987, when land-and-shoot was legal, the effect of this harvest method on the legal take varied yearly. The greatest percentage (57%) of the annual harvest taken by same-day-airborne occurred in 1981; however, this amounted to only 8 wolves. Between 1980 and 1987, same-day-airborne hunting accounted for 25% of the wolf harvest. Unreported and illegal harvests were minimal during the reporting period.

Hunter/Trapper Residency and Success. During the 1992-93 season, 8 individuals sealed an average of 4.1 wolves from Unit 11. During the preceding 5 seasons, the average harvest was 2.3 wolves per individual. In 1992-93, 1 nonresident took 2 wolves, while 7 trappers living in or adjacent to Unit 11 took 31 wolves.

Harvest Chronology. Table 3 presents the harvest chronology for wolves over the past 5 years. The proportion of monthly harvest has varied year to year, but December, January and February had the highest harvest. The annual harvest chronology for trapped wolves probably reflected conditions for snowmachine travel (snow depth, river ice, and weather conditions), rather than any pattern of trapper effort or success. The number of wolves taken during the fall months, presumably by big game hunters, has ranged from 1 to 4 since 1985 and includes most of the nonresident take.

Transport Methods. The method of transport used in harvesting wolves has only been recorded on sealing certificates since 1985. In Unit 11 most wolves have been taken with the use of snowmachines (Table 4).

The use of aircraft has declined since land-and-shoot became illegal. Very few wolves were taken by trappers using aircraft to fly out and make sets, although this trapping method may increase. Aircraft can be used effectively to find wolf kills, and a trapper can land and set snares for wolves returning to the kill site. Most aircraft use was by hunters taking a wolf incidentally during fly-in hunting trips for other game.

Nonregulatory Management Problems/Needs

Wolf estimates are difficult to attain in Unit 11. All wolf estimates for the unit are based on pack or track sightings by department staff, hunters, trappers, and the public. Track surveys have only been periodic and in different locations since 1978. The lack of a systematic survey method hampers efforts to estimate wolf numbers. Even establishing a yearly trend area will not assure yearly population estimates. High winds in Unit 11 often obscure tracks or blow snow to the extent surveys may not be feasible.

CONCLUSIONS AND RECOMMENDATIONS

The estimated number of wolves in Unit 11 has been declining the last 3 years. The 1993 estimate was the lowest in recent years. Wolf population estimates in Unit 11 fluctuate

yearly as a direct result of survey effort and snow conditions affecting survey results. In the past few years, wolf survey work has been reduced in Unit 11. Surveys for other species have also been reduced, and the number of incidental observations of wolves has declined. There were large portions of Unit 11 where population data were not collected or were unavailable. Wolf estimates were considered a minimum because of the decreased effort.

Harvest rates have increased over the last 3 years in Unit 11. The wolf harvest rate for this period was 27% of the estimated fall population. Most wolf harvest in Unit 11 was concentrated near access points and trappers' homes. High harvest rates concentrated in these areas could result in localized population declines; however, wolves in vast portions of the unit were not hunted or trapped because aircraft use was illegal, roads were lacking, and physical barriers such as large rivers and mountains limit snowmachine and ORV travel. I assume there was immigration of wolves from untrapped areas in Unit 11 and adjacent Unit 13 to trapped areas of Unit 11.

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Table 1. Unit 11 fall and spring wolf population estimates[a], 1988-92.

Year	Population estimate		Number of packs	Basis of estimate
	Fall	Spring		
1988/89	103-133	70-90	8-10	b, c
1989/90	149-173	100-110	11-13	b, c
1990/91	127-132	90-95	15	b, c
1991/92	130-135	85-95	11	b, c
1992/93	120-130	58-78	9	b, c
1993-94	91-110	--	--	b, c

a Fall estimate = pretrapping season population.
b Fall estimates based on known spring pack sizes, mean birth rate of 5-6.5 pups/pack, a pup survival rate of 0.82 and fall sightings.
c Basis of spring estimate is from limited track surveys, incidental observations, reports from public, and sealing records.

Table 2. Unit 11 wolf harvest, 1988-92.

Regulatory year	Reported harvest				Estimated harvest		Method of take				Successful	
	M (%)	F (%)	Unk. (%)	Total	Unreported	Illegal	Trap/snare (%)	Shot (%)	(L&S) (%)	Unk. (%)	Total	Trappers/hunters
1988/89	12 (48)	13 (52)	0 (0)	25	2	3	21 (84)	4 (16)	0	0	13	
1989/90	15 (63)	8 (33)	1 (4)	24	2	3	19 (79)	5 (21)	0	0	10	
1990/91	14 (38)	23 (62)	0 (0)	37	2	3	32 (86)	0	0	5 (14)	13	
1991/92	19 (64)	10 (33)	1 (3)	30	2	3	27 (90)	3 (10)	0	0	12	
1992/93	17 (52)	12 (36)	4 (12)	33	2	3	31 (94)	2 (6)	0	0	8	

Table 3. Unit 11 wolf harvest chronology percent by time period, 1988-92.

Regulatory year	Harvest periods									n
	August	September	October	November	December	January	February	March	April	
1988/89	4	8	4	0	16	28	24	16	0	25
1989/90	19	0	0	24	19	28	10	0	0	21
1990/91	0	0	0	30	21	8	38	3	0	37
1991/92	0	7	0	23	7	33	23	7	0	30
1992/93	0	6	0	9	39	12	18	15	0	33

Table 4. Unit 11 wolf harvest percent by transport method, 1988-92.

Regulatory year	Percent of harvest								
	Airplane	Dogsled Skis Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n
1988/89	16	12	0	4	64	4	0	0	25
1989/90	13	0	0	0	79	0	0	8	24
1990/91	3	5	0	0	76	0	0	16	37
1991/92	3	13	0	0	70	0	7	7	30
1992/93	0	6	0	0	94	0	0	0	33

LOCATION

Game Management Unit: 12 (10,000 mi^2)

Geographical Description: Upper Tanana and White River drainages; includes the North Wrangell, Nutzotin, and Mentasta Mountains and the eastern Alaska Range

BACKGROUND

Historically, Unit 12 wolf population fluctuated dramatically in response to federal and state predator control programs, ungulate prey abundance, and harvest by the public. During the 1940s wolves were abundant, but numbers were reduced by a federal control program conducted between 1948 and 1960. Before 1960, local residents commonly killed wolf pups at dens, keeping wolf populations at low levels near human settlements. After 1960 the wolf population increased rapidly and remained high until the mid 1970s. About 1975 the wolf population declined rapidly due to a severe prey shortage. Between 1975 and 1990 the moose and wolf populations in Unit 12 remained at a low density equilibrium (Gasaway *et al.* 1992).

Since 1960 the Unit 12 wolf population has been lightly harvested. Rarely has annual harvest approached or exceeded sustainable rates. Few local trappers select for wolves; most trappers concentrate on marten and lynx. However, during years when marten and lynx pelt prices are low, more trappers concentrate on catching wolves. Also, when land-and-shoot taking of wolves was legal, harvests were higher, especially in the southern portion of the unit.

Historically, moose have been the most important subsistence species in Unit 12 (Haynes *et al.* 1984, Halpin 1987), but since the late 1970s, the low moose densities have not provided for subsistence needs. In response, the majority of local residents have favored wolf management to benefit depressed moose populations. However, most of Unit 12 (about 65%) is in either the Wrangell-St. Elias National Park and Preserve or the Tetlin National Wildlife Refuge. Federal policy on those lands has not included predator management programs. On the remaining Unit 12 lands, primarily the northwest portion, local people still support wolf management to benefit the moose population and the subsistence users.

MANAGEMENT DIRECTION

Management Goals

Wolf populations will be managed to provide for human uses and to ensure that wolves remain an integral part of Interior Alaska's ecosystems. Compatible human uses include hunting and trapping (both for personal use and commercial sale of furs), photography,

viewing, listening, and scientific and educational purposes. The aesthetic value of observing wolves in natural interactions with their environment is also recognized as an important human use of wolves. The domestication of wolves for personal use or for commercial purposes is generally considered incompatible with department management policies.

Management may include human manipulation of wolf population size, as well as total protection of wolves from human influence. Not all human uses will be allowed in all areas or at all times; management will focus on providing sustained, diverse human uses of wolf populations consistent with goals listed in the Wolf Conservation and Management Policy for Alaska, adopted by the Alaska Board of Game (BOG) 30 October 1991 and revised 29 June 1993. Those goals are listed:

- To ensure long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.

- To provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and reflect the public's interest.

- To increase public awareness and understanding of the uses, conservation and management of wolves, their prey and habitat in Alaska.

Management Objectives

Between 1990 and 1993 the Alaska Wolf Management Planning Team, the BOG, the ADF&G, and many members of the public recommended and planned future state wolf management actions. Based on agreements during this process, most of Unit 12 will be managed to maintain relatively natural ecosystems. This decision was based primarily on land-ownership patterns. However, the northwestern portion of Unit 12, because of its importance to the subsistence hunter, was designated as an area that may receive intensive wolf management in the future.

The following objectives apply to the reporting period, regulatory years 1990-92. New objectives were drafted following the BOG's decision to rescind the area specific plan. The new objectives will guide management during regulatory years 1993-95 and are presented in the conclusions of this report.

- Monitor wolf numbers, population characteristics, and harvests.

- Temporarily reduce wolves in the northwestern portion of Unit 12 by 70-80% by the year 1995.

- Maintain sustained yield objectives after population objectives are achieved.

- Increase human-use opportunities of wolves and moose by significantly increasing moose numbers and by maintaining a healthy, productive wolf population.

METHODS

Estimating Wolf Population Size

Since 1980 the late winter wolf population estimates were based upon sightings of wolves and wolf tracks observed during aerial surveys (Stephenson 1978, Gasaway *et al.* 1983). Trapper and pilot reports and trapper questionnaire results were compiled and contributed to population estimates where complete aerial surveys were not flown. Estimates of wolf numbers were increased by 10% to account for lone wolves present but not found (Mech 1973). All wolf packs having territories wholly or partially in Unit 12 were included in the estimate.

Autumn wolf population estimates were calculated by adjusting the late winter estimate upward, based on the number of wolves harvested before surveys. Each year many wolf packs observed in March and April were also observed during the previous autumn and early winter. Therefore, changes in pack size for those packs were known.

Determining Wolf Population Characteristics

During the past 12 years, wolves in Unit 12 were captured by aerial darting, trapping, or live-snaring, and fitted with radiocollars. Periodic radiomonitoring surveys allowed accurate determinations of seasonal pack size, territory and den site location, and pup survival. However, only one pack in Unit 12 had members with functioning collars during this reporting period.

Harvest Monitoring

Wolves taken in Alaska must be sealed by an ADF&G representative or an appointed fur sealer. During the sealing process, information is collected on the sex, date and specific location and method of take, access used, color of pelt, estimated size of the wolf pack.

RESULTS AND DISCUSSION

Population Status and Trend Population Size

Overall, between 1988 and 1992 Unit 12 wolf numbers increased by an estimated 26.7% (Table 1). Autumn pack size and number of packs increased, indicating improved recruitment

and, possibly, adult survival. However, the population remained stable or slightly declined in 1991 following a large harvest during 1990.

The wolf population increase can be attributed to the tens of thousands of Nelchina, Mentasta, and, periodically, Fortymile caribou that have traveled through or wintered in Unit 12 since 1988. Large numbers of caribou have been available to Unit 12 wolves between October and April except during 1992 when most of the caribou traveled through Unit 12 and wintered in Unit 20E. The timing of Unit 12 wolf population growth closely corresponds to the range expansion of the Nelchina and Mentasta caribou herds into Unit 12 wintering areas.

The seasonal, high caribou density benefited the area's wolf population and subsistence caribou hunters. However, the increase in wolf numbers was followed by a decline in the Unit 12 moose population. The moose population increased in Unit 12 during most of the 1980s, but since 1989 the population has declined (Gardner, in press). The timing of the decline corresponds to the Nelchina Herd's use of Unit 12 wintering areas and the wolf population increase. Because large numbers of caribou are in portions of Unit 12 only during winter, the elevated wolf population necessarily depends upon moose as primary prey the remainder of the year.

Mortality

Harvest:

Season and Bag Limit.

Unit/ Bag Limit Special Restrictions	Subsistence/Resident Open Seasons	Nonresident Open Seasons
Regulatory Years 1990 and 1991		
Hunting - Unit 12, 10 wolves. Same-day-airborne hunting of wolves allowed 10 Aug.-31 Mar., registration permit and locking tags required.	10 Aug.-30 Apr.	10 Aug.-30 Apr.
Trapping - Unit 12, no limit. Only snares, 3 times or larger, are allowed for trapping wolves during the months of October, March, and April.	1 Oct.-30 Apr.	1 Oct.-30 Apr.

Regulatory year 1992

Hunting - Unit 12, five wolves. No same-day-airborne taking of wolves.	10 Aug.-30 Apr.	10 Aug.-30 Apr.
Trapping - Unit 12, no limit. Only snares, 3 times or larger, are allowed for trapping wolves during the months of October, March, and April.	1 Oct.-30 Apr.	1 Oct.-30 Apr.

Board of Game Actions and Emergency Orders. During 1991 the BOG eliminated same-day-airborne taking of wolves statewide. The regulation became effective during the 1992-93 season.

During November 1992 the BOG adopted a wolf management plan that would have affected northwestern Unit 12 and portions of adjacent Units 20D and 20E. The plan called for a 70-80% reduction of the wolf population in that area. Implementation of the plan was to begin after 1 January 1993, but in December 1992 implementation was postponed by the commissioner to allow for greater public input. In January 1993 the BOG rescinded the plan following political pressures created by a threatened tourism boycott sponsored by animal rights groups.

In June 1993 the BOG adopted a regulation that allowed the taking of wolves by trappers the same day airborne if the person is over 300 feet from the airplane at the time of taking. The BOG also extended the use of steel traps for taking wolves to the end of March and set a minimum snare cable diameter of 3/32 inches for wolf trapping during October and April.

Hunter/Trapper Harvest. The regulatory year 1990, 1991, and 1992 wolf harvests in Unit 12 were 73, 32, and 52 wolves, respectively (Table 2). The 1990 harvest of 73 wolves (32% of the autumn population) was followed by a 1-year decline in the wolf population, and that harvest probably exceeded the long-term sustainable harvest. However, the wolf population again increased following the 1991 harvest of 32 wolves (15% of the autumn population), and the population remained stable or increased following the 1992 harvest of 52 wolves (22% of the autumn population).

The response of the Unit 12 wolf population to harvest by hunters and trappers was similar to that documented in other wolf populations. Numerically stable wolf populations throughout North America have sustained harvests of 20-40% (Keith 1983). Harvests of greater than 40% generally result in declining wolf populations, and those populations harvested at less than 20% generally increase. Those effects of exploitation seem consistent across a broad range of reported wolf densities in Alaska, Canada, Michigan, and Minnesota.

During years when land-and-shoot taking of wolves was allowed, that method of harvest accounted for only 13.4% of the Unit 12 harvest. Greater harvests by trappers using traps and snares, rather than land-and-shoot hunting, accounted for the high harvests during 1990 and 1992 (Table 2). During 1990 wolves concentrated their movements among large numbers of caribou wintering near the road system and Tok. Therefore, the high wolf harvest during 1990 probably resulted from increased wolf vulnerability to ground-based trappers. During 1992 the price for marten and lynx pelts declined, and as wolf harvest increased, trappers switched to wolf trapping to supplement their trapping income.

Kelleyhouse (1991) indicated the low harvests during the 1988-89 and 1989-90 seasons were due to the ban on land-and-shoot hunting of wolves. However, based on the total fur harvests before and after the ban, the wolf harvest decline during those 2 years was more a function of trappers responding to high marten prices by concentrating their efforts on trapping marten. I believe since most of Unit 12 trappers are ground based and concentrate their efforts based on the fur market, wolf trapping pressure and success in Unit 12 is more a function of fur prices and weather conditions than method of take.

Harvest Chronology. Chronology of wolf harvest in Unit 12 (Table 3) reflects a low incidental harvest of wolves (5.7%) during the August and September hunting seasons, no harvest during the snaring season in October, a moderate harvest (29.1%) during the snaring season in March and April, and the highest harvest (65.2%) between November and February when all harvest methods and means are allowed. The percent harvest during the late snaring season has increased during each of the last 5 years.

Transport Methods. During the report period most successful wolf trappers in Unit 12 (73%) used snowmachines (Table 4). However, beginning in 1989, the use of airplanes as a transport method by successful wolf trappers using primarily traps and snares increased, and since 1989, average 24.3%. Trappers using airplanes find wolf kills easier and cover more ground to find areas to set. I suspect that even with the ban on land-and-shoot taking of wolves, the number of wolves harvested in Unit 12 by airplane trappers will remain relatively high.

Habitat Assessment: Only about 7,000-8,000 mi^2 of Unit 12 is considered normal wolf habitat. Wolves seldom use the remaining 2,000-3,000 mi^2 of glacial ice fields and high rocky terrain.

Good wolf habitat is determined more by ungulate prey abundance than by vegetative characteristics. Using this criterion, the best wolf habitat in Unit 12 is along the foothills of the Wrangell, Mentasta, and Nutzotin Mountains and the eastern Alaska Range where either resident or migratory moose are available to wolves year-round. Although mountainous areas support dense populations of Dall sheep, wolves apparently cannot thrive on sheep alone as a primary prey species (Sumanik 1987). The nonmigratory Chisana caribou herd also provides a reliable food source for wolves in eastern Unit 12, but the herd numbers only 900-950 caribou. Caribou from the Mentasta, Nelchina, Macomb, and Fortymile Herds have also used portions of Unit 12 in recent years. The use of Unit 12 during winter by these herds,

especially the Nelchina Herd, has caused the wolf population to grow by increasing the unit's prey base.

Approximately 30 years of wildfire suppression in Unit 12 have resulted in less diverse and productive wildlife habitats than would occur under natural conditions. Human developments and disruption of wildlife habitat are largely restricted to immediate vicinities of communities and have had a minor effect on wolves in Unit 12.

Enhancement: A large percentage of Unit 12 has been afforded Limited Suppression status for wildfires in the Fortymile Area Interagency Fire Management Plan. This includes nearly all of the Wrangell-St. Elias National Park and Preserve and most of the Tetlin NWR. Unfortunately, much of the Limited Suppression area is essentially unburnable due to sparse fuels, high fuel moistures, low temperatures, and lack of ignition through lightning. Much of the more fire-prone land is in state or private ownership and was afforded Critical, Full, or Modified Suppression status.

During June-September 1990 a wildfire burned approximately 97,000 acres of primarily decadent black spruce muskeg in the Tetlin Hills and the adjacent Tok River lowlands. This fire is expected to improve moose winter browse supplies for 15-20 years, benefiting both moose and wolves.

CONCLUSIONS AND RECOMMENDATIONS

Between 1988 and 1992 the wolf population in Unit 12 increased by 25-27%. The increase in wolf numbers was probably due to an increase in the winter prey base as thousands of Nelchina and Mentasta Herd caribou have traveled through or wintered in Unit 12 since 1988. During this period pack size has increased, indicating improved recruitment.

The Unit 12 moose population has declined during the recent period of wolf population growth. Moose are the only ungulate prey available to much of the Unit 12 wolf population between late April and mid October. Before the arrival of wintering Nelchina and Mentasta Herds and the increase in the unit's wolf population, the Unit 12 moose population was increasing at about 5% annually.

The Unit 12 wolf population is lightly harvested. Harvest rates are primarily dependent on fur price, weather conditions, and wolf movement patterns in relationship to the road system.

Most of the area residents want a wolf control program designed to benefit depressed Unit 12 moose populations. Moose are the most important subsistence species in Unit 12, and the present population is not meeting subsistence demands. However, because of land-ownership patterns and public requests from outside the area, no active wolf management programs will be conducted in the foreseeable future in most of Unit 12. The one exception may be in the northwestern portion of the unit where wolf control could benefit that area's subsistence hunters.

The plan to conduct wolf control beginning in 1993 in northwestern Unit 12 was suspended by the BOG. Because of that decision, the population objectives for wolves and the harvest objectives for moose were not met. New objectives consistent with the recent predator management decisions were drafted. Those objectives are as listed:

1. To provide opportunity to participate in hunting, trapping, and viewing wolves.
   a. Monitor harvest through sealing records and trapper questionnaires.
   b. Temporarily close the wolf trapping season if the population declines below 100 wolves.

2. Monitor wolf numbers and population characteristics.
   a. Conduct fixed-wing aerial surveys during the winter in selected areas.
   b. In cooperation with U.S. Fish and Wildlife, radiocollar and monitor selected packs.

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Table 1. Unit 12 autumn wolf population estimates[a], 1988-92.

Year	Population estimate[b]	Number of packs	Mean pack size[c]	Basis of estimate
1988	136	21	5.8	Spring survey, reports, observations, sealing records
1989	172-188	27	6.0	Spring survey, reports, observations, sealing records
1990	220-236	29	7.1	Spring survey, reports, observations, sealing records
1991	198-239	29	6.8	Spring survey, reports, observations, sealing records
1992	230-243	29	7.4	Spring survey, reports, observations, sealing records

[a] Autumn estimate = pretrapping season population.
[b] Includes 10% estimated number of single wolves present.
[c] Calculated using mean population estimate x 0.9 divided by number of packs.

Table 2. Unit 12 wolf harvest, 1988-92.

Regulatory year	Reported harvest						Method of take								Successful	
	M	(%)	F	(%)	Total[a]	% autumn pop.[b]	Trap or snare	(%)	Shot	(%)	SDA[c]	(%)	Unk		Total trappers and hunters	Wolves/ person
1988	6	(40)	9	(60)	17	12	12	(75)	4	(25)	--	--	0		8	2.0
1989	15	(83)	3	(17)	20	11	7	(89)	2	(11)	--	--	0		10	1.9
1990	45	(63)	27	(37)	74	32	56	(77)	7	(10)	10	(14)	0		26	2.8
1991	19	(59)	11	(41)	34	15	20	(63)	8	(25)	4	(13)	0		16	2.0
1992	26	(52)	24	(48)	54	22	51	(98)	1	(2)	--	--	0		15	3.5

[a] Total harvest includes animals of undetermined sex.

[b] Proportion of the estimated autumn population harvested by the end of the season in April. If a range estimate was given in Table 1 the proportion taken is given as the harvest divided by the mean estimate.

[c] SDA - wolf harvest taken by hunters and trappers same day airborne.

Table 3. Unit 12 wolf harvest chronology by time period, 1988-92.

Regulatory year	Harvest periods											
	Aug (%)	Sep (%)	Oct (%)	Nov (%)	Dec (%)	Jan (%)	Feb (%)	Mar (%)	Apr (%)	May (%)	Unk	*n*
1988	1 (6)	0 (0)	0 (0)	3 (19)	3 (19)	3 (19)	3 (19)	1 (6)	2 (13)	0 (0)	0	16
1989	1 (5)	0 (0)	0 (0)	1 (5)	7 (37)	3 (16)	3 (16)	4 (21)	0 (0)	0 (0)	0	19
1990	3 (4)	1 (1)	0 (0)	1 (1)	6 (8)	15 (21)	27 (37)	16 (22)	4 (5)	0 (0)	0	73
1991	1 (3)	3 (10)	0 (0)	2 (7)	4 (13)	3 (10)	7 (23)	4 (13)	6 (20)	0 (0)	2	32
1992	1 (2)	0 (0)	0 (0)	3 (6)	13 (25)	14 (27)	2 (4)	15 (29)	4 (8)	0 (0)	0	52

Table 4. Unit 12 wolf harvest by transport method, 1988-92.

Regulatory year	Airplane (%)	Dogsled, skis, or snowshoes (%)	Boat (%)	3- or 4-wheeler (%)	Snowmachine (%)	ORV[a] (%)	Highway vehicle (%)	Unknown	*n*
1988	1 (6)	0	0	0	13 (81)	0	2 (13)	0	16
1989	5 (26)	0	0	0	13 (68)	1 (5)	0	0	19
1990	14 (20)	4 (6)	0	1 (1)	48 (69)	0	3 (4)	3	73
1991	6 (24)	0	0	0	19 (76)	0	0	7	32
1992	14 (27)	0	0	0	38 (73)	0	0	0	52

[a] Other than snowmachine and 3- or 4-wheeler.

LOCATION

Game Management Unit: 13 (22,857 mi^2)

Geographical Description: Nelchina and Upper Susitna Rivers

BACKGROUND

Wolf numbers in Unit 13 were low from the late 1900s until the early 1930s, reflecting corresponding low prey densities (Skoog 1968). Wolf numbers increased after this period, and by the mid-1940s wolves were considered common (Ballard et al. 1987). As a result of predator control by the U.S. Fish and Wildlife Service (FWS) between 1948 and 1953, wolf numbers declined dramatically. Based on estimates in Rausch (1967), as few as 12 wolves may have remained in the unit in 1954. Following cessation of wolf control, wolf numbers increased rapidly. A population of 350 to 450 wolves was estimated in 1965, and fall population estimates in subsequent years exceeded 300 wolves through the 1970s (Ballard et al. 1987). During the early to mid-1980s, wolf estimates were somewhat lower, averaging approximately 275 wolves each year during the fall.

Prior to statehood (i.e., 1959), wolves were harvested under FWS regulations that provided year-round seasons and no bag limits. Denning and aerial shooting were legal, and bounties were paid. Beginning with statehood in 1959, the wolf season was closed in Unit 13 for a 5-year period. In 1965, a short season was held. By the late 1960s seasons approximating current dates were established with no bag limits. In 1971, mandatory sealing was established and aerial shooting without a permit was prohibited (Harbo and Dean 1983). Harvest levels prior to mandatory sealing are unknown. Between 1971 and 1991, an average of 91 (range = 32-145) wolves per year have been sealed in Unit 13.

MANAGEMENT DIRECTION

Management Goals

Determine wolf population estimates yearly. Regulate wolf harvests annually to prevent overharvesting, yet maintain high enough harvests to meet management objectives for wolves in Unit 13.

Management Objectives

To achieve and maintain a posthunting season population of 175 to 225 wolves distributed proportionally among subunits.

METHODS

We conduct aerial track surveys to estimate the wolf population in Unit 13 during late fall and again in late winter. Biologists fly surveys systematically to locate wolf tracks, then follow tracks to determine the size and color composition of the pack. Additional information on wolf numbers and distribution is collected by trapper surveys and incidental sightings by department personnel and the public. This information is combined with survey data to extrapolate a unit-wide population estimate. Harvest is monitored by requiring sealing of all wolves taken in the unit.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Wolf numbers in Unit 13 started increasing in 1988 and peaked in 1991. Subsequently, we observed a reduction in the size of the population over a 2-year period. Recent trend data from spring 1993 indicated an increase in wolf numbers in Unit 13.

During autumn 1992, there were an estimated 320 (310-335) wolves in a minimum of 40 packs in Unit 13 (Table 1). This estimate was based on approximately 40 hours of aerial surveys, incidental sightings and trapper reports. Known pack size was as high as 19 wolves. In recent years pack size has increased. The estimated autumn density was 7.6 wolves/1,000 km^2 (7.2-7.8 wolves/1,000 km^2), down from the recent high estimate of 9.7 wolves/1,000 km^2 in 1991. The spring 1993 population estimate was 210 wolves, an increase from an estimated 195 wolves the previous year.

Distribution and Movements: Distribution and movement patterns of wolves in Unit 13 are primarily dependent on prey availability (Ballard et al. 1987). In Unit 13, wolf territory size and productivity are functions of moose densities. For example, aerial surveys conducted during spring 1990 resulted in higher density estimates in the Alphabet Hills study area with 23.2 wolves/1,000 km^2 than in the Lake Louise study area with only 9.5 wolves/1,000 km^2 (Becker and Gardner 1991). Moose survey data indicated the Alphabet Hills study area supported 4 to 8 times more moose than the Lake Louise area.

Mortality

Harvest:

Season and Bag Limit. Wolves were harvested under hunting and trapping regulations. Wolf trapping season was from 10 November until 31 March, and there was not a bag limit. Wolf hunting season was from 10 August to 30 April. In 1990 and 1991, the hunting bag limit was 10 wolves; same-day-airborne hunting was allowed by registration permit from 10 August to 31 March. In 1992, the bag limit was reduced to 5 wolves and same-day-airborne hunting was prohibited.

Game Board Actions and Emergency Orders. The Board of Game adopted same-day-airborne wolf hunting in Unit 13 during the spring 1990 meeting. The Board also required same-day-airborne wolf hunters to obtain a permit and metal locking tags for this hunt. The metal locking tags were attached to the wolves as soon as they were taken. Emergency orders were used to close wolf hunting seasons in subunits where the desired harvest was taken. During the 1990-91 season, Unit 13A was closed by emergency order on 4 January, Unit 13C on 11 February, and the remainder of the unit on 3 March. During the 1991-92 season, Unit 13E was closed on 9 March, while other subunits remained open.

Between November 1992 and June 1993, the Board considered a number of proposals on wolf hunting and control in Unit 13. The Board passed a wolf management plan for Unit 13 that would have regulated the wolf population between 175 and 225 wolves in the spring. The wolf population was to be regulated by a same-day-airborne permit hunt by the general public. This management plan, however, was rescinded and the Board adopted a same-day-airborne trapping regulation during the June 1993 meeting.

Hunter/Trapper Harvest. Hunters and trappers harvested 93 wolves in Unit 13 during the 1992-93 season (Table 2). This was a 20% decline from the previous year's harvest of 115 animals. Males composed 54% (n = 50) of the 1992-93 harvest.

Table 2 presents the reported harvest methods in Unit 13. The same-day-airborne hunting method accounted for an average of 62% of the Unit 13 wolf harvest for the last 2 years, 1990-91 and 1991-92. This percentage was higher than the 51% average take for the 3-year period between 1985 and 1988 when same-day-airborne was legal. The increase in the percentage of take by same-day-airborne hunting during 1990 and 1992 was probably because wolves were more abundant and had been virtually unharvested in remote portions of the unit for the 2 years (1988 to 1989) same-day-airborne hunting was illegal.

Trapping and snaring accounted for an average of only 24% of the take in 1990 and 1991 when same-day-airborne was legal. This compared to an average of 53% in those years without same-day-airborne. Although the percent of the harvest taken by trapping and snaring increases in importance during years when same-day-airborne is not legal, the actual numbers of wolves taken do not increase.

Historically, trappers do not take a large number of wolves. The largest change in harvest rates between years with same-day-airborne and those without involves harvest of wolves ground shot. It appears that when wolf numbers increase and same-day-airborne is illegal, hunters and trappers have been able to take more by ground shooting. This is a somewhat recent development and should be closely watched. It may be related to the upsurge in the popularity of winter snowmachining in recent years. Late-model snowmachines are powerful, have wide, long tracks, and are efficient for long-distance tracking under deep snow conditions that formerly limited winter travel.

Permit Hunts. During 1990 and 1991, same-day-airborne hunting of wolves was allowed by registration permit only. Permits for Unit 13 were available only through the Glennallen

office. Successful permittees had to report wolves killed and harvest locations to the Glennallen office within 5 days of take. Harvest quotas for same-day-airborne hunts were established by subunits. Subunits were closed to same-day-airborne hunting as quotas were reached. There were 29 hunters in 1990 and 31 in 1991 who received permits for same-day-airborne wolf hunting in Unit 13.

Hunter/Trapper Residency and Success. During the 1992-93 season, 51 hunters and trappers harvested an average of 1.8 wolves in Unit 13; the average take per trapper over the previous 4 years (1988-1991) was 2 wolves per year. In 1992, 1 wolf was taken by a nonresident, 46 wolves were killed by 20 local residents, and 47 wolves were taken by 28 nonlocal Alaska residents. The highest nonresident harvest during this reporting period occurred in 1990 when 4 nonresidents took 8 wolves.

Harvest Chronology. Table 3 presents the harvest chronology for wolves taken in Unit 13 over the past 5 years. Harvest chronology varied depending on whether trapping or same-day-airborne hunting was the most important harvest method. Ground trappers usually concentrated their activities from the start of the season or as soon after the opening as snow conditions allowed snowmachine travel. Ground trappers usually attempted to take the different furbearers species on their line and were not targeting wolves. As a result, most of the early season wolf harvest was attributed to ground trapping. Historically, same-day-airborne hunters often waited until later in the season, when better snow conditions facilitated landing and there was more daylight for tracking.

The harvest chronology for same-day-airborne hunters changed in 1990 and 1991. First, deep snows provided good tracking and landing conditions early in the season. Also, the fact the season would be closed when harvest quotas were reached prompted competition for allowable take, increasing hunting effort earlier in the year.

High harvest similar to the one in April 1993 had not been observed in prior years. The 1993 harvest occurred because snow conditions and longer daylight were favorable for using snowmachines to hunt wolves in more remote portions of the unit. Warm temperatures also allowed late season hunters to camp out overnight, effectively extending their hunting radius.

Transport Methods. Transportation methods used by hunters and trappers to harvest wolves are presented in Table 4. When same-day-airborne hunting was legal, aircraft were the most important means of transportation for successful hunters and trappers. Historically, more wolves were taken with the use of aircraft, reflecting the remote nature of the unit and the importance of same-day-airborne harvesting.

Comparisons of reported harvest locations from 1986 to 1992 show the wolf harvest was distributed throughout the unit during years same-day-airborne was legal. During 1988-89 and 1989-90, few wolves were taken far from the road system, which left remote, interior portions of the unit virtually unharvested. In 1992, there was an indication that snowmachine hunters were taking some wolves from more remote portions of the unit formerly harvested with aircraft. This trend will be closely monitored.

Other Mortality: Natural mortality rates for radiocollared wolves in a portion of Unit 13 were determined by Ballard et al. (1987). They attributed 11% of annual mortality to intraspecific strife and 9% to accidents, injuries, starvation, and drownings. The remaining 80% was attributed to legal and illegal human harvest. Some illegal harvesting of wolves by aerial shooting probably occurs in Unit 13. The low number of suspected illegal harvest sites as well as sealed wolf pelts that appear to have been shot from the air suggest the number of wolves taken illegally is usually not large and does not affect the population.

Nonregulatory Management Problems/Needs

Between 1975 and 1982 Unit 13 wolf population estimates were obtained by extrapolating from densities determined for radio-collared packs in a portion of the unit (Ballard et al. 1987). Since 1983, estimates have been primarily derived by extrapolating the number of wolves determined from trend area track surveys. Sightings reported by hunters, trappers, and others and observations by department personnel during aerial surveys for other species are considered in this estimate. Wolf population estimates based on track surveys and incidental sightings may be less accurate than estimates from extrapolating radiotelemetry information. However, these estimates are considered adequate for management purposes. In most years the actual number of wolf sightings is high and usually exceeds the number of wolves required to meet minimum population objectives.

CONCLUSIONS AND RECOMMENDATIONS

Wolf numbers in Unit 13 doubled from the mid-1980s until 1990. Most of the population increase occurred after same-day-airborne hunting became illegal in 1988. Historically, changes in the Unit 13 wolf population can be attributed to human harvest by same-day-airborne hunting. After peaking in 1990, wolf numbers declined over the next 2 years when wolf harvests increased because of same-day-airborne hunting. The reduction in wolf numbers observed in 1991 and 1992 was, however, closely monitored and controlled. Management actions were directed at distributing same-day-airborne hunting pressure among subunits to ensure the management objective was met. By spring 1992, this management objective was achieved. In addition, wolves were not overharvested in any subunit as harvests had been more evenly distributed. Wolf numbers started increasing slightly by spring 1993 because same-day-airborne hunting was not allowed. Unless the situation changes, wolf numbers should continue to increase because moose and caribou prey are plentiful in Unit 13.

Historically, wolf numbers have not been limited in Unit 13 by ground trapping or ground shooting harvest methods. Whether this trend will continue is unknown. During 1992-93, hunter harvest by ground shooting was the highest ever reported for this method of take. Perhaps with the newer snowmachines and increased interest, ground shooting could limit wolves in some portions of the unit. Because of the size of the unit, however, it is doubtful wolf harvests will occur in more remote portions of the unit without aircraft as a method of harvesting wolves.

Well-controlled, same-day-airborne harvests with established subunit harvest quotas were effective means of meeting management objectives for Unit 13. This was the first time wolves had been managed on a permit basis in this unit. Because of tight controls on permittees and strict reporting requirements, harvests were limited and population objectives were met. Overall hunter acceptance and compliance was excellent. Wolf surveys verified harvest levels were not excessive and wolf numbers were within management objectives. The advantage of this wolf management technique was that quotas can be established on a smaller area such as a subunit, and harvests can be directed at areas that are underharvested. This was especially important in Unit 13 because trappers cannot ensure adequate harvests of remote portions of the unit. Some of the more important moose, caribou, and sheep habitats are in these remote areas where wolves were lightly harvested by ground methods. When wolves increase over management objectives, predation on these species becomes more important. With the loss of same-day-airborne hunting, we do not have a management tool to distribute wolf harvest to more remote portions of the unit.

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Table 1. Unit 13 fall and spring wolf population estimates[a], 1988-1992.

Year	Population estimate		Number of packs	Basis of estimate
	Fall	Spring		
1988/89	175-225	150 (125-175)	25	b
1989/90	357-443	285 (275-295)	40	b
1990/91	357-443	242 (228-257)	39	b
1991/92	359-472	195 (170-220)	40	b
1992/93	310-335	210 (170-240)	40	b

[a] Fall estimate = pretrapping season population, spring estimate = posttrapping season population.
b Basis of estimate, aerial track surveys, incidental observations, reports from public, sealing records.

Table 2. Unit 13 wolf harvest, 1988-92.

Regulatory	Reported harvest				Estimated harvest		Method of take				Successful	
year	M (%)	F (%)	Unk. (%)	Total	Unreported	Illegal	Trap/snare(%)	Shot(%	(SDA) (%)	Unk.(%)	Total Trappers/hunters	
1988/89	16 (50)	15 (47)	1 (3)	32	5	5	20 (62)	12 (38)	0 (0)	0 (0)	22	
1989/90	43 (51)	36 (43)	5 (6)	84	5	5	41 (49)	43 (51)	0 (0)	0 (0)	38	
1990/91	83 (57)	57 (39)	5 (4)	145	5	5	41 (28)	15 (10)	88 (61)	1 (1)	65	
1991/92	51 (44)	61 (53)	3 (3)	115	5	5	23 (20)	19 (17)	73 (63)	0 (0)	53	
1992/93	50 (54)	42 (45)	1 (1)	93	5	5	45 (48)	46 (50)	0 (0)	2 (2)	51	

Table 3. Unit 13 wolf harvest chronology percent by time period, 1988-92.

Regulatory year	Harvest periods									
	August	September	October	November	December	January	February	March	April	*n*
1988/89	3	12	0	25	16	9	16	19	0	32
1989/90	2	7	1	25	16	19	8	19	2	84
1990/91	1	1	1	22	37	8	21	8	1	145
1991/92	1	3	3	8	20	16	17	32	1	115
1992/93	4	7	1	10	14	11	13	30	10	93

Table 4. Unit 13 wolf harvest percent by transport method, 1988-92.

Regulatory year	Percent of harvest								
	Airplane	Dog sled Skis Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1988/89	3	9	0	0	59	3	22	3	32
1989/90	13	13	4	1	61	1	7	0	84
1990/91	61	0	0	2	19	0	8	10	145
1991/92	64	3	0	0	25	2	6	0	115
1992/93	8	0	0	5	75	2	8	2	93

LOCATION

Game Management Unit: 14 (6,624 mi^2)
Geographical Description: Eastern Upper Cook Inlet

BACKGROUND

Wolf numbers in Unit 14 were low to moderate in the 1950s and early 1960s, primarily due to predator control efforts by the federal government (Rausch 1967). Wolf populations increased during the late 1960s and early 1970s after cessation of predator control activities and bounty payments. Development in the Anchorage area and along the highway system in the Matanuska and Susitna valleys was probably responsible for wolf numbers remaining low near human settlements during the 1970s. Subsequent large increases in human population in this area brought substantial increases in hunting and trapping pressure, and by the mid-to-late 1980s wolf numbers were relatively low throughout Unit 14. During the early 1990s wolves increased, possibly due to high prey densities, high wolf densities in adjacent areas, and low harvest of wolves.

A black female wolf, captured and radiocollared in February 1991, near the Moose Research Center on the Kenai Peninsula, was located (with a gray companion) in Hunter Creek during December 1991. Both wolves exhibited behaviors indicating they had lice (which commonly infest Kenai wolves). This pair remained and denned in the Knik River area. Reports from trappers indicated wolves had not inhabited the Knik River area for several years prior to 1991.

MANAGEMENT DIRECTION

Management Goals

In Units 14A and 14B the primary goal is to provide for optimum harvest of wolves. In Unit 14C the primary goal is to provide opportunity to view, photograph, and enjoy wolves. The secondary goal for all of Unit 14 is to provide maximum opportunity to participate in hunting and trapping wolves.

Population Objectives

To maintain a minimum unitwide population of 55 wolves with 35 wolves in Units 14A and 14B (combined), and 20 wolves in Unit 14C.

Human-Use Objectives

In Units 14A and 14B, objectives are to allow low harvest by hunting and trapping if harvest does not conflict with maintaining the population objective, and in Unit 14C our objective is to provide for photography, viewing, listening, and appreciating the presence of wolves.

METHODS

Biologists conducted nonsystematic surveys when snow conditions permitted tracking, using a Piper PA-18 aircraft. In February 1991, we surveyed the western Talkeetna Mountains and in March 1994, we flew a portion of the southern Talkeetna Mountains and the Knik River/Lake George area. We mailed questionnaires to all trappers who sealed fur taken in Unit 14, and incidental observations were made by staff (primarily during surveys for other species) and the public. We determined harvest by sealing all wolves presented for examination. During 1991 and 1992, we examined pelts for lice from wolves taken in Unit 14.

During December 1991, the former Kenai wolf and its partner were captured, using a Hughes 500 helicopter and standard darting techniques, on the Knik River flats near Wolf Point. Samples of hair and dander were collected from each wolf to check for lice. We treated the pair with Ivermectin to prevent the spread of lice and fitted each with a radiocollar to determine if these wolves remained in the area and associated with other wolves. We conducted periodic tracking flights to relocate the pair January and December 1992.

To evaluate a program to provide a viewing/educational opportunity, air taxi operators in Units 14A and 14B were queried regarding the feasibility of telemetry-assisted wolf viewing. This survey, mailed during July 1992, was intended primarily to determine whether these operators 1) felt there was sufficient public interest in a wolf-viewing opportunity and 2) would be interested in providing such an opportunity. I intended to survey other interested publics if the air taxi operators felt there was a demand for this opportunity.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Based on incidental observations by staff and members of the public, there were an estimated 30-45 wolves in Units 14A and 14B (combined), and 15-20 wolves in Unit 14C (R. Sinnott, pers. commun.). Two wolves and tracks of up to 5 animals were seen during the February 1991 tracking flight. During March 1994, 2 wolves (and tracks of 2 others) were seen on the Knik River, and tracks of 8-9 wolves were seen on the Kashwitna River. Wolf numbers have remained stable during the past 5 years (Table 1).

During 1992, the Knik River pair produced at least 6 pups, and 8 wolves were seen in October 1992. Five pups were legally harvested during the 1992-93 trapping and hunting season. During June 1993, 6 wolves, including 3 pups, were seen near the den.

Distribution and Movements: Areas in Unit 14 that contained wolf packs included Sheep River/Iron Creek, Kashwitna River/Purches Creek, Matanuska River/Carpenter Creek, Knik River, Peters Creek/Eagle River, Ship Creek, and Twenty-mile River/Portage Creek. Areas where packs were suspected (and have inhabited) included: Talkeetna River, Chickaloon River and Upper Lake George. Some of the packs undoubtedly used areas adjacent to Unit 14. There have been sightings of wolves east of the Susitna River near Bell Island, but this pack frequents Unit 16.

Mortality

Harvest:

Season and Bag Limit. Wolves could be harvested with a hunting or trapping license. The hunting season was 10 August to 30 April and during 1990-91 and 1991-92 the bag limit was 4 wolves in Units 14A and 14B, and 1 wolf in Unit 14C. During 1992-93, the hunting bag limit for all of Unit 14 increased to 5 wolves.

The trapping season was 10 November to 31 March in Units 14A and 14B, and 10 November to 28 February in Unit 14C; in all of Unit 14 there was not a bag limit for trappers.

Board of Game Actions and Emergency Orders. During fall 1991, the Board of Game changed the hunting bag limit for wolves in most game management units in the state. This action, meant to standardize regulations, increased the hunting bag limit to 5 wolves in Unit 14. At a special June 1993 meeting, the Board reauthorized same-day-airborne (SDA) shooting of wolves, provided the person attempting to take the wolf had a trapping license and was at least 300 feet from the airplane.

Hunter/Trapper Harvest. Trapper surveys indicated that each year up to 3 people made sets specifically for wolves in Unit 14. Most wolves were harvested in Units 14A and 14B; only 1 wolf (a male trapped during 1992-93) was taken in Unit 14C in the last 5 years (Table 2). Harvest increased significantly during 1992-93; however, 9 of the 10 wolves taken came from 2 packs. Five pups were harvested from the newly reestablished Knik River pack, and a single trapper took 4 wolves in the Kashwitna River. This area had not been trapped in recent years.

Harvest Chronology. Most wolves were taken during December and January (Table 3) when furs were prime. Chronology of harvest was affected by snow conditions and trapper effort, which were variable in Unit 14.

Transport Methods.. Most people used snowmachines to access their trapping/hunting areas (Table 4). During 1992-93, however, 5 Knik River wolves were taken by people using 4-

wheelers. During winter this area can easily be accessed with wheeled vehicles, and presence of this pack was widely publicized.

Nonregulatory Management Problems/Needs

Lice were not recovered from the Knik River wolves at the time of capture (December 1991), but the male did have a patch of hair (approximately 5 inches in diameter) missing from his belly. These wolves were repeatedly observed during 1992 and 1993 but did not show behaviors typical of wolves with lice. During 1991-92, staff examined 19 wolf pelts from Units 13 and 14; none showed signs of lice (W. Taylor, pers. commun.).

The Knik River female was last observed by Kenai Refuge personnel on the Chickaloon Flats on 11 June 1991 (A. Lorenger, pers. commun.). During 11 radiotracking flights (January 1992-March 1993) these 2 wolves were not seen with other adult wolves, and they were always located <10 miles from the capture location (between Burnt Butte and the toe of the Knik Glacier). The pair denned in the Knik River valley during 1992. The radiocollars failed by February 1993, but observations by staff and pilots confirmed these wolves used the same den site in 1993.

We mailed surveys regarding telemetry-assisted wolf viewing to 15 air taxi operators. We received 8 responses, including 4 operators in Talkeetna and 4 in the Palmer area. Most respondents (n=6) felt the demand for such an opportunity existed, most (n=6) were interested in providing the opportunity, and most (n=7) felt the program could be conducted without "excessive" harassment. All respondents indicated the program could be safe and most (n=6) felt it was possible to conduct such a program where ground trapping/hunting was allowed. However, many (4 of 6 responding) felt that people would react adversely knowing that wolves in the area were trapped or hunted. Seven operators provided distances beyond which such a program would be cost-prohibitive; 1 said "no limit" and the average of the other 6 was 54 miles.

One air taxi operator thought the viewing idea atrocious and alerted several environmental groups and members of the news media. Media coverage was generally fair, but environmental groups were opposed to marking wolves for a tourist opportunity and concerned about harassment of wolves. Plans to poll other interested publics (environmental, tourism, sportshunting and animal-welfare groups) were shelved.

CONCLUSIONS AND RECOMMENDATIONS

We met the minimum population objectives for Unit 14; however, systematic surveys will be necessary to determine wolf numbers. The human-use objective for Units 14A and 14B was met, and harvest levels were within sustainable limits. The human-use objective for Unit 14C was also met; resident wolf packs within 20 miles of Anchorage continued to provide an opportunity for outdoor recreationists to enjoy wolves. No change in season or bag limit was indicated.

I recommend we conduct systematic wolf surveys within 3 years in Unit 14. High prey densities, relatively low wolf harvest, and high wolf densities in Units 7 and 13 (Hughes 1993) may cause an increase in wolf numbers. The number of incidental reports of wolves (often very near urban areas) has increased, and wolves severely injured 2 dogs in Unit 14C during 1993. Wolf packs near urban areas may increase human-wolf conflicts yet provide unique educational and management opportunities.

The department should continue to evaluate programs that enhance wolf-viewing/listening opportunities. It may be possible to develop regular (ground-based) viewing and listening programs in Unit 14C, particularly in the Ship Creek and Eagle River drainages (R. Sinnott, pers. commun.). Objective evaluation of any program may be hindered by current attitudes toward wolves and wolf management.

There may be a demand for aerial wolf-viewing opportunities. Such a program could be educational, allowing the public to actively participate in wolf "research," and stimulate public and private-sector interest in wildlife conservation and management. In addition, data gathered from tracking flights could be used to demonstrate both short- and long-term aspects of wolf ecology. However, significant resources may be necessary to ensure wolves not be subjected to harassment. A similar program in Minnesota, which has been in place for over 10 years, has been very successful and used by devoted "wolf-lovers." If this idea is pursued, the department should proceed slowly to ensure adequate public discussion.

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Table 1. Unit 14 fall wolf population estimates[a], 1988-1992.

Year	Population estimate	Number of packs	Basis of estimate
1988/89	30-60	10	b
1989/90	50-60	10	b
1990/91	45-65	8-10	b
1991/92	45-65	8-10	b
1992/93	45-65	8-10	b

[a] Fall estimate = pretrapping season population.
b Incidental observations, sealing records, and reports from the public.

Table 2. Unit 14 wolf harvest, 1988-92.

Regulatory year	Reported harvest				Method of take			Total Number Successful Trapper/hunters
	M	F	Unk	Total	Trap/ Snare	Shot	Unk.	
Subunit 14A								
1988/89	0	1	0	1	1	0	0	1
1989/90	1	0	0	1	0	1	0	1
1990/91	0	2	0	2	0	2	0	2
1991/92	2	1	0	3	1	2	0	2
1992/93	2	3	0	5	4	1	0	3
Subunit 14B								
1988/89	0	0	0	0	0	0	0	0
1989/90	1	0	0	1	1	0	0	1
1990/91	0	0	0	0	0	0	0	0
1991/92	0	0	0	0	0	0	0	0
1992/93	4	0	0	4	0	4	0	1
Unit 14 Total[a]								
1988/89	0	1	0	1	1	0	0	1
1989/90	2	0	0	2	1	1	0	2
1990/91	0	2	0	2	0	2	0	2
1991/92	2	1	0	3	1	2	0	2
1992/93	7	3	0	10	5	5	0	5

[a] Only 1 wolf reported taken in Subunit 14C during this period, a male trapped during 1992/93

Table 3. Unit 14 wolf harvest chronology percent by time period, 1988-92.

Regulatory year	Harvest periods							*n*
	Sept.-Oct.	November	December	January	February	March	April	
1988/89	0	0	0	100	0	0	0	1
1989/90	0	0	50	50	0	0	0	2
1990/91	0	0	0	100	0	0	0	2
1991/92	0	0	0	67	0	33	0	3
1992/93	0	40	60	0	0	0	0	10

Table 4. Unit 14 wolf harvest percent by transport method, 1988-92.

Regulatory year	Harvest								
	Airplane	Dogsled Skis Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1988/89	0	100	0	0	0	0	0	0	1
1989/90	0	0	0	0	100	0	0	0	2
1990/91	0	0	0	0	0	0	100	0	2
1991/92	0	0	0	0	100	0	0	0	3
1992/93	0	0	0	50	40	0	10	0	10

LOCATION

Game Management Unit: 16 (12,300 mi^2)
Geographical Description: West side of Cook Inlet

BACKGROUND

Before the 1900s wolf numbers in Unit 16 fluctuated with prey densities. In the late 1980s the number of wolves were very low (Harkness 1991), probably due to illegal harvest. Recent increases in reports of wolves and wolf sign indicated the population was increasing.

Legal methods to harvest wolves in Unit 16 have gotten more restrictive as human attitudes toward wolves have changed. From 1915 to 1968 there was a bounty on wolves and from 1948 to 1960 wolves were poisoned in a predator control program (Rausch et al. 1974). Unlike similar efforts in other states, usually initiated to protect livestock, predator control efforts in Alaska were promoted as a means of protecting indigenous ungulate and fur species (Rausch 1967). These programs probably had significant effects on wolf populations in Unit 16, given its proximity to Anchorage, Kenai, Palmer, and Wasilla.

Organized predator control efforts ended with statehood, although the bounty remained until 1968. Aerial hunting permits were issued from 1969 to 1971. Subsequently, land-and-shoot hunting was legal until mid 1986. However, most biologists believe a significant amount of illegal, aircraft-assisted harvest has occurred in Unit 16 in recent years, based on reports from local residents and the proximity of Unit 16 to urban areas. From 1990-92 the department issued same-day-airborne permits for (adjacent) Units 13 and 19; some wolves in Unit 16 may have been taken illegally by airborne hunters passing through the unit.

Reported wolf harvest in Unit 16 has declined with more restrictive regulations. Bounty records show that from 1962 to 1967 an average of 41 wolves (range = 5-84) were killed each year. The department began sealing wolves in 1971; annual harvest between 1971 and 1977 averaged 26 wolves (range = 11-41) (Didrickson and Taylor 1979). Annual average harvest declined to 11 wolves (range = 3-18) between 1983 and 1987.

MANAGEMENT DIRECTION

Management Goals

The wolf management goal for Unit 16 is to conserve the wolf population, retain desirable predator/prey ratios, and provide a sustainable harvest of wolves.

Management Objectives

The population objective for Unit 16 is to maintain a wolf population of 30-60 wolves in at least 4 packs. This should include 8-15 wolves (in 1-3 packs) in Unit 16A and 22-45 wolves (in 3-5 packs) in Unit 16B. The human-use objective is to allow maximum opportunity for harvest while maintaining minimum wolf population objectives.

METHODS

Before 1992-93, we did not conduct systematic wolf surveys. Wolf numbers, distribution and population trends were estimated based on observations by biologists, trappers, pilots, and from a trapper questionnaire mailed each spring to trappers sealing fur from Unit 16.

During March 1993, we tested a new method of estimating wolf densities. This method, called the subunit probability estimator, uses both probability and network sampling to develop a statistically valid unitwide population estimate (E. Becker, pers. commun.). Using map section lines to form a grid, we divided Unit 16 into sample units (SUs), measuring 4 miles on a side. We deleted from further analysis those SUs covered by rock, glaciers, or very deep snows because they were unlikely to contain wolves or wolf sign. This left 542 SUs (22,460 km^2) considered to be wolf habitat. These SUs were subjectively classified into 3 strata, depending on whether they had a high (71 SUs), medium (149 SUs), or low (322 SUs) probability of containing wolves or wolf tracks. SUs were assigned to strata based primarily on previous wolf sightings, assumed pack territories, and winter moose density.

A random sample of SUs was selected from each strata, with proportionate emphasis on high and medium strata. When fresh snow provided good tracking conditions, SUs were searched for approximately 16 minutes by biologists and pilots in PA-18 aircraft. While attempts were made to overfly all parts of the SU, teams usually focused their effort on portions of the SU likely to contain wolf sign. When fresh wolf tracks were found, observers followed tracks, in both directions, to determine the number of wolves and the number of SUs containing that set of tracks. These data were used to calculate strata-specific probabilities of sighting wolves or wolf sign.

Annual wolf harvest was determined by sealing all wolves presented for examination.

RESULTS AND DISCUSSION

Population Status and Trend

The wolf population in Unit 16 seems to be increasing (Table 1), although it is below the number (60-75 wolves) estimated during the mid 1980s (Harkness 1991). During frequent telemetry flights associated with 10 years of Susitna Valley moose research, R. Modafferi (pers. commun.) never saw wolf-killed moose, and he saw wolves on only 3 occasions.

However, he and other department personnel reported seeing wolves relatively frequently during fall 1993 moose surveys. Incidental reports from members of the public also indicated wolf numbers were increasing.

Population Size: Unit 16 contained an estimated 48-62 wolves, in 8-10 packs, during fall 1992 (Table 1). This estimate was derived from the spring 1993 wolf survey, known wolf mortality, and estimates (from other wolf studies) of wolf observability and natural mortality.

During 3-24 March 1993, we surveyed 120 SUs (60, 37 and 23 from high-, medium-, and low-probability strata, respectively). We observed 39 wolves in 6 packs. Using the subunit probability estimator sampling technique, Unit 16 was estimated to contain 39-42 wolves. For a preharvest estimate of wolf numbers during fall, the upper and lower point estimates were modified upward using reported harvest (8 wolves), a 3-10% natural mortality rate, and a correction factor (0-20%) for lone wolves and missed packs (Ballard et al. 1987, Fuller 1989, Gasaway et al. 1992).

The wolf density (2.1-2.8 wolves/1000 km^2) derived from our spring 1993 survey was very low compared to other wolf studies. (See summary density table in Ballard et al. 1987.) In addition, the number of moose per wolf was very high, indicating the area could sustain more wolves. An estimated 10,000 moose for Unit 16 was equivalent to 161-208 moose per wolf. This was 2-3 times higher than the highest ratio (in Unit 13E) reported for stationary or declining moose populations where predation was indicated or a suspected factor limiting moose population growth (Gasaway et al. 1992). The low wolf density in Unit 16 may reflect illegal harvest or inadequacies in our new survey technique.

Distribution and Movements: Resident wolf packs are in moose wintering areas (Table 2). Most of these areas contain open habitats conducive to aerial observation; predictably, there have been fewer wolf observations in forested areas. During fall 1993, wolves were seen on the Susitna River west of the mouth of Montana Creek, and tracks were seen on Amber Lake. Several sightings of wolves near Mt Susitna, Alexander Creek and the mouth of the Susitna River (including Unit 14A) indicated a separate pack may inhabit that area.

Unit 16 contains approximately 22,460 km^2 of wolf habitat, and the prey density indicates the habitat could support additional wolf packs. Wolf studies indicate packs maintain adjacent territories and use all available habitat. Average territory size in Unit 13 was 1,645 km^2 (Ballard et al. 1987). If we assume a similar territory size in Unit 16, the suitable habitat could support 13 wolf packs.

Mortality

Harvest:

Season and Bag Limit. Wolves could be taken with a hunting or trapping license. The wolf hunting season in Unit 16 was 10 August to 30 April, and the bag limit was 4 wolves until

1992-93, when the bag limit increased to 5 wolves. The trapping season was 10 November to 31 March with no bag limit.

Board of Game Actions and Emergency Orders. During the fall 1991 meeting, the Board of Game changed the hunting bag limit for wolves in most game management units in the state. Bag limits were reduced in units with very liberal bag limits and increased in units with low bag limits. As a result, the hunting bag limit for most of the state, including Unit 16, increased from 4 to 5 wolves.

At a special June 1993 meeting dealing strictly with wolf management, the Board of Game reauthorized same-day-airborne (SDA) harvest of wolves. However, the person taking the wolf SDA must have a trapping license and be at least 300 feet from the airplane before attempting to kill the wolf.

Hunter/Trapper Harvest. The wolf harvest during this reporting period averaged 5 wolves each year (Table 2). This was slightly less than the average (7 wolves) during 1985-89 (Harkness 1991). Method of take has varied among years; however, 1992-93 was the first year people harvested more wolves by shooting than by trapping or snaring. This may have reflected lack of trapper effort due to low fur prices and a restricted marten trapping season.

Harvest Chronology. During 1992-93, the pattern of harvest chronology shifted considerably; most wolves were taken by hunters prior to snowfall or during late spring. In previous years, most wolves were taken December through February (Table 3).

Transport Methods. Hunters and trappers primarily used aircraft and snowmachines to get to their hunting areas (Table 4). However, hunters using off-road vehicles in the Peters/Dutch Hills harvested 2 wolves during 1992-93. This could indicate an increase in wolf numbers and human access into that area.

CONCLUSIONS AND RECOMMENDATIONS

The management objectives for the wolf population and the number of packs in Unit 16 were achieved. The wolf population seemed to be increasing. The number of wolves in this area was adequate to maintain diverse opportunities to harvest wolves, and recent harvest has been below sustainable levels.

The wolf population has probably been increasing due to a reduction in the illegal kill of wolves and favorable prey/predator ratios. Although recent surveys indicated the moose population in the northern portion of Unit 16B (north of the Skwentna River) was declining, moose numbers in Unit 16A and the middle portion of Unit 16B were stable. Predation from wolves and bears, and winter mortality due to above-average snow depths, may have been responsible for the decline in moose in 16B-North.

I recommend further testing and development of the subunit probability estimator technique to estimate wolf densities. Our initial efforts in Unit 16 produced a very narrow population estimate (39-42 wolves) because the calculated probabilities of observing wolf tracks was very high for every pack observed. Our assumptions regarding our ability to 1) correctly enumerate pack size, 2) encounter all packs, and 3) account for lone wolves need to be verified. Perhaps the best way to do this is to apply the subunit probability estimator to an area with known (by radiotelemetry) wolf numbers and distribution. Most long-term wolf studies rely on repeated observations of the same pack to report pack size and also account for lone wolves (Peterson et al. 1984, Ballard et al. 1987, Fuller 1989).

Land and wildlife management agencies in Alaska and Canada are increasingly involved in predator/prey issues, and reliable wolf-density estimates have traditionally been obtained through expensive telemetry studies. A relatively inexpensive yet systematic and statistically valid method of estimating wolf densities will be of great benefit to managers and policy-makers.

I recommend we refine our overall wolf management goal to define a desired minimum prey/predator ratio for Unit 16. I further believe the department should solicit public input regarding acceptable ratios. Our current goal refers to maintaining a "desirable" ratio, implying at some point wolf numbers may get too high (or prey numbers too low), resulting in unacceptable predation rates and perhaps requiring management actions to reduce wolf numbers. Bear numbers will also be a factor in determining desirable prey/predator ratios, and relatively inexpensive methods to estimate both wolf and bear numbers will be required.

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Table 1. Unit 16 fall wolf population estimates[a], 1988-92.

Year	Population estimate	Number of packs	Basis of estimate
1988/89	30-40	6	b
1989/90	35-45	6	b
1990/91	34-45	unknown	b
1991/92	35-45	unknown	b
1992/93	48-62	8-10	c

a Fall estimate = pretrapping season population.
b Incidental observations, records, and reports from the public.
c New method being developed, using components of both probability and network sampling, developed by Becker.

Table 2. Known and suspected wolf packs, locations, and source of information for Unit 16, March to November 1993.

Pack name/Location	Minimum Pack Size	Source
<u>Known packs</u>		
Tokositna River[a]	3	Fall 1993 moose survey
Kahiltna River/Peters Hills	11	March 1993 wolf survey
East Fork Yentna	9	March 1993 wolf survey
Happy River	5	March 1993 wolf survey
Beluga Mountain/Talachulitna River	7	March 1993 wolf survey
Theodore River	5	March 1993 wolf survey
Drift/McArthur Rivers	2	March 1993 wolf survey
<u>Suspected packs</u>		
Mt. Susitna/Alexander Creek[b]	unknown	Several incidental sightings
Amber Lake/Middle Susitna River	3	Fall 1993 moose survey

[a] Pack probably uses both Subunits 16A and 13E.
[b] Pack probably uses both Subunits 16B, 16A and 14A.

Table 3. Unit 16 wolf harvest, 1988-92.

Regulatory year	Reported harvest				Method of take			Total Number Successful Trapper/hunters
	M	F	Unk	Total	Trap/ Snare	Shot	Unk.	
1988/89	6	1	0	7	4	3	0	6
1989/90	4	4	2	10	6	4	0	6
1990/91	4	1	0	5	5	0	0	3
1991/92	2	1	0	3	3	0	0	3
1992/93	3	2	3	8	1	7	0	7

Table 4. Unit 16 wolf harvest chronology percent by time period, 1988-92.

Regulatory year	Harvest periods							
	Sept.-Oct.	November	December	January	February	March	April	*n*
1988/89	29	0	43	14	0	14	0	7
1989/90	0	0	20	20	50	0	10	10
1990/91	0	20	60	20	0	0	0	5
1991/92	0	0	0	33	0	66	0	3
1992/93	63	0	0	0	13	25	0	8

Table 5. Unit 16 wolf harvest percent by transport method, 1988-92.

Regulatory year	Harvest								
	Airplane	Dogsled Skis Snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1988/89	57	0	0	0	0	0	14	29	7
1989/90	20	10	0	0	70	0	0	0	10
1990/91	80	0	0	0	20	0	0	0	5
1991/92	33	0	0	0	66	0	0	0	3
1992/93	38	0	0	0	13	25	0	25	8

LOCATION

Game Management Unit: 17 (18,771 mi^2)

Geographical Description: Northern Bristol Bay

BACKGROUND

Wolves are common residents throughout the northern Bristol Bay area. However, we do not have objective data on historic or current abundance of wolves in this area. Harvest data from 1962 to the present provide some indication of wolf distribution and relative abundance, but these data are inconsistent. Bounty records give us a partial record of harvest from 1962 through 1971. Mandatory sealing records from 1972 to the present provide greater accuracy in harvest reporting (Figure 1). In 1988 the department implemented a trapper questionnaire program to collect information on relative abundance of furbearers, including wolves.

MANAGEMENT DIRECTION

Management Objectives

Maintain a wolf population that will sustain an annual harvest of 25 wolves.

METHODS

We collect harvest data from trappers when they bring their wolf pelts in for sealing. We send an annual trapper questionnaire to selected trappers in the unit to quantify their observations of furbearer populations during the trapping season and to estimate trends in the populations. We also gain insight into wolf population trends and distribution incidental to moose and caribou surveys.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The estimated 1992 fall wolf population in Unit 17A was 5-10 wolves in 1 to 3 packs; Unit 17B population was 195 to 250 wolves in 15 to 20 packs; and the Unit 17C population was 50 to 90 wolves in 4 to 7 packs (Table 1).

Trapper reports and general observations indicated the wolf population increased during this reporting period. The wolf population in this unit reached its highest density from 1974 to 1977

but declined sharply by 1980. Rabies may have been a contributing factor. Densities increased until 1989, when another rabies epidemic affected canid populations in the unit. Wolf populations began to increase in 1992.

Distribution and Movements: Wolves were present throughout the Unit. Highest densities were along the major drainages of the Nushagak and Mulchatna rivers. There was not evidence of transitory packs following the Mulchatna caribou herd. Packs have established territories and take caribou as they move through those territories.

Mortality

Harvest:

Season and Bag Limit. The wolf hunting season in Unit 17 was from 10 August to 30 April and the bag limit was 5 wolves. Wolf trapping season in the unit was 10 November to 31 March and there was not a trapping bag limit.

Board of Game Actions and Emergency Orders. The Board of Game restricted the bag limit for hunters from 10 to 5 wolves starting in the 1992-93 regulatory year. This action resulted from a statewide proposal and was not precipitated by biological concerns specific to wolf populations in Unit 17.

Statewide regulations affecting same-day-airborne shooting of wolves fluctuated between 1991 and 1993. During 1991-92, same-day-airborne trappers were required to affix a metal locking tag to wolves as soon as they were harvested. In 1992-93, same-day-airborne trapping was prohibited. Starting in the 1993-94 season, same-day-airborne trapping will be reinstated, but trappers must be more than 300' from their aircraft when they shoot a wolf.

Hunter/Trapper Harvest. The wolf harvest in Unit 17 decreased during the 1989-90 season, and it was below the 5-year average of 24.4 wolves (Table 2). Fourteen trappers reported taking 19 wolves (12 males, 5 females, and 2 unknown sex). Fourteen (74%) were taken in Unit 17B and 5 (26%) were killed in Unit 17C. Most were taken with a firearm (79%).

Harvest Chronology. Harvest chronology has been variable from year to year (Table 3). During the 1992-93 season, most wolves were harvested in February (53%). In most years, harvest chronology reflects the suitability of snow conditions for tracking and landing rather than the availability of wolves.

Transport Methods. Aircraft have been the most common means of transport for wolf trappers/hunters in Unit 17 (Table 4). However, in 1992-93 the prohibition of same-day-airborne shooting resulted in most of the wolves being harvested with assistance of a snowmachine (84%).

CONCLUSIONS AND RECOMMENDATIONS

Few data are available to help us interpret the status of the wolf population in Unit 17. General observations and public contacts suggest the wolf population is healthy, rebounding from the decline from 1989 through 1992. Moose are the primary large prey for most packs in the unit, and moose populations have been stable-to-increasing in Unit 17B and increasing in Unit 17C since the late 1980s. Although packs are not known to follow the Mulchatna caribou herd, most wolves take advantage of this rapidly increasing herd as caribou move through their territories. It is logical to expect increases in wolf populations along with increases in prey densities. There is also movement into Unit 17 by wolves emigrating from Units 9 and 19.

The cause of declines in wolf numbers in the late 1970s and late 1980s is unknown but rabies is suspected. There is not evidence that human-induced mortality was the cause of these declines. Rabies is endemic to fox populations in southwestern Alaska and red fox populations are greatly influenced by periodic epidemics. One rabid wolf was confirmed from the unit in 1981. Samples from 6 wolves trapped in Unit 17 in 1991-92 were sent to the Alaska State Virology Laboratory for rabies tests. All were negative; however, the tests could not indicate if the wolves had been exposed to rabies and survived.

Same-day-airborne shooting of wolves has traditionally been the most common and effective method of harvesting wolves in Unit 17. Department records confirm this from 1961-62 through 1991-92, and local residents have documented extensive use of aircraft by wolf hunters back to the 1930s. Prohibition of same-day-airborne wolf shooting in 1992-93 shifted the most commonly reported method of access to snowmachines. Recent developments in snowmachine technology have improved their effectiveness for assisting in wolf harvests, especially near villages. However, aircraft remain the most effective means in the remote portions of the unit.

Aerial surveys of portions of Units 17B and 17C are needed to better quantify population density. Nearly constant winds cause rapid snowdrifts, and good survey conditions seldom last more than 1 day. Survey efforts should be coordinated with department personnel in Units 9 and 19 and with Lake Clark National Park personnel to maximize the area surveyed while good conditions persist.

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Table 1. Unit 17 fall wolf population estimates[a], 1988-1992.

Year	Population estimate	Number of packs	Basis of estimate
1988/89	177-245	24-39	a, b
1989/90	150-200	20-30	a, b
1990/91	150-225	20-30	a, b
1991/92	200-250	20-30	a, b
1992/93	250-350	20-30	a, b

[a] Fall estimate = pretrapping season population.
[b] Sources: trapper questionnaire,incidental observations during moose and caribou surveys, and harvest data.

Table 2. Unit 17 wolf harvest, 1988-1992.

Regulatory	Reported harvest				Method of take (%)			Successful
year	Male	Female	Unk	Total	Trap/snare	Shot	Unk	trappers
1988/89	12	10	1	23	2 (9%)	21 (91%)	0 (--)	11
1989/90	13	8	4	25	0 (--)	24 (100%)	0 (--)	9
1990/91	9	4	5	18	2 (11%)	16 (89%)	0 (--)	9
1991/92	20	9	8	37	9 (24%)	28 (76%)	0 (--)	20
1992/93	12	5	2	19	4 (21%)	15 (79%)	0 (--)	14

Table 3. Unit 17 wolf harvest chronology percent by time period, 1988-1992.

Regulatory year	Harvest period: December	January	February	March	April	Unknown/ Other	*n*
1988/89	9	52	13	26	0	0	23
1989/90	24	0	0	72	4	0	25
1990/91	0	6	44	44	0	6[a]	18
1991/92	5	32	30	22	0	11	37
1992/93	5	21	53	11	0	10[b]	19

a Includes 1 wolf (6%) harvested in September.
b Includes 1 wolf (5%) harvested in August and 1 wolf (5%) harvested in October.

Table 4. Unit 17 wolf harvest percent by transport method, 1988-1992.

Regulatory year	Percent of harvest: Airplane	Dogsled Skis Snowshoes	Boat	3 - or 4-Wheeler	Snow machine	ORV	Highway vehicle	Unk	*n*
1988/89	83	4	0	0	13	0	0	0	23
1989/90	96	0	0	0	4	0	0	0	25
1990/91	61	0	0	11	28	0	0	0	18
1991/92	70	0	0	0	30	0	0	0	37
1992/93	5	5	0	0	84	0	5	0	19

LOCATION

Game Management Unit: Unit 18 (46,000 mi^2)

Geographical Description: Yukon-Kuskokwim Delta

BACKGROUND

Reported observations from trappers, furbuyers, and agency biologists indicate wolf numbers are increasing in Unit 18, particularly in the Yukon drainage and northern Kilbuck Mountains. The distribution of wolves in Unit 18 reflects the distribution of moose and caribou. Although wolf and ungulate numbers are growing slowly in Unit 18, their overall densities remain low. Sealing certificate data indicate little change in the size of the harvest of wolves in Unit 18, except for 1992-93 when no harvest was reported.

MANAGEMENT DIRECTION

The following population management goals and objectives have been established for Unit 18:

1. Establish and maintain viable wolf populations in Unit 18.

    1a. Monitor harvests through the sealing program, contacts with the public, and an annual trapper questionnaire.

    1b. Explain and promote compliance with the sealing requirements among local hunters and trappers.

    1c. Monitor the size and population status of wolves and wolf packs in Unit 18.

2. Minimize adverse interactions between wolves and the public.

METHODS

No aerial surveys were specifically conducted to determine numbers and distribution of wolves in Unit 18. Wolves were observed occasionally during aerial surveys of moose and caribou. Wolf sightings were compiled with those received from other agencies, the public, trappers, and furbuyers. Harvest information was collected from sealing records, interviews with furbuyers, and the annual trapper questionnaire. Public notices were sent to 43 villages in Unit 18 for the fifth consecutive year informing the public that wolves and some furbearers taken by hunters and trappers need to be sealed.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Trappers reported seeing evidence of wolves in more places in Unit 18 during the reporting period than at any time since the 1930s. Wolf numbers are reportedly stable along the entire lower Yukon drainage in Unit 18 and increasing slightly in the Kuskokwim drainage. Previous estimates of population size of 25-50 wolves in Unit 18 may have been low, and may actually range from 75-100 wolves (Table 1).

Distribution and Movements: Two packs of 5-7 wolves each has been resident in the Kilbuck Mountains, including the Kwethluk, Kiseralik, Fog, and Tuluksak drainages since at least 1984. During November 1991 a pack of 7 wolves was seen along the Fog River between the Tuluksak and Kisaralik Rivers. These 7 wolves were observed preying upon caribou.

During aerial surveys of caribou on several occasions during fall 1989, U. S. Fish and Wildlife Service (FWS) biologists observed wolves in the Kilbuck Mountains and along the Goodnews-Kanektok drainages during spring 1990. We observed 2 wolves feeding on a caribou and moose kill during fall 1988 along the Kiseralik River, and wolves chasing caribou during 1992 surveys of the Kilbuck herd. At least 2 other packs resided in the Goodnews River drainage. Other packs remained near the periphery of Unit 18, principally moving between Unit 18 and Units 17A, 17B, 19A, 19B, 21E and 22. Dispersing juvenile wolves have moved from northern and eastern montane and riparian regions of Unit 18 onto the lowlands of the Yukon-Kuskokwim Delta.

Trappers from the villages of Akiachak, Akiak, and Kwethluk on the lower Kuskokwim have also reported observing tracks of lone and small groups of wolves on the Gweek River and the Kiseralik River during 1992-93. Wolves had not been seen in the Gweek River drainage since the demise of the reindeer industry over 50 years ago.

Trappers and residents from the villages of Mountain Village, Sheldon's Point, Pilot Station, Russian Mission, and Alakanuk reported observing tracks of single wolves or packs of wolves throughout the reporting period. A pack of 15-18 wolves has reportedly ranged between Pilot Station and Russian Mission along the Yukon River during the last 5 years. Wolves now range along the entire Yukon drainage in Unit 18 from the Unit 21E border to the mouth of the Yukon.

Mortality

Harvest:

Seasons and Bag Limits.

Hunting:	Aug. 10-Apr. 30	4 wolves

Trapping:	Nov. 10-Mar. 31	No limit

Board of Game Actions and Emergency Orders. Statewide changes in wolf seasons and bag limits have been recommended at the present time by the Department. The proposals to the Alaska Board of Game would increase the bag limit to 5 wolves for hunters in Unit 18 and bordering units. The bag limit would be the same for all units in Alaska, except Units 7, 15, and 26.

Harvest:

Human-Induced Mortality. Sealing certificate data indicate the reported Unit 18 harvest during the 1990-91 season was 1 male wolf. Four wolves (2 males and 2 females) were reported harvested in Unit 18 during the 1991-92 season, and none were reported harvested during 1992-93. The reported wolf harvest has fluctuated in size each year. The unusually high 1988-89 harvest of 17 wolves was probably related to increased availability of wolves and to an active furbuyer offering good prices. The high value of wolf pelts to the trapper in Unit 18 has remained relatively stable during the last several years although their value in other parts of Alaska has declined. This decrease in harvest reflects the overall decline in trapping activity during the last 3 regulatory years. According to trappers, travel conditions during the winters of 1990-91 and 1992-93 were not good for tracking wolves, which also effected low harvest.

We believe that most wolves caught are not sold, and thus not sealed. Wolf ruffs are highly prized as parka trim, and the local domestic demand for wolf pelts is high. Local residents prefer stiffer home-tanned wolf pelts for parka ruffs. Knowledgeable furbuyers believe that only about one-third to one-half of the wolves harvested are actually sealed.

Harvest Chronology. One wolf was reported taken during February 1991 and 4 during March 1992 (Table 3).

Transport Methods. All 5 wolves were taken by individuals using snowmachines as transportation during the segment period (Table 4). Of the 5 wolves harvested, 1 was snared and 4 were trapped.

Natural Mortality. No new information is available on natural mortality of wolves in Unit 18. The period of extremely cold weather in late January and early February 1992 (windchill to -70 degrees F) may have caused some mortality for smaller furbearers, but trappers reported no observable effects on wolves.

Habitat

Assessment: As mentioned in previous progress reports, extensive riparian, upland and montane tundra habitats are available to support much larger populations of moose, caribou, and muskoxen in Unit 18. These ungulate populations could support much larger populations of wolves.

CONCLUSIONS AND RECOMMENDATIONS

Wolf numbers are increasing in Unit 18, presumably in response to moose and caribou population growth and dispersal. Wolf numbers are apparently stable along the entire lower Yukon drainage in Unit 18, and are increasing slightly in the lower Kuskokwim drainage. Wolf packs are present in at least 3 locations in the Kilbuck and Andreafsky Mountains and in the Paimiut Hills.

The current population estimate is 75-100 wolves and 6-7 packs for Unit 18. One wolf was reportedly harvested in Unit 18 during 1990-91, compared to 4 during 1991-92, and none during 1992-93 (Table 2). In previous years, the annual harvest ranged from 1-7 wolves

Current management strategies in Unit 18 are to increase ungulate numbers. An indirect result of increasing ungulate populations is an increased prey base available to wolves. Although excessive human harvest has been the principal factor limiting ungulate population growth in Unit 18, wolf densities may need to be maintained at sufficiently low levels to allow for maximum growth of ungulate species.

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Table 1. Unit 18 fall wolf population estimates[a], 1985-93.

Year	Population estimate[b]	Number of Packs
1985-86	25-50	5-7
1986-87	25-50	5-7
1987-88	25-50	5-7
1988-89	50-75	6-7
1989-90	50-75	6-7
1990-91	75-100	6-7
1991-92	75-100	6-7
1992-93	75-100	6-7

a Fall estimate of pre-trapping season population.
b Basis of estimate are incidental observations, reports from public, sealing records and trapper questionnaire results.

Table 2. Unit 18 wolf harvest, 1985-93.

Regulatory year	Reported harvest			Method of take			Number Successful trappers/hunters
	M	F	Unknown	Trap/snare	Shot	Unknown	
1985-86	1		6	6	1		2
1986-87	2				2		2
1987-88	4	4	3	5	5	1	6
1988-89	11	6					7
1989-90	2	2					2
1990-91	1			1			1
1991-92	2	2		4			2
1992-93	0	0		0			0

Table 3. Unit 18 wolf harvest chronology by time period, 1985-93.

Regulatory year	Harvest periods					*n*
	November	December	January	February	March	
1985-86	6	1				7
1986-87		2				2
1987-88		1	5	3	2	11
1988-89		5	1	4	7	17
1989-90			1	1	2	4
1990-91				4		1
1991-92					4	4
1992-93						0

Table 4. Unit 18 wolf harvest by transport method, 1985-93.

Regulatory year	Percent of harvest			n
	3 or 4-Wheeler	Snowmachine	Unknown	
1985-86		7		7
1986-87		2		2
1987-88	1	9	1	11
1988-89		16	1	17
1989-90		4		4
1990-91		1		1
1991-92		4		4
1992-93				0

LOCATION

Game Management Units: 19A, 19B, 19C, 19D, 21A, and 21E (60,523 mi^2)

Geographical Description: All drainages of the Kuskokwim River upstream of the village of Lower Kalskag; the drainages of the Yukon River between Paimiut and to, but not including, the Blackburn Creek drainage; and the drainages of the upper Nowitna River upstream of the confluence of the Little Mud and Nowitna Rivers

BACKGROUND

Wolves have long played multiple roles in the history of the area. They have provided pelts for subsistence-based residents and, more recently, they have provided recreation (sport harvesting) and income from sale of their pelts. Also, wolves have competed with man for big game animals. Monitoring the effects of wolf predation on moose and caribou herds is expensive and time-consuming, and very little research has been conducted in the area. However, incidental observations by biologists, reports by members of the public, review of sealing documents, and interviews with wolf hunters and trappers have resulted in collection of limited data on wolves in the area.

Because no exhaustive research has been conducted on wolves in this area, no statistically valid estimates of current population levels or trends are available. However, it appears that recent populations are at higher levels than they have been in the recent past. Prey densities throughout most of the area are relatively high, leading to good annual production and survival within the wolf population.

Beginning with the 1988-89 seasons same-day-airborne hunting of wolves was prohibited in the south central, eastern interior, and northern portions of Alaska. This effectively displaced many wolf hunters from previously-used areas to Unit 19 or 21, and the resultant harvest increased dramatically. Re-instigation of same-day airborne wolf hunting in some of those previously-used game management units beginning in 1990-91 again reduced the Unit 19 and 21 harvests. More strict interpretation and enforcement of the Federal Airborne Hunting Act by federal wildlife officers further reduced wolf harvest efforts after 1991.

MANAGEMENT DIRECTION

Management Goals

Wolf populations will be managed to provide for human uses and to ensure that wolves remain an integral part of interior Alaska's ecosystems. Compatible human uses include: hunting and trapping (both for personal use and commercial sale of furs), photography, viewing, listening, and scientific and educational purposes. The aesthetic value of being

aware of or observing wolves in natural interactions with their environment is also recognized as an important human use of wolves. The domestication of wolves for personal use or for commercial purposes is generally considered incompatible with department management policies.

Management may include manipulation of wolf population size by humans, as well as total protection of wolves from human influence. Not all human uses will be allowed in all areas or at all times, rather management will focus on providing sustained, diverse human uses of wolf populations consistent with goals listed in the Wolf Conservation and Management Policy for Alaska, adopted by the Alaska Board of Game 30 October 1991 and revised 29 June 1993. Those goals are:

- To ensure the long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.

- To provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and which reflect the public's interest.

- To increase public awareness and understanding of the uses, conservation and management of wolves, their prey and habitat in Alaska.

Management Objectives

For the 1988 annual survey and inventory report, I proposed the following management objectives for wolves:

1. Manage to maintain a harvestable population of wolves capable of sustaining an annual harvest of at least 100 wolves, assuming a continuation of current harvest regulations and bag limits.

2. In areas where wolf predation is thought to be significantly affecting ungulate populations through calf or adult mortality, attempt to redirect wolf harvest efforts to those areas.

3. Continue to refine annual wolf population estimates in the area based on incidental sightings, hunter interviews, and sealing documents.

4. Delineate wolf survey area boundaries in Subunit 19D and attempt to survey those respective areas beginning in March 1995.

METHODS

Harvest statistics were gathered largely from sealing documents, although Fur Acquisition Reports and Fur Export Reports were also used. Because of the statewide sealing requirement, I assumed that >90% of the annual wolf harvest from Unit 19 and 21 was reflected by those sealing documents. In addition, conversations with several wolf hunters and trappers led to additional information on wolf pack sizes and territory boundaries. To arrive at population estimates for the various subunits, I listed packs of known size (minimum estimates), plotted harvest locations, and estimated territory boundaries. Based on hunter and trapper interviews and sealing documents, I then estimated mean pack size and mean territory size for each subunit. Ten percent was added to those estimates to account for single wolves not associated with packs.

Trapper questionnaires have been sent annually to >100 trappers and hunters in Units 19 and 21. Respondents to the questionnaires rated the current years' abundance of wolves in their respective areas as either abundant, moderate, or low. Additionally, they were asked whether the trend (relative to the previous year) was increasing, stable, or declining. Responses were assigned a numeric index value (high or increasing = 9, moderate or stable = 5, low or declining = 1), and a mean index was obtained for both current abundance and trend.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Between the 1987-88 season and 1991-92, wolf harvests were high, averaging a reported take of 183 wolves. During the 1992-93 season, harvests declined substantially (N = 48), and are assumed to again be low during the 1993-94 season. This decline in number of harvested wolves certainly does not reflect population changes, but rather a change in legal methods and means of harvesting. I assume that annual pup production and survival has also remained high, countering the relatively high mortality rate. Estimates of the wolf population size have continued to increase, especially in the face of decreasing harvests (Table 1).

In an attempt to distribute wolf harvests throughout the area, especially where historic harvests have been low or where substantial ungulate predation is suspected or documented, I have remained in contact with hunters and trappers and have tried to redirect their harvest efforts.

According to respondents to the Unit 19 and 21 trapper questionnaire, wolf abundance has increased during the past 7 years, with a dramatic increase during the 1992-93 and 1993-94 seasons. From the 1987-88 season to the 1991-92 season, trappers considered wolf populations moderate or moderately high. During the 1992-93 and 1993-94 seasons, however, wolf populations were thought to be extremely high. According to the trend index, wolf populations have been increasing steadily during that same time period. These data,

coupled with the relatively high harvests of wolves during the period 1987-88 through 1991-92 regulatory years (Table 2) suggest that wolf numbers were probably moderately high during this reporting period, and since that time have increased dramatically.

Based on analyses of sealing documents, trapper interviews, and incidental observations throughout Unit 19 and Subunits 21A and 21E, I've estimated the fall 1993 wolf population at 770-1,000 individuals in 72-90 packs (Table 1). This represents a numerical increase of approximately 10% over the previous years' estimate.

Population Composition: Other than sex ratios reported in the harvested segment of the population, no data were available concerning composition of the Unit 19 and Subunits 21A and 21E wolf population. Those sex ratios in the harvest have not been significantly different from 1:1 during the past 5 years, and I suspect the population at large also contains nearly equal sex ratios. No information is available concerning age ratios in the population.

Distribution and Movements: Only limited information is available on wolf distribution in Unit 19 and Subunits 21A and 21E. The harvest is well distributed, as are wolf tracks and incidental sightings. Because reasonably good habitat and at least moderate densities of potential ungulate prey exists throughout the area, I suspect wolves are present throughout.

Mortality

Harvest:

Season and Bag Limit.

Unit/Bag Limit/ Special Restrictions	Resident/Nonresident/Subsistence Open Seasons
Regulatory Years 1990 and 1991	
Hunting: Unit 19, 21A and 21E, 10 wolves. Same-day-airborne hunting of wolves allowed 10 Aug.-31 Mar., registration permit and locking tags required. During 1991 no same-day-airborne hunting in a National Preserve.	10 Aug.-30 Apr.
Trapping: Unit 19, 21A, and 21E, no limit.	1 Nov.-31 Mar.
Regulatory year 1992	
Hunting: Unit 19, 21A, and 21E, five wolves. No same-day-airborne	10 Aug.-30 Apr.

hunting of wolves.

Trapping: Unit 19, 21A, and 21E, no limit. 1 Nov.-31 Mar.

Board of Game Actions and Emergency Orders. During the 1990-91 wolf hunting season, registration permits and metal locking tags were required by hunters who utilized the same-day-airborne hunting techniques. The limit remained at 10 wolves per person under the hunting regulations. Wolf harvest by trapping or snaring remained as before, with no individual bag limits. Strict enforcement and questionable interpretation of the Federal Airborne Hunting Act during the 1992-93 and 1993-94 seasons resulted in substantially lower harvests.

Human-Induced Mortality. In Unit 19 and Subunits 21A and 21E, a total of 130 wolves were reported to have been harvested during 1991-92, (Tables 2 and 3). Based on the estimates of wolf numbers throughout the area, I've calculated a mean harvest rate during 1991-92 of 14-18% for the area. During the 1992-93 season, the estimated mean harvest rate was 5-6%. The prohibition of same-day-airborne wolf hunting in the area led to the dramatic decrease in wolf harvest.

Although the harvest trend in Unit 19 declined during the period 1971-72 through 1983-84, harvests generally rebounded during the next 7 years (1984-85 through 1991-92). I suspect that the prohibition against the use of land-and-shoot wolf hunting tactics will continue. Although same-day-airborne taking of wolves again became legal beginning in 1993, hunters are required to be at least 300 feet from the airplane before attempting to shoot a wolf. That hunting method will likely be relatively inefficient and wolf harvests will remain at levels below that which occurred during 1991-92, and wolf populations will continue to expand.

Hunter Residency. The 1992 wolf harvest in Unit 19, 21A, and 21E was low because of the prohibition on same-day-airborne hunting of wolves, but differences in the distribution of the harvest among residency classes was notable. Historically, about one-third of the annual wolf harvest is taken by local residents. Nonlocal Alaskan residents have traditionally taken approximately two-thirds of the annual harvest. During regulatory years 1990 and 1991 the distribution of harvest among residency classes was consistent with that traditional pattern. However, during 1992, the proportion of the harvest taken by local residents increased. Local residents took 34 of 48 (71%) wolves harvested, nonlocal Alaskan residents took only 10 wolves (21%), and nonresidents took 4 wolves (8%). I believe nonlocal Alaskan residents will increase their proportion of the take as they become more familiar with trapping and snaring techniques.

Harvest Chronology. The majority of the wolf harvest occurs during spring (Table 3). During 1992-93, 11 of 48 wolves (23%) were taken during the period August-December. Reported harvest during March remains higher than other months, generally followed by February and January.

Transport and Harvest Methods. Again, in comparing harvest and transport methods among years, no significant changes have been noted. Most are taken by ground shooting. Trapping and snaring have become more important recently because of the ban on same-day-airborne hunting.

Other Mortality. No information is available regarding natural mortality of wolves in the area, but it is suspected to be quite low.

CONCLUSIONS AND RECOMMENDATIONS

Reported wolf harvests in the area declined significantly following restrictions on legal methods and means. Even during years when reported harvests were in excess of 100 wolves per year, indications were that those wolf harvests were not significant enough to cause long-term declines in the population. Close contact with area hunters and trappers will continue. Apparently, same-day-airborne hunting restrictions and increased enforcement of the Federal Airborne Hunting Act have increased, causing a decline in hunter interest in that type of hunting. This significantly decreased the harvest of wolves during the 1990-91 and 1991-92 seasons. Trapper education courses designed to encourage efficient trapping and snaring methods will be conducted in an effort to encourage wolf harvests in areas where significant predation is occurring. Plans for the 1994-95 winter include conducting an additional moose survey in the upper reaches of the Kuskokwim River, followed by an intense wolf survey in the same area to evaluate predator:prey ratios.

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Table 1. Unit 19, 21A, and 21E fall wolf population estimates[a], 1985-93.

Regulatory Year	Population Estimate	Number ofx Packs	Wolves/ Pack[b]
1985-86	660-780	110-129	5.4
1986-87	670-780	107-136	5.4
1987-88	665-770	76-95	7.6
1988-89	710-815	72-88	8.6
1989-90	720-940	72-91	9.2
1990-91	720-940	72-91	9.2
1991-92	720-940	72-91	9.2
1992-93	750-950	71-92	9.4
1993-94	770-1,000	72-90	10.0

[a] Fall estimate = pretrapping season population based on incidental observations, reports from public, sealing records, and trapper questionnaire.

[b] Mean pack site estimated from packs observed on aerial surveys and from pack sizes reported on sealing certificates, rather than simply dividing numbers of wolves by number of packs.

Table 2. Unit 19, 21A, and 21E wolf harvest by sex, method of take, and wolves/trapper, 1985-92.

Regulatory	Sex				Method of Take			
Year	M	F	Unk	Total	Trap	Shot	Unk	Wolves/Trapper
1985-86	26	29	0	55	24	31	0	2.2
1986-87	50	38	4	92	24	68	0	4.2
1987-88	110	92	5	207	27	178	2	3.8
1988-89	82	61	38	181	14	167	0	3.6
1989-90	108	89	11	208	38	169	0	3.4
1990-91	98	89	2	189	11	178	0	3.1
1991-92	57	59	14	130	23	107	0	2.4
1992-93	21	14	13	48	24	22	2	1.9

Table 3. Unit 19, 21A, and 21E wolf harvest chronology by time period, 1985-92.

Regulatory Year	Harvest Periods									Unk	Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr		
1985-86	0	2	0	2	11	14	21	5	0	0	55
1986-87	0	1	0	8	5	5	38	34	1	0	92
1987-88	1	5	0	4	9	27	51	92	18	0	207
1988-89	2	3	1	5	7	16	12	121	2	12	181
1989-90	1	8	0	7	23	30	25	111	3	0	208
1990-91	0	5	1	1	8	25	37	112	0	0	189
1991-92	0	2	0	1	17	18	37	55	0	0	130
1992-93	1	5	0	4	1	2	12	22	1	0	48
5-year monthly mean	<1	5	<1	4	11	18	25	84	1	2	
Monthly %	0.7	3.3	0.7	2.6	7.3	11.9	16.5	55.6	0.7	1.3	

Table 4. Unit 19, 21A, and 21E wolf harvest, 1985-92.

Regulatory Year	Unit 19						Subunits 21A and 21E			
	A	B	C	D	Unk	Subtotal	A	E	Subtotal	Total
1985-86	2	2	5	31	0	40	12	3	15	55
1986-87	8	16	22	29	0	75	17	0	17	92
1987-88	60	52	12	14	4	142	34	31	65	207
1988-89	6	32	40	32	0	110	31	40	71	181
1989-90	28	46	41	22	0	137	66	5	71	208
1990-91	41	11	45	31	0	128	34	27	61	189
1991-92	19	22	50	20	0	111	7	12	19	130
1992-93	15	7	10	3	0	35	8	5	13	48
5-year mean	22	24	37	22	0	104	29	18	47	151

LOCATION

Game Management Unit: 20A, 20B, 20C, 20F, and 25C (39,231 mi^2)

Geographical Description: Lower Tanana Valley, Middle Yukon Valley

BACKGROUND

People's perceptions of wolves vary widely in Alaska. Wolves are an important furbearing resource to trappers, they are viewed as a trophy and/or competitor by some big game hunters, and they are a symbol of wilderness to people who may or may not otherwise express interest in wildlife or wildlife management.

As a result, wolf management has also varied widely in Alaska during the last 80 years. In 1915 Alaska's first territorial legislature established a bounty on wolves, which continued through 1968. From 1948 to 1959 the federal government used poison, aerial shooting, and trapping to reduce the wolf population. In 1959 state management of wildlife began and the following year the use of poison was discontinued. Since 1967 the Board of Game has authorized periodic wolf predation control programs to increase specific prey populations. Wolves have been legal for the public to take under trapping regulations (as "fur animals" from 1960 to 1984, as "furbearers" from 1985 to present) and hunting regulations (as "big game" from 1963 through present, and as "fur animals" from 1985 to 1987). Since before statehood (1959) wolves have been federally protected from hunting or trapping in 2% of the state (within the original boundaries of Denali, Katmai, and Glacier Bay National Parks).

Predator-prey relationships in Subunit 20A are among the best understood in Alaska (Gasaway *et al.* 1983; Boertje *et al.*, *In Prep*). In addition, within Denali National Park and Preserve (DNP&P) in adjacent Subunit 20C, wolves have been studied extensively as a "naturally regulated" population, most recently focusing on pack structure and genetics (Meier *et al.*, *In Press*), prey selection (Mech *et al. In Press*), and predation on caribou calves (Adams *et al.*, *In Press*).

Human consumptive use of caribou, moose, and sheep has been a priority use for decades in Subunit 20A, partly because of its proximity to Fairbanks, the second largest concentration of people in the state. During the last 20 years, wolf predation control programs have been conducted in Subunit 20A (1975-76 through 1981-82) and 20B (1979-80 through 1985-86) to increase moose and caribou populations. Immediately following wolf reduction in Subunit 20A, caribou and moose survival increased significantly. Populations of moose and caribou each peaked at about 11,000 animals in 1989, up from lows of approximately 1,800 caribou and 2,800 moose in 1976 (Gasaway *et al.* 1983; Boertje *et al.*, *In Prep*). Between 1989 and 1993, the caribou population declined from approximately 10,700 to approximately 3,600 caribou due to unfavorable weather and predation. This decline was the catalyst for a wolf predation control program scheduled to begin in 1993. The wolf population had been reduced

to as few as 45-55 wolves in spring 1979 during the control program, however, by 1992 the wolf population had rebounded to 220-295 wolves.

Although wolf predation control programs have effectively increased survival of prey, they have also been surrounded by controversy and numerous regulatory and legal challenges. In recent years, the public's desire for a larger role in wildlife management has been accompanied by the demand for more information on wolf population sizes, and the impact of wolf predation on prey populations.

This report covers regulatory years 1990, 1991, and 1992.

MANAGEMENT DIRECTION

Management Goals

Wolf populations will be managed to provide for human uses and to ensure that wolves remain an integral part of interior Alaska's ecosystems. Compatible human uses include: hunting and trapping (both for personal use and commercial sale of furs), photography, viewing, listening, and scientific and educational purposes. The aesthetic value of being aware of or observing wolves in natural interactions with their environment is also recognized as an important human use of wolves. The domestication of wolves for personal use or for commercial purposes is generally considered incompatible with department management policies.

Management may include manipulation of wolf population size by humans, as well as total protection of wolves from human influence. Not all human uses will be allowed in all areas or at all times, rather management will focus on providing sustained, diverse human uses of wolf populations consistent with goals listed in the Wolf Conservation and Management Policy for Alaska, adopted by the Alaska Board of Game 30 October 1991 and revised 29 June 1993. Those goals are:

- To ensure the long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.

- To provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and which reflect the public's interest.

- To increase public awareness and understanding of the uses, conservation and management of wolves, their prey and habitat in Alaska.

Management Objectives

During this reporting period, which ended 30 June 1993, the management objectives were:

- To estimate wolf population size from aerial surveys in all subunits by 1993.
- To model the potential range of the impact wolf predation has on ungulates in each subunit by 1993.
- To determine wolf population objectives that will reasonably meet public needs for consumptive and nonconsumptive uses of wolves and their prey in all subunits of the study area by 1993.
- To implement policies and programs for wolf management as directed by the Board of Game.

Revised objectives to guide management through the next reporting period (30 June 1993-30 June 1996) are presented in the conclusions of this report.

METHODS

Population Size: During this reporting period we conducted two intensive wolf population surveys. We conducted a census of Subunit 20A using traditional track count methods between 15 February and 17 April 1992. To calculate a fall 1991 estimate from this census, we 1) flew 125 hours of search time by fixed-wing aircraft, 2) monitored movements of five radio-collared packs within the census area, 3) compiled data from pilots/observers and trappers regarding pack color combinations, size, and distribution, 4) added 10% to the spring population estimate to account for lone wolves, and 5) added the 1991-92 harvest of 67 wolves to the spring estimate. Seven wolf packs identified during the census were known, or were believed, to range outside of Subunit 20A. To reduce the chance of overestimating the Subunit 20A wolf density, in our final estimate we included only one-half of the wolves estimated to be in each of these "boundary packs."

We also conducted a census in Subunit 20B West in March 1991 using both traditional track count techniques and a newer track intercept technique. McNay (1993) thoroughly described our techniques and a comparison of the results of the two methods. To calculate a fall 1990 population estimate for Subunit 20B West from this census, we added the 1990-91 harvest to this spring estimate. We calculated a separate estimate for Subunit 20B Central/East based on an assumed fall density of 10 wolves/1,000 km^2. The sum of these two estimates provided us with a population estimate for the entire subunit.

We estimated wolf population size in Subunit 20C using data from National Park Service biologists who conducted intensive wolf studies within DNP&P, and by extrapolating densities from surrounding subunits. Because we did not conduct wolf surveys in Subunits

20F or 25C, we estimated fall population sizes by extrapolating from spring densities found in Subunit 20B West (7.6 wolves/1,000 km^2) and adding harvest.

We did not conduct any wolf surveys in spring 1993 because of poor tracking conditions due to a lack of snowfall in March and April.

Harvest

I estimated the number of wolves harvested by examining sealing certificate data. To estimate what proportion of this harvest was taken under SDA regulations, I counted the number of wolves shot from the ground by hunters using aircraft. Nearly all of this harvest occurred during winter and presumably very few (if any) of these hunters spent the night out before shooting the wolf the following day. Therefore, because SDA registration numbers were not recorded consistently on sealing certificates, this count probably more accurately estimates the number of wolves taken under the SDA regulation.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: After an intensive survey in spring 1992, we estimated that the Subunit 20A fall 1991 wolf population included 267 wolves (16.0 wolves/1,000 km^2), including 24-34 packs with an average of 6.5 wolves each (Table 1). This represented an increase of approximately 15% per year since the fall 1988 estimate of 183 wolves (10.9 wolves/1,000 km^2). During winter 1992-93, several large wolf packs were reported in the subunit, including one pack of 24 wolves. We were unable to complete a thorough search in spring 1993 because of a lack of snow in March and April. From the information we did get, we estimated that the Subunit 20A fall 1992 population included 220-295 wolves in 25-35 packs.

After two intensive surveys in spring 1991, we estimated that the Subunit 20B fall 1990 wolf population included 222 wolves (9.4 wolves/1,000 km^2); 74 wolves in 20B West, and 148 in 20B Central/East (McNay 1993). In 20B West, the traditional track count and newer line transect techniques yielded density estimates of approximately 8.2 (7.8-8.6, no CI) and 6.7 (4.6-8.7, 80% CI) wolves/1,000 km^2, respectively. We multiplied the mid-point of these two estimates (7.5 wolves/1,000 km^2) by the area in 20B West (8,840 km^2) to arrive at an estimate of 66 wolves. To this, we added the 1990-91 harvest of 8 wolves, which resulted in the 20B West fall estimate of 74 wolves. In 20B Central/East, we assumed that fall wolf densities were more similar to the higher densities found in Subunit 20A in fall 1988 (10 wolves/1,000 km^2) than in 20B West; wolf predation control occurred in 20B West from 1984-86 and the population may not yet have recovered. Extrapolating this density to the area in Central/East (14,789 km^2) results in the fall 1990 estimate of 148 wolves. We have not intensively surveyed Subunit 20B since 1991, but we estimated that in fall 1992 Subunit 20B included 150-225 in 20-30 packs. Based on reports from the public and sealing certificates, I estimate that the population had increased by fall 1993.

In Subunit 20C we estimated that the wolf population included 320 wolves in fall 1990. This included an estimate of 107 wolves (10.0 wolves/1,000 km^2 for 10,683 km^2) in suitable habitat in the Subunit 20C portion of DNP&P (L. Adams, pers. commun.). It also included a fall estimate of 190 wolves in the 19,224 km^2 outside the park, by extrapolating Subunit 20B West densities (7.5/1,000 km^2) to this area and adding in the 1990-91 harvest of 46 wolves. In October 1992, residents of Lake Minchumina in the western portion of the subunit said they thought the wolf population had increased over the last 3-4 years. By fall 1992, we estimated that 200-320 wolves in 25-40 packs occurred in Subunit 20C, including 93 wolves in 13 packs in the NPS study area in DNP&P.

We estimated that in fall 1990 the wolf populations in Subunit 20F and 25C included 130 wolves and 107 wolves, respectively. These estimates are based on an assumption that spring densities were similar to Subunit 20B West (7.5 wolves/1,000 km^2) in the 16,427 km^2 of Subunit 20F (123 wolves) and 13,655 km^2 of Subunit 25C (102 wolves), then adding the 1990-91 harvest of 7 and 5 wolves, respectively. Based on observations and sealing certificates, we estimated that the fall 1992 populations included 75-125 wolves in 10-20 packs in each of Subunits 20F and 25C.

To determine the impact various wolf population sizes have on prey populations, a research project was initiated in 1992 to develop and test a predator-prey computer model (M. McNay, pers. commun.). We used this model to examine the potential effects of various management scenarios for wolves and their prey in Subunit 20A. These scenarios were discussed with the public and Board of Game during the planning process for Area Specific and Implementation Plans. A final report on this modeling project is expected by September 1995.

Mortality

Harvest:

Season and Bag Limit. The hunting season during regulatory years 1990, 1991, and 1992 was open 10 August through 30 April with a bag limit of 5 (1991, 1992) or 10 (1990) wolves. During the same 3 years, the trapping season extended from 1 November to 31 March with no bag limit.

Same-day-airborne (SDA) hunting (in a form now referred to as land-and-shoot) of up to 10 wolves/hunter was legal 10 August-31 March in Units 20 and 25C in regulatory years 1990 and 1991 by registration permit only, but during 1991 was prohibited in National Preserves (Denali National Preserve the only one in this area). Same-day-airborne hunting was also allowed in regulatory years 1988 and 1989 in Subunit 25C, in addition to other areas of the state outside Unit 20. Regulatory year 1992 was the first year that wolves could not be taken SDA anywhere in the state with either a trapping or hunting license. Smith (1994) summarized the history of regulations pertaining to SDA and land-and-shoot taking of wolves in Alaska.

In regulatory year 1992-93 the federal subsistence bag limit for wolves was higher (10) than the state bag limit (5).

Board of Game Actions and Emergency Orders. During this reporting period, there were many changes in the regulations and management of wolves in Alaska. Franzmann (1993) discussed these changes in detail and provided his perspective as a member of the Board of Game since 1992.

In an attempt to reduce the unproductive divisiveness of polarized groups, a 12-member citizen's advisory committee on wolf management (the Alaska Wolf Management Planning Team) was appointed in October 1990 by the director of the Division of Wildlife Conservation to provide ADF&G with recommendations on wolf management throughout the state. A broad spectrum of wolf management philosophies was represented. The planning team held several public meetings during 1990 and 1991 and presented its final recommendations to the Board of Game in October 1991.

In October 1991 the board adopted the department's Strategic Wolf Management Plan. The Plan outlined a strategy for wolf management in Alaska intended to be fair to a wide range of public desires. This strategy was based on assigning all areas of the state into one of seven zones to designate the intensity of management, thus providing "something for everyone."

In spring 1992 the board assigned zones to portions of southcentral and interior Alaska based on public and department input. They also eliminated same-day-airborne hunting of wolves by the public.

In November 1992 the board adopted the department's Area Specific Wolf Management Plan for southcentral and interior Alaska, which described zones assigned to the area, wildlife resources, human uses, past management, proposed management options, and population and harvest objectives. They also adopted Implementation Plans for wolf predation control within zones 6 and 7 in Unit 13, 20A, and the Upper Tanana/Fortymile. This action spurred national criticism and a threatened tourism boycott because of the plan to kill wolves to benefit ungulates and humans. Because of the protests, in December 1992 Commissioner Rosier suspended all aerial wolf control efforts for 1993.

In January 1993 Governor Hickel held a "Wolf Summit" in Fairbanks to bring together people with a wide range of views regarding wolf management in Alaska. Later in January, the board met and rescinded the Area-Specific and Implementation Plans, the associated wolf protection and control regulations, and most of the Strategic Plan. Following this board meeting, four Fish and Game advisory committees adjacent to the Subunit 20A wolf predation control area petitioned Commissioner Rosier to declare an emergency in the area and recommend a new aerial control program.

In response, the board held a special meeting in June 1993 to discuss wolf management. They rejected proposals for aerial shooting, land-and-shoot hunting, and use of snowmachines for taking wolves. They passed a regulation allowing holders of a trapping license to take wolves

same-day-airborne; however, shooting is prohibited within 300 feet of the aircraft. This regulation was intended to allow trappers to take wolves on their trapline the same day they flew in, and was discussed as primarily an access issue. The trapping season was extended from 31 March to 30 April and trappers were prohibited from trapping a wolf during October and April with a steel trap or with a snare made of cable smaller than 3/32 inch diameter. The board also revised the Strategic Plan by removing the zoning concept and specified the conditions under which the Board would consider wolf predation control. This revised document is now titled "Wolf Conservation and Management Policy for Alaska." The board then discussed and approved one control program in the state, a 3-year, ground-based program for a portion of Subunit 20A (excludes military land and a strip adjacent to Denali National Park). This program is scheduled to begin in October 1993 and has two objectives:

1. To reverse the decline of the Delta caribou herd and increase the mid-summer population to 6,000-8,000 caribou, with a sustainable annual harvest of 300-500 caribou.

2. To determine whether or not ground-based control methods can effectively reduce wolf numbers temporarily to reverse declines in prey populations.

Within these five subunits wolf predation control last occurred during winter 1985-86 in Subunit 20B. Although the department did not request board approval to control wolves after 1986, the program was retained in regulation because it contained long-term management objectives that had not been completely met. The program expired from regulation in April 1991.

Harvest by Hunters/Trappers. The number of wolves harvested during this 3-year period ranged from 56-67 in Subunit 20A, 11-56 in Subunit 20B, 17-46 in Subunit 20C, 2-10 in Subunit 20F, and 7-28 in Subunit 25C (Table 2). The combined-subunit mean of 148 wolves per year was nearly twice the 1985-89 mean of 83 wolves. Preliminary data from 1993 indicate a combined subunit wolf harvest of 308 wolves; 210 by the public, and 98 by department personnel during the Subunit 20A wolf predation control program. In nearly all subunits and years, the harvest included more males than females.

In October 1992 and 1993 several dozen trappers each year attended a Wolf Trapping School cosponsored by the department and the Alaska Trappers Association.

Harvest Chronology. I pooled 3 years of data from five subunits to examine harvest chronology (Table 3). The distribution of the harvest by time period included 8% (36/445) during August-October, 49% (218/445) during November-January, and 43% (191/445) during February-April.

Method of Take and Transport. Nearly two-thirds (62%) of the 444 wolves harvested in these five subunits during the last 3 years were taken in traps or snares (Table 2). Most of the remaining wolves that were harvested (35%) were shot. Subunits 20A and 20C had higher proportions (41% and 44%, respectively) of shot wolves in the harvest, which reflect 1) better

land-and-shoot conditions in these areas, 2) higher wolf densities, and 3) proximity to Fairbanks.

Almost half (47%) of the wolves harvested during the last 3 years were taken by hunters/trappers using snowmachines (Table 4). Another third (36%) were harvested by hunters/trappers using aircraft. The use of aircraft was highest in Subunit 20A (49%); many of these wolves were harvested under the SDA provision.

Same-Day-Airborne Hunting. We were not able to determine exactly how many wolves were taken under the SDA provision because SDA registration numbers were not consistently recorded on sealing certificates. Although a few wolves may be shot by hunters using aircraft after the day they were airborne, I assumed most wolves that were shot were taken under the SDA provision. The most likely period when ground-shot wolves would be taken by hunters not being SDA is during the fall moose hunting season, and only three wolves were harvested each year in fall 1990 and 1991. The following summary includes all wolves shot by hunters using aircraft, so it is possible that it is a slight overestimate of the number of wolves actually taken under the SDA provision.

In 1990-91, 50% of the 127 wolves killed in the five subunits were shot from the ground by hunters using aircraft for transport; the highest proportion was taken in Subunit 20A (74% of 55) (Table 5). In 1991-92, although harvest increased to 161 wolves, the proportion taken from the ground by hunters using aircraft declined to only 22%. In 1992-93, when SDA was illegal, five wolves were reported shot from the ground by hunters using aircraft; four during the fall hunting season, one during spring.

The decline in wolves harvested by same-day-airborne hunters during 1991-92 was, at least in part, related to a well publicized, strict interpretation of the Federal Airborne Hunting Act (FAHA). In spring 1990 federal wildlife enforcement agents obtained convictions on three wolf hunters near Bettles. The hunters hazed wolves from the air, herding them into areas suitable for landing. Although the wolves were shot from the ground, the use of aircraft to harass and herd the wolves was specifically prohibited by the FAHA, and the convictions were obtained on that basis.

A federal wildlife enforcement agent made that interpretation clear when testifying before the Alaska Wolf Management Planning Team (AWMPT) in spring 1991. He interpreted any alteration of behavior by wolves on the ground in response to airborne hunters as a violation of the FAHA, regardless if the wolves were or were not successfully taken. Coincidentally, two more convictions were obtained on land-and-shoot hunters near Galena during spring 1991 based on that interpretation. By the beginning of the 1991-92 hunting season it was obvious to hunters that their continued practice of the traditional land-and-shoot method of hunting would eventually result in a federal citation for violation of the FAHA. The publicity resulting from the convictions and the agents testimony before the AWMPT undoubtedly reduced overall hunting effort and effectiveness of same-day-airborne hunters throughout Alaska beginning in the 1991-92 season.

Other Mortality: Several nonharvest related causes of wolf mortality were documented during this reporting period. During a 6-year study (1986-92) of a naturally regulated wolf population in DNP&P, an average of 22% of radio-collared wolves died each year, 15% dispersed from packs in which they were first collared, and 8% could not be found again (either dispersed or the collar failed) each year (Meier *et al., In Press*). Of 31 radio-collared wolves that died in the study area, at least 52% (from 10 different packs) were killed by neighboring wolf packs, 39% died from various natural causes (starvation, disease/malnutrition, avalanches, and some may also have been wolf kills), and 10% were harvested outside the park/preserve boundary.

Nonregulatory Management Problems/Needs

During this reporting period we had several reports from the public about dogs that were attacked and/or killed by wolves. Most of these reports were from the outskirts of Fairbanks to the north or east.

CONCLUSIONS AND RECOMMENDATIONS

We did not meet our objective to estimate wolf population size from aerial surveys in all subunits by 1993. Although we conducted surveys in Subunits 20A and 20B during this reporting period, we did not conduct aerial surveys in Subunits 20C, 20F and 25C (DNP&P biologists did survey wolves in southern Subunit 20C). During the next reporting period, Subunit 20A will likely be the focus of most wolf surveys because of the upcoming wolf control program. However, I recommend that we also conduct aerial surveys in Subunit 20B and 25C to more completely understand the possible effects of the recent relatively severe winters on predator and prey populations.

Modeling the potential range of the impact of wolf predation on ungulates has now been identified as a separate research project (McNay 1993) with a final report due in September 1995, therefore, I recommend deleting this objective. We plan to use the model to assess and explain different options as we discuss management objectives for wolves and their prey. To more clearly understand the effects of the upcoming wolf control program, I also recommend that we pursue a calf mortality study of moose and/or caribou in Subunit 20A.

During this reporting period, we attempted to determine what wolf population objectives would reasonably meet public needs for consumptive and nonconsumptive uses of wolves and their prey in this study area through the wolf management planning process. During the next reporting period, we will continue soliciting public input but our objectives must be consistent with new guidelines established in the Board of Game's "Wolf Conservation and Management Policy for Alaska," the Wolf Predation Control Implementation Plan for Subunit 20A (5 AAC 92.125), and the Alaska State Legislature's Intensive Management of Big Game Act (effective 7/11/94).

The Policy is intended to "1) help the department, while working with the public and other agencies, provide for the conservation of Alaska's wolves and their prey populations, and 2) establish a process to prepare and adopt measures to implement the policy consistent with Alaska's constitution and with due consideration to public review and comment."

The Implementation Plan for controlling wolf predation in Subunit 20A (5 AAC 92.125) describes how we intend to increase the Delta caribou herd to 6,000-8,000 caribou by 1998 by reducing the wolf population over a 3-year period. The late-winter wolf population cannot be reduced to fewer than 35 wolves in the control area or 100 wolves in all of Subunit 20A.

The Intensive Management Act states that the legislature found that "providing for high levels of harvest for human consumptive use in accordance with the sustained yield principle is the highest and best use of identified big game prey populations in most areas of the state and that big game prey populations in these areas should be managed accordingly."

Therefore, I recommend the following management objectives for the next reporting period (1993-96):

1. Estimate wolf population size and distribution from aerial surveys and harvest in Subunits 20A, 20B, and 25C by 1996.

2. Solicit public input regarding prey population and harvest objectives prior to the spring 1995 board meeting. Determine what wolf population levels can be supported with these objectives.

3. By 1995 initiate a calf mortality study of moose and/or caribou in Subunit 20A.

4. By 1996 identify locations that offer unique opportunities to hear or see wolves, while discouraging habituation of wolves to people.

5. Implement the wolf predation control plan from as directed in 5 AAC 92.125.

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Table 1. Fall wolf population estimates for Subunits 20A, 20B, 20C, 20F, and 25C, 1985-92.

Subunit	Year	Population estimate[a]	Number of packs	Basis of estimate
20A	1985	195	26	Aerial survey, trapper interviews
	1986	220-240	25-30	Extrapolation from previous year
	1987	200-230	25-30	Extrapolation from previous year
	1988	183	21	Aerial survey, trapper reports, radiocollars
	1989	180-220	20-25	Extrapolation from previous year
	1990			
	1991	267	24-34	Aerial survey, trapper reports
	1992	220-295	25-35	Extrapolation from previous year
20B	1985	168	25	Aerial survey, radiocollars
	1986	140-180	21-27	Extrapolation from previous year
	1987	140-180	21-27	Extrapolation from previous year
	1988	140-180	21-27	Extrapolation from previous year
	1989	150-225	20-25	Extrapolation from previous year
	1990	222		Aerial survey of 20B West, extrapolation
	1991			
	1992	150-225	20-30	Extrapolation
20C	1985	120-140	20-25	Density extrapolation from 20B
	1986	120-140	20-25	National Park Service study and extrapolation
	1987	100-120	20-25	National Park Service study and extrapolation
	1988	180-220	20-25	National Park Service study and extrapolation
	1989	175-225	20-25	National Park Service study and extrapolation
	1990	320		
	1991			
	1992	200-320	25-40	National Park Service study and extrapolation

Table 1. Continued.

Subunit	Year	Population estimate[a]	Number of packs	Basis of estimate
20F	1985	60-100	10-15	Density extrapolation from 20B
	1986	60-100	10-15	Density extrapolation from 20B
	1987	60-100	10-15	Density extrapolation from 20B
	1988	80-120	15-30	Density extrapolation from 20C
	1989	75-110	15-30	Density extrapolation from 20C
	1990	130		Density extrapolation from 20B
	1991			
	1992	75-125	10-20	
25C	1985	--	--	
	1986	50-60	8-10	Density extrapolation from 20B
	1987	50-60	8-10	Density extrapolation from 20C
	1988	60-100	15-30	Density extrapolation from 20C
	1989	75-110	15-30	Density extrapolation from 20C
	1990	107		Density extrapolation from 20B
	1991			
	1992	75-125	10-20	Density extrapolation

[a] Includes an additional 10% to account for wolves not in packs.

Table 2. Wolf harvest in Subunits 20A, 20B, 20C, 20F, and 25C, 1985-92.

Subunit	Regulatory year	Reported harvest				Method of take			
		M	F	Unk	Total	Trap/ snare	Shot	Unk/ Other	Wolf control
20A	1985	--	--	--	24	17	7	0	0
	1986	--	--	--	37	33	3	1	0
	1987	19	13	4	36	30	5	1	0
	1988	17	11	4	32	23	9	0	0
	1989	20	10	1	31	21	9	1	0
	1990	31	20	5	56[a]	10	44	2	0
	1991	35	28	4	67	43	24	0	0
	1992	30	25	2	57	49	6	2	0
20B	1985	--	--	--	57	20	5	0	32
	1986	--	--	--	6	5	1	0	0
	1987	8	10	0	18	17	1	0	0
	1988	20	13	1	34	31	3	0	0
	1989	18	16	1	35	28	6	1	0
	1990	5	6	0	11	8	3	0	0
	1991	25	23	8	56	41	13	2	0
	1992	27	17	3	47	38	9	0	0
20C	1985	--	--	--	8	6	0	0	0
	1986	--	--	--	4	1	2	0	0
	1987	7	5	1	13	8	3	2	0
	1988	5	4	0	9	8	1	0	0
	1989	8	8	1	17	11	5	1	0
	1990	21	22	3	46	18	25	3	0
	1991	16	5	0	21	13	8	0	0
	1992	11	5	1	17	12	4	1[a]	0
20F	1985	--	--	--	2	2	0	0	0
	1986	--	--	--	2	2	0	0	0
	1987	1	1	3	5	1	4	0	0
	1988	2	3	0	5	5	0	0	0
	1989	10	2	2	14	11	2	1	0
	1990	2	5	0	7	6	0	1	0
	1991	4	6	0	10	7	2	1	0
	1992	0	2	0	2	1	1	0	0

Table 2. Continued.

Subunit	Regulatory year	Reported harvest M	F	Unk	Total	Method of take: Trap/ snare	Shot	Unk/ Other	Wolf control
25C	1985	--	--	--	2	2	0	0	0
	1986	--	--	--	2	0	1	1	0
	1987	5	5	0	10	10	0	0	0
	1988	2	1	0	3	0	3	0	0
	1989	3	4	0	7	0	7	0	0
	1990	8	4	0	12	1	10	1	0
	1991	2	5	0	7	3	4	0	0
	1992	18	9	1	28	27	1	0	0
Combined	1985				93				
	1986				51				
	1987				82				
	1988				83				
	1989				104				
	1990				132				
	1991				161				
	1992				151				

[a] One killed by other wolves.

Table 3. Wolf harvest chronology, Subunits 20A, 20B, 20C, 20F, and 25C, regulatory years 1985-92.

Subunit	Regulatory year	Harvest periods			*n*
		Aug-Oct	Nov-Jan	Feb-Apr	
20A	1985	2	11	11	24
	1986	0	24	9	33
	1987	3	22	11	36
	1988	4	11	17	32
	1989	8	13	10	31
	1990	5	27	24	56
	1991	7	36	24	67
	1992	4	31	22	57
20B	1985	1	9	15	25
	1986	0	5	1	6
	1987	0	9	9	18
	1988	2	27	5	34
	1989	4	18	13	35
	1990	1	7	3	11
	1991	7	25	24	56
	1992	6	26	15	47
20C	1985	0	3	3	6
	1986	0	3	0	3
	1987	2	8	2	12
	1988	1	10	0	11
	1989	0	8	9	17
	1990	2	19	25	46
	1991	0	12	9	21
	1992	0	7	10	17
20F	1985	0	1	1	2
	1986	0	1	1	2
	1987	0	2	3	5
	1988	0	1	3	4
	1989	2	5	7	14
	1990	0	4	3	7
	1991	0	6	5	11
	1992	0	1	1	2

Table 3. Continued.

Subunit	Regulatory year	Harvest periods			*n*
		Aug-Oct	Nov-Jan	Feb-Apr	
25C	1985	0	1	1	2
	1986	0	0	1	1
	1987	0	9	1	10
	1988	0	1	2	3
	1989	2	0	5	7
	1990	3	6	3	12
	1991	0	1	6	7
	1992	1	10	17	28
3-year total (1990-92)		36 (8%)	218 (49%)	191 (43%)	445

Table 4. Wolf harvest by transport method Subunits 20A, 20B, 20C, 20F, and 25C, regulatory years 1985-92.

Subunit	Regulatory year	Airplane	Dogsled, skis, snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Horse	Unk	*n*
20A	1985	7	8	0	0	5	0	0	0	4	24
	1986	5	0	0	2	28	0	0	0	0	35[a]
	1987	9	1	0	1	24	0	1	0	0	36
	1988	14	0	0	0	17	1	0	0	0	32
	1989	4	0	0	1	17	0	3	1	5	31
	1990	42	1	0	1	10	0	1	0	1	56
	1991	25	2	0	2	34	1	2	0	1	67
	1992	21	3	0	0	30	0	0	0	2	56
20B	1985	5	1	0	0	14	0	2	0	3	25[b]
	1986	2	0	0	0	4	0	0	0	0	6
	1987	2	0	0	0	16	0	0	0	0	18
	1988	5	0	1	1	26	0	1	0	0	34
	1989	9	0	1	0	15	1	5	4	0	35
	1990	2	2	0	1	6	0	0	0	0	11
	1991	10	1	1	1	34	1	4	0	3	55
	1992	6	1	1	0	34	1	3	0	1	47
20C	1985	0	3	0	0	2	0	1	0	0	6
	1986	0	2	0	0	1	0	0	0	0	3[c]
	1987	3	0	0	3	5	0	1	0	1	13
	1988	3	0	1	2	2	0	1	0	0	9[c]
	1989	9	0	0	0	7	0	0	1	0	17
	1990	22	10	0	0	5	0	3	0	6	46
	1991	7	2	0	0	12	0	0	0	0	21
	1992	1	4	0	0	10	0	0	0	0	15

Table 4. Continued.

Subunit	Regulatory year	Airplane	Dogsled, skis, snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Horse	Unk	*n*
20F	1985	0	0	0	0	0	0	0	0	0	0
	1986	0	2	0	0	0	0	0	0	0	2
	1987	3	1	0	0	1	0	0	0	0	5
	1988	0	0	0	0	4	0	1	0	0	5
	1989	0	0	2	0	7	0	0	5	0	14
	1990	0	2	0	0	5	0	0	0	0	7
	1991	0	0	0	0	8	0	2	0	0	10
	1992	0	0	0	0	1	0	1	0	0	2
25C	1985	0	1	0	0	0	0	0	0	1	2
	1986	0	0	0	0	0	0	1	0	0	1
	1987	0	4	0	0	6	0	0	0	0	10
	1988	2	1	0	0	0	0	0	0	0	3
	1989	5	0	0	2	0	0	0	0	0	7
	1990	5	1	0	1	1	1	2	0	1	12
	1991	4	0	0	0	2	0	1	0	0	7
	1992	13	0	0	0	15	0	0	0	0	28

[a] Excludes one Denali National Park wolf.
[b] Excludes 28 wolves taken by ADF&G.
[c] Excludes two Denali National Park wolves.

Table 5. Estimates of the proportion of the wolf harvest taken by same-day-airborne hunters, 1990-91 and 1991-92.

	1990-91 Harvest			1991-92 Harvest		
		SDA[a]			SDA[a]	
Subunit	Total	No.	%	Total	No.	%
20A	55[b]	41	75	67	20	30
20B	11	1	9	56	4	7
20C	45[b]	19	42	21	7	33
20F	7	0	0	10	0	0
25C	9[c]	3	33	7	4	57
Total	127	64	50	161	35	22

[a] Same-day-airborne. This is tally of hunters using aircraft and ground shooting wolves. Some may not be SDA.

[b] Excludes one wolf mortality in Denali National Park.

[c] Information on three additional wolves unavailable.

LOCATION

Game Management Unit: 20D (5,637 mi^2)

Geographical Description: Central Tanana Valley near Delta Junction

BACKGROUND

Wolves are present throughout Subunit 20D where their primary prey species are moose, caribou, and Dall sheep. Wolf and prey numbers were high in Subunit 20D during the 1960s. The wolf population was estimated at 200-250 at that time (14.8-18.6 wolves/1,000 km^2). Moose populations began to decline in the mid 1960s, and a wolf reduction program was authorized in 1979 to increase moose numbers (ADF&G 1984). This program included the issuance of aerial shooting permits to the public. From fall 1979 to spring 1983, 105 wolves were removed from Subunit 20D by trappers, ADF&G staff, and hunters with permits for aerial shooting. Most wolves were taken in southern and eastern Subunit 20D (ADF&G 1983). Since the wolf reduction program ended in spring 1983, all wolf harvest in Subunit 20D has been by hunting or trapping.

MANAGEMENT DIRECTION

Management Goals

Wolf populations will be managed to provide for human uses and to ensure that wolves remain an integral part of interior Alaska's ecosystems. Compatible human uses include: hunting and trapping (both for personal use and commercial sale of furs), photography, viewing, listening, and scientific and educational purposes. The aesthetic awareness or observation of wolves in natural interactions with their environment is also recognized as an important human use of wolves. However, the domestication of wolves for personal use or for commercial purposes is generally considered incompatible with department management policies.

Management may include manipulation of wolf population size by humans, as well as total protection of wolves from human influence. Not all human uses will be allowed in all areas or at all times, rather management will focus on providing sustained, diverse human uses of wolf populations consistent with goals listed in the Wolf Conservation and Management Policy for Alaska, adopted by the Alaska Board of Game 30 October 1991 and revised 29 June 1993. Those goals are listed:

- To ensure the long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.

- To provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and which reflect the public's interest.

- To increase public awareness and understanding of the uses, conservation and management of wolves, their prey and habitat in Alaska.

Management Objectives

1. Determine distribution, abundance, predation rates, and population trends in selected areas.

   a. Seal hides taken by hunters and trappers; interview hunters and trappers to assess relative abundance of wolves.

   b. Conduct fixed-wing aerial surveys during the winter in selected areas.

   c. Radiocollar and monitor selected packs.

METHODS

Wolves were radio-collared by locating a pack using a fixed-wing aircraft and then darting a wolf using a Robinson R22 helicopter. Wolves were immobilized with 667 mg of Telazol plus 1 cc of propylene glycol to prevent the Telazol from freezing.

Population estimates were made for packs with a radio-collared wolf by using fixed-wing aircraft equipped with radio-tracking equipment to locate packs and determine pack size based on visual observations. The number of wolves in packs that did not contain radio-collared wolves was estimated by interviewing reliable local pilots, hunters, and trappers to determine spring pack size at the end of trapping and hunting season. Wolves harvested during the winter were added to spring pack size to estimate fall pack size prior to hunting and trapping season. The total number of wolves estimated in the subunit was increased by an additional 10% assumed to be lone wolves.

Wolves harvested by trappers and hunters were sealed to monitor harvest. Information recorded for each wolf included date of kill, name of trapper or hunter, location of kill, method of take and transportation, sex of the wolf, color of the pelt, and the number of other wolves thought to be in the pack.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: No population surveys were conducted during this reporting period. Population estimates were based on observations of packs containing a radio-collared wolf and from observations by reliable hunters and trappers.

Wolves are at moderate densities in Subunit 20D. The estimated number of wolves declined from 108-109 (8.0 wolves/1,000 km^2) in fall 1990 to 75-79 (5.1 wolves/1,000 km^2) in fall 1992 (Table 1). Part of this decline occurred because the 100-Mile pack was not observed in Subunit 20D after 1990 and was not included in the Subunit 20D population estimate during 1991, 1992, and 1993. Although the autumn population declined between 1990 and 1991, it remained relatively stable from 1991 to 1993 (Table 1).

Subunit 20D has an estimated 13,472 km^2 (5,200 mi^2) of wolf habitat. Estimated density of wolves/1,000 km^2 of wolf habitat during autumn was as follows: 1990 = 8.0, 1991 = 6.0, 1992 = 5.7, and 1993 = 5.3 (1993 estimate is preliminary that does not include two packs). Those densities are within the range of densities recorded in adjacent Subunit 20E (Gasaway *et al.* 1992) and indicate that wolves in Subunit 20D are at densities comparable to an adjacent area with similar prey densities.

Tables 2-4 list individual pack size and location for spring population estimates.

Distribution and Movements: Table 5 lists wolves radio-collared in Subunit 20D during this reporting period and their status. Radio-collared wolves were located about once per month from October to May 1991-92 through 1993-94.

Movement data have not been analyzed, however, there were several movements of interest. An adult male from the Black Mountain pack was snared near Molly Creek in Subunit 20E, an immature female from the Billy Creek pack moved into the Mosquito Flats of Subunit 20E, and an adult female from the Central Creek pack joined the Healy River pack.

Mortality

Harvest:

Season and Bag Limit.

Unit/Bag Limit/ Special Restrictions	Resident/Nonresident/Subsistence Open Seasons
Regulatory Years 1990 and 1991	
Hunting: Unit 20D, 10 wolves. Same-day-airborne hunting of wolves allowed 10 Aug.-31 Mar., registration permit and locking tags required. During 1991 no same-day-airborne	10 Aug.-30 Apr.

hunting within a National Preserve.
Trapping: Unit 20D, no limit. 1 Nov.-31 Mar.

Regulatory year 1992

Hunting: Unit 20D, five wolves. 10 Aug.-30 Apr.
No same-day-airborne hunting of wolves.
Trapping: Unit 20D, no limit. 1 Nov.-31 Mar.

Human-Induced Mortality. Annual human-induced mortality ranged from 9-23 wolves killed per year. Mortality was nearly equal in 1990-91 and 1992-93 with 23 and 22 wolves killed each year, respectively. High harvest in 1990-91 was attributed to the land-and-shoot method of take. However, the high harvest in 1992-93 was from trapping with snares and traps. Harvest was lowest in 1991-92 with only nine wolves killed (Table 6).

The reported harvest rate was consistent with the sustainable harvest rate of £25% reported by Gasaway *et al.* (1992). During 1990-91 and 1991-92, reported harvest was 21% and 11%, respectively. The harvest may have exceeded the sustainable rate during 1992-93 when approximately 28% of the estimated population was harvested.

Most harvest occurs south of the Tanana River in Subunit 20D. During 1990-91 and 1991-92, 61% and 78% of harvest was from southern Subunit 20D, respectively. During 1992-93 only 36% of the harvest occurred in southern Subunit 20D, although 10 of 14 wolves harvested in northern Subunit 20D came from one pack (Billy Creek pack).

Harvest Chronology. Wolves are taken in all months during which harvest is legal (Table 7). During this reporting period, most wolves were harvested during December, February, and March.

Transport Methods. Airplanes and snowmachines continued to be the most common mode of transportation used by trappers and hunters who harvested wolves (Table 8).

CONCLUSIONS AND RECOMMENDATIONS

Most wolf management objectives were met during this reporting period. Between 1990 and 1993 the wolf population in Subunit 20D decreased and stabilized at a lower level. Harvest was less than the maximum sustainable level during 2 of 3 years. Thirteen wolves were radio-collared in seven packs. No changes in wolf hunting or trapping seasons or bag limits are recommended.

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Table 1. Subunit 20D fall wolf population estimates[a], 1985-92.

Year	Population estimate	Number of packs	Basis of estimate[b]
1985	39-65	12	1, 2, 4, 6
1986	60-80	10-13	2, 6
1987	60-80	10-12	2, 4, 6
1988	79-83	10	1, 2, 4, 6
1989	94-113	13-15	1, 2, 3, 4, 5, 6
1990	108-109[c]	12	2,4,6
1991	78-83[c]	12	2,3,4,6
1992	75-79[c]	11	2,3,4,6
1993	70-73[d]	10	2,3,4,6

[a] Fall estimate = pre-trapping season population.

[b] 1 = aerial surveys, 2 = trapper/hunter reports, 3 = radio telemetry, 4 = sealing certificates, 5 = density extrapolation, 6 = miscellaneous observations.

[c] Estimates assume 10% of the population are lone wolves not associated with packs.

[d] Preliminary minimum estimate without information on several packs.

Table 2. Wolf packs, locations, estimated size, and source of information for Subunit 20D, March 1991.

Pack name	Location	Pack size	Source
Southern Subunit 20D			
Jarvis	Jarvis Creek	3	trapper interview
Macomb	Macomb Plateau	4-5	trapper interview
Robertson River	Robertson River	12	aerial survey
Barley	Delta Agricultural Project	2	trapper interview
Northern Subunit 20D			
Billy Creek	Billy Creek	10	aerial survey
Healy River	Healy River	4	trapper interview
Mt. Harper	Upper Goodpaster River	2	aerial survey
Shaw Creek	Shaw Creek Flats	5-6	trapper interview
Central Creek	Central Creek	8	trapper interview
Black Mountain	Eisenmenger Fork, Upper Central Creek	7	aerial survey
Eisenmenger	Upper Eisenmenger Fork	6	pilot interview
Indian Creek	Indian Creek	5-6	interview
George Creek	George Creek, Sand Creek	11	aerial survey
Slate Creek	Middle Goodpaster River	4	trapper interview

Table 3. Wolf packs, locations, estimated size, and source of information for Subunit 20D, March 1992.

Pack name	Location	Pack size	Source
Southern Subunit 20D			
Jarvis	Jarvis Creek	3	aerial sighting
Macomb	Macomb Plateau	4-6	trapper interview
Robertson River	Robertson River	9-10	aerial sighting
Northern Subunit 20D			
Billy Creek	Billy Creek	10	aerial survey
Healy River	Healy River	7	aerial survey
Volkmar	South Fork Goodpaster, Volkmar River	8	aerial survey
Shaw Creek	Shaw Creek Flats	5-6	aerial survey
Central Creek	Central Creek	5	aerial survey
Black Mountain	Eisenmenger Fork, Upper Central Creek	2	aerial survey
Eisenmenger	Upper Eisenmenger Fork	2	aerial survey
Indian Creek	Indian Creek	6	aerial survey
George Creek	George Lake, George Creek	2	trapper interview

Table 4. Wolf packs, locations, estimated size, and source of information for Subunit 20D, March 1993.

Pack name	Location	Pack size	Source
Southern Subunit 20D			
Jarvis	Jarvis Creek	5-6	trapper interview
Macomb	Macomb Plateau	5	aerial sighting
Robertson River	Robertson River	13-16	aerial sighting
Northern Subunit 20D			
Billy Creek	Billy Creek	5	aerial survey
Healy River	Healy River	3	aerial survey
Shaw Creek	Shaw Creek Flats	4	aerial survey
Central Creek	Central Creek	6	aerial survey
Black Mountain	Eisenmenger Fork, Upper Central Creek	2	aerial survey
Eisenmenger	Upper Eisenmenger Fork	3	aerial survey
Indian Creek	Indian Creek	6	aerial survey
George Creek	George Lake, George Creek	2	trapper interview

Table 5. Status of wolves radio-collared in Subunit 20D from November 1991 to November 1993.

Date Collared	Pack Name	Age/Sex		Status of Wolf
26 Nov 91	Healy River	Adult	M	Killed by wolves March 1992
15 Mar 92	Healy River	Adult	M	Snared May-June 1992
15 Mar 92	Healy River	Adult	F	Shot September-October 1992
15 Mar 92	Eisenmenger	Adult	M	Alive
16 Mar 92	Black Mountain	Adult	F	Radio failed January 1994
16 Mar 92	Black Mountain	Adult	M	Snared January 1994
17 Mar 92	Billy Creek	Immature	F	Alive in Subunit 20E
17 Mar 92	Billy Creek	Adult	F	Snared February 1993
10 Nov 92	Central Creek	Adult	F	Alive in Healy River pack
12 Nov 92	Indian Creek	Immature	F	Alive
12 Nov 92	Indian Creek	Adult	M	Alive
13 Nov 92	Robertson River	Adult	F	Alive
13 Nov 92	Robertson River	Immature	M	Probably dead of unknown cause

Table 6. Subunit 20D wolf harvest, 1985-86 through 1992-93.

Regulatory year	Reported harvest			Estimated harvest		Method of take				Total
	M	F	Unk	Unreported	Illegal	Trap/snare	Shot	SDA[a]	Unk	
1985-86	17	10	1	0	0	19	0	9	0	28
1986-87	11	7	0	0	0	18	0	0	0	18
1987-88	5	7	0	0	0	11	1	0	0	12
1988-89	5	12	4	0	0	20	1	0	0	21
1989-90	2	4	0	0	0	4	2	0	0	6
1990-91	8	13	2	0	0	6	4	13	2	23
1991-92	4	3	2	0	0	3	5	1	0	9
1992-93	8	9	5	0	0	16	6	0	0	22

[a] SDA refers to animals taken by hunters the same day hunters were airborne.

Table 7. Subunit 20D wolf harvest chronology, 1985-86 through 1992-93.

Regulatory year	Harvest periods										
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Unk	*n*
1985-86	0	0	0	4	3	4	5	8	2	2	28
1986-87	0	0	0	0	2	8	2	6	0	0	18
1987-88	1	0	0	4	0	1	6	0	0	0	12
1988-89	0	0	0	0	5	5	10	0	1	0	21
1989-90	0	1	0	0	3	0	0	2	0	0	6
1990-91	0	0	2	2	0	0	3	16	0	0	23
1991-92	0	2	0	0	2	1	1	3	0	0	9
1992-93	1	1	0	2	8	0	4	3	2	1	22

Table 8. Subunit 20D wolf harvest by transport method, 1985-86 through 1992-93.

Regulatory year	Airplane	Dogsled skis, snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1985-86	10	0	0	0	16	0	1	1	28
1986-87	1	1	0	0	16	0	0	0	18
1987-88	1	5	0	0	4	0	1	1	12
1988-89	0	0	0	0	21	0	0	0	21
1989-90	0	0	0	0	4	1	0	1	6
1990-91	15	0	0	0	4	1	3	0	23
1991-92	1	0	0	0	6	0	2	0	9
1992-93	10	0	0	1	8	1	0	2	22

LOCATION

Game Management Unit: 20E (11,000 mi^2)

Geographical Description: Fortymile, Ladue, and Charley River drainages

BACKGROUND

Historically wolf numbers fluctuated widely in Unit 20E in response to ungulate prey abundance and to federal and state wolf control programs (Gasaway *et al.* 1992). Wolves were abundant in the mid 1940s, but numbers were substantially reduced by a federal predator control program from 1948 to 1960. Wolves were killed by poison, cyanide guns, killing pups at dens, year-round trapping, and aerial shooting. Once the control program ceased in 1960, the Unit 20E wolf population increased rapidly and remained high until the 1970s. The population subsequently declined during the mid 1970s after moose and caribou populations declined to low levels. At that time, the population was estimated at 250 wolves.

Following the wolf population decline, wolf reproduction rates remained low, and the population remained stable, indicating wolves in Unit 20E were still nutritionally limited by low prey availability. During 1981-83, a wolf control program was conducted by the Alaska Department of Fish and Game (ADF&G) in a 6,000 mi^2 area primarily located in Unit 20E. Following the department's wolf removal efforts and public harvest, the unit's wolf population numbered about 175 wolves. The wolf population within the control area increased to 91% of the precontrol level by fall 1986. Because the control program was terminated prematurely, the ungulate populations did not display significant growth. Similarly, the wolf population throughout Unit 20E has remained at low density because of the low prey base.

Historically the wolf population in Unit 20E was lightly harvested. However, during some years in accessible areas, moderate to high harvests caused population declines. Wolf trapping intensity is highly affected by the fur market and trapping methods. When marten and lynx fur prices are high, there is substantially reduced effort in trapping wolves. Also, trapping pressure in Unit 20E is higher when land-and-shoot taking of wolves is legal because more nonlocal trappers travel to the area.

Since the early 1980s wildlife agencies in Alaska and Canada have experienced difficulties implementing wolf management programs because wolves are valued differently by different groups of people. Consequently, most wolf management programs did not receive uniform public support. To trappers, wolves are a prized and important furbearer, and many trappers do not want management programs that cause large population declines. To some subsistence and sport hunters, wolves are viewed as competitors. Those hunters want wolves controlled to allow for more human use of ungulate resources. In contrast, wolves are a symbol of wilderness to others who want wolves and their prey naturally regulated with minimum human influence.

Philosophical differences on wolf management have caused heated disagreements and divisiveness among wildlife enthusiasts. To resolve those differences, we need to present an ecologically sound program that reflects the diverse set of public values for wildlife.

MANAGEMENT DIRECTION

Management Goals

Wolf populations will be managed to provide for human uses and to ensure that wolves remain an integral part of interior Alaska's ecosystem. Compatible human uses include: hunting and trapping (both for personal use and commercial sale of furs), photography, viewing, listening, and scientific and educational purposes. The aesthetic value of observing wolves in natural interactions with their environment is also recognized as an important human use of wolves. However, the domestication of wolves for personal or commercial purposes is generally considered incompatible with department management policies.

Management may include manipulation of wolf population size by humans, as well as total protection of wolves from human influence. Not all human uses will be allowed in all areas or at all times; management will focus on providing sustained, diverse human uses of wolf populations consistent with goals listed in the Wolf Conservation and Management Policy for Alaska, adopted by the Alaska Board of Game (BOG) 30 October 1991 and revised 29 June 1993. Those goals are as follows:

- To ensure the long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.
- To provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and which reflect the public's interest.
- To increase public awareness and understanding of the uses, conservation and management of wolves, their prey and habitat in Alaska.

Management Objectives

Between 1990 and 1993 the Alaska Wolf Management Planning Team, the BOG, the ADF&G, and many members of the public cooperatively developed criteria to guide wolf management in Alaska. Based on those criteria, intensive wolf management in Unit 20E may be justified to enhance the Fortymile caribou herd. Currently, wolf control is not authorized in Unit 20E. However, the local people continue to support a short-term intensive wolf reduction program to enhance the Fortymile Herd.

The following management objectives were in effect during the 1990-92 reporting period. Following suspension of the wolf implementation plan, new objectives were drafted. Those

objectives will guide management during the 1993-95 reporting period and are presented in the conclusions of this report.

- To monitor wolf numbers and population characteristics, through aerial surveys and radiotelemetry, and monitor harvests through sealing records and trapper questionnaires.
- To temporarily reduce wolf numbers to less than 100 by 1993.

METHODS

Estimating Wolf Population Size

During March and April 1990 aerial wolf surveys (Stephenson 1978, Gasaway *et al.* 1983), trapper and pilot reports, and trapper questionnaires were used to estimate population size and pack distribution. Between 1991 and 1993 standard radiotelemetry techniques, in conjunction with pilot and trapper reports and questionnaire results, were used to estimate wolf population size and trend. All estimates of wolf numbers were increased by 10% to account for lone wolves present but not found (Mech 1973). All wolf packs having territories wholly or partially in Unit 20E were included in the estimates.

Wolf Population Characteristics

In the Upper Tanana/Fortymile valleys between 1991 and 1993, radiocollars were deployed on 30 wolves associated with 20 packs. Most of those packs resided in Unit 20E. Radiocollared wolves were located periodically during the year to determine pack and territory size, movement patterns, and population demographics.

Harvest Monitoring

Harvest statistics were determined from sealing documents and fur acquisition reports. An official ADF&G seal must be attached to all wolves taken in Alaska. During the sealing process, information is collected on specific location and method of take, date, sex, color of pelt, estimated wolf pack size, and method of transportation.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The wolf population in Unit 20E increased by approximately 17% annually between 1988 and 1990, reaching an estimated 231 wolves in 1990 (Table 1). Two thorough wolf surveys were conducted in Unit 20E during 1991 and 1992. Based on those surveys, the population

stabilized or slightly declined between 1990 and 1992. Late winter and fall population densities during regulatory year 1992 were 5.2 and 6.9 wolves/1,000 km^2, respectively.

Mortality

Harvest:

Season and Bag Limit.

Unit/Bag Limit/ Special Restrictions	Subsistence/Resident Open Seasons	Nonresident Open Seasons
Regulatory Years 1990 and 1991		
Hunting: Unit 20, 10 wolves. Same-day-airborne hunting of wolves allowed 10 Aug.-31 Mar., registration permit and locking tags required.	10 Aug.-30 Apr.	10 Aug.-30 Apr.
Trapping: Unit 12 and 20E, no limit. Only snares, 3x or larger, are allowed for trapping wolves during the months of October, March, and April.	1 Oct.-30 Apr.	1 Oct.-30 Apr.
Regulatory year 1992		
Hunting: Unit 20, five wolves. No same-day-airborne taking of wolves.	10 Aug.-30 Apr.	10 Aug.-30 Apr.
Trapping: Unit 12 and 20E, no limit. Only snares, 3x or larger, are allowed for trapping wolves during the months of October, March, and April.	1 Oct.-30 Apr.	1 Oct.-30 Apr.

Board of Game Actions and Emergency Orders. During 1991 the BOG eliminated same-day-airborne taking of wolves statewide. The regulation became effective during the 1992-93 season. The elimination of same-day-airborne hunting was part of a broad wolf management strategy that also involved adoption of area-specific management plans and development of plans for implementing intensive management of wolf-prey systems.

During November 1992 the BOG adopted a wolf management plan that would have affected the wolf population in most of western and central Unit 20E. The plan called for a 70-80% reduction of the wolf population for up to 5 years. Implementation of the plan was to begin after 1 January 1993, but in December 1992 the plan was postponed by the commissioner to allow greater public input. In January 1993, in response to public dissatisfaction, the BOG rescinded the plan.

In June 1993 the BOG adopted a regulation allowing same-day-airborne shooting of wolves by trappers. To comply with the new regulation, the trapper must be more than 300 feet from the airplane before shooting a wolf. The BOG also extended the use of steel traps for the taking of wolves to the end of March and set the minimum cable diameter for snaring wolves at 3/32 inches during October and April.

Hunter/Trapper Harvest. The reported Unit 20E wolf harvest was 24, 19, and 57 wolves during regulatory years 1990, 1991, and 1992, respectively. The regulatory year 1992 harvest of 57 wolves removed 28% of the estimated fall population and was more than three times the previous 4-year (1988-91) mean annual harvest of 17 wolves. The 1992 harvest was probably near the maximum sustainable harvest from this wolf population.

Most of the 1992 harvest was in the central portion of the unit near the Taylor Highway. The estimated harvest rate for that area was 48.3%, causing a 16-18% overwinter decline in wolf numbers. Based on trapper reports and incidental sightings by department personnel, the increased harvest was facilitated by concentrations of caribou easily accessible by snowmachines. Wolves confined their movements to caribou wintering areas and, therefore, were more vulnerable to ground-based trappers. The caribou density in central Unit 20E was high during winter 1992-93 because portions of the Fortymile, Nelchina, and Mentasta caribou herds wintered in the vicinity of the Taylor Highway.

Land-and-shoot harvesting of wolves was prohibited during 1992. In response to the regulatory change, the proportion of wolves harvested by traps and snares increased (Table 2).

Harvest Chronology. The percent wolf harvest during August and September (wolf hunting only), November through February (snaring, trapping, and hunting) and October and March through April (snaring only) was 5.3%, 66.6%, and 28.1%, during 1992 (Table 3). Among those respective periods the harvest distribution between 1988 and 1992 averaged 13.4%, 71.7%, and 14.9%. The primary difference was during the 1992 late snaring season (March and April) when 26.3% of the total harvest was taken compared with the previous 4 years when only 11.9% of the harvest occurred during this period.

Transport Methods. Snowmachines were used by most of the successful wolf trappers in Unit 20E (Table 4). The use of aircraft to harvest wolves was low during 1988 and 1989 but increased during 1990 and 1991 when land-and-shoot taking of wolves was allowed. The future success of hunters using aircraft as a transport method is expected to decline because the same-day-airborne

regulation implemented in 1993 is more restrictive than previous regulations which allowed land-and-shoot harvesting of wolves.

Habitat

Assessment: Prey availability dictates wolf habitat use. Therefore, the better wolf habitat occurs where there is a greater ungulate prey base. Because of the migratory behavior of caribou, there are temporal high densities of caribou available to certain wolf packs. However, there are no packs in Unit 20E that can utilize caribou year-round; during all or portions of the year, every pack must rely on moose as their primary prey. Moose densities in Unit 20E are low, ranging from 0.2 to 0.9 moose/mi^2 (x = 0.46 moose/mi^2) (Gardner, In press). Those moose densities cannot support a large wolf population. Based on prey availability, wolf habitat in Unit 20E is poor, but the habitat could support high populations of prey and wolves if environmental or management action allow the Fortymile caribou herd to increase substantially.

Human development is not currently a problem for wolves in the area; however, over 30 years of intensive suppression of wildfires have lowered the habitat carrying capacities for early seral prey species such as moose and beaver. Food is not currently a limiting factor for any ungulate prey species.

Enhancement: Since the early 1970s the biotic element of the Upper Tanana/Fortymile ecosystem has been stable at a very low density for all large mammalian predators, ungulates, and scavengers. Because this area is in a low-density equilibrium (Gasaway *et al.* 1992) and there is no natural fast-acting feedback mechanism, we expect it to remain in this status for a long time. If extended good weather or an adjustment in the number of predators allowed caribou and moose populations to increase, the entire ecosystem could support more predators, scavengers, and human use.

Unit 20E is included in the Alaska Interagency Fire Management Plan. At least 60% of the area is classified in Limited Suppression status, which should assure a near-natural wildfire regime. This, in turn, should increase habitat diversity that will benefit wolf prey species.

CONCLUSIONS AND RECOMMENDATIONS

The wolf population in Unit 20E is currently at low density and is limited by low prey abundance. Harvest by humans during most years is below sustained harvest rates and has not affected overall wolf population growth. Even though the wolf population is low, the present wolf predation rates on caribou and moose are maintaining these populations at low levels. At the current wolf, caribou, and moose population levels, the management goals and objectives for each species are not being met.

Most biologists who have reviewed the biological data agree that to meet the current population and harvest objectives for Fortymile caribou, moose, and wolves, a wolf reduction program would be necessary. A wolf reduction program was adopted during November 1992 but later rescinded due to political decisions. However, because of the biological and social significance of reestablishing the Fortymile caribou herd to its historic range and population size, I recommend the department continue to pursue this goal.

Guidelines established by the International Union for the Conservation of Nature and Natural Resources (IUCN) Wolf Specialist Group state, "It is recognized that occasionally there may be a scientifically established need to reduce nonendangered wolf populations...The goal of wolf management programs must be to restore and maintain a healthy balance in all components of the ecosystem. Wolf reduction should never result in the permanent extirpation of the species from any portion of its ranges."

The Fortymile caribou herd is the key species to the ecological health of the Upper Tanana/Fortymile River valleys. It is unlikely that it will increase to former levels of abundance in the foreseeable future, however, without a temporary reduction in predation. While a short-term wolf management program would enhance the stability and species diversity of the Fortymile ecosystem, it is unlikely to be implemented unless it meets the guidelines of the IUCN Wolf Specialist Group. Consequently, management objectives were revised consistent with recent board decisions.

The following objective will guide management during the 1992-95 reporting period unless further actions are taken by the Board of Game:

To provide for the maximum harvest of wolves in western Unit 20E while maintaining a long-term viable population.

a. Through seasons and bag limits allowing the greatest harvest within and near the Fortymile caribou herd's calving ground.

b. Monitor harvest and population size.

c. Temporarily close the season if the population in western Unit 20E declines below 75 wolves.

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Table 1. Subunit 20E fall wolf population estimates[a], 1988-93.

Regulatory year	Population estimate[b]	Number of packs	Mean pack size[c]	Basis of estimate
1988	173	32	4.9	Aerial survey, observations, reports
1989	205	33	5.6	Aerial survey, observations, reports
1990	231	33	6.3	Aerial survey, observations, reports
1991	169-184 collars	31	5.1	Aerial survey, observations, reports, radio
1992	194-214	32	5.7	Aerial survey, observations, reports, radiocollars
1993	186-210 collars	34	5.2	Aerial survey, observations, reports, radio

[a] Fall estimate = pretrapping season population.

[b] Includes 10% estimated number of single wolves present.

[c] Calculated using mean population estimate x 0.9 divided by number of packs.

Table 2. Subunit 20E wolf harvest, 1988-92.

Regulatory year	Reported harvest M	(%)	F	(%)	Total[a]	% Fall pop.[b]	Method of take Trap or snare	(%)	Shot	(%)	SDA	(%)	Unk	Successful Total trappers and hunters	Wolves/ person
1988	2	(22)	7	(78)	9	5	7	(78)	2	(22)	-[c]		6	6	1.5
1989	7	(54)	6	(46)	15	7	12	(80)	3	(20)	-[c]		10	10	1.5
1990	15	(63)	9	(37)	24	10	12	(52)	5	(22)	6	(26)	1	13	1.8
1991	13	(68)	6	(32)	19	11	14	(77)	1	(5)	3	(17)	1	10	1.9
1992	28	(49)	28	(49)	57	28	52	(95)	3	(5)	0	(00)	2	21	2.7

[a] Total harvest includes animals of undetermined sex.
[b] Proportion of the estimated fall population harvested by the end of the season in April. If a range was given for the fall estimate, the proportion taken is given as the harvest divided by the mean estimate.
[c] SDA taking prohibited during 1988-89 and 1989-90.

Table 3. Subunit 20E wolf harvest chronology, 1988-92.

Regulatory year	Harvest periods Aug (%)	Sep (%)	Oct (%)	Nov (%)	Dec (%)	Jan (%)	Feb (%)	Mar (%)	Apr (%)	n[a]
1988	0 (0)	1 (11)	0 (0)	0 (0)	2 (22)	2 (22)	3 (33)	1 (11)	0 (0)	9
1989	0 (0)	2 (13)	1 (7)	2 (13)	3 (20)	6 (40)	1 (7)	0 (0)	0 (0)	15
1990	3 (15)	2 (10)	0 (0)	0 (0)	2 (10)	4 (20)	3 (15)	2 (10)	4 (20)	24
1991	0 (0)	1 (6)	1 (6)	2 (11)	4 (22)	4 (22)	5 (28)	1 (6)	0 (0)	19
1992	0 (0)	3 (5)	1 (2)	1 (2)	6 (11)	13 (23)	18 (32)	10 (18)	5 (9)	57

[a] Total includes wolves for which date of take was unknown.

Table 4. Subunit 20E wolf harvest by transport method, 1988-92.

Regulatory year	Airplane (%)	Dogsled, skis, or snowshoes (%)	Boat (%)	3- or 4-Wheeler (%)	Snowmachine (%)	ORV (%)	Highway vehicle (%)	Unk[a]	*n*
1988	1 (11)	1 (11)	0 (0)	1 (11)	6 (67)	0 (0)	0 (0)	0	9
1989	1 (7)	5 (33)	0 (0)	0 (0)	7 (47)	1 (7)	1 (7)	0	15
1990	8 (33)	1 (4)	0 (0)	2 (9)	10 (43)	0 (0)	2 (9)	1	24
1991	4 (24)	1 (6)	0 (0)	1 (6)	10 (59)	0 (0)	1 (6)	2	19
1992	6 (11)	6 (11)	0 (0)	0 (0)	41 (72)	0 (0)	4 (7)	0	57

[a] Unknown transport not used to calculate harvest percent.

LOCATION

Game Management Unit: 21B, 21C, 21D (20,150 mi^2)

Geographical Description: Yukon River drainage above Paimiut to Tozi River, including Koyukuk up to Dulbi Slough

BACKGROUND

Wolves are found throughout the unit in all habitat types, even near human settlements. The number of wolves within the unit varies depending on the availability of prey. There are more wolves in Unit 21D and the lowlands of Unit 21B than in Unit 21C.

Wolves were present when humans first settled the area and have since become part of the human environment and culture. Wolf populations have fluctuated from very low to very high numbers, depending on the availability of prey species and the wolf-controlling activities of man. In Unit 21D wolf numbers were probably lower before the early 1940s because moose were absent and caribou availability fluctuated. Immigration of moose coinciding federal wolf control rapidly increased the moose population. In the mid 1950s the moose population was estimated to be similar to current density, ranging from 3 to 9 moose/mi^2 in the Koyukuk lowlands near Three-day Slough. With cessation of wolf control, wolf numbers increased and are presently higher than historic levels. In Units 21B and 21C, wolf populations may be lower than in the early 1900s because moose densities in those areas are lower.

Historic harvests have ranged from 45 to 130 wolves per year and average about 52 per year. The local need for wolf pelts for parka ruffs and gifts at funeral potlatches is higher than the harvest. Local residents around Galena and Ruby recognize the predator-prey relationship between moose and wolves and make a conscious effort to increase their wolf harvests when moose are scarce.

MANAGEMENT DIRECTION

Management Goals

Wolf populations will be managed to provide for human uses and to ensure wolves remain an integral part of Interior Alaska's ecosystems. Compatible human uses include hunting and trapping (both for personal use and commercial sale of furs), photography, viewing, listening, and scientific and educational purposes. The aesthetic value of observing wolves in natural interactions with their environment is also recognized as an important human use of wolves. The domestication of wolves for personal or commercial use is generally considered incompatible with department management policies.

Management may include manipulation of wolf population size by humans, as well as total protection of wolves from human influence. Not all human uses will be allowed in all areas or at all times; management will focus on providing sustained, diverse human uses of wolf populations consistent with goals listed in the Wolf Conservation and Management Policy for Alaska, adopted by the Alaska Board of Game 30 October 1991 and revised 29 June 1993. Those goals are:

- To ensure the long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.

- To provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and reflect the public's interest.

- To increase public awareness and understanding of the uses, conservation and management of wolves, their prey and habitat in Alaska.

Management Objectives

- In Unit 21B manage the wolf population to maintain at least 50 moose per wolf until the moose population objective of 4000 to 4500 is attained. Thereafter, maintain a fall wolf density of approximately 8 wolves/1,000 km^2 and sustain an annual harvest rate of 15-25% from the wolf population.

- In Units 21C and 21D, maintain a fall wolf density of approximately 8 wolves/1,000 km^2 and sustain an annual harvest rate of 15-25% from the wolf population.

METHODS

Wolf pack numbers and distribution were determined by aerial surveys during winter in cooperation with the U.S. Fish and Wildlife Service (FWS) and by interviews with wolf trappers and aircraft pilots. During February 1994 a Sample Unit Probability Estimator (SUPE) census was conducted in Unit 21D. The Unit was divided into 760 sample units of 16 mi^2 each and each unit was classified into one of three density strata: high, medium or low. The probability of sighting wolf tracks after a fresh snowfall was used to obtain population estimates. Once tracks were sighted they were tracked until wolves were sighted and counted. Fifty wolves have been radiocollared and relocated in a cooperative ADF&G/FWS study. Harvests were monitored by pelt sealing requirements.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The estimated size of the wolf population has increased dramatically during the past 5 years (Table 1) but most of the increase has come from better survey information and density estimations in unsurveyed areas. In Unit 21D (12,096 mi^2) a SUPE population estimator was used from 8-16 March 1994 to estimate the wolf population. Of the 760 sample units 66.6% of the highs, 33% of the medium, and 14% of the lows were flown and searched for wolf tracks. We observed 173 wolves or distinct tracks. The SUPE estimate of the unit population was 256 wolves ± 14.2% (80% confidence interval) with a density of 8.2 wolves/1,000 km^2. The number of single wolves was 6.5% of the total. The fall population was estimated by adding a hunting and overwinter mortality estimate of 26% for local wolf packs (Spindler 1992).

In Units 21C and 21B the unsurveyed areas were 60% of Unit 21B and 50% of Unit 21C. In those areas, in addition to the known pack numbers, I estimated a fall density of 5-7 wolves/1,000 km^2.

Distribution and Movements: Since 1986, 50 wolves have been radiocollared in 25 packs on the Koyukuk National Wildlife Refuge (NWR) and the Nowitna NWR. Wolves were collared at the following locations: Dalki River, Upper Dulbi River, Lower Dulbi River, Nayuka River, Novi River mouth, Monzonite Hills, Ham Island, Three-day Slough, Bishop Rock, Happy Slough, Bonanza Creek, North Creek and Bear Creek pack. On the Kaiyuh Flats the density was 11 wolves/1,000 km^2; on the Koyukuk lowlands north of Galena (including Three-day Slough) the density was 8 wolves/1,000 km^2; and in the Nowitna drainage the density was 7 wolves/1,000 km^2 (Spindler 1992).

Movement data on the packs have not been completely analyzed. Preliminary data show the majority of packs ranged over 250-500 mi^2 areas. Some packs vacated their initial home ranges and moved to adjacent areas, but they were not followed long enough to know if they returned to their first area. Several wolves that started as pack members, or alone when collared, moved large distances over the course of our study. One wolf moved south 40 miles and then returned north. The next report will include more detailed information on distribution and movements.

Predation Rates: The FWS monitored daily wolf predation during February and March 1993. On the Nowitna River in Unit 21B all kills were moose. Wolves killed the equivalent of 1 adult moose every 6.4 days, with predation rates averaging 0.24 kg of prey/kg of wolf/day. We estimated the annual wolf mortality on moose at 12%. Within the Koyukuk NWR in Unit 21D, 68% of the kills were moose and 29% were caribou. The wolves killed an equivalent of 1 adult moose every 11.1 days, and the predation rate was 0.21 kg of prey/kg of wolf/day. The annual wolf mortality on moose was estimated at 8% (Spindler 1994).

Mortality

Harvest:

Hunters and trappers reported harvesting wolves (Table 2) during the period. Most of the wolves were taken in Unit 21D. The actual number harvested was probably higher because village residents seal only those wolf pelts sent to a commercial tannery or sold to a fur buyer. Hunting conditions vary from year to year which affects harvests. Under good conditions I estimate the unreported harvest can be as high as 30 wolves per year but only 5-10 during years with poor trapping or hunting conditions.

Seasons and Bag Limits.

Unit/Bag Limit/ Special Restrictions	Resident/Nonresident/Subsistence Open Seasons
Regulatory Years 1990 and 1991	
Hunting: Unit 21, 10 wolves. Same-day-airborne hunting of wolves allowed 10 Aug.-31 Mar., registration permit and locking tags required. During 1991 no same-day-airborne hunting within a National Preserve.	10 Aug.-30 Apr.
Trapping: Unit 21, no limit.	1 Nov.-31 Mar.
Regulatory year 1992	
Hunting: Unit 21, five wolves. No same-day-airborne hunting of wolves.	10 Aug.-30 Apr.
Trapping: Unit 21, no limit.	1 Nov.-31 Mar.

Board of Game Actions and Emergency Orders. The board in 1992 banned same-day-aerial trapping and hunting and placed a bag limit of 5 wolves when hunting. The terrain in the unit is excellent for land-and-shoot hunting and by stopping this method the wolf harvest may decline.

CONCLUSIONS AND RECOMMENDATIONS

The wolf population estimate in Unit 21 increased because prey populations increased and more information was collected about pack distribution. Presently only 50% of the area has been surveyed for wolf distribution. The unit population is probably much higher. Present population levels are stable or increasing throughout the unit.

I recommend seasons and bag limits remain as liberal as possible because the annual harvest is well below the sustainable rate. I recommend more radiotelemetry studies and more spring

censuses in other units to more accurately determine wolf population sizes. Within the Koyukuk/Nowitna NWR, the study on predation rates has improved wolf population estimates and increased our knowledge of moose predation dynamics.

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Table 1. Unit 21B, 21C, and 21D fall wolf population estimates[a,b], 1988-93.

Regulatory year	Population estimate	Number of packs
1988-89	305-330	42-52
1989-90	295-340	40-55
1990-91	295-335	54-58
1991-92	285-340	50-53
1992-93	295-365	50-53
1993-94	395-505	49-57

[a] Fall estimate = pretrapping season population.

[b] Basis of estimates are ADF&G/FWS aerial surveys, Sample Unit Probability Estimator census, hunter/trapper reports, sealing records and incidental observations and 5-7 wolves/1,000 km^2 in unsurveyed areas.

Table 2. Units 21B, 21C, 21D wolf harvest, 1988-93.

Regulatory year	Reported harvest			Estimated unreported harvest	Total estimated harvest	Method of take			
	M	F	Unk			Trap/snare	Shot	SDA[a]	Unk
1988-89	5	6	0	20	31	3	2	5	1
1989-90	14	15	0	20	49	7	3	19	0
1990-91	14	4	3	20	41	9	12	0	0
1991-92	22	14	4	20	60	19	18	1	2
1992-93	20	11	4	20	55	15	16	0	4

[a] SDA refers to animals taken by hunters the same day hunters were airborne.

LOCATION

Game Management Unit: Unit 22 (25,230 mi^2)

Geographical Description: Seward Peninsula and that portion of the Nulato Hills draining west into Norton Sound.

BACKGROUND

Long-term residents report that wolves have been scarce or nonexistent throughout much of Unit 22 for at least 50 years. Several small packs of wolves were known to inhabit portions of Units 22A and 22B, and we believe their numbers started increasing several years ago, especially during the winter months when caribou from the Western Arctic herd were seasonally present. Whether this increase was due to the establishment of new packs or to migration of packs into the area is unclear.

Reindeer herders, particularly those from Units 22A and 22B, contend that wolves are now permanent residents on their ranges and adverse interactions between wolves and reindeer are common.

MANAGEMENT DIRECTION

The following management goals and objectives for wolves have been established for Unit 22:

Population Goals

- Maintain existing population levels of wolves in Unit 22.
- Minimize adverse interactions between wolves and the public.

Management Objectives

- Assess harvest, interview hunter/trappers, and seal all pelts brought in for sealing.
- Establish and maintain license vendors and sealers in all Unit 22 villages.
- Improve compliance with current sealing requirements through public communication and education.
- Cooperate with reindeer herders to evaluate methods for reducing adverse interactions between wolves and reindeer.
- Develop a Unit 22 wolf management plan in cooperation with interested local residents and other agencies.

METHODS

Specific population data concerning Unit 22 wolves are not available. Limited information about wolf distribution, population densities, harvest, and human use are collected annually from biologists' incidental observations, visual observations provided by reindeer herders and other local residents, and from sealing certificates.

A study entitled "Demography and Movements of Wolves in Relation to Western Arctic Caribou Herd in Northwest Alaska" was begun during 1987 in Unit 23, north and east of Unit 22. Completion of this study has provided some insight into distribution, density, and movements of wolves in and adjacent to Unit 22.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Although wolf numbers remained low throughout the unit, their numbers are increasing in portions of Units 22A and 22B and, to a lesser extent, in Unit 22D. Radio-collared wolves from other locations in Alaska have been observed or harvested in Unit 22 in recent years, proving movement of wolves into the area. It is presently unknown whether these wolves were attempting to establish themselves within the unit or if they were transient migrants.

The size of the Unit 22 wolf population is unknown. Estimates provided by staff in past years indicated the population size ranged from 50 to 150 animals. However, recent information indicates this range may be low, and it is conceivable the high estimate of 150 wolves may represent a minimum.

Mortality

Seasons and Bag Limits.

Unit 22	**Season**	**Limit**
Trapping:	Nov. 1-Apr. 15	No limit
Hunting:	Aug. 10-Apr. 30	5 Wolves

Board of Game Actions and Emergency Orders. During the reporting period, the Alaska Board made the following changes:

- A bag limit of 5 wolves was placed on all persons taking wolves under a hunting license in Unit 22, effective July 1992.

- Effective July 1993, persons taking wolves under a trapping license are allowed to shoot a wolf the same day as airborne, provided they are more than 300 feet from the aircraft when the wolf is shot.
- The trapping season was extended through April for those persons taking wolves with firearms or snares.

No emergency orders were enacted during the reporting period.

Harvest:

Human-Induced Mortality. Interest and success in harvesting wolves has increased significantly during the past 8 years (Table 1). The reported harvest of wolves in Unit 22 increased from a low of 3 during 1985-86 to an unprecedented high of 54 during 1991-92. This increase is largely a result of increased hunting in wintering areas of the Western Arctic Caribou Herd. Sex composition of the reported harvest throughout the 3-year reporting period is as follows: 43% males, 27% females, and 30% sex unknown (N=108). Until 1989-90, all of the reported wolf harvest came from Units 22A and 22B (Table 2). Local hunters reported observing a pack of approximately 10 wolves in Unit 22D during 1989-90. During spring 1990, 4 wolves were harvested from 22D. Additional sightings and harvests of wolves annually from Unit 22D suggest that 1 pack resides in the area, and perhaps even more packs are within the unit.

Unreported harvest of wolves remains a problem in Unit 22. Many harvested wolves are not sealed because they are used in the local manufacture of parka ruffs and other garments. The size of this unreported harvest is unknown.

Hunter Residency and Success. Sealing certificate data indicate all wolves taken during the 1990-92 reporting period were harvested by residents of Unit 22. Residents of Shaktoolik in Unit 22A harvested most of the wolves (63%).

Harvest Chronology. The size of the wolf harvest in Unit 22 during the past 5 years is directly related to caribou harvests, distribution, and movements. During the past several years, Western Arctic caribou have reached the Seward Peninsula during late November, and the Nulato Hills of Unit 22A during December. For the past 3 years, a significant portion (76%) of the reported wolf harvest occurred during January, February, and March (Table 3).

Harvest Methods. Commercial trapping is not a major activity in Unit 22. During the reporting period, 90% (N=103) of the wolves were ground shot and only 10% were trapped or snared.

Transport Methods. Snowmachines were the most common method of travel used by hunter/trappers taking wolves in Unit 22. Hunter/trappers reporting transport means on sealing certificates indicated that 96% of the harvest during the past 3 years was taken using a snowmachine as transportation.

CONCLUSIONS AND RECOMMENDATIONS

Although quantitative data are not available, wolf densities seem to be increasing in portions of Unit 22. It is presently unclear whether this increase was caused by a seasonal influx of wolves from other areas or whether local resident populations are increasing.

The following specific goals need to be addressed if we are to effectively manage wolves on the Seward Peninsula and ensure compliance with our stated management objectives for Unit 22 wolf populations:

- A long-term management plan is needed. It is currently unclear whether we are managing for high or low wolf numbers in Unit 22.

- Compliance with our sealing requirements is poor throughout the Unit. Some village residents seal only those pelts which will be commercially tanned or sold to furbuyers. A more dynamic information and education program and more active enforcement of sealing regulations can improve the accuracy of our harvest data.

- Quantitative data on wolf populations of Unit 22 are lacking. I recommend research to improve our understanding of wolf population dynamics and the effects of wolf predation on local ungulate populations of Unit 22.

No changes in Unit 22 wolf regulations are recommended at this time.

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Table 1. Reported Unit 22 wolf harvest for regulatory years 1985-1992.

Regulatory year	Reported Harvest				Method of Take			No. of successful Trappers/hunters
	M	F	Unknown	Total	Trap/snare	Shot	Unknown	
1985-86	0	1	2	3	0	3		1
1986-87	4	2	2	8	1	7		5
1987-88	8	6	10	24	14	10		8
1988-89	11	8	2	21	1	20		9
1989-90	28	13	2	43	0	43		14
1990-91	14	11	6	31	5	26		11
1991-92	21	13	20	54	3	51		18
1992-93	12	5	6	23	1	16	6	9

Table 2. Reported Unit 22 wolf harvest by Subunit for regulatory years 1985-1992.

Regulatory year	Subunit				
	A	B	C	D	E
1985-86	0	3	0	0	0
1986-87	5	3	0	0	0
1987-88	20	4	0	0	0
1988-89	15	6	0	0	0
1989-90	33	6	0	4	0
1990-91	21	8	0	2	0
1991-92	43	9	0	2	0
1992-93	13	9	0	1	0

Table 3. Chronology of Unit 22 wolf harvest for regulatory years 1985-1992.

Year	Harvest periods										n
	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Unk.	
1985-86	0	0	0	0	2	0	0	1	0	0	3
1986-87	0	0	0	0	6	0	0	2	0	0	8
1987-88	0	0	0	3	8	5	5	3	0	0	24
1988-89	0	0	0	0	1	3	11	6	0	0	21
1989-90	0	0	0	7	2	11	3	18	2	0	43
1990-91	0	0	0	0	6	7	9	8	1	0	31
1991-92	1	1	0	0	1	28	11	8	4	0	54
1992-93	1	0	0	4	6	3	2	2	0	5	23

LOCATION

Game Management Unit: Unit 23 (43,000 mi^2)

Geographical Description: Western Brooks Range and Kotzebue Sound

BACKGROUND

Wolves are indigenous to northwest Alaska. Prior to statehood in 1959, wolves were subject to bounty hunts and informal predator control programs to protect reindeer and caribou (McKnight 1973). After statehood, these practices were replaced by liberal hunting and trapping regulations which allowed harvests by aerial shooting and same-day-airborne hunting. High fur prices in the mid-1970s attracted nonlocal hunters to Unit 23, and wolf harvests were high when snow conditions were favorable for use of aircraft or snowmachines. During the 1980s, regulatory restrictions on aircraft use and low fur prices reduced the harvest of wolves. Today, local residents using snowmachines harvest most of the wolves sealed in Unit 23.

Extensive aerial wolf surveys were flown in Unit 23 during the spring of 1977 by R. Stephenson (Johnson 1978) and 1981 (Quimby 1982). Portions of major drainages were surveyed and estimated densities were extrapolated to the remainder of the drainage. The result was a late winter estimate of 670 wolves (one wolf per 68 mi^2) for Unit 23. Using the same method in 1981, Quimby derived a unitwide minimum estimate of 476 wolves. Both biologists recognized 4 geographic areas where wolf densities needed to be separately assessed: (1) Buckland drainage; (2) Middle Kobuk drainage; (3) Noatak, Wulik, and Kivalina Rivers drainages; and (4) the remainder of the unit.

MANAGEMENT DIRECTION

The following population management goals have been established for Unit 23:

- Establish and maintain viable populations of wolves in Unit 23.
- Minimize adverse interactions between wolves and the public.

METHODS

Investigators used radiotelemetry to document productivity, mortality, and movements of wolf packs in the Kobuk and Selawik drainages. Between 1988 and 1990, data were collected from wolf packs containing radiocollared wolves and used to develop a density estimate for the middle Kobuk drainage. We completed a second density estimate for this area spring of 1990, using a line-intercept track sampling technique (Becker and Gardner 1990). Predation rates were determined by direct observation of 6 radiocollared packs from

1988 through 1990 during the late winter season. We collected serological data from wolves at the time of capture. Local trappers provided information regarding wolf population status and trends on a May 1990 questionnaire. Harvest and other human-induced mortality information was collected from sealing certificates.

Two research studies have been conducted on wolves in Unit 23. James (1981) investigated the diet and seasonal movements of wolves in the northern portion of Unit 23. In the southern portion of Unit 23, a cooperative, comprehensive interagency study involving the Alaska Department of Fish and Game, the National Park Service (NPS), and the U. S. Fish and Wildlife Service (FWS) began during 1987 and ended during 1991. Wolf movements, predation rates, and densities in the Kobuk and Selawik drainages were documented, and the relationship of wolves to the Western Arctic Caribou (WAH) herd and moose populations were investigated (Ballard 1993).

RESULTS AND DISCUSSION

Population Status and Trend

Wolf densities in the Kobuk and Selawik drainages slowly increased from 1987 through the spring of 1990, despite moderate to heavy harvests (Ballard 1993). The annual finite rate of increase during the study for radiocollared individuals and associated packs ranged from 0.64 to 1.34. Impressions of local hunters regarding population trends supported these findings. Respondents from the Trapper Survey (n=45) reported wolf densities as medium to high and increasing throughout Unit 23 during 1989-90.

High mortality due to rabies combined with heavy human harvest caused a widespread decline in wolf numbers that persisted through 1991-92. The first cases of rabies were confirmed in 1989-90 among radiocollared wolves and associated packs in the Kobuk drainage. During the following 2 years, 11 wolves in 6 packs were suspected of dying from rabies.

Wolf populations north and south of the study area in the Noatak Buckland and Tagagawik River drainages probably exhibited a similar trend except harvest mortality was lower. The number of reported cases of rabies among foxes and wolves dropped to zero by the end of this reporting period. Opportunistic observations and public reports now suggest that wolves are increasing throughout the Unit.

Population Size: During May 1990 Ballard (1993), using radiocollars, estimated a density of 1 wolf/53 mi^2 in the middle Kobuk and a density of 1 wolf/50 mi^2 with an 80% confidence interval of 1 wolf/37 mi^2 to 1 wolf/74 mi^2 using a line-intercept track sampling for the same area. If extrapolated to all of Unit 23, the population estimate would be 869 wolves (80% CI, 580-1169 wolves). However, unitwide surveys and local observations indicate wolf densities are not uniform throughout Unit 23, and such extrapolations should be viewed with caution.

Wolves in the Kobuk and Selawik drainages maintained large territories ranging from 1,410 mi^2 to 755 mi^2 (Ballard 1993). Some wolf packs followed migratory caribou up to 169 straight-line miles when densities of caribou or moose were relatively low in their established territories. These packs were in the southern portion of the study area near the current winter range used by the WAH caribou. Observations of wolves interacting with radiocollared moose in the Noatak drainage confirmed presence of resident packs in the Noatak despite the absence of caribou (Dau and Ayres 1993).

Distribution and Movements. The question of whether wolves are migratory has been of interest to researchers in Unit 23. James (1981) found that wolves on the North Slope in Unit 26A and upper Noatak moved to the lower Noatak in response to caribou distribution. However, Ballard (1993) found radiocollared wolf packs in the Kobuk and Selawik drainages sedentary. However, a few packs occasionally followed migratory caribou when prey densities within their established territories were low.

Mortality

Harvest:

Season and Bag Limits.

Unit 23	**Season**	**Limit**
Trapping:	Nov. 1 - Apr. 15	No Limit
Hunting:	Aug. 10 - Apr. 30	5 wolves

Human-Induced Mortality. Hunters reported a harvest of 39 wolves during 1990, 56 during 1991 and 71 during 1992 (Table 1). Most wolves were harvested in the Kobuk drainage followed by the Selawik, Buckland, and Noatak drainages (Table 2). Hunting mortality accounted for 69% of known mortalities for radiocollared wolves from 1987-91 (Ballard 1993). If the rabies outbreak had not occurred, this percentage would probably have been higher. Using radiotelemetry data, Ballard (1993) estimated the Kobuk population to be sustaining a 30-40% hunting mortality.

Unreported harvest probably exceeds reported harvest. Because most hides are used locally, many harvested wolves are not sealed. In addition, confusion over sealing requirements, low compliance with license requirements, and unavailability of fur sealers in villages aggravates the problem. There have been efforts to document the unreported harvest of wolves. During 1982, department staff estimated only 44% of the harvest was reported, and in 1983 only 25% was reported.

In Unit 23, several factors other than wolf density affect reported harvest levels. These factors include regulatory changes, fur prices, snow cover, weather conditions, and hunter

access. During this reporting period, snow conditions were excellent for wolf hunting using snowmachines in most of Unit 23.

Transportation Methods. Snowmachines were the primary means of transportation used by hunters who reported harvesting wolves (Table 4). As expected, use of aircraft was minimal following the regulatory closure of Unit 23 to same-day-airborne wolf hunting. Some individuals continued to use aircraft to access traplines or shot wolves incidental to other hunting activities.

Method of take. Ground-shooting using snowmachines as transportation continues to be the most common method of harvesting wolves in Unit 23. Over 80% of wolves reported are taken in this manner (Table 3). Only a small percentage of wolves are trapped.

Natural Mortality

All wolves captured for the telemetry study tested positive for serum antibodies to canine parvo virus (n=40). Infectious canine hepatitis was also present in 21 out of 23 animals during 1990 and 17 out of 17 animals during 1991. Three of 16 wolves sampled for canine distemper tested positive during 1991. The prevalence of *Brucella* was higher in this study area than elsewhere in Alaska (2 of 28 in 1990 and 1 of 15 in 1991) and is related to its occurrence in the Western Arctic Caribou Herd.

During the spring of 1990, rabies was confirmed in 3 wolves from 2 packs located in the Kobuk drainage. During 1991, a rabid wolf wandered into a dog yard outside of Ambler. During 1991 and 1992, 11 wolves in 6 packs studied were suspected of dying of rabies. Rabies may have accounted for up to 21% of the total wolf mortalities in the telemetry study. Rabies was the second largest cause of death for wolves in the Kobuk/Selawik research study. Rabies has probably had a historic role in regulating Unit 23 wolf populations. Chapman (1978) also reported the transmission of rabies within a wolf pack on the North Slope.

Effects of Predation

In the Kobuk and Selawik drainages, Ballard (1993) estimated each wolf pack (average size of 8.5 wolves $\pm$ 6.6 SD) killed a moose or caribou every 3.8 days or a moose every 6.7 days late winter from 1988 to 1990. Wolves preyed primarily on caribou but often when caribou were not available, they fed on moose. Using estimated ungulate densities, Ballard concluded that predation by wolves combined with hunting mortality may be sufficient to cause a significant decline in the study area's moose population.

The effect of wolf predation on sheep and moose in the Noatak drainage is probably more severe than suggested by Ballard for the Kobuk drainage. Harvest pressure on wolves in the Noatak drainage tends to be lower than in the Kobuk drainage due to poorer access. During the first year of the Noatak moose telemetry study (1992-93), 22% of the collared moose died of natural causes (Dau and Ayres 1993). Predation by wolves and brown bears seemed the

most likely cause, although starvation may also be a contributing factor. Hunting mortality for the same sample of moose was 7%, indicating natural mortality is affecting moose abundance more than hunting mortality.

Predation and the absence of significant numbers of caribou during the winter has exacerbated the effects of severe winter conditions on moose and sheep in Unit 23. Beginning in 1988-89, northwest Alaska experienced 3 consecutive severe winters. The winter of 1990-91 was particularly harsh on ungulates, and large numbers of moose and sheep in Unit 23 died directly from starvation, or indirectly from predation predisposed by malnutrition and deep snow. The level of wolf predation will probably be a significant factor affecting the recovery of moose and sheep populations, especially in the Noatak drainage.

CONCLUSIONS AND RECOMMENDATIONS

The population objectives for wolves in Unit 23 are being met. The highest management priority should be to obtain an accurate population estimate for wolves in the middle Noatak drainage. The reasons for focusing efforts in the Noatak drainage include:

- Concern over low moose and sheep populations in the Noatak drainage.
- Increasing public interest in harvesting moose and sheep.
- Complementary data currently being collected on moose demography.
- The Noatak drainage has the least amount of quantitative or qualitative data available concerning wolf numbers compared to other major drainages.

Less intensive surveys should be completed in the remainder of the Unit. This would allow managers to relate areas of known wolf density to the remainder of the unit and generate a unitwide population estimate of wolves. An effort should be made to identify areas with similar wolf densities.

Our second recommendation is that hunting seasons and bag limits be liberalized to agree with trapping regulations. Increasing trends in wolf population size, concern over low moose and sheep numbers in some parts of the unit, public demand for more opportunity to harvest wolves, and confusion with inconsistent hunting and trapping regulations supports efforts to liberalize the wolf hunting regulations.

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Table 1. Reported wolf harvest summarized from sealing certificates for Unit 23, 1977-1993.

Year	Males	Females	Unknown	Total
1977-78				65
1978-79				50
1979-80	12	6	0	18
1980-81	33	17	0	50
1981-82	10	7	0	17
1982-83	25	19	4	48
1983-84	30	14	2	46
1984-85	45	20	0	65
1985-86	10	8	1	19
1986-87	23	10	1	34
1987-88	52	33	9	94
1988-89	42	36	5	83
1989-90	27	25	5	57
1990-91	17	15	13	45
1991-92	30	22	6	58
1992-93	28	32	11	71

Table 2. Wolf harvest by drainage in Unit 23, 1971-93.

Year	Kivalina	Noatak	Kobuk	Selawik	Buckland	Unknown	Total
1971-72	0	9	29	6	26	6	76
1972-73	1	24	40	15	4	1	85
1973-74	1	6	13	16	4	0	40
1974-75	3	5	22	20	0	0	50
1975-76	2	9	78	53	0	0	142
1976-77	0	26	28	82	1	10	157
1977-78	0	3	25	20	1	70	65
1978-79	7	4	11	15	1	30	50
1979-80	1	2	9	4	2	0	18
1980-81	2	3	11	24	3	7	50
1981-82	1	10	3	3	0	0	17
1982-83	1	11	6	21	8	1	48
1983-84	0	9	7	21	7	2	46
1984-85	1	16	20	21	3	4	62
1985-86	0	11	4	2	2	0	19
1986-87	2	5	6	18	0	2	34
1987-88	0	27	41	11	15	0	94
1988-89	1	12	28	39	0	3	83
1989-90	3	10	27	2	15	0	57
1990-91	0	7	18	15	5	0	45
1991-92	2	8	30	4	13	1	58
1992-93	2	11	30	15	4	9	71

Table 3. Methods used to harvest wolves in Unit 23, 1985-86 through 1992-93.

Year	Ground Shooting	Trapping	Snaring	Unknown	Total
1985-86	14	2	0	3	19
1986-87	26	4	0	4	34
1987-88	90	2	0	2	94
1988-89	72	9	0	2	83
1989-90	45	8	0	4	57
1990-91	32	3	3	7	45
1991-92	43	7	0	8	58
1992-93	69	2	0	0	71

Table 4. Number of hunters and method of transport used to harvest wolves in Unit 23 from 1985-86 through 1992-93.

Year	Hunters	Airplane	Snowmachine	Boat	Unknown	Total Harvest
1985-86	12	8	7	0	4	19
1986-87	17	20	9	0	5	34
1987-88	32	48	40	2	4	94
1988-89	29	10	70	0	3	83
1989-90	25	11	32	2	12	57
1990-91	23	4	32	0	9	45
1991-92	25	9	47	0	2	58
1992-93	24	2	69	0	0	71

LOCATION

Game Management Unit: 24 (24,150 mi^2)

Geographical Description: Koyukuk River drainage above Dulbi River

BACKGROUND

Wolves are present throughout Unit 24. Wolf abundance in Unit 24 has fluctuated over time in response to the availability of prey and, in more recent times, the controlling activities of man. Wolf numbers were low in the Brooks Range during the late 1800s due to the scarcity of moose, caribou, and Dall sheep, the primary big game prey species available to wolves (Campbell 1974). Prey populations increased during the early 1900s, leading to concurrent increases in wolf numbers. Currently, wolves are more numerous than in the 1970s, but are not as abundant as during the 1940-50s (R. Stephenson, pers. commun.)

Before the 1940s fewer wolves inhabited the southern portion of the unit than exist now because there was no stable prey base. At the time, moose populations were still expanding into this area, and the availability of caribou varied widely year-to-year. Federal wolf control greatly reduced the limiting effect of wolf predation on local moose populations, rapidly increasing moose numbers. When wolf control ceased, this new abundance of moose allowed wolf numbers to increase. Wolf numbers are presently as high in southern Unit 24 as at any time in history.

Reported wolf harvests have ranged from 30 to 100 wolves per year and average about 52 wolves annually. The local demand for wolf pelts used as parka ruffs and gifts at funeral potlatches is higher than the harvest. The local residents around Huslia and Hughes recognize the predator-prey relationship between moose and wolves and make a conscious effort to increase their wolf harvest when moose are scarce.

MANAGEMENT DIRECTION

Management Goals

Wolf populations will be managed to provide for human uses and to ensure wolves remain an integral part of interior Alaska's ecosystems. Compatible human uses include: hunting and trapping (both for personal use and commercial sale of furs), photography, viewing, listening, and scientific and educational purposes. The aesthetic value of observing wolves in natural interactions with their environment is also recognized as an important human use of wolves. The domestication of wolves for personal use or for commercial purposes is generally considered incompatible with department management policies.

Management may include manipulation of wolf population size by humans, as well as total protection of wolves from human influence. Not all human uses will be allowed in all areas or at all times. Management will focus on providing sustained, diverse human uses of wolf populations consistent with goals listed in the Wolf Conservation and Management Policy for Alaska, adopted by the Alaska Board of Game 30 October 1991 and revised 29 June 1993. Those goals are listed:

- Ensure long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.

- Provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and which reflect the public's interest.

- Increase public awareness and understanding of the uses, conservation and management of wolves, their prey, and habitat in Alaska.

Management Objectives

In the southern part of Unit 24 (south of Hughes, 6,150 mi^2), the objective is to manage a stable fall wolf population with a density of approximately 8 wolves/1,000 km^2 with the intent to sustain an annual harvest of approximately 30 wolves.

In the central part of the unit (Hughes to Bettles), reduce wolf density to 4 wolves/1,000 km^2 to achieve a moose:wolf ratio of 50:1.

In the northern part of the unit (north of Bettles, including Gates of the Arctic National Park (GANP), maintain a stable fall wolf density of approximately 8 wolves/1,000 km^2, with the intent to sustain an annual harvest of 30 wolves while providing for nonconsumptive uses within the GANP.

METHODS

Wolf pack numbers and distribution were determined by aerial surveys during winter in cooperation with the U.S. Fish and Wildlife Service (FWS) and U.S. National Park Service (NPS) and by interviews with wolf trappers and light aircraft pilots. Five radiocollared wolf packs within the Kanuti National Wildlife Refuge were tracked during March to determine predation rates. Harvests were monitored by pelt sealing requirements and NPS collected carcasses in the GANP for determination of physical condition, stomach contents, and reproductive characteristics.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Wolves are throughout the unit in all habitat types and in proximity to human settlements. The numbers of wolves within the unit vary, depending on the availability of prey. There are more wolves in the south and north than in the central portion of the unit which has lower moose densities and more sporadic movements of caribou.

The estimated Unit 24 population (Table 1) derived from plotting known pack locations and assuming a density of 6-8 wolves/1,000 km^2 for unknown areas.

Distribution and Movements: The radiocollared wolves in the Kanuti area were tracked infrequently after 1991, but information on distribution and movements was collected. All the wolves which were pups or yearlings when collared dispersed from the area and were not followed. During autumn, 9-11 packs with 85-100 wolves used the refuge. The average pack size for the collared packs in the spring was 4 wolves. The area covered by the packs ranged from 987-1,567 km^2.

Mortality

Harvest:

Hunters and trappers reported harvesting wolves (Tables 2 and 3) during the period. Usually the number taken in the central part of the unit was highest since that was the area with the most land-and-shoot activities. Recently, more wolves have been reported from the northern and southern parts, and sealing compliance may be increasing. Generally, village residents seal only those wolf pelts sent to commercial tanneries or sold to a fur buyer; thus, total harvest may be higher. Hunting conditions vary yearly, affecting harvests. Under good conditions I estimate the unreported harvest can be as high as 100 wolves per year but only 50 during years with poor trapping and hunting conditions.

Seasons and Bag Limits.

Unit/Bag Limit/ Special Restrictions	Resident/Nonresident/Subsistence Open Seasons
Regulatory Years 1990 and 1991	
Hunting: Unit 24, 10 wolves. Same-day-airborne hunting of wolves allowed 10 Aug.-31 Mar., registration permit and locking tags required. During 1991 no same-day-airborne hunting within a National Preserve.	10 Aug.-30 Apr.

Trapping: Unit 24, no limit. 1 Nov.-31 Mar.

Regulatory year 1992

Hunting: Unit 24, five wolves. 10 Aug.-30 Apr.
No same-day-airborne hunting of wolves.

Trapping: Unit 19, 21A, and 21E, 1 Nov.-31 Mar.
no limit.

Board of Game Actions and Emergency Orders. The board in 1992 banned same-day-aerial trapping and hunting and reduced the hunting bag limit to 5 wolves. The terrain in the unit is excellent for the land-and-shoot hunting method, and by stopping this method the numbers of wolves reported harvested will probably decline significantly.

CONCLUSIONS AND RECOMMENDATIONS

The current wolf population estimate for Unit 24 is higher than previous estimates because of an increase in wolf populations and because the cooperative NPS and FWS studies have enabled us to more accurately determine wolf population sizes through radiotelemetry. Present population levels are stable or increasing.

I recommend that seasons and bag limits remain as liberal as possible and harvest from the central portion of the unit be encouraged. I also recommend the radiocollared packs in the Kanuti area continue to be monitored to help improve population estimates and provide information on predation rates.

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Table 1. Unit 24 fall wolf population estimates[a], 1988-93.

Year	Population estimate[b]	Number of packs
1988-89	420-450	55-60
1989-90	400-440	55-60
1990-91	400-440	55-60
1991-92	420-450	68-70
1992-93	388-415	51-55
1993-94	405-540	58-66

[a] Fall estimate = pretrapping season population.

[b] Basis of estimate - ADF&G, NPS, and FWS aerial surveys, hunter/trapper reports, sealing records and incidental observations.

Table 2. Unit 24 wolf harvest, 1988-93.

Regulatory year	Reported harvest			Estimated unreported harvest	Total estimated harvest	Method of take			
	M	F	Unk			Trap/snare	Shot	SDA[a]	Unk
1988-89	38	32	6	50	126	16	20	39	1
1989-90	17	9	4	60	90	25	3	0	2
1990-91	16	24	2	60	102	22	20	0	0
1991-92	42	39	4	55	140	70	15	0	0
1992-93	41	32	6	80	159	43	35	1	0

[a] SDA refers to animals taken by hunters the same day hunters were airborne.

Table 3. Unit 24 wolf reported harvest chronology by month, 1988-93.

Regulatory year	Harvest periods							*n*
	Sep	Nov	Dec	Jan	Feb	Mar	Apr	
1988-89	2	3	7	4	10	50	0	76
1989-90	2	1	1	9	10	6	1	30
1990-91	1	13	8	3	11	6	0	42
1991-92	6	12	15	19	21	7	5	85
1992-93	3	0	7	6	26	37	0	79

LOCATION

Game Management Unit: 25A, 25B, 25D, 26B, and 26C (75,000 mi^2)

Geographical Description: Eastern Interior, Eastern Brooks Range, and Central and Eastern Arctic Slope

BACKGROUND

Wolves are present throughout the management area. They are well adapted to living in the interior taiga forests, the rugged mountains of the Brooks Range, and the arctic slope tundra. Despite available caribou, moose, Dall sheep, and other prey, wolves are generally less abundant than in other parts of the interior, in large part because populations of resident prey such as moose are scarce in many areas.

Relatively little is known about wolf populations or their influence on ungulate populations in northeastern Alaska. U.S. Fish and Wildlife Service (FWS) biologists studied the movements and denning of 11 wolf packs in the northern Arctic National Wildlife Refuge (ANWR) in 1984 and 1985 (Garner and Reynolds 1986). Subsequent occasional aerial surveys and incidental observations further documented the presence of wolves within ANWR and to the west in Unit 26B. However, no systematic surveys were conducted within the area. Nowlin (1985) flew aerial wolf surveys in Unit 25D (west) in March 1984. A wolf survey covering most of Unit 25D was completed in March 1992. Wolf surveys have not been conducted in Units 25A and 25B.

MANAGEMENT DIRECTION

Management Goals

Wolf populations will be managed to provide for human uses and to ensure that wolves remain an integral part of interior Alaska's ecosystems. Compatible human uses include hunting and trapping (both for personal use and commercial sale of furs), photography, viewing, listening, and scientific and educational purposes. The aesthetic value of observing wolves in natural interactions with their environment is also recognized as an important human use of wolves. The domestication of wolves for personal or commercial purposes is generally considered incompatible with department management policies.

Management may include manipulation of wolf population size by humans, as well as total protection of wolves from human influence. Not all human uses will be allowed in all areas or at all times. Management will focus on providing sustained, diverse human uses of wolf populations consistent with goals listed in the Wolf Conservation and Management Policy for Alaska, adopted by the Alaska Board of Game 30 October 1991 and revised 29 June 1993.

Those goals are listed:

- Ensure the long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.

- Provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and which reflect the public's interest.

- Increase public awareness and understanding of the uses, conservation and management of wolves, their prey and habitat in Alaska.

Management Objectives

- Conduct a wolf census in Units 25A, 25D east, and 25B west by 1995.

- Evaluate the effects of wolf predation on moose in Unit 25D using computer modeling.

METHODS

Population data were extrapolated from survey estimates in 1984-85 and 1992, and from incidental observations. Sealing certificates provided most of the harvest data.

RESULTS AND DISCUSSION

Population Status and Trend

Few wolves are present relative to adjacent areas. Populations in Units 25A, 25B, and 25D have increased in recent years and seem stable in Units 26B and 26C.

Population Size: Estimates from surveys, hunter observations, and harvest data indicate that 65-85 packs, including 470-570 wolves, were present in Units 25A, 25B, and 25D in fall 1988. By fall 1992 these estimates had increased to 72-93 packs including 520-634 wolves. Average wolf density was roughly 4.1-5.1 wolves/1,000 km^2 in 1992. Nowlin (1988) believed the wolf population density was lowest in western Unit 25D. An estimated 150-215 wolves in 22-32 packs are in 26B and 26C, indicating a fall 1992 wolf density of 2.2-3.2 wolves/1,000 km^2. Resident packs are rare on the coastal plain in the northern portion of these units (Garner and Reynolds 1986).

Distribution and Movements: Radiocollared wolves in northern ANWR were members of packs in the Canning, Sadlerochit, Aichilik, Kongakut, Hulahula, Egaksrak, Drain, and Malcom drainages (Garner and Reynolds 1986). Several lone wolves were also radiocollared.

Relocations indicated wolves did not follow caribou to their winter ranges but generally remained within the same pack territories all year. Wolves preyed primarily on caribou from spring to fall but switched to Dall sheep, moose, and small game in winter when caribou were not present. However, several wolves dispersed as far as 500 miles away from their home range (Garner and Reynolds 1986).

Mortality

Harvest:

Season and Bag Limit. The wolf hunting season in Units 25 and 26 was open from 10 August through 30 April. The bag limit was 5 wolves in Unit 25 and 10 in Unit 26; however, same-day-airborne hunting of wolves was prohibited.

Unit/Bag Limit/ Special Restrictions	Resident/Nonresident/Subsistence Open Seasons
Regulatory Years 1990 and 1991	
Hunting: 25A, 26, no limit.	10 Aug.-30 Apr.
No same-day-airborne hunting.	10 Aug.-30 Apr.
Units 25B and 25D, 10 wolves. Same-day-airborne hunting allowed 10 Aug.-31 Mar.; registration permit and locking tags required. During 1991 National Park and Preserve lands were closed to same-day-airborne hunting.	
Trapping: Unit 25, No limit.	1 Nov.-31 Mar.
Unit 26, No limit.	1 Nov.-15 Apr.
Regulatory year 1992	
Hunting: Unit 25, five wolves.	10 Aug.-30 Apr.
Unit 26, 10 wolves. No same-day-airborne hunting of wolves in all game management units, statewide.	10 Aug.-30 Apr.
Trapping: Unit 25, no limit.	1 Nov.-31 Mar.
Unit 26, No limit.	1 Nov.-15 Apr.

Human-Induced Mortality: The wolf harvests in Units 25A, 25B, and 25D increased slightly between 1989 and 1990 and ranged from 52-57 from 1990 to 1992 (Table 1). Most of the harvest occurred in Units 25A and 25D. Harvests in both areas are still moderate compared to

historic levels. The Unit 26B and 26C harvests were higher in 1989-92 than in the early 1980s (Table 1). The harvest occurs predominantly in Unit 26B, probably because of greater access and increased wolf numbers, as suggested by recent incidental field observations.

Wolves were reported taken in scattered locations in Unit 25, including parts of the Coleen, Sheenjek, Hodzana, and Chandalar drainages in Unit 25A, in the Black and Porcupine drainages in Unit 25B, and in the Birch, Beaver, Hodzana, Porcupine, and Yukon drainages in Unit 25D. In Unit 26B, wolves were taken at scattered locations near the pipeline corridor from the Atigun River north to Sagwon. Wolves harvested in Unit 26C were taken on the Canning River and in various drainages south of Barter Island. Overall, more males than females were harvested.

Some unreported harvest occurs, primarily in Units 26B and 26C, where hides are often used in clothing and handicrafts (Whitten 1988).

Harvest Chronology. Most reported wolf harvest occurred from November through March, although a few wolves were taken in Units 25 and 26 in August or September (Table 2).

Take and Transport Method. Most wolves harvested in Unit 25 in regulatory year 1989 were taken with traps or snares. Snowmachines were the most common method of access (Table 3). The occurrence of snared and trapped wolves in the harvest and the use of snowmachines for access has changed little over the years. What has changed is the proportion taken by the land-and-shoot method involving aircraft. This was the predominant harvest method before the prohibition on same-day-airborne hunting. This regulatory change probably accounts for reduced wolf harvest in Units 25B and 25D.

In Units 26B and 26C, wolves were taken primarily by shooting from the ground; 3 wolves were trapped in Unit 26B (Table 1). Most hunters and trappers used highway vehicles to get to the area by the Dalton Highway. A few wolves were taken by individuals transported by snowmachine or aircraft.

Natural Mortality: The relatively low density of wolves in Units 25A, 25B, 25D, 26B, and 26C may, in part, be a result of relatively scarce prey. Many moose populations are at low densities, and caribou are only seasonally abundant in some areas because of their wide-ranging migrations. Small pack sizes, small litter sizes, and poor pup survival coincide with areas of relative prey scarcity.

Garner and Reynolds (1986) reported that 8 of 11 packs studied in ANWR had 5 or fewer wolves, which inhibited pup production and survival. Summer survival rates for packs of 5 or fewer wolves were 23-25%, while larger packs had nearly 100% pup survival.

Predation by other wolves in coastal areas such as Units 26B and 26C where wolves coexist with rabies-prone arctic fox populations (Zarnke and Ballard 1987) is also an important mortality factor among wolves.

CONCLUSIONS AND RECOMMENDATIONS

The highest priority for wolf management is to acquire better information on the size, trend, and distribution of wolf populations. Populations seem stable or increasing, but that assumption is based on scant data. I recommend that ADF&G allocate more funds for cooperative wolf surveys in this area with the FWS and the National Park Service. In view of the increase in wolf numbers reported by reliable observers in various areas, the status of prey populations, particularly moose and sheep, should be closely monitored.

The next priority is to improve hunters' and trappers' wolf harvest documentation. People throughout the study area, especially those in Units 26B and 26C, should be better informed of the sealing requirements for harvested wolves. Known harvests of wolves account for 9-11% of the estimated population in Unit 25 and 20-25% in Unit 26. Harvests of this magnitude are below maximum sustainable levels for wolf populations.

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Table 1. Subunits 25A, 25B, 25D, 26B, and 26C wolf harvest, 1987-92.

Regulatory year	Reported harvest				Method of take		
	M	F	Unk	Total	Trap/snare	Shot	Unk
25A							
1987-88	14	16	0	30	7	23	0
1988-89	2	6	2	10	6	4	0
1989-90	5	9	0	14	8	6	0
1990-91	15	6	2	23	18	5	0
1991-92	7	11	7	25	14	11	0
1992-93	20	7	0	27	11	16	0
25B							
1987-88	4	1	1	6	5	1	0
1988-89	3	4	5	12	12	0	0
1989-90	3	1	1	5	4	1	0
1990-91	2	2	1	5	4	1	0
1991-92	7	5	1	13	13	0	0
1992-93	7	7	1	15	14	1	0
25D							
1987-88	2	2	2	6	6	0	0
1988-89	0	0	2	2	2	0	0
1989-90	6	5	1	12	9	3	0
1990-91	14	10	0	24	6	18	0
1991-92	8	11	0	14	9	10	0
1992-93	2	1	8	11	9	1	1
26B							
1987-88	2	1	0	3	0	3	0
1988-89	12	3	0	15	7	7	1
1989-90	4	7	0	11	3	7	1
1990-91	15	9	1	25	0	24	1
1991-92	10	4	3	17	6	10	1
1992-93	14	11	6	31	5	26	0
26C							
1987-88	1	1	0	2	0	2	0
1988-89	3	0	0	3	0	3	0
1989-90	1	0	0	1	0	1	0
1990-91	7	4	1	12	2	10	0
1991-92	3	2	0	5	0	5	0
1992-93	3	3	0	6	3	3	0

Table 2. Subunits 25A, 25B, 25D, 26A, and 26B wolf harvest chronology percent by time period, 1987-92.

Regulatory year	Harvest periods									Unk	*n*
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr		
25A											
1987-88	3	7	0	3	7	7	7	67	0	0	30
1988-89	0	30	0	10	10	0	10	40	0	0	10
1989-90	0	21	0	21	14	29	14	0	0	0	14
1990-91	0	4	0	0	26	13	17	39	0	0	23
1991-92	8	0	0	12	12	16	12	36	4	0	25
1992-93	7	4	0	15	7	0	4	59	4	0	27
25B											
1987-88	0	0	0	17	17	33	17	17	0	0	6
1988-89	0	0	0	17	50	8	17	8	0	0	12
1989-90	0	0	0	20	60	0	0	20	0	0	5
1990-91	0	0	0	0	20	20	0	60	0	0	5
1991-92	0	0	0	0	69	8	15	8	0	0	13
1992-93	0	0	0	0	7	33	27	33	0	0	15
25D											
1987-88	0	0	0	0	50	33	17	0	0	0	6
1988-89	0	0	0	0	50	0	50	0	0	0	2
1989-90	0	0	0	0	42	0	25	33	0	0	12
1990-91	0	8	0	0	8	8	0	75	0	0	24
1991-92	0	0	0	0	0	5	21	74	0	0	19
1992-93	0	0	0	9	18	0	64	0	9	0	11
26B											
1987-88	0	0	0	0	0	0	33	33	33	0	3
1988-89	0	13	0	7	33	0	0	40	7	0	15
1989-90	18	18	0	27	18	9	0	9	0	0	11
1990-91	16	8	0	4	0	4	0	4	64	0	25
1991-92	18	6	0	0	24	12	0	18	24	0	17
1992-93	3	0	0	0	0	0	3	58	36	0	31
26C											
1987-88	50	0	0	0	0	0	0	0	50	0	2
1988-89	0	67	0	0	0	0	0	0	33	0	3
1989-90	100	0	0	0	0	0	0	0	0	0	1
1990-91	25	0	0	25	0	0	0	0	50	0	12
1991-92	100	0	0	0	0	0	0	0	0	0	5
1992-93	17	33	0	0	0	0	0	50	0	0	6

Table 3. Subunits 25A, 25B, 25D, 26B, and 26C harvest percent by transport method, 1987-92.

Regulatory year	Percent of harvest								
	Airplane	Dogsled Skis Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
25A									
1987-88	73.3	6.7	3.3	0.0	16.7	0.0	0.0	0.0	30
1988-89	10.0	20.0	10.0	0.0	60.0	0.0	0.0	0.0	10
1989-90	21.4	28.6	0.0	0.0	35.7	0.0	14.3	0.0	14
1990-91	0.0	13.0	4.3	0.0	69.6	0.0	0.0	13.0	23
1991-92	8.0	8.0	0.0	0.0	72.0	0.0	0.0	12.0	25
1992-93	11.1	0.0	0.0	0.0	77.8	0.0	3.7	7.4	27
25B									
1987-88	0.0	16.7	0.0	0.0	66.7	0.0	16.7	0.0	6
1988-89	0.0	16.7	0.0	0.0	83.3	0.0	0.0	0.0	12
1989-90	60.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	5
1990-91	20.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	5
1991-92	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	13
1992-93	6.7	13.3	0.0	0.0	66.7	0.0	0.0	13.3	15
25D									
1987-88	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	6
1988-89	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	2
1989-90	8.3	0.0	0.0	0.0	91.7	0.0	0.0	0.0	12
1990-91	54.2	0.0	0.0	0.0	45.8	0.0	0.0	0.0	24
1991-92	57.9	0.0	0.0	0.0	42.1	0.0	0.0	0.0	19
1992-93	9.1	0.0	0.0	0.0	81.8	0.0	9.1	0.0	11

Table 3. Continued.

Regulatory year	Percent of harvest								
	Airplane	Dogsled Skis Snowshoes	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
26B									
1987-88	33.3	0.0	0.0	0.0	0.0	0.0	33.3	33.3	3
1988-89	13.3	0.0	0.0	0.0	46.7	0.0	33.3	6.7	15
1989-90	18.2	0.0	0.0	9.1	0.0	0.0	63.6	9.1	11
1990-91	12.0	0.0	0.0	0.0	16.0	0.0	20.0	52.0	25
1991-92	17.6	5.9	0.0	0.0	23.5	0.0	52.9	0.0	17
1992-93	3.2	0.0	0.0	0.0	12.9	0.0	83.9	0.0	31
26C									
1987-88	50.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	2
1988-89	66.7	0.0	0.0	0.0	33.0	0.0	0.0	0.0	3
1989-90	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
1990-91	25.0	0.0	0.0	0.0	75.0	0.0	0.0	0.0	12
1991-92	60.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	5
1992-93	50.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	6

LOCATION

Game Management Unit: Unit 26A (56,000 mi^2)

Geographical Description: Western North Slope

BACKGROUND

Wolf numbers in Unit 26 have fluctuated widely since the turn of the century. During the early 1900s caribou, moose, and wolves were less abundant than they are today. Caribou and moose numbers increased after 1930, and by the 1940s wolves were quite abundant. Wolf numbers were greatly reduced by federal wolf control during the 1950s, and by public aerial hunting during the 1960s. Following the outlawing of aerial wolf hunting in 1970 and land-and-shoot aircraft hunting of wolves in 1982, wolf populations increased in size, especially in the mountains and foothills of the Brooks Range. Wolves are less abundant on the coastal plain because of seasonal scarcity of caribou, outbreaks of rabies, and their vulnerability to hunters in the open country.

The reported harvest of wolves in recent years has ranged from 13 to 30 animals, but the actual harvest has ranged from approximately 55 to 112. The pelts of nearly all wolves harvested in Unit 26A are used locally for the manufacture of parka ruffs or handicrafts and often are not sealed. The harvest of wolves is greatest in the southeastern part of Unit 26A where residents of Anaktuvuk Pass and Nuiqsut hunt and trap wolves throughout winter.

Stephenson and James estimated the wolf population size for Unit 26A at 144-310 wolves in 1982 (James 1982). Trent (1988) surveyed a 6480 mi^2 (16,848 km^2) area around Umiat and estimated density in 1986 at 2.6 wolves/1000 km^2 and 2.7-3.2 wolves/1000 km^2 in 1987.

MANAGEMENT DIRECTION

The following population goals and management objectives have been established for Unit 26A:

1. Maintain viable wolf populations in Unit 26A.

    - Monitor the population density of wolves in the most heavily hunted area in Unit 26A once every 3 years.

    - Monitor harvest through the statewide sealing program and by interviewing knowledgeable people in the villages.

    - Interview hunters, guides, and pilots to collect harvest and population status information.

2. Determine effects of wolves on Unit 26A moose populations.

    - Monitor the wolf population by conducting surveys in the primary moose habitat area once every 3 years.

    - Record wolf observations during moose counts and compare to observations made during past counts.

3. Involve the public in developing a management plan and in making future management decisions concerning wolves.

METHODS

From 23-26 April 1992, a Traditional Track Count (TTC) survey was conducted in a 23,293 km^2 (8955 mi^2) study area in the southeastern corner of Unit 26A. On 27 April 1992, a Track Intercept Probability (TIP) sampling survey (Becker 1991, Becker and Gardner 1990, Gardner and Becker 1991) was used to census wolves in a 10,343 km^2 (3994 mi^2) area on the Colville River drainage within the TTC study area. We used 3 PA-18 aircraft, each with an experienced pilot and observer to conduct both surveys.

We collected harvest data from sealing certificate records, and informal discussions with village residents, and composition data from wolf carcasses collected by hunters at Anaktuvuk Pass.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size. Using the TTC method, we sighted 14 packs containing 63 wolves in the 23,293 km^2 TTC study area (2.7 wolves/1000 km^2). Within the 10,343 km^2 area where we later conducted the TIP survey, we counted 30-44 wolves (2.9-4.2 wolves/1000 km^2) using the TTC survey method (Table 1).

Using the TIP method, we counted 37 wolves in 5 packs considered residents of the 10,343 km^2 TIP study area. Wolves are defined as resident when most of their fresh tracks are within the study area. This resulted in a population estimate of 41 to 65 wolves (4.0-6.2/1000 km^2) at the 80% confidence interval. The density estimate of the TIP and TTC surveys overlap at approximately 4.2 wolves/1000 km^2, a reasonable point estimate for density within the TIP survey area.

The size of the wolf population is increasing in the study area and probably growing in the remainder of Unit 26A. TTC surveys conducted during 1986 and 1987 in approximately the

same area as the recent survey resulted in smaller density estimates of 2.6 wolves/1000 km^2 and 2.7-3.2 wolves/1000 km^2, respectively (Trent 1988).

Because the density of wolves in the study area is probably greater than in the remainder of the subunit, we did not extrapolate that density to the entire subunit. Assuming most of the coastal plain has a lower wolf density than the surveyed foothill region, we estimate 240-390 wolves (1.8-2.9 wolves/1000 km^2) in 32 to 53 packs were resident in Unit 26A.

Population Composition. Staff have collected necropsy data on wolves harvested at Anaktuvuk Pass since the winter of 1985-86. Out of 110 wolf carcasses examined at Anaktuvuk Pass during 1990-91, 73 were from wolves harvested in Unit 26A. Forty-six (42%) were males, 52 (47%) were females, and 12 (11%) were unknown. Of 82 carcasses that were aged, 37 (45%) were adults and 45 (55%) were pups. Ninety-three (85%) of the wolves were gray or white, and 17 (15%) were black. Sixty-seven (61%) of these wolves were shot and 43 (39%) were trapped. Fifteen were caught during December, 23 during January, 23 during February, and 44 during March.

Fifty-two carcasses were examined during 1991-92. Thirty-five were from wolves harvested in Unit 26A. Twenty-eight (54%) were males, 23 (44%) were females, and 1 was unknown. Twenty-three (44%) were pups, 15 (29%) were adults, and 4 were of unknown age. Eight (15%) animals were black, 43 (81%) were gray, and one was unknown. Twenty (38%) were shot and 32 (62%) trapped.

Of the 48 carcasses examined at Anaktuvuk Pass during 1992-93, 21 were taken in Unit 26A. Ten (48%) were males, 2 (10%) were females, and 9 were unknown. Twelve (57%) were shot and 9 (43%) trapped. All were gray.

Composition of the harvest probably does not reflect accurate age composition because pups are more susceptible to harvest than adults. Composition data from sources other than hunter harvest are not available at this time.

Distribution and Movements. Most wolves are found in the southern portion of Unit 26A near the Brooks Range and along the Colville River. However, in recent years wolves have been seen in increasing numbers by residents of the coastal plain. Wolves often move toward areas of high caribou concentration. For instance, during the winter of 1990-91, many caribou concentrated near Anaktuvuk Pass which attracted wolves and resulted in a larger than normal wolf harvest.

Mortality

Harvest:

Season and Bag Limits.

Unit 26A	*Limit*	*Season*
Trapping:	No limit	Nov. 1 - Apr. 15
Hunting:	10 wolves	Aug. 10 - Apr. 30

Board of Game Actions and Emergency Orders. The Alaska Board of Game changed the bag limit under hunting regulations from no limit during the 1991-92 season to a limit of 10 wolves during the 1992-93 season. The change has had little effect on hunters or the wolf densities because few, if any, hunters have harvested more than 10 wolves before the regulatory change was adopted.

Human-Induced Harvest. During the 1990-91 season, 30 wolves were sealed (Table 2). Twenty (66%) were males and 10 were females (34%). Twenty-five (83%) were gray, 4 (13%) were black, and 1 (3%) was white. Knowledgeable individuals in each village were interviewed to determine how many wolves were harvested by local residents during the 1990-91 season. A minimum of 8 wolves were taken by Atqasuk hunters, 9 by Wainwright hunters, 11 by Nuiqsut hunters, 3 by Point Lay hunters, 8 by Barrow hunters, and 73 by Anaktuvuk Pass hunters, yielding 112 wolves.

During the 1991-92 season, 18 wolves were sealed. Twelve (67%) were males, 5 (28%) were females, and 1 was unknown. Thirteen (72%) of the wolves were gray, 4 (22%) were black, and 1 (6%) was white. We interviewed individuals in each village to estimate how many wolves were harvested by local residents. A minimum of 4 wolves were taken by Atqasuk hunters, 9 by Wainwright hunters, 17 by Nuiqsut hunters, 3 by Point Lay hunters, 5 by Barrow hunters, and 35 by Anaktuvuk Pass hunters, yielding 55 wolves during 1991-92.

During the 1992-93 season, 29 wolves were sealed. Seventeen (59%) were males, 9 (30%) were females, and 3 (11%) were unknown. Twenty-two (79%) of the wolves were gray, 5 (17%) were black, 1 (3%) was white, and 1 was unknown. Again we interviewed individuals in each village to estimate how many wolves local residents harvested. A minimum of 6 wolves were taken by Atqasuk hunters, 8 by Wainwright hunters, 15 by Nuiqsut hunters, 2 by Point Lay hunters, 5 by Barrow hunters, and 35 by Anaktuvuk Pass hunters, yielding a total of at least 71 wolves harvested during 1992-93.

Hunter Residency and Success. Most wolves were harvested by residents from Unit 26A or from villages that border the unit. During 1990-91, 1 wolf was reported harvested by a nonresident. During 1991-92, 4 wolves were taken by nonlocal Alaska residents. Three wolves were taken by nonlocal residents during 1992-93.

Method of Take, Transportation, and Chronology. Of the 30 wolves sealed from Unit 26A during 1990-91, 24 (80%) were ground shot and 6 (20%) trapped. Twenty-seven (90%) were taken using snowmachines for transportation, 2 (7%) were harvested using a tracked vehicle,

and 1 (3%) was taken by a hunter using an aircraft. The chronology of the harvest was: September 1, December 3, March 22, April 4.

Of the 18 wolves harvested in Unit 26A during 1991-92, 11 (61%) wolves were shot from the ground, and 7 (39%) were trapped. Seventeen (94%) animals were taken using snowmachines for transportation, and 1 (6%) was taken using an aircraft. The chronology of the harvest was: September 1, January 2, February 1, March 11, and April 3.

Of 29 wolves sealed during 1992-93, 18 (63%) animals were ground shot, 9 (30%) were trapped, and 2 (7%) were unknown. Twenty-six (89%) animals were taken using snowmachines for transportation, 2 (7%) were taken using an aircraft, and 1 (4%) was unknown. The chronology of the harvest was September 2, November 2, December 2, March 18, April 4, and 1 unknown.

Habitat

Assessment: Unit 26A contains an extensive prey-base available to wolves. The Western Arctic Caribou Herd (WAH), which numbers over 415,000 animals, seasonally occupies the unit, and a portion of this herd remains throughout the winter. The Teshekpuk Lake Caribou Herd (TLH) numbers over 27,000, and most of this herd remains in the unit throughout the year. In addition, over 1500 moose reside in the Colville River drainage. This prey-base could support many more wolves than currently exist in the unit.

CONCLUSIONS AND RECOMMENDATIONS

The results of TTC and TIP wolf population surveys in the southeast corner of the unit during April 1992 indicate the density of wolves has increased from 2.6 - 3.2 wolves/1000 km^2 during 1986 and 1987 to 4.2 wolves/1000 km^2 during 1992. This study area, located in the foothills of the Brooks Mountain Range bordered by the Colville, Killik, and Itkillik Rivers, is important because it supports more harvest of wolves than any other area in Unit 26A, and it represents the most productive moose habitat in Unit 26A. By estimating wolf density for the area, we hopefully can detect overhunting of the wolves and better monitor the effects of wolf predation on the moose population.

The harvest of 110 wolves near Anaktuvuk Pass during 1990-91 was significantly greater than in past years. However, the number of wolves harvested during 1991-92 and 1992-93 was 52 and 48, respectively, which is closer to normal harvest levels reported by Anaktuvuk Pass hunters. The harvest was larger in 1990-91 because many WAH caribou wintered near Anaktuvuk Pass, attracting wolves and making them more accessible to hunters. If the harvest routinely exceeded 100 each year, we may have reason for concern. However, the normal harvest is apparently within sustained yield limits.

Because many North Slope residents do not participate in the department's wolf sealing program, we do not have accurate harvest information. We are assisting the North Slope

Borough develop a harvest reporting system more acceptable to local residents. Harvest monitors will be hired in each village, and we should gain more accurate harvest information through this system.

A wolf management plan for the North Slope was developed during 1992 and 1993. In developing the management plan, we held public meetings in North Slope villages and consulted local governments and federal management agencies. Most local people agreed that: 1) a moderate level of harvest of wolves should continue, 2) wolf pelts are highly prized and a valuable resource for North Slope residents, 3) wolf control is unnecessary on the North Slope at this time, 4) residents oppose using aircraft to harvest wolves, and 5) if wolf populations do become too large, local people could use ground hunting methods to control the populations.

Wolf predation may be adversely affecting dall sheep and moose populations in Unit 26A. Sheep populations have declined in number throughout the Brooks Range, and hunters have reported finding remains of many sheep apparently killed by wolves in the mountains of Unit 26A. Moose surveys completed in count areas in the Colville River drainage have indicated moose numbers may be declining. During moose surveys, the number of sightings of wolves and of moose killed by wolves has been gradually increasing during the last 14 years. We will census the area in 1995 to assess the status of the moose population and effects of wolves on the moose population.

Open terrain combined with moderate to high wolf numbers make the North Slope one of the best places for people to observe and photograph wolves. They are commonly seen by residents as well as visitors to the region, especially in the mountains and foothills.

No changes in bag limits or seasons are recommended at this time because wolves are fairly abundant in Unit 26A and the population is increasing. Because aerial hunting is not allowed, extensive areas in Unit 26A receive little hunting pressure. Except for the area within 50-70 miles of Anaktuvuk Pass, much of the wolf population inhabiting the foothills of the Brooks Range probably will not be utilized heavily. On the coastal plain, wolf numbers appear to be increasing but will continue to be vulnerable to hunters on snowmachines and probably will not become plentiful.

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Table 1. Wolf population estimates for Unit 26A and the Colville River TTC/TIP study area [a],1982-1993.

Year	TTC/TIP Study Area		Unit 26A		Basis of estimate
	Wolves per 1000 km^2	Number of packs	Population estimate	Number of packs	
1982			144-310		TTC survey[b] and extrapolation to rest of unit.
1986	2.6	2			TTC surveys[b]
1987	2.7-3.2	4-5			TTC surveys[b]
1990			145-350	14-30	Past surveys and interviews with pilots-hunters.
1992	2.9-4.2	4-8			TTC survey[b]
1992	4.0-6.2	5-8			TIP survey[c]
1993			240-390	32-53	1992 surveys and interview with pilots-hunters.

[a] Colville Study Area - southeast corner of GMU 26A bordered by the Colville, Killik, and Itkillik Rivers, and the Brooks Mountain Range.
[b] Traditional Track Count Survey.
[c] Track Intercept Probability Survey.

Table 2. Number, sex, and color for reported wolf harvest and estimated unreported harvest, Unit 26A, 1988-1993.

Regulatory year	Total reported harvest	Sex			Color			Estimated unreported harvest
		% Males	% Females	% Unknown	% Gray	% Black	% White	
1988-89	13	38	62		100	0	0	
1989-90	14	71	29		64	29	7	48
1990-91	30	66	34		83	13	3	82
1991-92	18	67	28		72	22	6	37
1992-93	29	59	30	11	79	17	3	42

Table 3. Number, method, and transportation for reported wolf harvest, Unit 26A, 1988-1993.

Regulatory year	Total	Method of Take			Transportation		
		% Trap	% Rifle	% Unknown	% Aircraft	% Snowmachine	% ORV
1988-89	13	15	85			100	
1989-90	14	64	36		15	85	
1990-91	30	20	80		3	90	7
1991-92	18	39	61		6	94	
1992-93	29	30	63	7	7	89	4

Table 4. Chronology for reported wolf harvest in Unit 26A, 1988-1993.

Year	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Unknown	Total
1988-89	1				1		2	9			13
1989-90		2		1	2	2	2	5			14
1990-91		1			3			22	4		30
1991-92		1				2	1	11	3		18
1992-93		2		2	2			18	4	1	29

NOTES

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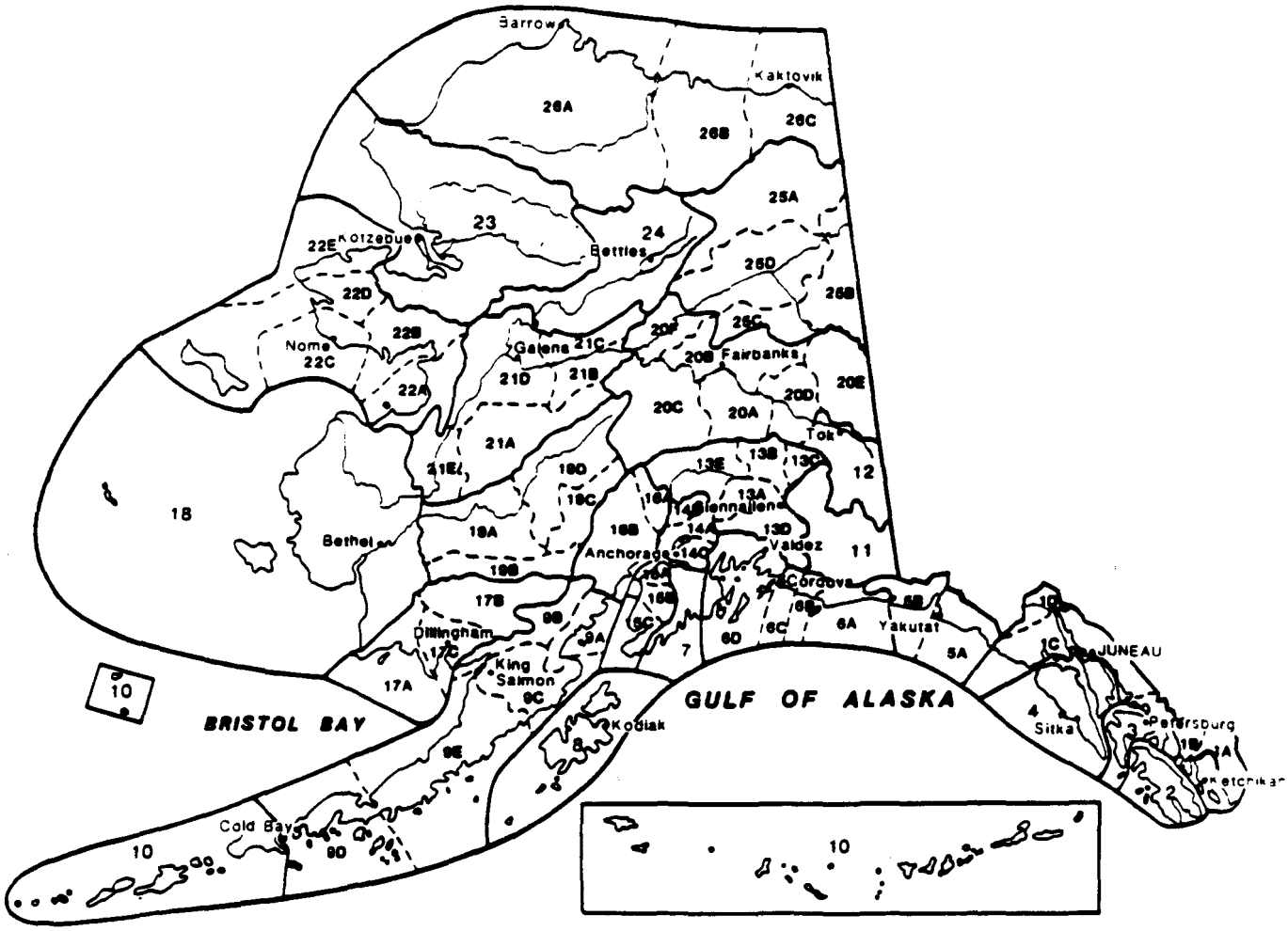
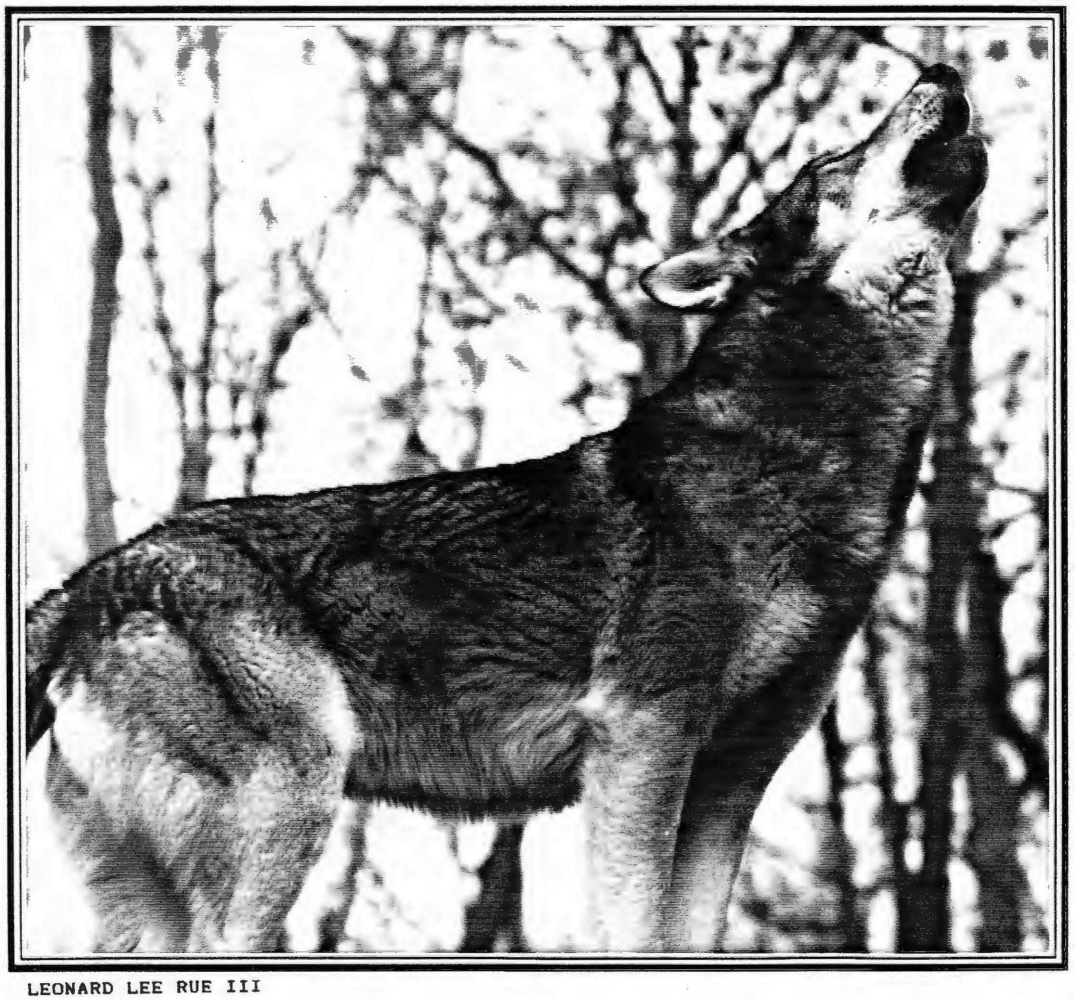
Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.



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