Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Management Report
Survey-Inventory Activities
1 July 1996-30 June 1999

WOLF

Mary V. Hicks, Editor

Craig Flatten

Grants W-24-5, W-27-1, and W-27-2
Study 14.0
December 2000

Wolf
Management Report
of survey-inventory activities
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Please note that population and harvest data in this report are estimates and may be refined at a later date.

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If used in part, the reference should include the unit number, page numbers and author's name, which can be found at the end of each unit.

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Mary Hicks
Publications Specialist
ADF&G, Wildlife Conservation
P.O. Box 25526
Juneau, AK 99802
(907) 465-4190

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LOCATION

GAME MANAGEMENT UNIT: 1A (5300 mi^2)

GEOGRAPHIC DESCRIPTION: Unit 1 south of Lemesurier Point, including all drainages into Behm Canal and excluding all drainages into Ernest Sound

BACKGROUND

Wolves live throughout the islands and mainland of Unit 1A, although densities on the mainland are generally lower than on maritime-influenced offshore islands. Wolves are capable swimmers and regularly travel between adjacent islands in search of prey.

Wolves feed primary on deer in southern Southeast Alaska, particularly on islands in the area. On the mainland, where deer densities are generally lower than on islands, wolves primarily prey on mountain goats and moose. Marine mammals, salmon, waterfowl, and small mammals supplement the diets of wolves in the area.

The coloration of Southeast Alaska wolf pelts varies; however, the brown/gray color phase is most common. During the past decade, white or near-white pelts have comprised less than 1% of the harvest while black pelts have accounted for about 20% of the Unit 1A harvest.

From 1915 through the early 1970s, cash bounty was paid for wolves taken in the region and in the 1950s Federal agents poisoned wolves on many Southeast islands in an effort to increase or maintain deer numbers. None of these programs had long-lasting effects on wolf abundance or distribution. However, in 1990 Southeast Alaska wolves, named by some taxonomists as the Alexander Archipelago wolf, were identified by a USDA Forest Service-sponsored interagency committee as a species for which there were concerns about viability or distribution as a result of extensive timber harvesting in the Tongass National Forest. In 1993 the Biodiversity Legal Foundation (Boulder, CO) and an independent biologist from Haines, Alaska filed a petition with the U. S. Fish and Wildlife Service (FWS) requesting that Southeast Alaska wolves be listed as a threatened subspecies pursuant to the Endangered Species Act. The FWS ruled that listing was not warranted at the time, but indicated that they felt it was clear that without significant changes to the existing Tongass Land Management Plan, the long-term viability of Southeast wolves was seriously imperiled. A comprehensive conservation assessment about was subsequently prepared through the USDA Forest Service (Person et al. 1996). The most important consideration identified in the assessment was the need to maintain long-term carrying capacity for deer, the principal prey for most of the wolf population. The authors suggested that a series of old-growth forest reserves might provide an effective strategy to increase the likelihood that wolves will persist where extensive timber harvesting has occurred or is planned.

MANAGEMENT OBJECTIVES

Our management objectives are to maintain an average annual harvest of at least 20 wolves from Unit 1A. This level reflects the average harvest for this unit during 1984–1990.

METHODS

We obtained harvest information through a mandatory-sealing program. The left foreleg must remain attached to the hide until it is sealed for aging purposes. Information obtained from hunters and trappers included the number and sex of harvested wolves, date and location of harvest, method of take, transportation used, and pelt color. We obtained anecdotal information about wolves from hunters and trappers as well as from department staff. Additional information was obtained from trappers through an annual mail-out survey.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

No current population data are available for Unit 1A wolves. Based on the moderate harvest levels reported and low indices of abundance (I_A) reported by trappers, wolves in Unit 1A appear to have declined slightly during this report period (Kephart 2000).

Distribution and Movements

There are currently no wolves with radio transmitters in Unit 1A. Attempts to collar wolves on the Cleveland Peninsula during fall 1999 resulted in 2 males being outfitted with transmitters. Both of those died within one month of capture. Efforts will be made again this coming fall to capture and collar wolves in that area. Anticipated work on Cleveland Peninsula will eventually provide demographic information in an area with less access (fewer roads) and less historical logging activity to compare to data gathered in ongoing research in Unit 2.

MORTALITY

Season and Bag Limit	Residents and Nonresidents	
Hunting:	August 1–April 30	5 wolves
Trapping:	November 10–April 30	no limit

Effective July 1, 1997 the left foreleg must remain attached to the hide until it is sealed.

Hunter/Trapper Harvest. The Unit 1A 1996/97 harvest of 15 wolves was one of the lowest on record. The following year the harvest rebounded to 26, but was still below the seasonal average of 28. Only 7 trappers were successful during the 1996/97 season, which is the lowest number of successful trappers since pelt sealing began in 1985. The low number of successful trappers partly explains the low number of wolves harvested during that season. However, the average catch remained about the same as 1996/97 at 2.1 wolves per trapper. The number of successful trappers was back up during the 1997/98 season, but the catch per trapper was below average at 1.4. On average 15 trappers are successful and each harvest 2 wolves. Eighty percent of the wolves harvested during 1996/97 were trapped while the remainder was shot. Sixty-nine percent of the wolves killed during the 1997/98 season were trapped and the remainder were shot.

Hunter Residency and Success. Local residents regularly account for 94–100% of hunters and trappers pursuing wolves in Unit 1A. Ninety-five percent of the harvest since 1990 has been taken by local residents, followed by nonlocals (3%) and nonresidents (2%). Local residents took all of the 1996/97 harvest and 83% of the 1997/98 harvest.

Harvest Chronology. March has historically seen the peak of the Unit 1A wolf harvest followed by February. In the past 2 years the harvest was spread out more evenly over the open season with slightly more taken during December and March.

Transport Methods. Boats and highway vehicles continue to account for the majority of transport methods used by Unit 1A wolf hunters and trappers. During this report period the majority of trappers used boats (95%) and the remainder used highway vehicles.

Other Mortality

Mortality from natural causes (starvation, accidents, disease, fighting) in exploited populations is low, typically averaging 5 to 10% per year (Fuller 1989). One male wolf was killed by a car on South Tongass Highway during early fall 1998. This male had an old wound on one front leg, and consequently the animal was in poor physical condition. Four wolves have reportedly been killed on the highway by cars since 1985.

CONCLUSIONS AND RECOMMENDATIONS

We believe Unit 1A wolf numbers have slightly declined during this report period. Trapping effort has also declined, although the catch per successful trapper has remained similar to the preceding 10-year average.

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PREPARED BY:

Boyd Porter
Wildlife Biologist II

SUBMITTED BY:

Bruce Dinneford
Management Coordinator

Table 1 Unit 1A wolf harvests, 1985–1998

					Method of take			Pelt color			
Season	Males	Females	Unk	Total	Shot	Trapped	Unk	White	Grey	Black	Unk
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
1993/94	18	14	0	32	6	26	0	0	24	7	1
1994/95	22	18	0	40	11	29	0	1	35	4	0
1995/96	24	25	0	49[b]	17	29	3	0	38	11	0
1996/97	5	10	0	15	3	12	0	0	12	3	0
1997/98	13	13	0	26[c]	8	18	0	0	21	5	0
Totals	188	169	2	359	114	242	3	1	284	73	1

[a] Does not include 1 gray female killed by a car on South Tongass Highway, Ketchikan.
[b] Does not include 2 gray males killed by cars on North Tongass Highway and White River Road, Ketchikan.
[c] Does not include 1 gray male killed by a car on South Tongass Highway, Ketchikan.

Table 2 Unit 1A wolf hunter/trapper transport methods, 1985–1998

Season	Air	Boat	Highway vehicle	Walked	Unknown
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
1993/94	1	28	2	0	1
1994/95	1	32	6	1	0
1995/96	1	33	12	2	1
1996/97	0	15	0	0	0
1997/98	0	24	2	0	0
Totals	19	275	43	11	11

Table 3 Unit 1A wolf harvest chronology by month, 1985–1998

Season	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
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[a]	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
1993/94	0	2	0	0	0	3	6	5	13	2	1	0
1994/95	0	0	2	6	1	1	2	16	6	6	0	0
1995/96	0	2	3	2	6	5	4	8	12	6	1	0
1996/97	0	0	0	3	0	1	4	1	3	3	0	0
1997/98	0	1	0	4	0	6	3	4	6	2	0	0
Totals	0	9	12	28	27	38	44	64	78	46	10	3

[a] Hunting season changed from year round, no limit, to August 1–April 30, 5 wolf limit.

Table 4 Number of hunters/trappers who killed Unit 1A wolves, and average catch per trapper, 1985–1998

Season	Number of trappers harvesting wolves	Average catch/person
1985/86	7	1.6
1986/87	10	2.1
1987/88	12	1.9
1988/89	15	1.4
1989/90	18	1.8
1990/91	13	1.1
1991/92	17	1.8
1992/93	19	2.2
1993/94	15	2.1
1994/95	17	2.3
1995/96	25	2.0
1996/97	7	2.1
1997/98	18	1.4

Table 5 Residency of Unit 1A wolf trappers/hunters, 1990–1998

Season	Local resident[a]	Nonlocal resident[b]	Nonresident
1990/91	13	0	0
1991/92	16	1	0
1992/93	19	0	0
1993/94	15	0	0
1994/95	15	1	1
1995/96	25	0	0
1996/97	7	0	0
1997/98	15	2	1
Totals	125	4	2

[a] Local residents are those individuals living within the boundaries of Unit 1A.

[b] Nonlocal residents are Alaska residents living somewhere outside Unit 1A.

LOCATION

GAME MANAGEMENT UNIT: Unit 1B (3000 mi^2)

GEOGRAPHIC DESCRIPTION: The Southeast Mainland from Cape Fanshaw to Lemesurier Point

BACKGROUND

Wolves inhabit the mainland of Unit 1B, where they immigrated following post-glacial immigration and establishment of deer populations. Deer are the primary food source for wolves in Southeast Alaska, with moose and mountain goat being important in some mainland areas.

Wolf densities are higher in Unit 1B than in interior regions of Alaska, but due to dense forest cover viewing opportunities are infrequent.

Government wolf control programs and bounties were maintained into the 1970's in an effort to increase deer numbers. Today a few recreational trappers and opportunistic sport hunters harvest wolves in the subunit.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain a viable wolf population in all areas of historic range.

METHODS

We monitored the wolf harvest through a mandatory pelt-sealing program. We collected data on the number of wolves killed, sex, date of take, method of take, method of transportation used from home to the field, and the estimated number of wolves associated with the ones killed. The left foreleg was collected from each sealed wolf to determine relative age, beginning in 1997–98.

We recorded observations of wolves made by Forest Service biologists, trappers, hunters, and other members of the public. An annual statewide trapper survey supplied additional information.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We did not collect sufficient data to make a meaningful estimate of wolf populations. Conversations with trappers, hunters, pilots, and other biologists and information from trapper questionnaires indicated the wolf population increased in the 1990s.

MORTALITY

Harvest

Season and Bag Limit	Residents and Nonresidents	
Trapping:	November 10–April 30	No limit
Hunting:	August 1–April 30	5 wolves

Board of Game Actions and Emergency Orders. There was no Board of Game action or emergency orders issued during this report period.

Hunter/Trapper Harvest. Unit 1B witnessed 4, 9, and 13 wolves taken by 4, 4, and 6 individuals in 1996/97, 1997/98, and 1998/99, respectively (Table 1). In 1997/98, 33% of harvested wolves were adults, and in 1998/99 55% were adults (Table2). Wolves were not aged in 1996/97. Trapping continues to be the primary method of take. Deer hunters, and occasionally moose hunters, are generally responsible for shot wolves.

Most of the wolf harvest takes place in close proximity to local communities. Much of the mainland is not trapped.

Harvest Chronology. In the 1996/97 season, August, September, January, and February each accounted for an equal percentage of the harvest (Table 3). In 1997/98, December, January, and February accounted for the highest percent of the harvest. In 1998/99, August, December, and January accounted for the highest percentage of the harvest. Wolves harvested in August and September are taken incidentally to other hunting activities.

Transport Methods. Trappers using small boats in 1996/97, 1997/98, and 1998/99 (Table 4) harvested all wolves. Other forms of transportation are rarely used.

CONCLUSIONS AND RECOMMENDATIONS

The wolf harvest remains low in Unit 1B and much of the unit is not trapped. I recommend no change in regulations.

PREPARED BY:

Edward B. Crain
Wildlife Biologist III

SUBMITTED BY:

Bruce Dinneford
Management Coordinator

Table 1 Unit 1B wolf harvest, 1988–98

Regulatory year	Reported harvest				Method of take			Successful trappers/hunters
	M	F	Unk.	Total	Trap/Snare	Shot	Unk.	
1988/89	4	5		9	6	3		6
1989/90	12	7		19	14	5		8
1990/91	7	8		15	10	5		3
1991/92	4	6		10	7	3		7
1992/93	3	5		8	7	1		2
1993/94	9	8		17	11	6		9
1994/95	11	5		16	14	2		8
1995/96	1	3		4	3	1		4
1996/97	2	2		4	2	2		4
1997/98	5	4		9	9	0		4
1998/99	6	7		13	8	5		6

Table 2 Age of harvested Unit 1B wolves[1], 1997–98

Regulatory year	Adults	Subadults[2]	% adults
1997/98	2	4	33
1998/99	6	5	55

[1] Not all harvested wolves were aged.
[2] Less than 1 year of age.

Table 3 Unit 1B wolf harvest chronology, by percent by month, 1988–98

Regulatory	Harvest periods												
year	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	n
1988/89		11		11	11	56	11						9
1989/90			11	11	16	32	26			15			19
1990/91				13		7	40	13	26				15
1991/92		10			10	20	60						10
1992/93					12	50	26			12			8
1993/94		6		6	17	36	12	17		6			17
1994/95		6			6	57	19	6	6				16
1995/96					25	25		25	25				4
1996/97		25	25				25	25					4
1997/98						33	11	56					9
1998/99		15	8		8	23	38	8					13

Table 4 Unit 1B wolf harvest, by percent by transport method, 1988–98

Regulatory year	Percent of harvest					
	Airplane	Boat	3- 4-wheeler	Snowmachine	Other	*n*
1988/89	11	78		11		9
1989/90		89		11		19
1990/91		73	7	13	7	15
1991/92		90		10		10
1992/93		100				8
1993/94	6	88		6		17
1994/95	6	94				16
1995/96		100				4
1996/97		100				4
1997/98		100				9
1998/99		100				13

LOCATION

GAME MANAGEMENT UNIT: 1C (6500 mi^2)

GEOGRAPHIC DESCRIPTION: That portion of the southeast Alaska mainland from Cape Fanshaw to the latitude of Eldred Rock

BACKGROUND

Wolves are distributed throughout the mainland portion of Unit 1C, but anecdotal evidence suggests they primarily inhabit major mainland river drainages. An exception is in the Chilkat Mountains and the Gustavus Forelands where wolves appear to be uniformly distributed, probably in part due to the distribution of moose. During the report period we received reports of packs in the Gustavus Forelands, Endicott River, St. James Bay, Point Couverden, Berners Bay, Nugget Creek, Taku River, Snettisham, and Endicott Arm areas. Several people reported seeing wolves on Douglas Island, but none of these reports were substantiated. There is no evidence that wolves exist on Shelter, Lincoln, or Sullivan Islands.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

No formal wolf management goals have been established for this unit, however our general management objectives are to regulate seasons and bag limits to maintain populations of wolves for viewing and harvest. Our management strategy is to maintain wolf harvests at a level similar to the mean for the previous 5 seasons. No wolf control is contemplated for this area at this time.

METHODS

Through mandatory sealing of wolf hides taken by successful hunters and trappers we collected the following data: date and method of take, sex, transportation mode, and number of animals in the pack the wolf was harvested from. We also required hunters and trappers to leave the lower front leg bone attached to the hide for sealing. We used this bone to separate wolves into 3 age categories, juveniles (less than 1 year of age), yearlings, and adults. The population was monitored by whatever means were available including anecdotal reports, aerial survey sightings, discussions with hunters and trappers, and information collected from the annual statewide trapper surveys.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We did not collect sufficient data to make meaningful estimates of wolf populations within the unit. Although no quantitative data is available, anecdotal reports and discussions with local hunters, trappers, and pilots as well as harvest data suggest wolf numbers are stable or slowly

increasing. Wolves appear to be increasing near Gustavus and the Chilkat Range where moose are becoming more abundant.

MORTALITY

Harvest

Seasons and Bag Limits

Hunting:	August 1–April 30	5 Wolves
Trapping:	November 10–April 30	No Limit

Board of Game Actions and Emergency Orders. There were no Board of Game actions or Emergency Orders issued during the report period.

Hunter/Trapper Harvest. Eight wolves (5 males, 3 females) were harvested in 1996 (Table 1), 4 from the Chilkat Mountains, 3 from the Gustavus area, and one from Cape Fanshaw. This is higher than the previous 5-year mean of 5.8 (range = 5–7). In 1997, 9 wolves (6 males, 3 females) were harvested, 7 from the Chilkat Mountains, 1 from the Taku River valley, and 1 from Hobart Bay. This was again higher than the 5-year mean of 6.6 (range = 5–9). In 1998, 4 wolves (1 male, 2 females, and 1 of unknown sex) were harvested, 3 from the Chilkat Mountains, and one from the Gustavus area. This was lower than the 5-year mean of 7.2.

The combined harvest for 1996–1998 was 21 wolves, comprising 19 (90%) taken in snares and 2 (10%) taken with firearms. The color of these wolves ranged from black to gray, with 7 gray wolves, 11 black, and 3 of unknown color.

Hunter/Trapper Residency and Success. In 1996, 2 residents of the unit harvested 7 of 8 wolves that were taken. This trend continued in 1997 and 1998 when 3 and 2 local residents respectively accounted for the entire harvest.

Harvest Chronology. Trapping harvest is spread throughout the season, with the exception of summer months, and is not consistent from year to year (Table 2). Most recent harvest has occurred from January to March.

Transport Methods. Boats were the primary access for wolf hunters and trappers, although airplanes 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 people afield and incidental observations by Department of Fish and Game staff indicate that wolves are common in some areas and may be more plentiful than we previously thought near Gustavus. Mountain goats and moose are the most common big game prey species in the area, and the effect of wolves upon

these populations may be considerable. Low deer densities on the mainland portions of the unit are likely due in part to wolf predation.

Wolf harvests are stable but low. Little effort is exerted towards taking wolves in this unit, and the harvest remains well below the level that would exert significant pressure on the population. No changes in seasons or bag limits are recommended at this time.

PREPARED BY:
Neil L. Barten
Wildlife Biologist III

SUBMITTED BY:
Bruce Dinneford
Management Coordinator

Table 1 Unit 1C wolf harvest chronology, 1988–1998

Regulatory year	Males	Females	Unknown	Total
1988	3	2	0	5
1989	4	7	1	12
1990	4	2	0	6
1991	1	4	0	5
1992	3	2	0	5
1993	3	4	0	7
1994	4	1	2	7
1995	2	3	0	5
1996	5	3	0	8
1997	6	3	0	9
1998	1	2	1	4

Table 2 Unit 1C wolf harvest chronology by month, 1988–1998

Regulatory year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1988									5			
1989				1	1	5	3	1		1		
1990			1			3				1	1	
1991			2							2	1	
1992					1		1		2	1		
1993							2	3	1	1		
1994			2	2		1		1	1			
1995		1		1		2			1			
1996					1		3	3	1			
1997			1				6	1	1			
1998								3		1		

Table 3 Unit 1C wolf harvest percent by transport method, 1988–1998

Regulatory year	Airplane	Dogsled, skis, snowshoes	Boat	3- or 4-wheeler	Snow-machine	ORV	Hwy vehicle	Unknown
1988			50		50			
1989			84		8		8	
1990			83				17	
1991	40		60					
1992			80				20	
1993			100					
1994		14	86					
1995			20			40	40	
1996	44		56					
1997	100							
1998	75						25	

LOCATION

GAME MANAGEMENT UNIT: 1D (2700 mi^2)

GEOGRAPHIC 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

We have not conducted wolf investigations in this unit, and population information is based upon anecdotal information, sightings made during aerial moose surveys, and discussions with hunters and trappers. This subunit differs from many other areas in southeast Alaska in that deer are nearly absent and are not an important prey source for wolves. The major prey species are moose, mountain goats, and beaver. The beaver population is increasing and probably represents a much greater portion of the wolves' diet than in the past.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

No formal management goals have been established for wolves in this unit, however, our general management objectives are to regulate seasons and bag limits to maintain populations of wolves for viewing and harvest. Our management strategy is to maintain wolf harvests at a level similar to the mean over the previous 5 seasons. No wolf control methods are planned for this area at this time.

METHODS

Through the mandatory sealing of wolves taken by successful hunters and trappers we collected the following data: date and method of take, sex, transportation mode, and number of animals in the pack the wolf was taken from. We also required hunters and trappers to leave the lower front leg bone attached to the hide for sealing. We used this bone to separate wolves into 3 age categories; juveniles (less than 1 year of age), yearlings, and adults. The population was monitored by whatever means were available, including anecdotal reports, aerial survey sightings, discussions with trappers and hunters, and information collected from the annual statewide trapper survey. Alaska Department of Fish & Game and Fish and Wildlife Protection staff sealed wolves in Haines.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We did not collect sufficient data to make meaningful estimates of wolf populations within the unit. Although no quantitative data is available, anecdotal reports and discussions with local hunters, trappers, and pilots suggest wolf numbers are stable.

MORTALITY

Harvest

Seasons and Bag Limits

Hunting:	August 1–April 30	5 Wolves
Trapping:	November 10–April 30	No Limit

Board of Game Actions and Emergency Orders. No Board of Game actions or emergency orders were issued for this unit during the report period.

Hunter/Trapper Harvest. During the 1996 regulatory year 8 wolves (4 males, 4 females) were harvested by local residents of Unit 1D (Table 1). Five of these were taken along the Chilkat River. In 1997, 3 wolves (1 male, 2 females) were taken, and the 1998 harvest was 4 wolves (1 male, 2 females, and 1 of unknown sex).

As in past years, hunters harvested more wolves than trappers did during the report period. The combined harvest for 1996–1998 was 15 wolves, comprising 13 (87%) harvested with firearms and 2 (13%) harvested with traps. This is partly due to the ease with which hunters detect wolves on the Chilkat River flats. The color of these wolves was 2 white, 6 gray, and 7 black.

Harvest Chronology. There was no pattern to the harvest timing during the report period (Table 2), and numbers are so low that one individual could change the harvest pattern by taking a few wolves at a different time.

Transport Methods. Access methods used by trappers and hunters who took wolves during the report period show little consistency year to year (Table 3). Because the harvest is small and few hunters and trappers are represented in more than a single year, inconsistency is not surprising. Again, 1 or 2 individuals focusing on hunting or trapping in the subunit could dominate the harvest data.

Other Mortality

No natural mortality was documented during the report period.

CONCLUSIONS AND RECOMMENDATIONS

The current status of the Unit 1D wolf population is uncertain. Little effort is made to take wolves in the area, but with lower moose numbers than in the past in the Chilkat Valley, any noticeable predation raises public concern. Balanced against this are the nonconsumptive values that wolves may offer ecotourism operations. Wolf management planning in 1991 and 1992 showed most local respondents preferred no wolf control and some even recommended no harvest of wolves be allowed. No changes in seasons or bag limits are recommended at this time.

PREPARED BY:
Neil L. Barten
Wildlife Biologist III

SUBMITTED BY:
Bruce Dinneford
Management Coordinator

Table 1 Unit 1D wolf harvest chronology, 1988–1998

Regulatory year	Males	Females	Unknown	Total
1988	0	1	0	1
1989	3	1	1	5
1990	0	1	0	1
1991	0	0	0	0
1992	0	3	0	3
1993	1	0	0	1
1994	1	1	0	2
1995	1	2	0	3
1996	4	4	0	8
1997	3	0	0	3
1998	1	2	1	4

Table 2 Unit 1D wolf harvest chronology, 1988–1998

Regulatory year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1988						1						
1989				3		1			1			
1990					1							
1991												
1992						1	2					
1993				1								
1994					1				1			
1995				1					1	1		
1996			2				2			4		
1997				1	1		1					
1998						2	1		1			

Table 3 Unit 1D wolf harvest percent by transport method, 1988–1998

Regulatory year	Airplane	Dogsled, skis, & snowshoes	Boat	3- or 4-wheeler	Snow-machine	ORV	Highway vehicle	Unknown
1988			100					
1989				20	20		60	
1990							100	
1991								
1992	67						33	
1993			100					
1994							100	
1995					33		33	33
1996			43		14		43	
1997		25	25				50	
1998		25			25		50	

LOCATION

GAME MANAGEMENT UNIT: 2 (3600 mi^2)

GEOGRAPHIC DESCRIPTION: Prince of Wales and adjacent islands south of Sumner Strait and west of Kashevarof Passage

BACKGROUND

Wolves live throughout the islands of Unit 2, and densities on Prince of Wales and the surrounding maritime-influenced offshore islands are generally higher than on the nearby Unit 1A mainland. Wolves are capable swimmers and regularly travel between adjacent islands in search of prey. Movements between Unit 2 and the mainland are likely much less frequent.

Wolves feed primarily on deer in southern Southeast Alaska, particularly on islands in the area. Unit 2 wolves depend on deer for the majority of their diet. Black bears are also occasionally killed by wolves, but probably provide a small portion of their diet. Marine mammals, salmon, waterfowl, and small mammals supplement the diets of wolves in the area.

The coloration of Southeast Alaska wolf pelts varies; however, the brown/gray color phase is most common. During the past decade, white or near-white pelts have comprised less than 1% of the harvest while black pelts have accounted for about 14% of the Unit 2 harvest.

From 1915 through the early 1970s, a cash bounty was paid for wolves taken in Southeast Alaska, and in the 1950s Federal agents poisoned wolves on many Southeast islands in an effort to increase or maintain deer numbers. None of these programs had long-lasting effects on wolf abundance or distribution. In 1990, Southeast Alaska wolves (named by some taxonomists as the Alexander Archipelago wolf), were identified by a USDA Forest Service-sponsored interagency committee as a species for which there were concerns about viability or distribution as a result of extensive timber harvesting in the Tongass National Forest. In 1993, the Biodiversity Legal Foundation (Boulder, CO) and an independent biologist from Haines Alaska, filed a petition with the U. S. Fish and Wildlife Service (FWS) requesting that wolves in Southeast Alaska be listed as a threatened subspecies pursuant to the Endangered Species Act. The FWS ruled that listing was not warranted at the time, but indicated that they felt it was clear that without significant changes to the existing Tongass Land Management Plan the long-term viability of the Southeast wolves was seriously imperiled. A comprehensive conservation assessment about Southeast Alaska wolves was subsequently prepared through the USDA Forest Service (Person et al. 1996). The most important consideration identified in the assessment was the need to maintain long-term carrying capacity for deer, the principal prey for most of the wolf population. The authors suggested that a series of old-growth forest reserves might provide an effective strategy to increase the likelihood that wolves will persist where extensive timber harvesting has occurred or is planned. In 1996 the Board of Game (BOG) recommended a harvest cap of 25% of the annual Unit 2 wolf population estimate. This change went into effect during the 1997/98 hunting and trapping season. In fall 1999 the Unit 2 wolf population was estimated to be about 350 wolves. The harvest guideline was reached during the 1999/00 trapping season and an emergency order was issued closing the remainder of the hunting and trapping season February 29, 1999.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Our objectives are to maintain an average annual harvest of at least 39 wolves from Unit 2. This level reflects the average harvests for this unit during 1984–1990.

METHODS

We obtained harvest information through a mandatory sealing program. Throughout Southeast the left foreleg must remain attached to the hide until it is sealed for aging purposes. Information obtained from hunters and trappers included the number and sex of harvested wolves, date and location of harvest, method of take, transportation used, and pelt color. We obtained anecdotal information about wolves from hunters and trappers as well as from department staff. Additional information was obtained from trappers through an annual mail-out survey. We also obtained information from research programs on both Heceta Island and POW looking at predator prey relationships.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Using a simulation model based on data collected through a graduate research project in Unit 2, Person and Ingle (1995) estimated that 321 wolves (SE = 135) inhabited Prince of Wales and Kosciusko islands during autumn 1994 and 199 wolves (SE = 111) during spring 1995. The smaller spring estimate reflected over-winter mortality, primarily from trapping (Table 1). No current data of a similar nature is available, nor are subsequent estimates available. Consistently high harvests during the past 5 seasons (Table 1) suggest that wolves have remained relatively high in that area as well, although declines in the *indices of abundance* suggest that the population may have declined slightly during the past 3 seasons (Kephart 2000).

Pack sizes on Prince of Wales and Kosciusko islands were larger, averaging 7 to 9 wolves in early autumn before the trapping season (Person and Ingle 1995). All members of wolf packs are rarely observed together, except during winter, and pack sizes are therefore difficult to estimate unless repeated, direct observations are made (Person et al. 1996).

Distribution and Movements

On Prince of Wales and Kosciusko islands, Person et al. (1996) similarly reported average home ranges of 109 mi^2. Core areas where wolf activity was concentrated averaged 48 mi^2, or 55 to 60% smaller than total home ranges.

Pups that survive to adulthood either remain in their natal packs or disperse. In wolf populations where mortality is high, lone wolves may be more successful in finding vacant territories in which to settle or in being accepted into other established packs (Ballard et al. 1987). Dispersing wolves are more vulnerable than non-dispersers to hunting and trapping and are more likely to be killed by other wolves (Peterson et al. 1984).

MORTALITY

Season and Bag Limit	Resident and Nonresident	
Hunting:	December 1–March 31	5 wolves
Trapping:	December 1–March 31	no limit

Effective July 1, 1997 the left foreleg must remain attached to the hide until it is sealed.

Board of Game Actions and Emergency Orders. During fall 1996 the BOG considered a petition to list the Alexander Archipelago wolf as a threatened subspecies. The BOG recommended that the Unit 2 trapping and hunting season be shortened. Effective July 1, 1997 the hunting and trapping season was changed from August 1 through April 30 to begin December 1 and end March 31. The BOG also imposed a harvest cap of 25% of the estimated fall Unit 2 wolf population. The 1999 fall population in Unit 2 was estimated at about 350 wolves. This estimate was based on population modeling augmented by current radiotelemetry and demographic data. A harvest of 80–90 wolves would represent about 25% of the fall population. A harvest in excess of the guideline was determined to be non-sustainable in the long term and could lead to a population decline.

The 1999/00 season was the first time the harvest ever reached the BOG guideline and the season was closed on February 29 by emergency order. The difference during that particular trapping season was the increase in successful trappers. Historically there have been 3–4 trappers capable of harvesting more than 15 wolves each in Unit 2. This past season there were several new trappers working in Unit 2 with good success.

During the 1998/99 season on Heceta Island there were 4 functioning radios on collared wolves. Three of those continued to produce data, and one (25%) was killed by a trapper. During the 1999/00 season 4 collars were functioning and 3 (75%) have since been killed by trappers. Nine collars were deployed on POW wolves during 1999, and 2 (22%) were subsequently killed by trappers.

Hunter/Trapper Harvest. About 85% of the wolves harvested during the past 2 seasons were caught in traps or snares, while the other 15% were shot (Table 1). The number of people harvesting wolves declined during the past 2 seasons while the average catch per person increased. On average 32 successful trappers took 2.3 wolves each during the season in Unit 2. However, during the 1997/98 season there were only 21 trappers, yet the average catch per trapper (3.8) was the highest since 1985/86 (Table 4).

Hunter Residency and Success. Nonlocal residents have accounted for 34% of the hunters and trappers who took wolves in Unit 2 during the past 10 years. However, despite the high percentage of nonlocals killing wolves in Unit 2, most (63%) wolves harvested are regularly taken by residents of the unit. Only 3% are taken by nonresidents (Table 5).

Harvest Chronology. Wolf harvests are generally affected by local weather conditions. Persistent freezing often makes intertidal sets inoperative and deep snow can bury snares and trail sets

rendering them useless. Typically the Unit 2 harvests have been highest during December and January. However, during the past 2 years the majority of wolves were taken during February (38%).

On average 34% of the harvest has been taken by shooting (both by trappers and hunters) during the past 10 years. Starting in 1997 the opening date for the hunting and trapping seasons was changed from August 1 to December 1, shortening the trapping season by 4 months. The number of wolves taken by shooting was consequently reduced, likely because hunters were not allowed to shoot wolves opportunistically during fall deer hunts.

Transport Methods. Highway vehicles and boats continue to account for the majority of the transport methods used by wolf hunters and trappers in Unit 2. Highway vehicles accounted for 54%, boats 45%, and walking 1% of the transport methods used during the past 2 years (Table 2).

Other Mortality

In exploited populations, mortality from natural causes (e.g., starvation, accidents, disease, and fighting) is low, typically averaging 5 to 10% per year (Fuller 1989). A more substantial cause of mortality is believed to result from unreported or illegal killing of wolves by people (Person et al. 1996). Of 17 radio-collared wolves on Prince of Wales Island that died during a 3-year study, 53% were legally killed by humans, 29% were killed by humans but not reported, and 18% died from natural causes (Person et al. 1996). Considering the additive effects of natural and unreported mortality, total mortality could be 35 to 50% higher than reported, although some bias may have existed against reporting legally killed wolves with radio collars. Regardless, we believe that reported mortality substantially underestimates total mortality in Unit 2.

HABITAT

Assessment

As we have reported previously (Wood 1990, Larsen 1991) and as Person et al. (1996) reiterated recently, the expanding road system and increasing human population in Unit 2 will continue to have a direct effect on wolves. We expect long-term reductions in wolf numbers as a direct result of deer declines through habitat loss. As the uneven-aged old growth forest is logged, deer carrying capacity will be reduced, and consequently wolf populations will decline as well. To help mitigate the effects of habitat loss, Person et al. (1996) suggested maintaining large, unfragmented and unroaded blocks of habitat within biogeographic areas where extensive timber harvesting has occurred, or where extensive harvesting is planned. They believe that making Old Growth Reserves large enough to encompass the core activity areas of at least one wolf pack would markedly increase the likelihood of their effectiveness and reduce the long-term risk to wolf viability.

CONCLUSIONS AND RECOMMENDATIONS

We believe that wolf populations have decreased slightly in Unit 2 during this report period. Although we do not consider wolves threatened in southern Southeast Alaska at this time, we have conservation concerns stemming from long-term habitat changes, human population growth, and increased roaded access into once remote wolf habitats. We support the concept of

establishing roadless reserves within logged areas. Current Old Growth Reserves appear to be providing some temporary refugia for wolves. Few wolves have been harvested in the reserves recently due to limited access.

By shortening the trapping season to coincide with the period of maximum pelt primeness (December 1–March 31) we have reduced the annual wolf harvest by an estimated 12%. The new regulation change relieves some concern about harvesting beyond a sustainable level in Unit 2 where habitat changes and increased access are notable.

The Unit 2 wolf harvest approached the BOG established guideline harvest level in winter 2000, and consequently the season was closed by emergency order effective February 29. Suitable weather conditions and an increase in the number of successful trappers resulted in a harvest that may surpass 100 wolves.

Trappers continue to harvest between 22%–75% of collared wolves from ongoing Unit 2 research programs.

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PREPARED BY:

Boyd Porter
Wildlife Biologist II

SUBMITTED BY:

Bruce Dinneford
Management Coordinator

Table 1 Unit 2 wolf harvests, 1985–1998

					Method of take			Pelt color			
Season	Males	Females	Unk	Total	Shot	Trapped	Unk	White	Grey	Black	Unk
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
1993/94	46	54	3	103	21	81	1	0	80	15	8
1994/95	50	32	3	85	21	64	0	0	82	2	1
1995/96	62	41	0	103	35	68	0	0	90	12	1
1996/97	82	30	0	132	24	108	0	0	118	14	0
1997/98	49	31	0	80	8	72	0	1	66	4	9
Totals	529	381	19	949	325	621	3	3	805	117	24

Table 2 Unit 2 wolf hunter/trapper transport methods, 1985–1998

Season	Air	Boat	Highway vehicle	Walked	Unknown
1985/86	0	4	5	0	9
1986/87	0	14	25	0	0
1987/88	0	31	20	0	4
1988/89	2	25	15	0	3
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
1993/94	1	59	42	0	1
1994/95	1	57	25	2	0
1995/96	3	60	39	0	1
1996/97	0	44	86	1	1
1997/98	0	51	29	0	0
Totals	12	493	404	4	36

Table 3 Unit 2 wolf harvest chronology, 1985–1998

Season	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
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[a]	0	1	3	8	10	19	15	16	28	4	1	0
1993/94	0	1	2	6	11	24	33	16	8	2	0	0
1994/95	0	1	2	4	4	22	18	19	12	3	0	0
1995/96	0	2	8	8	1	15	22	19	27	1	0	0
1996/97[b]	0	3	7	7	2	12	26	51	21	3	0	0
1997/98	0	0	0	0	0	20	27	30	3	0	0	0
Totals	1	18	47	62	61	175	186	200	134	39	16	10

[a] Hunting season changed from year round, no limit, to August 1–April 30, 5 wolf limit.

[b] Hunting and trapping seasons changed from August 1–April 30 to December 1–March 31.

Table 4 Numbers of trappers who caught wolves in Unit 2, and average catch per trapper, 1985–1998

Season	Number of trappers that harvested wolves	Average catch/trapper
1985/86	14	1.3
1986/87	27	1.4
1987/88	34	1.6
1988/89	31	1.4
1989/90	28	1.1
1990/91	42	1.6
1991/92	37	2.3
1992/93	35	3.0
1993/94	30	3.4
1994/95	37	2.3
1995/96	38	2.7
1996/97	36	3.7
1997/98	21	3.8

Table 5 Residency of Unit 2 wolf trappers/hunters, 1990–1998

Season	Local resident[a]	Nonlocal resident[b]	Nonresident
1990/91	24	18	0
1991/92	19	15	3
1992/93	18	16	1
1993/94	24	6	0
1994/95	24	11	2
1995/96	18	20	0
1996/97	30	5	1
1997/98	18	3	0
Totals	175	94	7

[a] Local residents are those individuals living within the boundaries of Unit 2.

[b] Nonlocal residents are Alaska residents living somewhere outside Unit 2.

LOCATION

GAME MANAGEMENT UNIT: Unit 3 (3,000 mi^2)

GEOGRAPHIC DESCRIPTION: Islands of the Petersburg, Wrangell, and Kake area

BACKGROUND

Wolves have inhabited Unit 3 islands since the postglacial immigration and establishment of deer populations. Deer are the primary food source for wolves in Southeast Alaska, with moose being important in some areas. Wolf densities are higher in Unit 3 than in Interior regions of Alaska, but due to the dense forest cover, viewing opportunities are infrequent.

Government wolf control programs and bounties were maintained into the 1970s in an effort to increase deer numbers. Today a few recreational trappers and opportunistic sport hunters harvest wolves.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain a viable population in all areas of historic wolf range.

METHODS

We monitored the wolf harvest through a mandatory pelt-sealing program. We collected data on the number of wolves killed, sex, date of take, method of take, method of transportation used from home to the field, and the estimated number of wolves associated with the ones killed. We collected the left foreleg from each sealed wolf to determine whether it was an adult or subadult.

In a cooperative program with the U.S. Forest Service, we radiocollared 1 female and 3 male wolves on Kupreanof Island.

We recorded observations of wolves made by Forest Service biologists, trappers, hunters and other members of the public. An annual statewide trapper survey supplied additional information.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We did not collect sufficient data to make a meaningful estimate of wolf populations. Conversations with trappers, hunters, pilots, and other biologists and information from trapper questionnaires indicated the wolf population increased during the 1990's corresponding to the increase in deer numbers.

MORTALITY

Harvest

Season and Bag Limit	Residents and Nonresidents	
Trapping:	November 10–April 30	No limit
Hunting:	August 1–April 30	5 wolves

Board of Game Actions and Emergency Orders. There was no pertinent Board of Game actions or emergency orders issued during this report period.

Hunter/Trapper Harvest. In 1996/97, 24 individuals harvested 59 wolves, in 1997/98 23 individuals harvested 43 wolves, and in 1998/99 22 individuals harvested 34 wolves (Table 1). In 1997/98 adults comprised 58% of the kill, and in 1998/99 58% were adults (Table 2). Wolves were not aged in 1996/97.

Trapping is usually the primary method of take, but in 1998/99 18 of 34 harvested wolves were shot. Deer hunters, and occasionally moose hunters, are generally responsible for shot wolves.

Most of the wolf harvest takes place in close proximity to local communities. Much of Unit 3 is not trapped for wolves.

Harvest Chronology. In 1996/97, February, March, and April accounted for the highest percent of the harvest (Table 3). January and February accounted for the highest percentage of the harvest in 1997/98. In 1998/99, October, February, and April accounted for the highest percent of the harvest.

Transport Methods. Trappers using small boats (Table 4) harvest the majority wolves. Some trapping occurs from the road system on Mitkof and Wrangell islands. Other forms of transportation are rarely used.

CONCLUSIONS AND RECOMMENDATIONS

Wolf populations and harvest have both increased in recent years. Much of Unit 3 is not trapped. I recommend no change in regulations.

PREPARED BY:
Edward B. Crain
Wildlife Biologist III

SUBMITTED BY:
Bruce Dinneford
Management Coordinator

Table 1 Unit 3 wolf harvest, 1988–98

Regulatory year	Reported harvest				Method of take			
	M	F	Unk.	Total	Trap/snare	Shot	Unk.	Successful trappers/hunters
1988/89	5	5	0	10	5	5	0	6
1989/90	12	10	0	22	12	10	0	13
1990/91	11	7	0	18	15	3	0	10
1991/92	26	25	0	51	33	17	1	25
1992/93	12	14	0	26	19	7	0	13
1993/94	27	19	2	48	37	11	0	20
1994/95	31	23	0	54	38	16	0	15
1995/96	27	13	0	40	26	13	1	20
1996/97	32	27	0	59	43	16	0	24
1997/98	25	16	2	43	29	14	0	23
1998/99	16	18	0	34	16	18	0	22

Table 2 Age of Unit 3 harvested wolves[1], 1997–98

Regulatory year	Adults	Subadults[2]	% adults
1997/98	22	16	58
1998/99	15	11	58

[1] Not all harvested wolves were aged.
[2] Less than 1 year of age.

Table 3 Unit 3 wolf harvest chronology, percent by month, 1988–98

Table 3 Unit 3 wolf harvest chronology, percent by month, 1988–98

Regulatory year	Harvest periods													
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	Unk	*n*
1988/89	10	0	10	0	0	0	0	50	0	20	10	0	0	10
1989/90	0	9	9	16	0	32	13	4	13	4	0	0	0	22
1990/91	0	6	0	6	0	11	28	22	16	11	0	0	0	18
1991/92	0	0	8	8	14	8	15	15	12	10	6	4	0	51
1992/93	0	0	15	4	0	12	35	0	15	19	0	0	0	26
1993/94	0	4	4	9	4	27	20	10	13	9	0	0	0	48
1994/95	0	2	4	2	11	15	20	7	11	9	0	0	19	54
1995/96	0	2	5	13	8	23	12	18	15	2	2	0	0	40
1996/97	0	0	3	5	7	10	7	20	24	22	2	0	0	59
1997/98	0	0	7	9	9	7	19	26	9	14	0	0	0	43
1998/99	0	0	6	18	9	3	12	8	18	26	0	0	0	34

Table 4 Unit 3 wolf harvest, percent by transport method, 1988–98

Regulatory year	Percent of harvest							
	Airplane	Boat	3/4 wheeler	Snowmachine	ORV	Highway vehicle	Other	*n*
1988/89	10	70	0	0	0	20		10
1989/90	0	77	5	0	0	18		22
1990/91	0	72	0	17	0	11		18
1991/92	4	69	0	0	0	22	6	51
1992/93	4	85	0	0	0	12		26
1993/94	4	81	0	0	0	13	2	48
1994/95	0	89	0	4	0	5	2	54
1995/96	0	85	0	0	0	13	2	40
1996/97	1	73	0	0	19	7		59
1997/98	2	85	2	0	2	9		43
1998/99	6	74	0	0	0	20		34

LOCATION

GAME MANAGEMENT UNIT: 5 (5800 mi^2)

GEOGRAPHIC DESCRIPTION: Cape Fairweather to Icy Bay, eastern Gulf Coast

BACKGROUND

Lifelong residents of Yakutat report that wolves were present on the Yakutat Forelands prior to the immigration of moose in the early 1930s (ADF&G files). Klein (1965) suggested that wolves reached this area through the Alsek/Tatsenshini River valley. Interestingly, there were no reports of wolves on the west side of Yakutat Bay (Unit 5B) before 1971, well after moose were established there. However, based on anecdotal information, a viable wolf population was probably established there by 1976.

In the winter of 1977, Yakutat Area Wildlife Biologist R. Quimby estimated a minimum of 6 different packs in Unit 5A, including Situk, Ahrnklin, Dangerous/Italio, Akwe, Tanis Mesa/East Alsek, and Doame/Clear packs. He estimated minimum pack sizes of 9, 7, 6, 3, 5, and 6, respectively, for a total of 36 wolves. He extrapolated this to a minimum of 45–50 animals (pre-pupping), estimating a density of 1 wolf/15 mi^2. However, the presence of a breeding population of wolves in Unit 5B was undetermined at that time. In winter 1979, area wildlife biologist R. Ball estimated the Unit 5A and 5B populations at 35 and 10 wolves minimum, respectively. By 1980 Ball felt wolf numbers were stable or increasing in Unit 5A, with a population estimate of 50 animals. By 1982 Ball suggested there might be a minimum of 12 wolves in Unit 5B in 2 packs. In 1985 B. Dinneford reported an increased number of accounts from local residents of moose mortality in winter months. These accounts may have reflected an increasing wolf population, responding to a larger moose population. Wolves probably subsisted mostly on mountain goats and salmon before the arrival of moose in the area. Salmon are considered very important for wolf maintenance, especially as a late fall/early winter food source.

Because of the decline in moose numbers and the apparent predation on moose by wolves, an attempt was made to reduce wolf numbers from 1974–76. This effort was unsuccessful, with only 1 wolf killed during 31 hours of aerial hunting. Bad weather, rough terrain, and dense forest prevented a higher take.

During the report period, interest in taking wolves in the subunit increased somewhat, primarily because of the efforts of a single trapper.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

No formal management goals have been established for wolves in this unit, however, general management objectives are to regulate seasons and bag limits to maintain populations of wolves for viewing and harvest. Our management strategy is to maintain wolf harvests at a level similar to the mean for the previous 5 seasons. No wolf control methods are contemplated for this area at this time.

METHODS

Through the mandatory sealing of wolves taken by successful hunters and trappers we collected the following data: date and method of take, sex, transportation mode, and number of animals in the pack the wolf was taken from. We also required hunters and trappers to leave the lower front leg bone attached to the hide for sealing. We used this bone to separate wolves into 3 age categories, including juveniles (less than 1 year of age), yearlings, and adults. ADF&G and Fish and Wildlife Protection staff in Yakutat sealed wolves. The population was monitored by whatever means were available, including anecdotal reports, aerial survey sightings, discussions with hunters and trappers, and information collected from the annual statewide trapper surveys.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We did not collect sufficient data to make meaningful estimates of wolf populations within the Unit. Although no quantitative data is available, anecdotal reports and discussions with local hunters, trappers, and pilots suggest wolf numbers are stable.

MORTALITY

Harvest

Seasons and Bag Limits

Hunting:	August 1–April 30	5 Wolves
Trapping:	November 10–April 30	No Limit

Board of Game Actions and Emergency Orders. No Board of Game actions or emergency orders were issued for this unit during the report period.

Hunter/Trapper Harvest. Difficult travel conditions and inconsistent weather (heavy snows often changing to rain) in the Yakutat area restricts hunting and trapping effort for wolves.

Twenty-four wolves (8 males and 16 females) were taken in Unit 5 during the 1996 regulatory year (Table 1). This is almost twice the harvest as recorded in any other year since 1998 (Table 1), and one local took 75% of these wolves resident. This compares to the prior 5-year mean of 9.6 (range = 4–13). Eleven wolves were killed in the Situk/Ahrnklin rivers area, 4 in the Dangerous River area, 2 in Russell Fiord, and 2 west of Yakutat Bay in Unit 5B. In 1997, 3 wolves (2 males, 1 female) were harvested. This compares to the prior 5-year mean of 12.2 (range = 3–24). One was taken along the Alsek River, 1 from Russell Fiord, and 1 from the Akwe River. In 1998, 7 wolves (4 males, 3 females) were harvested. Three were taken near Harlequin Lake, 2 near the Akwe River, 1 near the Old Situk River, and 1 from Unit 5B.

Trapping and snaring continue to be the primary method of take. The combined harvest for 1996–1998 was 34 wolves, comprising 19 (56%) taken in traps or snares, and 15 (44%) that were shot. There were 12 white wolves, 11 gray, 7 black, and 3 of unknown color.

Hunter/Trapper Residency and Success. In 1996, 5 local residents and 2 nonresidents accounted for the entire wolf harvest. In 1997, 2 local residents, 1 non-local Alaskan, and 1 nonresident accounted for the harvest. In 1998, 4 local residents and 1 nonresident reported taking wolves. All wolves harvested by nonresidents were shot, almost always while hunting other game such as bear or moose.

Harvest Chronology. Trapping harvest occurred throughout the winter months (Table 2), although in 1996 twelve wolves were taken in March and April. It is worth noting that this intensive spring effort was the result of 1 trapper.

Transport Methods. During the report period successful trappers and hunters used varied transport modes, showing little consistency year to year (Table 3). Because of the small harvest, 1 or 2 serious trappers using consistent transport methods dominate this category.

Other Mortality

In 1997 a vehicle on Forest Service Road 10 killed a male wolf, and another was found dead in a snare after the close of the trapping season.

CONCLUSIONS AND RECOMMENDATIONS

Our knowledge of the wolf populations in Unit 5 is limited to information provided by hunters, trappers, local pilots, trapper surveys, and incidental observations by Department of Fish and Game staff. From these data sources, it appears that the wolf population is stable throughout the unit. The populations of moose and mountain goats are doing well, and along with the few deer and abundant beaver in the area, these prey species should continue to support wolves. Because of the difficult access and inclement weather in most of the unit, the pressure exerted on the overall wolf populations will probably remain low. No changes in seasons or bag limits are recommended at this time.

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PREPARED BY:
Neil L. Barten
Wildlife Biologist III

SUBMITTED BY:
Bruce Dinneford
Management Coordinator

Table 1 Unit 5 wolf harvest, 1988–1998

Regulatory year	Males	Females	Unknown	Total
1988	3	5	0	8
1989	7	6	0	13
1990	4	3	0	7
1991	8	3	0	11
1992	2	2	0	4
1993	6	3	0	9
1994	10	2	3	15
1995	6	3	0	9
1996	8	16	0	24
1997	2	1	0	5
1998	4	3	0	7

Table 2 Unit 5 wolf harvest chronology by month, 1988–1998

Regulatory year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1988			2	1	1	1		2			1	
1989			4	1	1				1	2	4	
1990			1	1	1		1			1	2	
1991		2	1			1		3	3	1	2	
1992			1	1						2		
1993		1				1	2	1		4		
1994			2		1	3		3	3	2		
1995			1			1	2	1	3	1		
1996			3	2	2		4	1	11	1		
1997			1	1		1						
1998			2	3						2		

Table 3 Unit 5 wolf harvest percent by transport method, 1988–1998

Regulatory year	Airplane	Dogsled, skis, & snowshoes	Boat	3 or 4 wheeler	Snow-machine	ORV	Highway vehicle	Unknown
1988	88			12				
1989	38		8	15		8	31	
1990	43		43		14			
1991	46	8		38			8	
1992	75		25					
1993	44		22				33	
1994	7		2				5	
1995	44			11			33	11
1996	25			75				
1997	67		33					
1998	86		14					

LOCATION

GAME MANAGEMENT UNIT: 6 (10,140 mi^2)

GEOGRAPHIC 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 were 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. They peaked in the mid 1980s. The population declined during the late 1980s (Carnes et al. 1996) and stabilized at a lower density during the 1990s (Nowlin 1997). Wolves inhabit 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 DIRECTION

MANAGEMENT OBJECTIVES

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

METHODS

No systematic wolf surveys were completed. I estimated population size and distribution before the trapping season, using U.S. Forest Service data and incidental observations by staff and the public. Forest Service data were collected during 1992–96 in Units 6A, 6B and 6C using radiotelemetry (Stephenson et al. 1993, Carnes et al. 1996).

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 mode, sex, and pack size.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The wolf population was approximately 48–62 in 1998–99, composed of 8 packs and loners. Numbers were probably stable over the past 5 years.

Distribution

Numbers varied among units in 1998–99. Unit 6A had approximately 24–30 wolves with 4 packs present. Unit 6B had 14–17 with 2 packs. Unit 6C had 2–4 lone wolves, and Unit 6D had 10–14 wolves with 3 packs.

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, with no bag limit.

Board of Game Actions and Emergency Orders. The Board of Game took no actions and no emergency orders were issued during this reporting period.

Hunter/Trapper Harvest. Reported annual harvest during this reporting period was 6–12 wolves, composed of 27–67% females (Table 2). Nine wolves were trapped and 11 shot. Total estimated unreported and illegal harvest was 4–5. Harvest of 12 wolves during 1996/97, most in Unit 6A, was the highest on record

Hunter Residency and Success. The number of successful hunters and trappers was 5–11.

Harvest Chronology. Wolves were taken throughout the season during 1996/97, and from November through April during 1997/98 (Table 3). Heavy snowfall during 1998/99 restricted hunting and trapping effort to early and late in the season.

Transport Methods. During this reporting period the primary methods of transportation were airplanes, snowmachines and highway vehicles (Table 4).

CONCLUSIONS AND RECOMMENDATIONS

The population objective was achieved. Number of packs exceeded the minimum of 5. The 40–60 wolves in the population were lightly harvested and could sustain the take of 10 animals specified in the objective. No management changes are recommended.

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PREPARED BY:

David W. Crowley
Wildlife Biologist II

SUBMITTED BY:

Michael G. McDonald
Wildlife Biologist III

Table 1 Unit 6 fall wolf population estimates[a], 1994–98

Regulatory Year	Population estimate	Number of packs	Basis of estimate
1994/95	40–60	9	b
1995/96	47–61	8	b,c
1996/97	46–61	10	b,c
1997/98	44–58	9	b,d
1998/99	48–62	8	b,d

[a] Pre-trapping season.

[b] Incidental observations.

[c] Radiotelemetry (Carnes et al. 1996).

[d] US Forest Service, Cordova Ranger District telemetry.

Table 2 Unit 6 wolf harvest, 1994–98

Regulatory	Reported harvest				Estimated harvest		Method of take			Successful
Year	M	F	(%)	Total	Unreported	Illegal	Trap/snare	(%)	Shot	Total trap/hunt
1994/95	0	0	(0)	0	1	3	0	(0)	0	0
1995/96	3	2	(40)	5	2	4	1	(20)	4	5
1996/97	8	3	(27)	12	2	3	5	(50)	5	11
1997/98	4	2	(33)	6	2	2	3	(60)	2	4
1998/99	2	4	(67)	6	2	2	1	(20)	4	5

Table 3 Unit 6 wolf harvest chronology percent, 1994–98

Regulatory Year	Harvest periods									
	August	September	October	November	December	January	February	March	April	*n*
1994/95	0	0	0	0	0	0	0	0	0	0
1995/96	0	40	20	0	0	20	20	0	0	5
1996/97	8	8	17	0	25	8	25	0	8	12
1997/98	0	0	0	33	0	17	17	0	17	6
1998/99	0	33	33	0	0	0	0	33	0	6

Table 4 Unit 6 wolf harvest percent by transport method, 1994–98

Regulatory Year	Percent of harvest						
	Airplane	Dogsled skis Snowshoes	Boat	Snow-machine	ORV	Highway vehicle	*n*
1994/95	0	0	0	0	0	0	0
1995/96	40	0	20	20	0	20	5
1996/97	20	10	0	30	0	40	10
1997/98	20	0	0	60	20	20	5
1998/99	50	0	0	0	0	50	6

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).

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

Aerial track counts and observations by trappers conducted from 1975 to 1999 indicated the Kenai Peninsula wolf population increased rapidly during the early 1970s, then remained relatively stable at 200 animals. According to Peterson and Woolington (1981), annual mortality of radio-collared wolves in Subunit 15A was 38%. Pups composed 37% of the early winter population, reflecting the stability of the population in the northern portion of the Kenai Peninsula from 1976 to 1981. Natural mortality rates were low, despite the 1970s growth rate of the wolf population. Mortality rates, however, may be increasing because of 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 1986/87 ranged from 42 to 64 wolves and averaged 51, suggesting 25% of the estimated population was removed annually from 1978 to 1987.

In 1987 the Kenai National Wildlife Refuge imposed a 4-day trap check for trappers using most refuge-managed lands and the season was reduced. These restrictions reduced the harvest which, over the next 12 years, ranged from 9 to 49 wolves and averaged 24 animals, 12% of the estimated population.

Historically, most of the wolf harvest has been during trapping season, while most nonconsumptive uses were in summer and early fall. Almost all wolves have been taken for recreational purposes; the dollar value received for pelts has been a secondary benefit. Although some hunters have used aircraft to locate wolves, trappers and hunters operating from the road system have killed most wolves. 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. The 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 the refuge was closed to aircraft.

An infestation of biting lice (*Trichodectes canis*) was identified from 2 packs of wolves during 1982/83. Wolves from these packs in Subunit 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 both captured and treated, or a medication (Ivermectin) was injected into moose recently killed by wolves or placed in treated baits near kills. Both methods proved unsuccessful, and the incidence of infestation spread rapidly across the Kenai. Infested wolves are common; using acceptable means, we have little chance to control the parasite.

Following exhaustive searches over the years, infested wolves were only found on the Kenai Peninsula until they were discovered in Units 14 and 16 in December 1998. Three packs, totaling approximately 28 animals, were identified with *T. canis*. Treatment efforts by the department and harvesting of wolves by local trappers from these packs, treated or removed most of the infested wolves.

MANAGEMENT DIRECTION

Management Objectives

- To maintain a postseason population of 25–35 wolves in Subunit 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 Subunits 15B and 15C and Unit 7.

METHODS

Experienced pilots and observers conducted aerial surveys during November and December but only under suitable snow and tracking conditions. Local trappers provided additional information concerning wolf pack distribution and size for unsurveyed areas. We monitored harvest 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 probably increased from previous years. However, lacking complete survey data, the estimated population for Units 7 and 15 remained at 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 5, 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 31 March, and there was no bag limit.

Board of Game Actions and Emergency Orders. The Board of Game increased the season length for trapping of wolves on the Kenai Peninsula by 31 days. Previously the season ended on 28 February.

Hunter/Trapper Harvest. Twenty-four wolves were killed during the hunting and trapping seasons in 1997/98, and 49 in 1998/99 in Units 7 and 15 (Table 3). The sex ratio was 14 (58%) males and 10 (42%) females in 1997/98 and 25 (56%) males and 20 (44%) females in 1998/99 (Tables 4 and 5). The mean annual harvest (37) for these 2 years represented an annual harvest rate of 19% of the estimated population.

The combined harvest for 1997/98–1998/99 was 73 wolves, comprising 37 (51%) taken by trapping or snaring and 35 (49%) by ground shooting (n=72).

Harvest Chronology. The combined harvest chronology for 1997/98–1998/99 was August, 1 (1%); September, 6 (8%); October, 4 (5%); November, 3 (4%); December, 9 (12%); January, 18 (25%); February, 14 (19%); March, 9 (12%), and Other, 9 (12%). Twenty-seven percent (20) of the harvest occurred before or after trapping season (Table 6).

Transport Methods. Transportation methods used to access traplines varied each year, depending on snow and ice conditions. Combined methods (n = 64) for 1997/98–1998/99 were aircraft 0 ; horse/dog team 1 (2%); boat 1 (2%); ATV 1 (2%); snowmachine 45 (70%), and highway vehicle 16 (25%).

CONCLUSIONS AND RECOMMENDATIONS

A mean annual harvest of 37 wolves during the past 2 years represents 19% 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 U S Fish and Wildlife Service (FWS) 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 FWS implemented several new restrictions on trappers using the refuge. These restrictions included a mandatory trapper orientation course before obtaining a permit, closures to trapping (except mink and muskrat) within 1 mile of a road and 2 miles from a trailhead or campground, prohibition of toothed traps and the requirement that traps be tagged by the owner. These new permit conditions to trap on the refuge, a limited season

on lynx harvest by the Board of Game, and the poor quality of lice-infested wolf pelts have reduced trapper effort and opportunity.

I recommend that we discontinue the quota system for Unit 15A. With low effort and harvest (average 8 from 1994–1999), 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 one population, accepting the fact that a some packs living close to developed areas will sustain heavy harvests in some years. The increased harvest in 1998/99 was probably the result of an increase in wolf density. Wolf survival probably increased during the severe winters of 1997/98 and 1998/99 when large numbers of moose died from winter stress. Allowable harvest should not exceed 35% or a 3-year mean annual harvest of 70 wolves.

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PREPARED BY:
Ted H. Spraker
Wildlife Biologist

SUBMITTED BY:
Michael G. McDonald
Assistant Management Coordinator

Table 1 Unit 7 fall wolf population estimate[a], 1994–1999

Year	Population estimate	Number of packs	Basis of estimate
1994/95	45	6	b
1995/96	45	6	b
1996/97	45	6	b
1997/98	45	6	b
1998/99	45	6	b

[a] Fall estimate = pretrapping season population.
[b] Estimates derive from incidental observations of staff, sealing records, and reports from public.

Table 2 Unit 15 fall wolf population estimates[a], 1994–99

Year	Population estimate	Number of packs	Basis of estimate
1994/95	155	14	b
1995/96	155	14	b
1996/97	155	14	b
1997/98	155	14	b
1998/99	155	14	b

[a] Fall estimate = pretrapping season population.
[b] Results of research and management studies in addition to incidental observations and trapper reports.

Table 3 Known wolf mortality in Units 7 and 15, 1994–1999

	Unit				
Year	7	15A	15B	15C	Total
1994/95	7	7	3	3	20
1995/96	17	6	10	9	42
1996/97	9	10	5	6	30
1997/98	7	7	2	8	24
1998/99	12	9	7	21	49

[a] Trapping season 10 November–28 February.

Table 4 Unit 7 wolf harvest, 1994–99

Regulatory year	Reported Harvest			Method of Take			Successful Trappers/hunters
	M	F(%)	Unk	Trap/snare (%)	Shot	Unk	
1994/95	3	4(57)	0	3(43)	4	0	6
1995/96	11	5(31)	1	11(65)	6	0	12
1996/97	3	6(67)	0	5(63)	3	1	7
1997/98	6	1(17)	0	4(57)	3	0	6
1998/99	8	3(27)	1	7(58)	5	0	10

Table 5 Unit 15 wolf harvest, 1994–99

Regulatory year	Reported Harvest			Method of Take			Successful Trappers/hunters
	M	F(%)	Unk	Trap/snare (%)	Shot	Unk	
1994/95	5	7(67)	1	9(69)	4	0	9
1995/96	11	14(56)	0	12(48)	13	0	17
1996/97	12	9(43)	0	10(48)	10	1	17
1997/98	8	9(53)	0	7(41)	10	0	14
1998/99	17	17(50)	3	19(53)	17	1	27

Table 6 Harvest chronology for wolves in Units 7 and 15, 1994–1999

	Month									
Year	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Other	Total
1994/95	0	5	0	1	5	1	7	1	0	20
1995/96	4	2	1	4	12	8	4	7	0	42
1996/97	1	4	0	1	3	9	8	3	1	30
1997/98	0	3	4	0	5	4	3	0	5	24
1998/99	1	3	0	3	4	14	11	9	4	49

LOCATION

GAME MANAGEMENT UNITS: 9 (33,638 mi^2) and 10 (1586 mi^2)
GEOGRAPHIC DESCRIPTION: Alaska Peninsula and Unimak Island

BACKGROUND

Wolves are found 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 reduced by wolf control work during the 1950s. After the end of the federal wolf control program, wolves increased and thereafter were primarily affected by prey abundance and periodic outbreaks of rabies. Conditions favorable for land-and-shoot and ground-based trapping have been rare over the past 20 years, so harvests have had relatively little influence on wolf numbers.

Prey abundance has varied during the past 30 years. Moose densities increased during the 1950s and 1960s and then decreased during the 1970s in all areas north of Port Moller. Moose numbers have been relatively stable during the past 20 years. The Mulchatna caribou herd increased from about 14,000 in 1974 to over 200,000 in 1996. The Northern Alaska Peninsula Caribou Herd (NAPCH) increased from about 13,000 in the mid-1970s to about 20,000 in 1984. During the next 10 years, the NAPCH remained relatively stable at 15,000–18,000. During the 1993–94 regulatory year, it declined to about 12,500; and has continued to decline during the rest of this reporting period. Caribou decreased dramatically on Unimak Island from a peak of 5000 in 1975 to only a few hundred by 1977. No change in caribou numbers on Unimak Island occurred during the next 20 years, but during the late 1990s the herd has grown to about 600. The mainland segment of the Southern Alaska Peninsula Caribou Herd (SAPCH) peaked at over 10,000 in 1983, and then declined to 2000 by 1995. This segment of the SAPCH has recovered to about 3600 by 1999.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

During the previous reporting period, the management objective was to maintain a wolf population that will sustain a 3-year-average annual harvest of 50 wolves. Given the limitations imposed by climate and budget, it was impractical to set a management goal based on a desired wolf density or total population when there is no feasible way to measure whether we were meeting the objective.

METHODS

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

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

By piecing together observations of wolf packs and general knowledge of territory size, I estimate that Units 9 and 10 contain approximately 350 wolves. This is a conservative estimate, but it cannot be refined without considerable expense, combined with abnormally good snow and flying conditions.

Wolf numbers appear to have increased throughout Unit 9, despite the decline of the NAPCH since 1993. Although relatively few trapper questionnaires have been returned in recent years, trappers generally agree that wolf abundance has increased during this reporting period.

MORTALITY

Harvest

Season and Bag Limits. The hunting season in Units 9 and 10 was 10 August to 30 April, and the bag limit was 5 wolves. The trapping season in Units 9 and 10 was 10 November to 31 March with no bag limit.

Board of Game Actions and Emergency Orders. No actions were taken that specifically pertained to Units 9 or 10.

Hunter/Trapper Harvest. The wolf harvest for 1996-97, 1997–98 and 1998–99 were 37, 72, and 91, respectively, in Unit 9 (Table 1). No wolves were sealed from Unit 10 during this reporting period.

Hunter Residency and Success. Furbearer harvest records from sealing certificates do not contain information on individual hunters or trappers, so no information on residency or success is available.

Harvest Chronology. Harvest chronology continues to peak December–March (Table 2).

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

Other Mortality

One rabid wolf was confirmed in Port Heiden, and a number of rabid red foxes and 1 coyote were reported elsewhere in Unit 9E during 1998.

HABITAT

Assessment

No significant alteration to habitats occurred in Units 9 and 10 during this report period.

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 and methods of take and transportation do not seem reliable; analyses using these data are not recommended. I recommend no regulatory changes.

PREPARED BY:
Richard A. Sellers
Wildlife Biologist III

SUBMITTED BY:
Michael G. McDonald
Assistant Management Coordinator

Table 1 Units 9 and 10 wolf harvest, 1994/95–1998/1999

Regulatory	Reported harvest				Method of take			Successful
Year	M	F	Unk	Total	Trap/Snare	Shot	Unk	Trappers/Hunters
1994/95	16	13	0	29	14	14	0	14
1995/96	20	10	1	31	10	21	0	19
1996/97	19	15	3	37	5	31	1	21
1997/98	36	30	6	72	51	21	0	43
1998/99	57	32	2	91	60	25	6	41

Table 2 Units 9 and 10 wolf harvest chronology percent, 1994/95–1998/99

Regulatory Year	August	September	October	November	December	January	February	March	April	*n*
1994/95	0	14	7	14	0	24	7	3	0	29
1995/96	3	6	16	3	6	45	16	3	0	31
1996/97	3	19	3	8	19	11	24	14	0	37
1997/98	0	10	11	7	15	24	28	3	3	72
1998/99	1	1	1	0	3	24	24	34	3	91

Table 3 Units 9 and 10 wolf harvest percent by transport method, 1994/95–1998/1999

Regulatory Year	Airplane	Dogsled Skis Snowshoe	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway Vehicle	Unknown	*n*
1994/95	21	0	3	0	45	0	0	31	29
1995/96	58	0	0	0	16	0	0	10	31
1996/97	41	0	8	8	22	3	3	15	37
1997/98	32	0	0	21	39	3	5	0	72
1998/99	3	0	0	7	78	0	4	8	91

LOCATION

GAME MANAGEMENT UNIT: 11 (13,257 mi^2)

GEOGRAPHIC DESCRIPTION: Wrangell Mountains

BACKGROUND

Wolf population estimates and trends are unavailable for Unit 11 before the 1950s. Skoog (1968) assessed that wolf numbers were low from 1900 to the 1930s, then increased, according to written accounts by settlers. In 1948 the U.S. Fish and Wildlife Service initiated an extensive wolf control program that lasted 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 unit population of 100–125 animals. Population estimates were not made until 1985. The Unit 11 wolf population has been stable the last 10 years.

Although the size of wolf harvests before mandatory sealing is unknown, harvests were probably similar to harvests reported during the early 1970s because trapping seasons were comparable and there were no bag limits. Wolf harvests since 1972 have averaged 26 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 management goals for the unit or objectives for the population.

METHODS

We monitor the annual wolf harvest by sealing the hides of all wolves harvested in the unit. We collected information on wolf numbers and distribution from interviews with hunters and trappers when pelts were sealed and from incidental observations while conducting surveys for other species. No aerial track surveys were conducted in Unit 11 during this reporting period.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The spring 1998 and 1999 population estimates for Unit 11 were identical at 70–85 wolves in 10–12 packs (Table 1). Wolf numbers were similar to the 5-year (1993–97) mean population estimate of 80 wolves in Unit 11. Using survival rates for exploited wolf populations (Ballard et al. 1987), the estimated fall 1999 wolf population in Unit 11 was between 100 and 115 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. Telemetry data during the winter of 1996–97 showed some wolves also use the higher elevations, suggesting they also target sheep as prey. Wolf numbers in the lower Chitina river valley remain lower than in the northern portion of the unit because caribou are absent and moose less abundant. Wolves heavily utilized sheep and mountain goats in the lower Chitina Valley, but because of their smaller body size and difficult terrain, these prey did not support as large a wolf population.

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 and there was no bag limit.

Board of Game Actions and Emergency Orders. In 1993 the Board of Game passed a regulation allowing trappers to shoot wolves same-day-airborne, if the trapper was 300 feet away from the aircraft before shooting. Methods and means for taking wolves in Unit 11 remained unchanged until Proposition 3 passed during the November 1996 general election. This referendum prohibited taking of wolves the same day airborne unless the wolf was in a trap or snare, effective 25 February 1997.

Hunter/Trapper Harvest. Hunters and trappers harvested 36 wolves from Unit 11 during the 1998–99 season (Table 2). Harvests during this reporting period fluctuate between years but the 5 year average take of 25 wolves is similar to the 26 wolf average harvest since 1972, when sealing of wolves became a requirement. Males composed 49% of the take during this reporting period, down slightly from 57% of the reported harvest during 1991-95. Hunters and trappers reported taking most of the wolves from either the Nabesna Road or along the Copper River. This harvest pattern was similar to past years when harvests were near areas with easy access.

The harvest methods for wolves killed in Unit 11 over the past 8 years are provided in Table 2. Over the period 1994–99, trapping and snaring accounted for 91% of the harvest for which the method of take was known. Prior to 1987, when land-and-shoot was legal, this harvest method was popular and accounted for 25% of the wolf harvest between 1980 and 1987. Unreported and illegal harvests were minimal during the reporting period.

Hunter/Trapper Residency and Success. During the 1998–99 season, 8 individuals sealed an average of 4.5 wolves from Unit 11. During the preceeding 5 seasons, the average harvest was 3.1 wolves per individual. Most individuals sealing wolves from Unit 11 live in the unit or in rural communities adjacent to the unit.

Harvest Chronology. Table 3 presents the harvest chronology for wolves over the past 5 years. The proportion of the harvest by month has varied yearly, but 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. Trappers who use aircraft to fly out and make sets have taken very few wolves; however, this trapping method may increase. Aircraft can be used effectively to find wolf kills, and a trapper can land and set snares for returning wolves at the kill site. Most aircraft use was by hunters who took a wolf incidentally while on fly-in hunting trips for other big game.

Nonregulatory Management Problems/Needs

Wolf estimates are difficult to assess 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 been done only periodically 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. The occurrence of high winds in Unit 11 often obscures tracks or blows snow to the extent that surveys are not feasible. The use of radiocollared wolves would provide more accurate information on wolf numbers in this unit.

CONCLUSIONS AND RECOMMENDATIONS

The number of wolves estimated to inhabit Unit 11 has remained relatively stable throughout this report period and is approaching the number of wolves estimated in the late 1980's. Wolf population estimates in Unit 11 fluctuate yearly as a direct result of survey effort and snow conditions that affect survey results. However, wolf estimates are considered a minimum because of the limited data available for many large areas in the unit.

Harvest rates have varied over the last 5 years in Unit 11. The wolf harvest rate for this period was 23% of the estimated fall population, up from 20% during the previous report period. Most wolf harvest in Unit 11 is concentrated near access points and inhabited areas where trappers live. High harvest rates concentrated in these areas could result in localized population declines. In vast portions of the unit, however, wolves are not hunted or trapped. The reasons are that aircraft use is illegal, much of the unit is without roads, and physical barriers such as large rivers and mountains limit snowmachine and ORV travel.

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PREPARED BY:

Robert W. Tobey
Wildlife Biologist

SUBMITTED BY:

Michael G. McDonald
Assistant Management Coordinator

Table 1 Unit 11 fall and spring wolf population estimates[a], 1994-2000

Year	Population estimate Fall	Spring	Packs	Basis of estimate
1994/95	105-125	65-80	11	b, c
1995/96	95-115	80-100	11-13	b, c
1996/97	110-125	90-105	13	b, c
1997/98	85-105	70-85	10	b, c
1998/99	100-125	70-85	11	b, c
1999/2000	100-115	75-85	14	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, 1994–99

Regulatory Year	Reported harvest M	%	F	%	Unk	%	Total	Estimated Harvest Unreported	Illegal	Method of Take Trap/ snare	%	Shot	%	L&S	%	Unk	%	Successful trappers/ Hunters
1994/95	17	(49)	18	(51)	0	(0)	35	2	3	32	(91)	3	(9)	0	(0)	0	(0)	12
1995/96	7	(64)	4	(36)	0	(0)	11	2	3	9	(82)	2	(18)	0	(0)	0	(0)	6
1996/97	8	(42)	11	(58)	0	(0)	19	2	3	17	(89)	2	(11)	0	(0)	0	(0)	7
1997/98	11	(44)	12	(48)	2	(8)	25	2	3	11	(100)	0	(0)	0	(0)	0	(0)	5
1998/99	16	(44)	16	(44)	4	(11)	36	2	3	35	(97)	1	(3)	0	(0)	0	(0)	8

Table 3 Unit 11 wolf harvest chronology by month, 1994–99

Regulatory Year	Harvest periods									
	August	September	October	November	December	January	February	March	April	*n*
1994/95	3	3	3	3	6	48	20	14	0	35
1995/96	0	9	0	9	27	27	27	0	0	11
1996/97	0	11	0	16	16	26	26	5	0	19
1997/98	0	0	0	20	8	28	36	8	0	25
1998/99	0	3	0	8	8	53	17	11	0	36

Table 4 Unit 11 wolf harvest percent by transport method, 1994–99

Regulatory year	Percent of Harvest								
	Airplane	Dog sled skis/ Snowshoes	Boat	4-wheeler	Snowmachine	ORV	Highway Vehicle	Unknown	*n*
1994/95	9	3	0	0	85	0	3	0	35
1995/96	0	0	0	0	91	0	9	0	11
1996/97	11	0	0	0	89	0	0	0	19
1997/98	4	4	0	0	88	0	4	0	25
1998/99	3	6	0	0	88	0	3	0	36

LOCATION

GAME MANAGEMENT UNIT: 12 (9978 mi^2)

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

BACKGROUND

Historically, the Unit 12 wolf population fluctuated dramatically in response to federal and state predator control programs, ungulate prey abundance, and harvest. During the 1940s wolves were abundant but numbers were reduced by a federal control program conducted between 1948 and 1960. Also, prior to 1960, local residents commonly killed wolf pups at dens which maintained wolf populations at low levels in the vicinity of human settlements. After 1960 the wolf population increased rapidly and remained high until the mid-1970s. About 1975 the wolf population declined substantially due to prey shortages (DV Grangaard, personal observation). Since 1975 the moose and wolf populations in Unit 12 remained at a low density equilibrium (Gasaway et al. 1992).

During most years 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 as most trappers concentrate on marten and lynx. However, during years when marten and lynx pelt price are low and wolf prices are adequate, 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 mid-1970s unitwide moose densities have been low. Throughout the 1980s local residents requested the Board of Game to conduct wolf control to benefit the depressed moose population. However, most of the unit's lands (about 65%) are included in either Wrangell-St Elias National Park and Preserve or the Tetlin National Wildlife Refuge. Federal policy on those lands did not include predator management programs. The department did conduct wolf control within the northwestern portion of Unit 12 between 1981 and 1983.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

The Unit 12 wolf management goals follow 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.

- 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

- Provide opportunity to participate in hunting, trapping, and viewing wolves.
  - Monitor harvest through sealing records and trapper questionnaires.
  - Temporarily close wolf trapping if the unit population declines below 100 wolves.
- Monitor wolf numbers and population characteristics.
  - Estimate wolf pack sizes and number of packs in selected areas within Unit 12.
  - Cooperate with any ongoing wolf studies conducted by the US Fish and Wildlife in Tetlin National Wildlife Refuge.

In 1998, the moose population in Unit 12 was designated by the Board of Game to be important for high levels of human consumptive use under the intensive management law (AS 16.05.255[e]–[g]). This designation means that the board must consider intensive management if regulatory action to significantly reduce the Unit 12 moose harvest becomes necessary because the population is depleted or has reduced productivity. If wolf control becomes necessary in the future to comply with this law, Unit 12 population objectives will be changed.

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 which were 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 prior to 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

Wolf research was not conducted in Unit 12 during the report 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 obtained on the date and specific location of take, sex, color of pelt, estimated size of the wolf pack, method of take, and access used. Harvest data were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY99 = 1 Jul 1999 through 30 Jun 2000).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size

During RY96–RY98, the Unit 12 autumn wolf population remained relatively stable at 223–237 wolves (Table 1). Estimated wolf numbers during this report period were 22% higher compared to the previous report period.

During the past 10 years, Unit 12 wolf numbers have fluctuated primarily due to prey availability and harvest rates. Between 1988 and 1992 Unit 12 wolf numbers increased by an estimated 27%. Autumn pack size and number of packs increased, indicating improved recruitment and adult survival. The population declined in 1993 due to harvest (36% harvest rate) and remained relatively stable due to moderate harvest rates until 1995. Area trappers selected for wolves during this period because wolf pelt prices were high and marten and lynx prices were low. Between RY94 and RY97, harvest was below the sustainable rate (≤25%) due to low fur prices, and the wolf population increased.

The wolf population increase between 1988 and 1992 was also aided by an elevated prey base as tens of thousands of Nelchina and Mentasta caribou annually traveled through or wintered in Unit 12, and also this period coincided with a snowshoe hare population high. Large numbers of caribou have been available to Unit 12 wolves between October and April except during 1992, 1995, and 1996 when most of the caribou traveled through Unit 12 and wintered in Unit 20E or returned to Unit 13. 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. However, the increase in wolf numbers occurred during the same period the unit's moose population stabilized following a growth period during most of the 1980s (Gardner 1995). Since large numbers of caribou are in portions of Unit 12 only during winter, the elevated wolf population necessarily depended upon moose and small mammals as their primary prey during the remainder of the year.

Mortality

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Seasons	Nonresident Open Seasons
Unit 12		
Regulatory year 1996		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. A wolf may be shot same day airborne if caught in a trap or snare, or trapper is over 300 ft from airplane. (This regulation was changed by an initiative disallowing wolves to be shot the same day airborne unless the wolf was in a trap or snare.) No trapping with a steel trap or a snare smaller than 3/32 inch in diameter during April or October.	15 Oct–30 Apr	15 Oct–30 Apr
Regulatory year 1997		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. No trapping with a steel trap or a snare smaller than 3/32 inch in diameter during April or October.	15 Oct–30 Apr	15 Oct–30 Apr
Regulatory year 1998		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. No trapping with a steel trap or a snare smaller than 3/32 inch in diameter during April or October.	15 Oct–30 Apr	15 Oct–30 Apr

Board of Game Actions and Emergency Orders. In November 1996 Alaskan voters passed an initiative which prohibited same-day-airborne hunting of wolves, fox, lynx, and wolverine. This initiative became effective on 25 February 1997. An initiative to ban the use of snares to catch wolves failed in November 1998.

During the spring 1998 meeting, the board designated the Unit 12 moose population as important for high levels of human consumptive use under the Intensive Management Law (AS 16.05.255(e)–(g). This designation means that the board must consider intensive management if regulatory action to significantly reduce moose harvest in Unit 12 becomes necessary because the population is depleted or has reduced productivity. Wolf control has been identified by the legislature as an important management tool consistent with the intent of the intensive management law.

Hunter/Trapper Harvest. RY96, RY97, and RY98 wolf harvests in Unit 12 were 35, 45, and 67 wolves, respectively (Table 2). The average harvest was 49 wolves ($\bar{x}$ harvest rate = 22%, range = 16–28%). The harvest rate during RY96 and RY97 allowed the wolf population to increase. In RY98, harvest increased and preliminary population data collected during RY99 indicated the wolf population declined, especially along the Glenn Highway and in Gardiner Creek Flats.

During the past 10 years, 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 >40% generally result in declining wolf populations, and those populations harvested at <20% generally increase. Those effects of exploitation seem to be consistent across a broad range of reported wolf densities in Alaska, Canada, Michigan, and Minnesota.

During RY96–RY98 the primary method used to harvest wolves in Unit 12 were traps and snares ($\bar{x}$ = 83%). Incidental harvest by moose and sheep hunters during August and September accounted for most of the remainder of the harvest. The loss of same-day-airborne hunting had little effect on wolf harvest in Unit 12. The average take during the last 6 years this method was legal was 3.8 wolves (7% of the harvest).

Harvest Chronology. Chronology of the Unit 12 wolf harvest during RY96–RY98 (Table 3) reflects a low incidental harvest of wolves (10.2%) during the August and September hunting seasons, 0% and 4% harvest during the snaring-only seasons in October and April, respectively, and the highest harvest (83.8%) between November and March when all harvest methods and means are allowed. The greatest harvest occurred in January and February.

Transport Methods. During RY96–RY98, most successful wolf trappers used snowmachines (81%) (Table 4). Between RY89 and RY93, 27% of successful trappers used airplanes for transportation. Since RY94 this transport method has declined to 7%. Because of the high costs associated with using an airplane for trapping, area trappers who use this transportation method only select for wolves if pelt prices are cost efficient. During years of low wolf pelt prices, little harvest is expected by trappers who use aircraft.

HABITAT

Assessment

Only 7000–8000 mi^2 of Unit 12 is considered normal wolf habitat. Wolves seldom use the remaining 2000–3000 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 better wolf habitat in Unit 12 is found 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. Even though 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 has provided a reliable food source for wolves in eastern Unit 12, but currently is declining rapidly and only numbers about 350 animals. Caribou from the Mentasta, Nelchina, and Macomb herds also used portions of Unit 12 in recent years. It seems the use of Unit 12 during the winter by these herds, especially the Nelchina Herd, improved the productivity of the wolf population during the late 1980s and throughout the 1990s.

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

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 National Wildlife Refuge. 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 continually for the next 15–20 years to the benefit of both moose and wolves. By 1994 moose densities in this area increased from 0.2 to 0.7 moose/mi^2 and supported at least 2 wolf packs numbering 6–11 wolves. As of RY99, the moose density in this area was 1.1 moose/mi^2, and 3 different wolf packs numbering 7–13 wolves were observed using the area.

Habitat enhancement programs using mechanical crushing and different logging techniques are being planned to effect over 1000 acres in the Tok River valley, a prime wintering area for moose. These programs are expected to benefit many species of wildlife including wolves.

Nonregulatory Management Problem/Needs

In the foreseeable future the intensive management law will most likely be enacted in Unit 12 based on the current trend of the unit's moose population and harvest pressure (Gardner 2000). In an attempt to better predict the outcome of wolf control on the moose population in Unit 12, I modeled the current population status and trend data for moose and their predators using the modeling software PredPrey (McNay and DeLong 1998).

Past research found that predation by both wolves and bears was the primary factor maintaining the area moose populations at low densities (0.2–1.0 moose/mi^2, Gasaway et al. 1992; US Fish

and Wildlife Service, unpublished data). The effects of wolves and bears vary between areas within Unit 12. In the Northway and Tetlin Flats, both calf mortality and predation rate studies indicated that wolves were the primary predator on calves and adult moose throughout the year. In comparison, along the Nutzotin Mountains calf recruitment to 5 months was substantially lower and was more indicative of grizzly bear predation.

Modeling exercises using actual moose composition and predator kill rate data indicated the Unit 12 moose population continues to be primarily limited by wolves, although grizzly bears are an important predator in portions of the unit. The model also predicts that under the present management scheme, the Unit 12 moose population will remain at low density for an extended period of time with little opportunity for increased harvest.

Assuming grizzly bear predation rates remain relatively constant during the next 5 years, the model predicts that the Unit 12 moose population would increase substantially if wolf numbers were reduced. The moose population will increase at 8–14% annually if the unit's wolf population is controlled at the 80% reduction level, which has been found to have caused moose and caribou population increases in other areas of Alaska and Yukon (Boertje et al. 1996). However, wolf control is not an option on federal lands, which constitute a majority of Unit 12. If wolf control is conducted only on state and private lands, the moose population will increase at about 6–9%.

Based on the response of the moose population affected by the combination of the 1990 Tok Wildfire and intense public hunting and trapping of wolves, it appears local moose population increases can occur in Unit 12 without government wolf control but with intensive habitat management. These moose population increases will be moderate and will be eventually limited by predation. However, the increases would be enough to satisfy the intensive management law as long as the number of moose hunters does not substantially increase. Because of land-ownership patterns in Unit 12, this will be the management direction taken during the next 5 years.

Management objectives for the next reporting period will be revised.

CONCLUSIONS AND RECOMMENDATIONS

Comparing the estimated average wolf population size during RY96–RY98 to RY93–RY95, the Unit 12 wolf population increased by an estimated 22%. The increase probably resulted from increased survival and productivity associated with an increased prey base. Harvest rates averaged 22% during RY96–RY98. Annual harvest rates >25% precludes wolf population growth in Unit 12.

The Unit 12 moose population stabilized during the 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. Prior to the arrival of the wintering Nelchina and Mentasta herds and the increase in the unit's wolf population, the moose population in Unit 12 was increasing at about 5% annually.

During the 1980s the Unit 12 wolf population was lightly harvested. During the 1990s the annual wolf harvest in Unit 12 varied and in some years was the primary limiting factor to the wolf population. Harvest rates were dependant on fur price, weather conditions, and wolf movement patterns in relationship to the road system.

Most of the area residents desire some type of intensive management to benefit Unit 12 moose. Area residents support management that incorporates a combination of area-specific wolf reduction programs conducted by the public and habitat enhancement programs conducted by the agencies. Modeling predicts this management regime could cause a low to moderate increase in the moose population. However this level of management is not expected to attain a high-density moose population.

The only quantifiable objective during this report period was to temporarily close wolf trapping if the unit population declines below 100 wolves. No closure was necessary because the population remained above 100. Other objectives were not quantifiable and, therefore, could not be evaluated. During the next report period, they will be defined as activities and management direction will be to:

Management Goals

- 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 Objective

- Temporarily close wolf trapping if the unit population declines below 100 wolves.

Management Activities

- Monitor harvest through sealing records and trapper questionnaires.
- Estimate wolf pack sizes and number of packs in selected areas within Unit 12.
- Cooperate with any ongoing wolf studies conducted by the US Fish and Wildlife in Tetlin National Wildlife Refuge.

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PREPARED BY:

Craig L Gardner
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Mark E McNay
Wildlife Biologist III

Table 1 Unit 12 autumn[a] wolf population estimates, regulatory years 1988–1989 through 1998–1999

Regulatory year	Population estimate[b]	Number of packs	$\bar{x}$ pack size[c]	Basis of estimate
1988–1989	136	21	5.8	Spring survey, reports, observations, sealing records
1989–1990	172–188	27	6.0	Spring survey, reports, observations, sealing records
1990–1991	220–236	29	7.1	Spring survey, reports, observations, sealing records
1991–1992	198–239	29	6.8	Spring survey, reports, observations, sealing records
1992–1993	230–243	29	7.4	Spring survey, reports, observations, sealing records
1993–1994	180–216	29	6.2	Reports, observations, sealing records
1994–1995	159–183	29	5.4	Reports, observations, sealing records
1995–1996	183–206	29	6.1	Reports, observations, sealing records
1996–1997	217–229	28	7.2	Reports, observations, sealing records
1997–1998	211–236	29	6.9	Reports, observations, sealing records
1998–1999	231–243	31	6.9	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 × 0.9 divided by number of packs.

Table 2 Unit 12 wolf harvest, regulatory years 1988–1989 through 1998–1999

Regulatory year	Reported harvest						Method of take							Successful Trappers and hunters	Wolves/ person
	M	(%)	F	(%)	Total[a]	% Autumn population[b]	Trap or snare	(%)	Shot	(%)	SDA[c]	(%)	Unk		
1988–1989	6	(40)	9	(60)	17	12	12	(75)	4	(25)			0	8	2.0
1989–1990	15	(83)	3	(17)	20	11	7	(89)	2	(11)			0	10	1.9
1990–1991	45	(63)	27	(37)	74	32	56	(77)	7	(10)	10	(14)	0	26	2.8
1991–1992	19	(59)	11	(41)	34	15	20	(63)	8	(25)	4	(13)	0	16	2.0
1992–1993	26	(52)	24	(48)	54	22	51	(98)	1	(2)			0	15	3.5
1993–1994	37	(57)	28	(43)	71	36	54	(78)	6	(9)	9	(13)	2	24	3.0
1994–1995	18	(58)	13	(42)	31	18	26	(84)	5	(16)	0	(0)	0	16	1.9
1995–1996	25	(69)	11	(31)	46	24	42	(91)	4	(9)	0	(0)	0	15	3.1
1996–1997	19	(63)	11	(37)	35	16	28	(80)	7	(20)	0	(0)	0	17	2.1
1997–1998	28	(67)	14	(33)	45	21	35	(81)	8	(19)	0	(0)	2	23	2.0
1998–1999	38	(58)	28	(42)	67	28	58	(87)	9	(13)	0	(0)	0	25	2.7

[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, regulatory years 1988–1989 through 1998–1999

Regulatory year	Harvest periods																					
	Aug	(%)	Sep	(%)	Oct	(%)	Nov	(%)	Dec	(%)	Jan	(%)	Feb	(%)	Mar	(%)	Apr	(%)	May	(%)	Unk	*n*
1988–1989	1	(6)	0	(0)	0	(0)	3	(19)	3	(19)	3	(19)	3	(19)	1	(6)	2	(13)	0	(0)	0	16
1989–1990	1	(5)	0	(0)	0	(0)	1	(5)	7	(37)	3	(16)	3	(16)	4	(21)	0	(0)	0	(0)	0	19
1990–1991	3	(4)	1	(1)	0	(0)	1	(1)	6	(8)	15	(21)	27	(37)	16	(22)	4	(5)	0	(0)	0	73
1991–1992	1	(3)	3	(10)	0	(0)	2	(7)	4	(13)	3	(10)	7	(23)	4	(13)	6	(20)	0	(0)	2	32
1992–1993	1	(2)	0	(0)	0	(0)	3	(6)	13	(25)	14	(27)	2	(4)	15	(29)	4	(8)	0	(0)	0	52
1993–1994	1	(2)	3	(4)	1	(2)	5	(7)	16	(24)	8	(12)	15	(22)	14	(21)	4	(6)	0	(0)	4	71
1994–1995	0	(0)	1	(3)	2	(6)	1	(3)	9	(29)	9	(29)	4	(13)	5	(16)	0	(0)	0	(0)	0	31
1995–1996	0	(0)	3	(7)	1	(2)	3	(7)	5	(12)	14	(33)	12	(29)	4	(10)	0	(0)	0	(0)	4	46
1996–1997	1	(3)	2	(6)	0	(0)	1	(3)	5	(15)	7	(21)	7	(21)	5	(15)	5	(15)	0	(0)	2	35
1997–1998	3	(7)	2	(4)	0	(0)	2	(4)	12	(27)	8	(18)	12	(27)	6	(13)	0	(0)	0	(0)	0	45
1998–1999	3	(4)	4	(6)	1	(1)	5	(7)	9	(13)	21	(31)	13	(19)	10	(15)	1	(1)	0	(0)	0	67

Table 4 Unit 12 wolf harvest by transport method, regulatory years 1988–1989 through 1998–1999

Regulatory year	Harvest by transport method															
	Airplane	(%)	Dogsled, skis, or snowshoes	(%)	Boat	(%)	3- or 4-Wheeler	(%)	Snowmachine	(%)	ORV[a]	(%)	Highway vehicle	(%)	Unk	*n*
1988–1989	1	(6)	0	(0)	0	(0)	0	(0)	13	(81)	0	(0)	2	(13)	0	16
1989–1990	5	(26)	0	(0)	0	(0)	0	(0)	13	(68)	1	(5)	0	(0)	0	19
1990–1991	14	(20)	4	(6)	0	(0)	1	(1)	48	(69)	0	(0)	3	(4)	3	73
1991–1992	6	(24)	0	(0)	0	(0)	0	(0)	19	(76)	0	(0)	0	(0)	7	32
1992–1993	14	(27)	0	(0)	0	(0)	0	(0)	38	(73)	0	(0)	0	(0)	0	52
1993–1994	27	(39)	3	(4)	0	(0)	1	(1)	30	(43)	0	(0)	8	(12)	2	71
1994–1995	2	(6)	0	(0)	0	(0)	0	(0)	27	(87)	0	(0)	2	(6)	0	31
1995–1996	4	(9)	0	(0)	0	(0)	0	(0)	38	(82)	0	(0)	0	(0)	0	46
1996–1997	2	(6)	2	(6)	0	(0)	0	(0)	29	(83)	0	(0)	2	(6)	0	35
1997–1998	4	(9)	3	(7)	1	(2)	0	(0)	33	(77)	0	(0)	2	(5)	2	45
1998–1999	3	(5)	6	(9)	0	(0)	2	(3)	54	(83)	0	(0)	0	(0)	2	67

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

LOCATION

GAME MANAGEMENT UNIT: 13 (22,857 mi^2)

GEOGRAPHIC 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 lower, averaging 275 wolves during the fall then increased to a 370 wolf average during the mid 1990s.

Before 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. The late 1960s established seasons approximating current dates 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 were sealed in Unit 13.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Determine wolf population estimates yearly. Regulate wolf harvests yearly to prevent overharvesting yet maintain adequate harvests to assure that management objectives for wolves in Unit 13 are met.

MANAGEMENT OBJECTIVES

To achieve and maintain a posthunting and trapping season population of 135 to 165 wolves (3–4 wolves/1000 km^2) distributed proportionally among subunits.

METHODS

We conducted aerial track surveys to estimate the wolf population in Unit 13 during late fall and again in late winter. Biologists flew surveys in a systematic manner in an attempt to locate wolf tracks, then followed tracks to determine the size and color composition of the pack. Additional information on wolf numbers and distribution was collected by trapper surveys and incidental sightings by department personnel and the public. This information was combined with survey

data to extrapolate a unit population estimate. We monitored harvest by requiring sealing of all wolves taken in the unit.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The spring 1999 wolf population estimate was 300 (7.0 wolves/1000 km^2) wolves (Table 1) and is the highest spring population estimate reported in GMU 13 in over 25 years. Spring population estimates have increased the last 5 years. Fall population estimates for 1998 and 1999 approached 500 (12.0 wolves/1000 km^2) wolves unitwide and are the highest ever reported. Fall wolf estimates between 1993 and 1997 averaged 370 wolves; the average between 1991 and 1992 was only 330 wolves.

Current wolf population estimates place the overall GMU 13 wolf density at approximately 12 wolves/1000km2. Some portions of the unit, such as 13D, are lower than this, and, in other areas, like portions of 13A and 13E probably support wolf densities around 15–18 wolves/1000km2. Historically other portions of Alaska have supported wolf densities as high as 20 wolves/1000km2 (Ballard et al. 1987). Modeling (Predprey ADF&G) indicates that until prey populations decline even further, wolf numbers will remain high and stable. Wolf abundance could also increase in some portions of the unit, depending upon locally available prey. Low densities of prey in 13D probably will not support higher numbers of wolves than currently exist. Harvest rates of wolves at present are sustainable and are not high enough to affect declines in overall wolf abundance.

Population Composition

Sex composition data for wolves in Unit 13 are not available. Age composition data are inferred by comparing fall population estimates to the previous spring. The fact that fall estimates are appreciably higher than spring estimates indicate pup production and survival is high in Unit 13. Pup production the last two years has been especially high, possibly because of a snowshoe hare cycle high. Hares provide an additional source of food during the critical whelping period and allow for higher pup survival.

Distribution and Movements

Distribution and movement patterns of wolves in Unit 13 are dependent on prey availability (Ballard et al. 1987). In Unit 13 wolf territory, size and productivity are primarily functions of moose densities. Locations of radiocollared wolves indicate wolves do not follow caribou that are migrating out of a wolf pack territory. As in other areas in Alaska, a certain percentage of Unit 13 wolves are observed as singles and may be dispersing. Immigration into Unit 13 is relatively common as radio collared wolves from the Kenai Peninsula, Denali National Park, and Units 20 and 12 have been observed or harvested in Unit 13.

MORTALITY

Harvest

Season and Bag Limit. Wolves are harvested under hunting and trapping regulations. Wolf trapping season runs from 15 October until 30 April. However, steel traps or snares smaller than 3/32-inch diameter may be used only between 10 November and 31 March. Wolf hunting season runs from 10 August to 30 April with a bag limit of 10 wolves per day. Between 1994 and February 1997, trappers could shoot wolves the same day airborne if they were 300 feet from the aircraft. Since February 1997, taking wolves the same day airborne has been prohibited.

Board of Game Actions and Emergency Orders. The board designated Unit 13 an intensive management area in 1995. Increased human harvest of moose and caribou became the primary objective for the unit. As a result, the Board reduced the wolf population management objective to between 135 and 165 wolves postharvest in the spring. Methods and means for wolf hunting and trapping remained unchanged until a statewide vote on Proposition 3 in the November 1996 general election passed. This proposition eliminated the taking of wolves the same-day-airborne as of 25 February 1997. During the March 1999 Board of Game meeting, the bag limit for wolf hunters in Unit 13 was increased to 10 wolves per day. The Board of Game, in March 2000, passed a wolf predation control implementation plan for Units 13A, B, and E east of the Alaska railroad except for federal lands. The management objective for a post control wolf population was 25 wolves in both 13A and B and 50 wolves in 13E. At this meeting, the Board also liberalized use of snowmachines for taking wolves.

Hunter/Trapper Harvest. Hunters and trappers harvested 176 wolves in Unit 13 during the 1998–99 season (Table 2). Wolf harvests have fluctuated during this reporting period from a 1995 low of 122 wolves to the current high of 176. The largest wolf harvest reported in Unit 13 in over 25 years was 179 wolves taken in 1993. A definite increase in the GMU 13 wolf harvest is evident when the 5 year average take of 148 wolves sealed during this reporting period is compared to the average harvest of 81 wolves a year during the 10 years from 1980 to 1989. Harvest composition data indicate a slight overall predominance (55%) of males in the harvest, but this is variable yearly (Table 2).

Trapping and snaring accounted for only 37% of the take in 1991–92 when same-day-airborne permit hunting was legal. Snaring and trapping have become the most successful methods of taking wolves since land-and-shoot permit hunts ended; snaring and trapping accounted for 80% of the 1998–99 harvest. Before this reporting period, ground trappers did not generally take as many wolves as land-and-shoot hunters.

Permit Hunts. The last permit wolf hunt in Unit 13 was a land and shoot registration hunt held between 1991 and 1993.

Hunter/Trapper Residency and Success. During the 1998–99 season, 58 hunters and trappers harvested an average of 3.0 wolves in Unit 13; the average take per trapper during the previous 4 years (1994–98) was 2.4 wolves per year. The average take per trapper has increased slightly from the 2.1 wolf average observed during the 1980s. In 1998–99, 5 nonresidents took 6 wolves, 18 local residents killed 80 wolves, and 35 nonlocal Alaska residents took 90 wolves.

Harvest Chronology. Harvest chronology varies somewhat during the last 5 years (Table 3). In 1997 and 1998, February had the highest reported wolf harvest. During the prior 3 years, December and January had higher reported harvests. The change in harvest chronology between years probably reflects yearly changes in snowfall which influences access and trapping conditions.

Transport Methods. When same-day-airborne hunting was legal (before 1992–93), successful hunters and trappers preferred using aircraft. 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. In recent years use of snowmachines has surpassed using aircraft as the most important method of transportation (Table 4). This change occurred not only because it became illegal to take wolves same-day-airborne but because of improvements in snowmachines themselves. A few years ago drastic improvements occurred in snowmachine design and manufacturing. Modern snowmachines are more powerful, faster, travel better in deep snow, and are more comfortable to ride and much more mechanically reliable. As a result, trappers and hunters are able to penetrate further into remote portions of the unit. Aircraft use did increase in 1998-99 but this increase was attributed to a few individuals who were very successful snaring wolves by finding kills from the air and setting snares at the kill sites. The area they trapped was very remote and accessible only by air.

Other Mortality

Ballard et al. (1987) determined natural mortality rates for radio collared wolves in a portion of Unit 13. They attributed 11% of annual mortality to intraspecific strife and 9% to accidents, injuries, starvation, and drowning. Ballard attributed the remaining 80% to legal and illegal human harvest. Since completion of this study, taking of wolves by land-and-shoot has become illegal. By observing kill sites, we can determine illegal use of airplanes to take wolves. Field observations in recent years indicate the illegal wolf harvest in Unit 13 is not large and does not affect population levels.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

During the spring 2000 session, the Legislature passed a bill allowing same-day-airborne hunting of wolves by the public in those units having wolf predation control areas established by the Board of Game. This is an open hunt and, unlike the last same-day-airborne hunt, permits are not required. Reduced control over wolf harvest will make achieving subunit population objectives, as directed by the Board, more difficult. This type of hunt increases the need for better population estimates on a subunit basis.

The possible introduction of the biting dog louse into the Unit 13 wolf population is another serious problem. A female yearling was trapped along the Copper River during January 2000 that had been tagged in 1999 while being treated for lice in Unit14. Although this wolf demonstrated clinical evidence of louse infection, individual lice were not observed. The outlook for preventing the spread of lice into Unit 13 is poor based on the high infection rate of wolves in Units 14 and 15 coupled with the observed dispersal of wolves from these units into Unit 13.

CONCLUSIONS AND RECOMMENDATIONS

Wolf numbers in Unit 13 increased during this reporting period. The spring population estimate increased to 300 wolves, the highest estimate in over 25 years. The current population estimates exceed the management objectives for wolves set by the Board of Game in 1995. Modeling of wolf population trends suggests that wolf numbers can be maintained and possibly increase during the next few years in all units except 13D where prey densities are lower. The observed density of wolves in Unit 13, although already very high, is still below densities observed in other portions of the state where prey is abundant and wolves are unregulated. Wolf numbers are expected to remain stable until the prey populations decline to low levels, then wolf numbers will also decline. Without some form of predator management, both prey and wolf numbers will decline and remain at a low level for a long period.

Wolf harvests increased during this reporting period. Yearly fluctuations in wolf harvests reflect trapping effort and weather conditions more than wolf abundance. Trapping effort reflects both trapping conditions and economic factors. Trappers must have sufficient snow to travel by snowmachine or to land ski planes, as well as make sets. Economic factors include the price paid for furbearers and their abundance. During the early to mid 1990's, fur prices were low on most of the common Unit 13 furbearer species, except marten and wolves. Prices on wolves peaked between 1993 and 1995 and contributed to the high harvests. Weather conditions and snow depths were favorable to wolf trapping those years. By 1995–96 wolf prices began to decline and snowfall was the lowest in over 7 years, restricting trapping activity. The demand and the price paid for wolves have continued to decline in recent years. Currently there is good market value for only the best quality adults; pups and average-quality adults are much less marketable. If the dog louse infects wolves in Unit 13, as it has in Units 7,14, and 15, wolf pelts will be worthless and trappers will quit taking wolves. The volatile fur market will continue to affect demand and prices for wolves.

The current wolf harvest appears to be insufficient to reduce the wolf population to meet wolf management objectives for intensive management. Harvests observed during 1990–95 were reducing wolves, and the spring population was approaching management objectives. Based on the effect these high harvests have had on wolf numbers, the potential existed for human harvests to control wolf numbers if some form of same-day-aircraft use was allowed. Since eliminating the same day use of aircraft, trappers have not been able to take enough wolves to limit population growth or reduce wolf numbers. Although ground trappers are taking more wolves and becoming more efficient, they have not been able to take enough wolves every year to limit population growth. Annual harvest rates would have to reach 35% or more of the fall population to cause a decline in wolf numbers.

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PREPARED BY:
Robert W. Tobey
Wildlife Biologist

SUBMITTED BY:
Michael G. McDonald
Assistant Management Coordinator

Table 1 Unit 13 fall and spring wolf population estimates[a], 1994–2000

Year	Population estimate			Packs (nr)	Basis of estimate
	Fall	Spring			
1994/95	325-375	180	(160-200)	40	b
1995/96	310-350	220	(200-240)	40	b
1996/97	375-425	240	(220-260)	45	b
1997/98	360-400	260	(240-280)	50	b
1998/99	475-525	300	(280-320)	55	b
1999/2000	490-540	---	---	60	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, 1994–1999

Year	Reported harvest							Estimated Harvest		Method of Take								Successful trappers/ Hunters
	M	%	F	%	Unk	%	Total	Unreported	Illegal	Trap snare	%	Shot	%	SDA	%	Unk	%	
1994/95	85	(56)	55	(43)	2	(1)	142	5	5	80	(52)	73	(43)	0	(0)	0	(0)	74
1995/96	64	(52)	57	(47)	1	(1)	122	5	5	91	(74)	30	(25)	0	(0)	1	(1)	58
1996/97	80	(57)	61	(43)	0	(0)	141	5	5	109	(77)	32	(23)	0	(0)	0	(0)	60
1997/98	73	(49)	75	(50)	1	(1)	149	5	5	126	(84)	22	(15)	0	(0)	1	(1)	50
1998/99	84	(48)	86	(49)	6	(3)	176	5	5	142	(80)	34	(20)	0	(0)	0	(0)	62

Table 3 Unit 13 wolf harvest chronology percent, 1994–99

Regulatory Year	Harvest periods									*n*
	August	September	October	November	December	January	February	March	April	
1994/95	4	3	0	6	19	29	18	20	1	153
1995/96	0	4	1	14	22	25	13	14	7	122
1996/97	3	4	0	8	26	18	24	12	1	141
1997/98	1	8	4	13	29	29	41	38	8	149
1998/99	1	5	2	7	16	16	23	22	5	176

Table 4 Unit 13 wolf harvest percent by transport method, 1994–99

Regulatory Year	Percent of Harvest								*n*
	Airplane	Dog sled skis/ Snowshoes	Boat	4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
1994/95	18	2	0	2	54	2	8	14	153
1995/96	10	1	0	2	66	0	6	16	122
1996/97	8	11	1	1	74	0	0	4	141
1997/98	6	1	0	1	79	1	12	0	149
1998/99	22	1	1	0	62	8	4	2	176

LOCATION

GAME MANAGEMENT UNIT: 14 (6624 mi^2)

GEOGRAPHIC DESCRIPTION: Eastern Upper Cook Inlet

BACKGROUND

Wolf numbers in Unit 14 were probably low to moderate in the 1950s and early 1960s, primarily due to predator control efforts by the federal government (Rausch 1967). Wolf populations probably increased during the late 1960s and early 1970s, after cessation of predator control activities and bounty payments. Development in the Anchorage and Matanuska–Susitna Valley areas was probably responsible for wolf numbers remaining low near human settlements during the 1970s. Subsequent large increases in human population in this area caused 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 wolf populations increased, in part because of high prey densities and excessive winter moose mortality caused by deep snows during the winters of 1989/90 and 1994/95. High wolf densities also occurred in adjacent areas having reduced hunting and trapping pressure. Wolf numbers remained high through 1999; hunters, pilots and winter recreationists frequently observed wolves. The reported harvest has increased significantly, coincident with high wolf densities.

During November and December 1998 trappers caught several wolves (and coyotes) in Unit 14B that were infested with the dog-biting louse *Trichodectes canis*. This was the first time lice had been confirmed in Alaskan wolves outside the Kenai Peninsula, where louse-infested wolves were first seen in 1981. The source of the Unit 14 infestation was unknown, but we suspect feral dogs or wolf-hybrids. During January 1999 we mounted a large effort to treat infested wolves in the Susitna Valley, with non-lethal means, to prevent the spread of lice to other areas of the state. Our efforts revealed that 2 packs in Unit 14B were infested and 1 pack in adjacent Unit 16A. We attempted to capture and treat all infested wolves with the antiparasitic drug ivermectin (Merial, Iselin New Jersey USA). We also distributed approximately 1200 medicated baits, aimed at coyotes, dogs, and lone wolves. However, several louse-infested wolves were caught during winter 1999–2000, indicating we were unsuccessful in eliminating lice from area wolves.

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.

MANAGEMENT OBJECTIVES

The population objective is to maintain a minimum unit population of 55 wolves, with 35 wolves in Subunits 14A and 14B (combined), and 20 wolves in Subunit 14C. The human-use objective

in Units 14A and 14B is to allow low levels of human harvest by hunting and trapping, provided harvest does not conflict with maintaining the population objective. The human-use objective in Unit 14C is to provide for nonconsumptive uses such as viewing, photography, listening, and the knowledge that wolves are present.

METHODS

Most reports of wolf distribution and pack size came from incidental observations by staff and the public, from sealing certificates, and interviews with wolf hunters and trappers. We collected harvest data when wolf hides were presented for sealing. All trappers who sealed fur in Unit 14 were queried, through our trapper questionnaire, regarding trends in wolf abundance.

With the unanticipated discovery of louse-infested wolves in this area, and the fear the infestation would move north, we met with staff from headquarters and regions 2 and 3 to discuss management options, political considerations and funding strategies. With direction from the Governor's office, we decided that area staff would use non-lethal means to attempt to eliminate lice from Susitna Valley wolves and coyotes, employing a capture/treatment program for wolves and distribution of medicated baits for coyotes. Additionally, regional staff would attempt to treat domestic dogs in the Parks Highway corridor.

We enlisted the aid of several other area biologists in our effort to capture and treat all infested wolves in the Susitna Valley. We used aerial reconnaissance from Piper PA-18 aircraft to first locate and examine wolf packs and then we captured 1–2 wolves in each pack to confirm the presence or absence of lice. We then captured and treated all known members of the infested packs, using 2 capture crews with 2 Robinson R-22 helicopters. Wolves were immobilized using Telezol (tiletamine HCL and zolazepam HCL, Fort Dodge Lab, Fort Dodge, Iowa, USA), and ivermectin was administered to rid wolves of lice. We also distributed meat baits, containing ivermectin paste, in the general area occupied by infested packs, to attempt to medicate coyotes and lone wolves potentially missed during our capture operation. Radiocollared wolves were tracked periodically to visually assess pelt characteristics and whether all pack members had been treated. No efforts were made to treat domestic pets in the affected area. The louse control effort is outlined completely in Golden and others. (1999, Appendix A).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

With information gathered during the lice control project, coupled with sealing information and observations from trappers and the public, we estimated Unit 14 contained 120–160 wolves during fall 1998 (Table 1). While this appears to be a large increase within a 5-year period, we believe wolf numbers have not changed significantly in recent years, and wolf numbers were under-estimated in earlier years. The effort to control the spread of lice allowed us to get reliable minimum estimates of pack sizes and distribution in most of Unit 14B and the western portion of Unit 14A, the resulting numbers were substantially higher than previous estimates in those areas. This demonstrates that the "traditional" method of estimating wolf populations solely from

incidental observations by staff, trappers, pilots and other outdoor enthusiasts probably results in a significant underestimation of wolf numbers. Further, we may be able to detect only large population shifts through traditional methodology.

Distribution and Movements

Areas in Unit 14 that contained wolf packs included Upper Talkeetna River, Wells Mountain, Lower Talkeetna River/Sheep Creek, Iron Creek, Montana Creek, Kashwitna River/Little Willow Creek, Willow Mountain, Bald Mountain, Lower Little Susitna River, Goose Bay, Kings River/Moose Creek, Chickaloon River, Carpenter/Wolverine Creeks, Knik River, Lake George, Eklutna River, Elmendorf/Ft. Richardson, Ship Creek/Eagle River, and Portage/Twentymile Rivers. The effort to control lice reaffirmed that, in contrast with our efforts to estimate population size, our method of seeking pack distribution information from trappers, pilots and staff provides relatively good information about the general location of pack territories.

Diseases/Parasites

Of 6 packs examined during louse-control effort in Units 14A and 14B, 2 packs (Willow Mountain and Montana Creek) were confirmed to have lice. Of 2 other packs in eastern Unit 14A evaluated by inspecting the hides of wolves taken by trappers or hunters, neither appeared infested (Golden and others. 1999, Appendix A). We captured and treated 12 wolves in the Willow Mountain pack, 4 wolves in the Montana Creek pack, 2 wolves each in the Bald Mountain Ridge and Sheep River packs, and 1 wolf in the Kashwitna River pack. The operational cost of the louse-control effort was $60,000 (including both Units 14 and 16). There were no indications that any 14A or 14C packs were affected. Because coyote and domestic/feral dogs are known to harbor lice, it is very difficult to totally remove lice from the area.

MORTALITY

Harvest

Season and Bag Limit. During the report period the hunting season for Unit 14 was 10 August–30 April, with a bag limit of 5 wolves. The trapping season in Units 14A and 14B was 10 November–31 March, and in Unit 14C the trapping season ran 10 November–28 February. Trappers had no bag limit on wolves.

Board of Game Actions and Emergency Orders. During June 1993 the Board of Game authorized same-day-airborne shooting of wolves, provided the person attempting to take the wolf had a trapping license and was at least 300 feet from the airplane. During November 1996 this method of take was prohibited through a statewide ballot initiative, but the prohibition did not go into effect until February 25, 1997.

During January 1998 Division staff asked the Board of Game to clarify whether wolf-hybrids could be possessed without a permit. The Board addressed the subject by stating that in their view possession of any hybrid of an animal not on the "clean" list had always been illegal, but they added language to 5AAC 92.029 explicitly addressing possession of hybrids. Top officials in both the Division of Wildlife Conservation and Department of Public Safety, Division of Fish

and Wildlife Protection (DPS/FWP) stated, however, that they would take no drastic enforcement action against the many people, and several businesses, who possess and sell hybrid wolves.

Hunter/Trapper Harvest. Harvest averaged slightly over 21 wolves per season during the 5 seasons spanning 1994/95–1998/99 (Table 2), continuing an increasing trend since 1992–93. Unitwide harvest averaged 2 wolves during the 4 seasons from 1988/89–1991/92 (Masteller 1994). Most of the harvest comes from Unit 14A because it has large areas open to hunting and trapping that are highly accessible to many people.

In recent years most wolves were trapped (Table 2), but the number has fluctuated significantly. The number of wolves shot has remained comparatively stable in the last 4 years. The number trapped can be greatly affected by weather and trapping conditions, whereas the number shot is more dependent on travel conditions.

Harvest Chronology. Most wolves were taken during mid-winter (December–February), although there has been a notable increase in the number of wolves taken during August–October (Table 3). The latter is primarily harvest by hunters afield during moose and sheep seasons. Many of these hunters report seeing wolves with increasing frequency. During 1998/99 there was little snow on the ground during December, and extremely cold temperatures during January. These factors probably combined to increase wolf harvest during February, relative to other years.

Transport Methods. Most successful wolf trappers and hunters used snowmachines to access their trapping/hunting areas (Table 4). Use of aircraft increased in 1998/99, due mainly to several experienced pilot/trappers who, after laying off trapping for several years, made a concerted effort to snare wolves in relatively remote parts of Unit 14. Snowmachine use was curtailed dramatically during 1995/96 because of unusually low snowfall.

Other Mortality

Following the louse-control capture effort there was an extended period of cold weather, with temperatures to 30 degrees below zero Fahrenheit. During this period 2 heavily louse-infested pups (or yearlings) disappeared from the Montana Creek pack. We suspect these 2 wolves died during this cold period, because of heavy pelt damage from lice (Golden et al. 1999, Appendix A). About 1 wolf per year is killed by vehicle collision in Unit 14C.

HABITAT

Assessment

Although wolf habitat in Unit 14 has changed significantly in the last 80 years, the large number of moose has undoubtedly allowed for increases in wolf numbers in the last 30 years. Beaver and hare numbers are currently high as well, providing good summer prey. Salmon escapement has remained fairly consistent at near objective levels, providing an additional summer food source. Wolves are very adaptable and able to use areas altered by humans.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

We received many reports from the public about wolves attacking dogs and possibly threatening other pets and livestock. Wolves have killed an estimated 3–10 dogs/year in the Anchorage area.

As wolf numbers increase, wolf/domestic animal conflicts may increase, especially with the dispersed pattern of human development in this area. Increasingly, we receive similar calls regarding wolf hybrids.

CONCLUSIONS AND RECOMMENDATIONS

While the population objectives have been met for Unit 14, and the number of wolves is increasing, systematic surveys will be necessary to maintain accurate population estimates of wolf numbers. The human-use objective was also met, with both consumptive and nonconsumptive users enjoying many opportunities to interact with wolves, even on the outskirts of urban areas. No changes in seasons or bag limits are recommended.

Surveys should be conducted every 3 years to assess wolf numbers. Minimum pack sizes can best be determined by simple reconnaissance flights when tracking conditions are best, utilizing 2–3 aircraft during a short period in January or February. This will require an additional $6,000, and some technical staff time, every 3 years. Current methodology (observations by staff, trappers and the public) should suffice for distribution information.

The spread of the non-native louse to the Susitna Valley is a very serious concern for managers. Unfortunately, the sensitivity surrounding wolf issues prevented managers from acting quickly to attempt to control the infestation. When lice were first discovered (November 1998) in the area, it took almost 2 months for Division staff to decide what course of action, if any, to take. Political considerations precluded action involving lethal methods of control, as was the case during the initial infestation on the Kenai Peninsula (Golden et. al 1999). By the time most wolves were treated (late January 1999), some wolves had probably begun to disperse (Mech et al. 1998). Although a great effort was expended to attempt to treat infested wolves during early 1999, financial and feasibility considerations precluded a follow-up program during winter 1999/2000 to assess the effectiveness of the effort. In addition Regional staff were unable to act on recommendations to treat domestic dogs in the Parks Highway corridor because of a number of Food and Drug Administration regulatory barriers.

Several infested wolves trapped during 1999/2000 (mainly in Unit 16) indicate we were unsuccessful in eliminating lice from Units 14 and 16. With current high wolf densities this parasite could spread rapidly within the Susitna Valley. Given natural dispersal rates for wolves, it appears likely that lice will infest wolves in other parts of the state in the near future. This could reduce wolf harvest rates, impacting prey populations, trappers and managers involved in intensive management programs. It could also affect wolf-viewing programs in areas like Denali National Park.

As suggested by Golden and others (1999), the division should develop a specific policy regarding louse infestations among wild canids in Alaska. Hopefully, such a policy would address appropriate actions and political and financial considerations, well ahead of the "crisis," allowing managers to act quickly in the event of infestation. At one time our objective was to confine the infestation to the Kenai Peninsula, but we have failed. Managers in other areas should be prepared to answer public inquiries regarding division policy regarding louse infestation among wild canids in Alaska.

The potential for wolf-human interactions, both positive and negative, in Unit 14 make this an excellent place to study wolves (e.g., population dynamics, prey selection, movements, dispersal, and "adaptability") in habitats that have been substantially altered by humans. Basic research on distribution and abundance could also further our educational, viewing and listening opportunities. Many aspects of wolf-lice relationships, such as pup survival in wolves and effects of cold temperatures on lice, could be studied in the Susitna Valley.

Estimates of harvest rates, based on the estimated number of wolves (Table 1), have remained at approximately 20% during the last 3 years. This is well below the 40% harvest rate considered sustainable in other areas (Ballard et al. 1987), and allows for further increases in wolf numbers (assuming the prey base is adequate). This will certainly affect area moose, sheep and caribou populations. Continued high wolf densities will also promote dispersal of young animals from established packs, potentially accelerating the spread of lice.

There is a compelling need for a clear policy on possession of wolf hybrids, since both ADFG and DPS/FWP have chosen not to enforce the regulation prohibiting possession of these animals. Enforcement is admittedly difficult because people can circumvent the regulation by claiming their animal is a "husky-mix," and to date there are no genetic tests that can differentiate between pure and hybrid wolves. Also, the Matanuska-Susitna Borough, which requires registration of all dogs, will not register an animal as a wolf hybrid because there is no approved rabies vaccine for hybrids. Many people own hybrid wolves in this area, and we receive many complaints about hybrid wolves running loose and threatening humans and livestock. This has resulted in a difficult position for division staff, as municipal animal control officials have, in some cases, decided that any wolf-hybrid case is the jurisdiction of the state. Our credibility suffers substantially when we are forced to tell members of other agencies and the public that possession of a hybrid is against state regulation, yet we will not take action to enforce the regulation.

There is a very real danger that wolf hybrids, through their potential association with both dogs and wolves, may introduce new diseases into wild wolf populations. This is especially true when wolf densities are high and wolves seek prey items near human habitation, and when many dog and wolf-hybrid owners shun veterinary care and seek remote living conditions. When the Board of Game clarified that possession of hybrids was not legal, DPS/FWP sent letters to the 2 major breeders/sellers in this area, asking them to cease selling hybrids. Neither vendor replied to the letter, and no further action was taken (Sgt. Charles Yoder, personal communication). I speculate that the potential for prosecution, coupled with obvious financial difficulties, may have led some wolf-hybrid owners to release their hybrids into the wild. This in turn, may have introduced lice into the wild wolf population, as all louse-infested wolf packs bordered that part of the Parks Highway.

I believe the division should develop a policy to permit current hybrid owners to keep their animals, as long as owners can prove the animals have been spayed or neutered, and aggressively enforce the regulation prohibiting future ownership. Concurrently, our research section should investigate whether new genetic techniques will help distinguish between hybrid and wild wolves. Alternatively, we could possibly develop a morphological key that could identify most hybrids that are closely related to wolves, or empanel a group of breeders, animal control officers, veterinarians, and biologists to make classifications based strictly on phenotypic

characteristics. (Most professionals agree they can tell when an animal has a large percentage of wolf.) Both alternatives could theoretically achieve the goal of identifying animals that look like wolves.

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PREPARED BY:

Mark Masteller
Wildlife Biologist II

REVIEWED BY:

Howard Golden
Wildlife Biologist III

SUBMITTED BY:

Michael McDonald
Assistant Management Coordinator

Table 1 Unit 14 fall (pre-trapping season) wolf population estimates, 1994–1998

Year	Population estimate	Packs (nr)	Basis of estimate
1994/95	60-85	8-11	Sample Unit Probability Estimate in 14C, incidental observations in 14A and 14B.
1995/96	70-100	9-11	Incidental observations, sealing records, reports from public
1996/97	80-115	11-13	same as above
1997/98	70-105	11-13	same as above
1998/99	120-150	19-21	ADFG staff; wolf/lice project

Table 2 Unit 14 wolf harvest, 1994–1998

Regulatory year	Reported harvest				Method of take			Successful Trapper/hunters
	M	F	Unk	Total	Trap/Snare	Shot	Unk	
Unit 14A								
1994/95	9	7	0	16	9	7	0	8
1995/96	12	7	0	19	14	5	0	6
1996/97	6	4	0	10	8	2	0	7
1997/98	4	2	0	6	3	3	0	6
1998/99	6	7	1	14	10	4	0	10
Unit 14B								
1994/95	2	2	0	4	1	3	0	2
1995/96	2	0	0	2	2	0	0	1
1996/97	2	2	0	4	2	2	0	3
1997/98	3	2	0	5	2	3	0	4
1998/99	5	5	0	10	9	1	0	6
Unit 14C								
1994/95	0	2	0	2	1	1	0	2
1995/96	0	3	0	3	2	1	0	3
1996/97	2	2	0	4	1	2	1	3
1997/98	3	0	0	3	3	0	0	2
1998/99	2	2	0	4	4	0	0	2
Unit 14 Total								
1994/95	11	11	0	22	11	11	0	12
1995/96	14	10	0	24	18	6	0	11
1996/97	10	8	0	18	11	6	1	13
1997/98	10	4	0	14	8	6	0	12
1998/99	13	14	1	28	23	5	0	18

Table 3 Unit 14 wolf harvest chronology percent, 1994–1998

Regulatory year	Harvest periods							
	Aug–Oct	November	December	January	February	March	April	*n*
1994/95	14	0	41	41	4	0	0	22
1995/96	4	4	42	33	8	4	4	24
1996/97	0	17	22	22	22	22	11	18
1997/98	28	0	43	7	14	0	7	14
1998/99	11	14	0	18	46	11	0	28

Table 4 Unit 14 wolf harvest percent by transport method, 1994–1998

Regulatory year	Harvest								
	Airplane	Dogsled Skis Snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1994/95	9	0	0	23	59	0	0	9	22
1995/96	4	0	0	58	4	0	17	17	24
1996/97	5	0	0	17	50	0	0	28	18
1997/98	7	7	7	14	36	0	28	0	14
1998/99	18	4	0	14	46	0	14	4	28

APPENDIX A

BRIEFING PAPER
ON
INFESTATION OF LICE AMONG WILD CANIDS IN ALASKA

Prepared for the Division Management Team

by
Howard N. Golden
Ted H. Spraker
Herman J. Griese
Randall L. Zarnke
Mark A. Masteller
Donald E. Spalinger
Bruce M. Bartley

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ABSTRACT

Several biological and social concerns regarding louse infestations in wild Alaskan canids were identified following the recently discovered infestation of lice on wolves (*Canis lupus*) and coyotes (*C. latrans*) in the Mat–Su Valley. The biting dog louse (*Trichodectes canis*) was first identified on a coyote and then on several wolves harvested on the Kenai Peninsula during the winters of 1981–82 and 1982–83. The department attempted to eliminate the louse infestation among the wild canids by capturing and treating them with injections of the antiparasitic drug ivermectin and with ivermectin-treated baits. This effort was not successful in stopping the spread of the infestation, because of the difficulty in catching and treating all infested animals, and funding was stopped precluding treatment after the second winter. In November and December 1998 trappers reported catching wolves and coyotes with evidence of lice in the Mat–Su Valley. Similar efforts to those on the Kenai resulted in all known infested wolves being treated. The results of trying to eliminate lice in coyotes with treated baits were not known. The operational cost of the effort in the Mat–Su Valley was $60,000. The rapid spread of lice among wolves on the Kenai and the recent outbreak in the Mat–Su Valley raises serious concerns that a similar infestation can happen elsewhere in the state. The source of lice in both areas was believed to be domestic dogs, which are infested with lice in a low-level enzootic stage throughout Alaska. The spread of lice to Interior coyotes and wolves, in particular, could have significant effects on the trapping economy and on the quality of wolf viewing. The relationships between parasites and their hosts can be complex, involving lengthy adaptations to each other. With the spread of lice, we may see higher morbidity of wolves and coyotes, particularly among young animals. However, there is no evidence of direct mortality from lice or of a negative population effect from lice on wolves or coyotes in Alaska or the lower 48 states.

INTRODUCTION

The purpose of this briefing paper is to provide the Wildlife Conservation Division Management Team with an overview of our current knowledge of louse infestations among wolves (*Canis lupus*) and coyotes (*C. latrans*) in Alaska to aid the team in policy development. A specific

policy regarding louse infestations among wild Alaskan canids should be considered in light of the recently discovered infestation of lice on wolves and coyotes in the Mat–Su Valley. The policy should address appropriate actions and funds necessary for research and management to implement policy.

The Wolf Conservation and Management Policy for Alaska (revised by the BOG, 29 June 1993) addresses the issue of disease and parasite control as follows:

> Like all other species, wolves have evolved in the presence of many natural diseases and parasites. In most cases, wolf populations are capable of responding to the effects of diseases and parasites without the need for human intervention. However, there may be times when action is warranted to halt the spread of a disease or parasite infestation for the benefit of the overall wolf population, particularly if the disease or parasite is introduced to wolves from an unnatural source.
>
> AS 16.05.020 directs and authorizes the Commissioner to protect the wildlife resources of the state. If, in the Commissioner's judgment, it is necessary to take an action to protect wolves or other wildlife from the adverse effects of disease or parasites, such action may be taken without further authorization by the board.
>
> The only situation in Alaska at this time that meets these criteria for human intervention is the infestation of wolves on the Kenai Peninsula by the biting dog louse *(Trichodectes canis)*. This louse probably infested wolves through initial contact with domestic dogs.

In this paper, we address the following topics:

1. Background on wild canids and lice, specifically the history of their infestation across North America, on the Kenai Peninsula, and in the Mat–Su Valley
2. Limitations to current knowledge on barriers and potential rates of transmission and on the adaptive ability of wild canids to minimize the effects of lice
3. Efforts to control the spread of lice in wolves and coyotes on the Kenai Peninsula and in the Mat–Su Valley
4. Projected effects of lice on wild canids and their management across Alaska if no further control effort is implemented

BACKGROUND

Lice and Their Effects on Wild Canids

Lice are distributed worldwide but are very host-specific (Turner 1971). The biting dog louse (Order Mallophaga) is an ectoparasite believed to live only on dogs, wolves, and coyotes. These lice spend their entire life cycle within 1–2 mm of the skin surface of the host. Eggs (or nits) are cemented to hair shafts and hatch in 1–3 weeks. Their life cycle takes 3–4 weeks and may result in 11–14 generations per year (Turner 1971). Nymphs are smaller but similar to adults, which

grow to 1–3 mm in length. Lice feed on skin debris, particles of hair, sebaceous secretions from the skin, and blood on the surface of the skin. Biting lice irritate the skin of their hosts by their movement and chewing. They are generally not a problem in healthy animals, and heavy infestations are probably due to poor condition of the host rather than the cause of it (Turner 1971).

The most obvious effect of lice on wolves and coyotes has been to their pelts. Pelts of wolves and coyotes infested heavily with lice are often in extremely poor condition, exhibiting various degrees of damage. In moderate cases guard hairs are broken at 10–20 mm lengths and underfur is matted by sebum that exudes from the skin because of the irritation by lice. This creates a smell described as a mix between rotting flesh and earwax. The irritation causes frequent scratching and rubbing. Hair damage and loss is greatest on the back between the shoulder blades and in the groin area. In extreme cases, pelt damage covers much of the body trunk and exposes the skin surface to the elements, causing skin to turn gray. Pups are usually affected most. The condition of louse-infested pelts makes many of them almost worthless to trappers and furbuyers, particularly later in winter when infestations intensify.

Wild Canids and Lice in North America

The occurrence and geographic distribution of louse-infested wolves and coyotes in North America is not well documented. Wolves and coyotes from several counties in Minnesota and Wisconsin were reported to have lice in the early 1980s (Mech et al. 1985), and lice are still common among wolves in Minnesota (William Berg, Minnesota DNR furbearer biologist, pers. commun.). Two coyotes with lice were collected in Michigan in 1979 and 1981. One coyote from Idaho, another from Washington in 1976, and a single wolf near the Manitoba–Saskatchewan border in 1983 had lice.

Although lice are found among several packs across the wolf's range in Minnesota, biologists do not consider them to be a population or management problem there. Controlled trapping of wolves around livestock operations by Wildlife Services (USDA) indicates that only 5–10% of the animals are infested with lice. Minnesota biologists believe the behavior of wolves isolates their packs and may be a factor in limiting the spread of lice (William Berg, Minnesota DNR furbearer biologist, pers. commun.). They also believe it is possible that wolves in Minnesota have developed some level of immunity to the effects of lice. The state takes no action to treat infested packs.

Wild Canids and Lice in Alaska

When and how lice first arrived in Alaska is highly speculative. The best guess is that lice were introduced to wild canids from contact with domestic dogs. In most Alaskan communities, there are a large number of dog kennels, dogs that are allowed to run free and feral dogs that often have lice and occasionally come in contact with coyotes and wolves.

The biting dog louse was first identified on a coyote and then on several wolves harvested in Game Management Unit (Unit) 15A on the Kenai Peninsula during the winters of 1981–82 and 1982–83. Lice were found on 11 wolves among 4 packs in 1981–82 and on 10 wolves among 5 packs in 1982–83 (Schwartz et al. 1983). Fourteen of those 21 infested wolves were pups. Louse

density on infested areas of 5 pups ranged from 2 to 8 lice/cm^2. Pups seemed most affected but all infested wolves had hair breakage and loss, seborrhea, dandruff, and lesions, which were most extensive between the shoulders and in the groin (Schwartz et al. 1983). Although all had heavy infestations, most of the 11 wolves initially examined after the outbreak of lice on the Kenai were in good physical condition (Schwartz et al. 1983). The only animal in poor condition was a pup with no visible fat reserves. No additional morbidity or mortality was observed, but department staff became concerned that heavily infested wolves would be more susceptible to disease and cold temperatures and commercial value of their pelts would drop significantly (Schwartz et al. 1983).

Except for the possibility that some heavily infested wolves died from exposure to severe cold, the louse infestation among Kenai wolves does not seem to have restricted reproduction or survivorship. Wolves recolonized the Kenai Peninsula during the 1960s, after being extirpated there 25 years before, and by 1975 had repopulated most of the suitable habitat (Spraker 1997). The population increased rapidly, mainly because of a high-density moose population, and has remained at 180–200 animals since 1981–82. Pups have comprised over 1/3 of the fall population. Wolf distribution has increased over the past 20 years on the Kenai. There are estimated to be 45 wolves among 6 packs in Unit 7 and 155 wolves among 14 packs in Unit 15 (Spraker 1997). Wolf packs are now found across Kachemak Bay down to the southern tip of Unit 15C. However, their numbers and distribution are not consistent over time. Wolf survival on the southern portion of their range is low, which could be due to low numbers of moose and lack of caribou. Spraker (1997) reported that natural mortality rates have been low among Kenai wolves but may be increasing due to high wolf densities and declining prey populations. Trappers and hunters annually harvested 2–12 wolves in Unit 7 and 5–17 wolves in Unit 15 between 1991–92 and 1995–96. The harvest in 1996–97 was 30 for the entire Kenai (Hicks 1997). An agreement with the U. S. Fish and Wildlife Service allows wolf harvest management on a quota system in Unit 15A. Spraker (1997:37) concluded the recent wolf harvest of 15% of the fall population was low and that "the wolf population will probably be controlled by prey abundance, increased dispersal, and natural mortality."

During the winter of 1991–92, a radiocollared wolf was reported in the Knik River valley of Units 14A and 14C, northeast of Anchorage. The wolf was identified as a Kenai wolf, and she and her mate both exhibited frequent shaking and scratching typical of louse-infested animals. The 2 wolves were captured and treated with ivermectin. Subsequent inspection of trapper-caught wolves from that pack indicated a successful cleansing effort.

During the winter of 1992–93, the department initiated a statewide effort to evaluate the extent of infestation by lice in wolves and coyotes. Our goal was to inspect all harvested wolves submitted for sealing. If the department believed the infestation was limited to the Kenai Peninsula, the strategy would be to attempt to confine the infestation there. No evidence of lice was found elsewhere during the evaluation. Furthermore, no subsequent sightings of louse-infested wolves off the Kenai Peninsula were reported until the winter of 1998–99.

In November and December 1998, trappers reported catching wolves and coyotes with evidence of lice between Willow and Talkeetna in the lower Susitna River valley. Department staff speculated on the extent of infestation and its potential rate of spread and deliberated the

feasibility of success in treating infested animals with ivermectin. The decision was made to commit funds and staff to investigate the infestation and then treat or remove infested packs if necessary. Our experiences with infestations in the Kenai packs suggested that if even 1 wolf escaped treatment, its pack would become reinfested and the control effort would fail.

LIMITATIONS TO CURRENT KNOWLEDGE

Several biological and social concerns regarding louse infestations in wild Alaskan canids were identified where our knowledge is limited. The following items incorporate (1) topics presented in the available literature, (2) experience gained through research and management activities by department staff, and (3) some of the ideas suggested by Dr. Walter Boyce, a specialist in wildlife ectoparasites from the University of California at Davis who provided analysis and recommendations at the division's request (Appendix B).

Biological Concerns

- Sources and mechanisms of louse transmission: Is the Mat–Su infestation an example of a low-frequency transmission rate that can potentially be controlled, or is this an indication that conditions are now right (e.g., wolf populations are dense enough or the climate has changed enough, etc.) to allow rapid transmission of the infestation northward?
- Extent of infestation among wolves, coyotes, and domestic or feral dogs (including wolf–dog hybrids)
- Level of interaction among wolves, coyotes, and dogs
- Influence of wolf population growth rates and pack stability on the spread of lice
- Survival and reproductive success of louse-infested animals: Will Interior wolves be affected similarly to Kenai wolves (e.g., low mortality, chronic infestation, no or slow rate of adaptation)?
- Susceptibility of individuals to infestation and the influence of disease and suppressed immune systems in wild canids on their vulnerability to lice
- Ability of lice to live in colder, dryer climates
- Genetic variability among lice affecting wolves, coyotes, and dogs

Social Concerns

- Ability of the division to influence dog owners and public agencies to take action to greatly reduce or eliminate the prevalence of lice among domestic and feral dogs
- Level of public concern about the esthetic and monetary value of wild canids that may be lost due to lice
- Level of public concern about the use of different options for eliminating louse infestations among wild canids in the state

LOUSE CONTROL EFFORTS

Most of the material in this section is from a paper presented to the 1999 Annual Meeting of the Alaska Chapter of The Wildlife Society by Herman J. Griese, Ted H. Spraker, and Mark A.

Masteller, entitled Recent attempts to arrest the spread of *Trichodectes canis* among wild canids in Southcentral Alaska.

Initial Efforts

In response to the initial infestation of wolves and coyotes on the Kenai Peninsula during the winter of 1981–82, the department proposed to identify and eliminate all infested packs there, which was the course of action recommended by several ectoparasitologists. However, this proposal followed attempts by the department to enact wolf control programs in Interior Alaska, and a vocal segment of the Anchorage public claimed it was a "smoke screen" to hide our continuing attempt to eliminate wolves. Subsequently, the Commissioner and Governor withdrew the option to kill infested wolves, forcing the department to use other measures to control or eliminate infestation.

During February 1983, ivermectin (an antiparasitic drug from Merck & Co., Inc. developed to eliminate ectoparasites in horses and cattle) was identified as a possible treatment for louse-infested wolves and coyotes (Taylor and Spraker 1983). When administered orally, subcutaneously, or intramuscularly at twice the recommended dosage, ivermectin eliminated the adult lice and any hatching nymphs before the lice could reproduce. Ivermectin was tested on 3 infested wolves held in captivity and was determined to be a possible alternative to killing the infested packs (Taylor and Spraker 1983). However, the efficacy of treating wolves and coyotes in the field had yet to be tested. Because the duration of the drug's action was limited to 6 months, it was uncertain whether wolves would become reinfested before all affected animals were treated.

Wolves from the 5 infested packs were captured from a helicopter and treated with intramuscular injections of ivermectin in March 1983 (Taylor and Spraker 1983). Baits treated with the liquid form of ivermectin were also scattered in the area at sites of wolf-killed moose. Although treatment with ivermectin appeared to rid at least some of the infested animals of lice, capturing and treating wolves proved ineffective because infested packs were relatively large (up to 18 individuals) and not all pack members could be caught. The treated baits were also of limited value because of the relatively small scope of their coverage and their consumption by nontarget species. Because of the lack of success in stopping the spread of the louse infestation and the significant staff time and resources already invested in the program, funding was stopped after the second winter (1983–84).

Subsequently, the lice rapidly spread to wolves in Unit 15C, then Unit 15B, and eventually Unit 7. An attempt to eliminate the initial foothold of lice in Unit 7 by trapping and treatment was successful but for only a short time. By the early 1990s, it was believed all known packs on the Kenai Peninsula were infested with the biting louse.

Recent Efforts

The most recent louse infestation was localized along the George Parks highway between Willow and Talkeetna, within the drainage of the lower Susitna River in Units 13E, 14A, 14B, 16A, and 16B. The area was bounded on the east by the Talkeetna Mountains, on the south by Knik Arm, on the west by the Yenlo Hills, and on the north by Denali State and National Parks. The source

of this new infestation was unknown, but it is possible that the wolves were infested from domestic dogs.

Methods

A reconnaissance of the area was made during 4–8 January 1999 and 3 wolf packs were inspected from fixed-wing aircraft. During 19–22 January wolves were captured using 2 Robinson-22 helicopters, each accompanied by 2 spotter aircraft. The objective was to capture at least 1 wolf from each pack in the study area but to strive for 1 adult and 1 pup in each pack.

Wolves were darted using Telazol®, which is a commonly used immobilizing drug for wolves. At least 1 wolf from each pack was radiocollared and every animal handled was treated with ivermectin at a dosage of approximately 20 mg/100-lb wolf. Numbered tags and flagging was attached to the ears of all wolves caught to aid in identifying treated pack members. Each captured animal was inspected for lice, and samples of hair, blood, lice, and louse egg casings were collected.

During 25–30 January all wolves in each infested pack were captured and treated. Each pack was radiotracked 1–9 times in the subsequent 6-week period to ensure that all infested wolves were treated.

In February and March 1200 treated baits were distributed in the area of infestation. Baits consisted of 3–6 ounces of moose meat injected with 10 mg of ivermectin in paste form. The goal was to reach coyotes and any lone wolves not previously captured and treated. Wildlife Services of U.S. Dep. of Agriculture was contracted to assist in distributing baits and to live-capture as many coyotes as possible within the area of the infested packs. Local trappers were relied upon heavily to disperse the baits and to observe the wolf packs for signs of infestation. Trappers were also questioned on the number and locations of louse-infested coyotes caught.

Results

Wolves. Through the end of January, 14 packs containing a minimum of 135 wolves were found and evaluated (Table 1). In the evaluation phase (19–22 January 1999), 20 wolves from 10 packs were captured and handled and 3 of the 14 packs were verified with lice. One female from the Sheep River pack, died as a result of capture efforts. Eleven wolves were radiocollared.

The infested packs included the Willow Mountain pack, the Montana Creek pack, and the Deshka River/Moose Creek pack (Fig. 1). During 25–30 January 27 of the 34 wolves in the 3 packs were treated (Table 1). An adult female in the Willow Mountain pack also died as a result of capture efforts. At the time it was believed all but 1 member of the 3 infested packs had been captured. A single wolf, observed in the Montana Creek pack during 19–22 January, could not be found during the capture and treatment period.

Nine separate visits to the Montana Creek pack were made over the next 6 weeks to find the remaining untreated wolf. During those visits, the pack declined to 2 adults. A trapper presented a wolf for sealing that he had trapped just inside the adjoining Kashwitna River pack territory.

The wolf was unmarked and was infested with lice. This may have been the missing Montana Creek pack member.

Trappers also caught 2 additional infested, unmarked wolves in or near the Deshka River/Moose Creek pack territory. Because of this pack's large size and because tracks of 2 single wolves were observed within this territory, these 2 wolves were probably the 2 lone, untreated members of that pack.

Trappers provided wolf pelts for evaluation from 2 additional packs of the original 14, the Little Susitna–Pt. Mackenzie pack and the Lake Creek pack; these pelts were free of lice. The 2 remaining packs, Upper Yentna River and Kahiltna Glacier packs, were observed at close range from the air and seemed healthy.

By the end of the required pelt sealing deadline (30 April 1999) at the end of the trapping season, trappers presented pelts of 14 wolves from 6 other packs in the general area, and these animals were all free of lice (Table 1). Based on observations and harvests by trappers, 34 wolves were estimated to have lice in the Mat–Su Valley before treatment began. Twenty-seven wolves from the 3 infested packs were treated. Trappers caught 7 more infested wolves, 3 of which were taken after treatment. Thirteen additional uninfested wolves were treated during 19–22 January 1999 (Table 1).

Blood samples were collected from wolves captured during the 1999 treatment program in the Mat–Su area. Serologic tests were conducted for selected disease agents, and antibody prevalence was high for canine parvovirus (18 of 27 wolves tested) and canine corona virus (19 of 27 wolves tested). These values were higher than those found in previous surveys. However, they were comparable with data from other regions of Alaska during the late 1990s. There was no apparent relationship between antibody prevalence for these viruses and louse infestation.

Coyotes. Fourteen active trappers within the study area were questioned and 36 coyotes were evaluated for lice. Although not all of those coyotes were available for inspection, up to 6 of them may have been infested. Department staff confirmed lice on 4 coyotes.

Of note was a coyote that had been killed 26 hours earlier and stored overnight in subfreezing temperatures. Upon inspection most (6 of 7) lice were found still alive on the partially frozen carcass. It had previously been assumed lice would survive only a few hours in freezing temperatures following the death of the host (Turner 1971).

Coyotes readily discovered and consumed the ivermectin-treated bait distributed along roads, trails, and waterways (Fig. 2). In many cases individual coyotes consumed several baits.

Attempts to live-capture coyotes proved unsuccessful. Many of the coyotes had become shy of traps and snares by the end of the trapping season.

Conclusions

It was believed all organized packs were identified and that approximately 90% of the infested wolves in the Mat–Su Valley study area had been treated. Trappers may have captured most of

the remaining infested wolves. The 3 infested wolves trapped after treatment are hoped to represent the only remaining untreated individuals. It is believed the infestation was beyond its first year of development, because the posttreatment captures of infested wolves outside territories of treated packs indicated wolves had already dispersed from infested packs.

It is possible there was wolf mortality caused in part by infestation of lice. The disappearance of the 2 younger wolves from the Montana Creek pack followed a period in which temperatures remained below –40 °C for a number of days. Such mortality would probably be restricted to pups and yearlings. Adults in fair to good physical condition tend to exhibit less hair loss and thus are less prone to mortality from exposure. Adults in poor condition can have hair loss as severe as pups.

It is unclear why lice have infested virtually all wolf packs on the Kenai but relatively few coyotes. In contrast, in the Mat–Su Valley, initial surveys estimated 10–20% of the coyotes in the study area were infested. This level is well above that observed on the Kenai Peninsula over the past 17 years.

As on the Kenai Peninsula, the suspected origin of the Mat–Su Valley infestation was from free-roaming domestic dogs. The potential for interaction between dog and wild canid has increased substantially in the last 2 decades. As people settled in the valley, they often sought remote locations along the main highway corridor to avoid municipal restrictions (such as leash laws). The concurrent elimination of same-day airborne hunting and an abundant moose resource enhanced the growth of the wolf population. It is also possible that coyotes served as intermediate hosts.

The cost of the effort in the Mat–Su Valley was approximately $60,000 in operational expenses, not including the time of several staff.

PROJECTED EFFECTS IF NO CONTROL EFFORT IS IMPLEMENTED

This is a difficult topic to address because of the lack of empirical data to support projections. The rapid spread of lice among wolves on the Kenai and the recent outbreak in the Mat–Su Valley raises serious concerns that a similar infestation can happen elsewhere in the state. It is well known that dogs throughout Alaska are infested with lice in a low-level enzootic stage (Zarnke 1985; William Taylor, ADF&G veterinarian, pers. commun.). However, the potential for dogs to transmit lice to wild canids around communities away from the road system may be minimal because wolf harvest there tends to be high. Dispersing Southcentral wolves and coyotes may be a bigger potential factor than domestic or feral dogs in the spread of lice to wild canids in the Interior. The tendency of wolf packs to isolate themselves from one another may help restrict the spread of lice as long as wolves do not come into contact with dispersing, infested animals. Zarnke (1985) found that lice did not establish a chronic infestation in an experiment to infest 4 captive wolves in Fairbanks with lice, which were obtained from free-ranging wolves on the Kenai Peninsula, although he found lice on captive wolves for 2 months following exposure. This study indicated lice were not as easily transmitted between animals as believed.

The spread of lice to Interior coyotes and wolves, in particular, could have a significant economic effect on trappers because of lost pelt value. In those areas where trapper incentive is reduced, the department would have to reassess ungulate management goals and develop new strategies to manage predators. Louse-infested wolves in Denali National Park would certainly affect the quality of wolf viewing.

The relationships between parasites and their hosts can be complex. Generally, hosts and parasites in well-established relationships have adapted so that neither is seriously harmed by the other. However, parasites that are not endemic to an area are more destructive to new hosts that have never encountered the parasite before (Chandler 1954). This seems to be the case with wild canids and lice in Alaska. Immune responses (whether cellular- or antibody-mediated) by wolves and coyotes may be a factor and play a significant role in their relationship with lice. Wolves and coyotes in Alaska may be suffering from acute allergic reactions to antigens from lice that may diminish over time as the canids and lice adapt to each other. However, heavy infestations, especially coupled with poor body condition, can inhibit the development of an improved immune system and allow further infection (Chandler 1954). Based on our limited observations of the Kenai infestation, it will likely take a significant number of generations of wolves and coyotes to develop an adaptive response that limits the effects of lice on their populations. Environmental conditions may not be severe enough on the Kenai Peninsula to significantly reduce the condition or fitness of heavily infested wolves and coyotes, thus preventing a selection against the condition. This may explain the lack of response by wild canids on the Kenai over the past 18 years. It can be speculated that the harsh winter conditions in the Interior would provide sufficient stress on infested animals to allow adaptation to proceed more rapidly.

With the spread of lice, we may see higher morbidity of wolves and coyotes, particularly among young animals. Animals already food-stressed or otherwise in poor condition will probably be more susceptible to disease and cold if they are also heavily infested with lice (Schwartz et al. 1983). However, there is no evidence of direct mortality from lice or of a negative population effect from lice on wolves or coyotes in Alaska or the lower 48 states.

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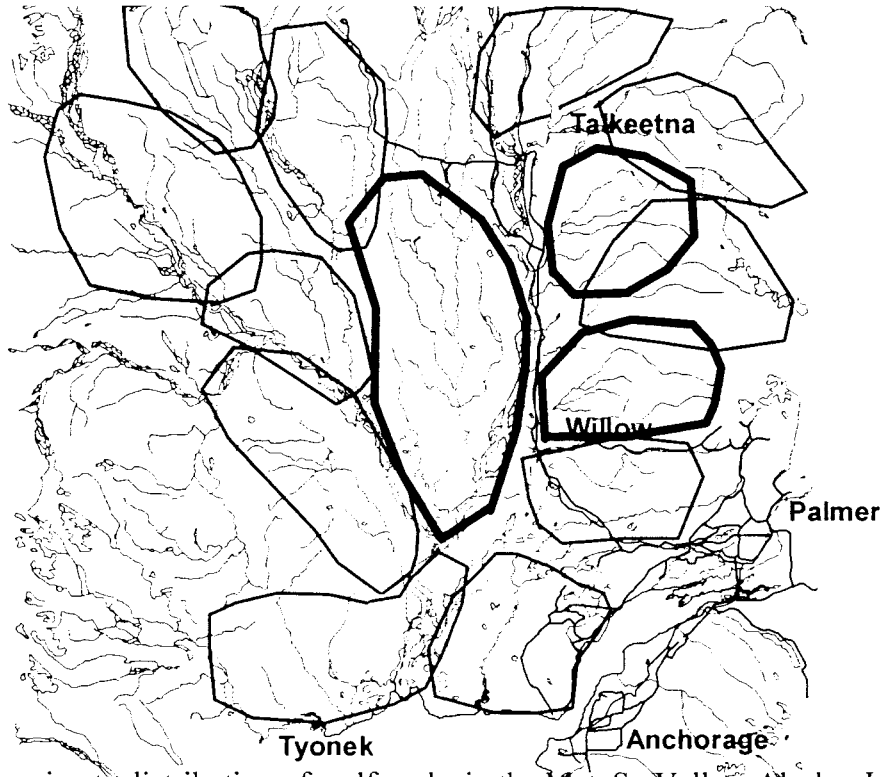

Figure 1 Approximate distribution of wolf packs in the Mat–Su Valley, Alaska, Jan–Feb, 1999. Heavy black lines delineate louse-infested packs.

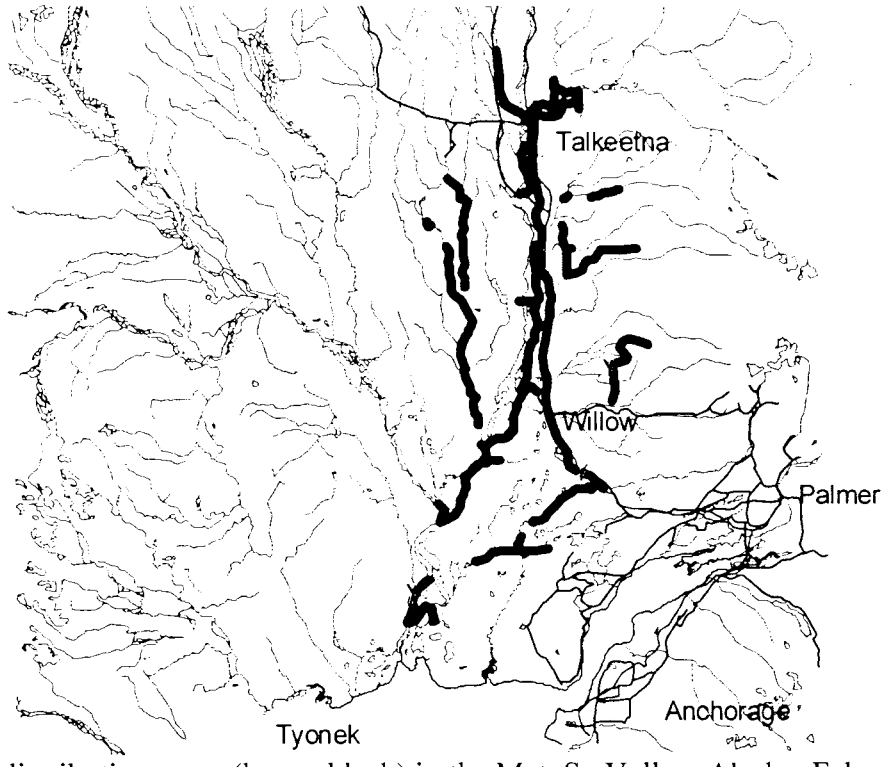

Figure 2 Bait distribution areas (heavy black) in the Mat–Su Valley, Alaska, Feb–Apr, 1999.

Table 1 Status of wolf packs that were examined and treated for lice in Game Management Units 13E, 14A, 14B, 16A and 16B, Alaska, December 1998–March 1999. Infested packs are shown in bold type.

Pack Name	Unit	Initial Pack Size	Observed Condition	Captured And Treated	Capture Mortality	Harvest by Trappers Before Treatment	Harvest by Trappers After Treatment	Pack as of 15 May
Packs found and evaluated before the end of trapping season								
Little Susitna/Point Mackenzie	14A	4	Clean	0	0	0	3	1
Bald Mountain	14A	5	Clean	2	0	0	4	1
Willow Mountain	**14B**	**14**	**Infested**	**12**	**1**	**2**	**1**	**8**
Kashwitna River	14B	16	Clean	1	0	0	0	16
Montana Creek	**14B**	**6**	**Infested**	**4**	**0**	**1**	**1[a]**	**2–4[b]**
Sheep River	14B	5	Clean	2	1	0	0	4
Chunilna Creek	13E	5	Clean	2	0	0	3	2
Kahiltna Glacier	16A/B	2+	Clean[c]	0	0	0	0	2+
Kahiltna River	16A	9	Clean	2	0	0	0	9
Deshka River/ Moose Creek	**16A**	**14**	**Infested**	**11**	**0**	**1**	**3[d]**	**10**
Upper Yetna River	16B	6	Clean[c]	0	0	0	0	6
Lake Creek	16B	12	Clean	0	0	3	5	4
Alexander Creek	16B	17	Clean	2	0	0	0	17
Theodore River	16B	20	Clean	2	0	1	4	15
Total		135		40	2	8	24	97–99
Adjacent packs evaluated by the end of trapping season[e]								
Portage Creek	13E	14	Clean	0	0	0	1	13
Knik River	14A	5–6	Clean	0	0	2	2	1–2
Granite Creek	14A	?	Clean	0	0	0	1	?
Prairie Creek/ Talkeetna River	14B/ 13E	15	Clean	0	0	0	3	12
Yellow Jacket Creek/ Beluga River	14B/ 13E 16B	16 5	Clean	0	0	0	3 2	13 3
Total		55–56		0	0	2	12	42–43

[a] A trapper caught a louse-infested wolf after treatment in the territory of the Kashwitna River pack, but we believe it was from the Montana Creek pack.
[b] We suspect the mortality of 2 pups or yearlings that disappeared after extreme cold temperatures.
[c] Louse infestation was determined from aerial observation.
[d] Two wolves captured after treatment were unmarked and had lice.
[e] Hides of trapped wolves were inspected for lice.

Appendix B. Transcript of analysis and recommendations of Dr. Walter Boyce concerning the infestation of biting lice in Alaskan canids. Dr. Boyce is Associate Professor and Associate Parasitologist in the Department of Pathology, Microbiology, and Immunology at the University of California at Davis. He has extensive experience with ectoparasite-host relationships. His special interest is in ectoparasitic mites and bighorn sheep.

After reviewing the materials you sent me, and based on our phone conversation, I have put together my thoughts on what you need to know, and how you might gain the answers you need.

Major unknowns and management implications:

1. What effect do lice have on survivorship and reproductive success?

   If no effect, then no need to manage. If lice do have negative effects, then appropriate management strategies should be explored.
2. Are lice on the Kenai genetically similar to those on the mainland?

   If lice are genetically similar on the Kenai and the mainland, then it is likely that there was/is gene flow between the two locations. In other words, we could not reject the hypothesis that the Kenai served as the original source of lice for infested mainland wolves. If the lice are dissimilar, this implies that there were different sources of lice for the two areas. From a management perspective, a single source of lice suggests more opportunities for effective control, whereas multiple sources of lice would be more difficult to manage/eliminate.
3. Are lice on wolves, coyotes, and domestic dogs genetically similar?

   Essentially an extension of #2 with similar implications. If dogs and/or coyotes share lice with wolves, then management becomes very problematic. If however, louse populations are essentially restricted to different host species (i.e., wolf lice, dog lice, coyote lice), then management is simplified. Knowing the answer to #3 will also provide solid insight into the origin of the wolf infestation on the mainland and Kenai (especially in combination with #2).
4. Is treatment an effective management tool?

   An essential question given the answers to 1–3 above. Without an effective treatment, management options will be limited. However, it is essential to evaluate the efficacy of treatment since it is all too easy to spend considerable time, money and effort on a less-than-useful treatment program.

My suggestion is to develop and initiate a research and management program that addresses these questions. The design must incorporate testable hypotheses so that every action you take moves you forward.

Hypotheses (null and alternate):

1. Ho – lice have no effect on survivorship

   Ha – lice significantly decrease survivorship

2. Ho – treatment has no effect on survivorship of infested wolves

   Ha – treatment significantly increases survivorship

3. Ho – wolves are susceptible to reinfestation after successful treatment

   Ha – wolves are not susceptible to reinfestation

4. Ho – treatment has no effect on pack survival and reproductive success

   Ha – treatment significantly increases pack survival and reproductive success

5. Ho – lice on mainland and Kenai wolves are genetically similar

   Ha – lice are not genetically similar

6. Ho – lice on wolves, coyotes, and dogs are genetically similar

   Ha – lice are not genetically similar

Hypotheses 1–4 could be tested in a field study using radiocollared wolves

Hypotheses 5–6 could be tested in the lab with a molecular study of lice

Outcome – the final outcome of the above studies would be definitive answers to questions that have major conservation and management implications (i.e., those identified at the beginning of this document).

LOCATION

GAME MANAGEMENT UNIT: 16 (12,300 mi^2)

GEOGRAPHIC DESCRIPTION: West side of Cook Inlet

BACKGROUND

Prior to the 1900s and the establishment of major human settlements in Anchorage, Palmer/Wasilla and Kenai/Soldotna, wolf numbers in Unit 16 fluctuated with prey densities. Since 1900 wolf populations have been heavily influenced by various human harvest regimes. These have ranged from predator-control strategies (including the use of poison, bounties, and aerial shooting) prior to statehood to relatively restrictive regulations including only trapping and sport hunting (Harkness 1991, Masteller 1994).

Reports from trappers, pilots and staff indicate wolf numbers began increasing in the early 1990s. The first systematic population estimate of wolves in Unit 16 occurred in March 1993, during the development of the Sample Unit Probability Estimator (Becker et al. 1998). At that time we estimated there were 48–62 wolves, in 8–10 packs, in this area. The population has more than doubled since that survey.

During November and December 1998 trappers caught several wolves (and coyotes) in the lower Susitna Valley (Units 16A and 14B) that were infested with the dog-biting louse *Trichodectes canis*. This was the first time lice had been confirmed in Alaskan wolves outside the Kenai Peninsula, where louse-infested wolves were first seen in 1981. The source of the recent infestation was unknown, but we suspect feral dogs or wolf-hybrids near the Parks Highway corridor. During January 1999 we mounted a large effort to treat infested wolves in the Susitna Valley, to prevent the spread of lice to other areas of the state. Our efforts revealed 1 pack in Unit 16A (and 2 adjacent packs in Unit 14B) were infested. We attempted to capture and treat all infested wolves with the antiparasitic drug ivermectin (Merck & Co, Inc.). We also distributed medicated baits, meant to treat coyotes, dogs and lone wolves. However, we were unsuccessful in eliminating lice from area wolves, as 6 louse-infested wolves (including 2 that had previously been treated) were trapped or found dead in Unit 16 during winter 1999–2000. These wolves were distributed from the lower Beluga River north to the West Fork of the Yentna River, and east to the Susitna River.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

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

MANAGEMENT OBJECTIVES

The population objective 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

During 1996–97 and 1997–98 we estimated wolf numbers, distribution, and population trends based on observations by staff, trappers, hunters, and pilots, and from interviews with trappers and hunters sealing fur from Unit 16. During 1998–99 numbers were estimated during our effort to control the lice infestation in the area. Annual wolf harvest was determined by sealing all wolves presented for examination.

With the unanticipated discovery of louse-infested wolves in this area, and the fear the infestation would move north, we met with staff from headquarters and regions 2 and 3 to discuss management options, political considerations and funding strategies. We decided that area staff would use non-lethal means to attempt to eliminate lice from Susitna Valley wolves and coyotes, employing a capture/treatment program for wolves and distribution of medicated baits for coyotes. Additionally, regional staff would attempt to treat domestic dogs in the Parks Highway corridor.

We enlisted the aid of several other area biologists in our effort to capture and treat all infested wolves in the Susitna Valley. We used aerial reconnaissance from Piper PA-18 aircraft to first locate and examine wolf packs, then we captured 1–2 wolves in each pack to confirm the presence or absence of lice. We captured and treated all known members of the infested packs, using 2 capture crews with 2 Robinson R-22 helicopters. Wolves were immobilized using Telezol, and ivermectin was administered to rid wolves of lice. We also distributed approximately 1200 meat baits, containing ivermectin paste, in the general area occupied by infested packs, to attempt to medicate coyotes and lone wolves potentially missed during our capture operation. Radiocollared wolves were tracked periodically to visually assess pelt characteristics and whether all pack members had been treated. No efforts were made to treat domestic pets in the affected area. The louse control effort is outlined completely in Golden and others (2000, Unit 14 Appendix A).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Unit 16 contained an estimated 120–140 wolves, in 16–19 packs, during fall 1998 (Table 1). This is approximately twice the number estimated during February 1993. The large increase in recent years is probably an artifact of our methodology and resources. The effort to control the spread of lice allowed us to get reliable minimum estimates of pack sizes and distribution in a large portion of Unit 16, and the resulting numbers were substantially higher than previous estimates in those areas. This demonstrates that the "traditional" method of estimating wolf populations solely from incidental observations by staff, trappers, pilots and other outdoor enthusiasts probably results in a significant under-estimation of wolf numbers. Further, we may be able to detect only large population shifts through traditional methodology.

I believe wolf numbers have steadily increased since the early 1990s, probably due to relatively high prey abundance, low rate of legal harvest, lower levels of illegal harvest, high wolf densities in adjacent areas, and several deep-snow winters, which increased prey vulnerability.

Distribution and Movements

Wolves inhabit most portions of Unit 16 (Table 2). Several packs utilize portions of other units. Territory boundaries can be very fluid over time, depending on factors such as wolf and prey density (Mech and others 1998)

Diseases/Parasites

Of 7 packs examined during the louse-control effort in Units 16, only 1 pack (Deshka River) was confirmed to have lice. An additional pack (Beluga River), evaluated by inspecting the hides of wolves taken by trappers or hunters, did not appear infested (Golden and others 2000, Unit 14 Appendix A). We captured and treated 11 wolves in the Deshka River pack and 2 wolves each in the Kahiltna River, Alexander Creek and Theodore River packs. The Kahiltna Glacier and Yentna River packs were classified as "clean" based on aerial observations only. The operational cost of the louse-control effort was $60,000 (including both Units 14 and 16). Because coyote and domestic/feral dogs (including hybrid wolves) are known to harbor lice, it is very difficult to totally remove lice from the area.

MORTALITY

Harvest

Season and Bag Limit. During the report period the hunting season for Unit 16 was 10 August–30 April, with a bag limit of 5 wolves. The trapping season was 10 November–31 March, with no bag limit.

Board of Game Actions and Emergency Orders. During June 1993 the Board of Game authorized same-day-airborne shooting of wolves, provided the person attempting to take the wolf had a trapping license and was at least 300 feet from the airplane. During November 1996 this method of take was prohibited through a statewide ballot referendum (effective 25 February 1997), so this method of take was legal during only a portion of the report period. For additional board action regarding wolf hybrids, please see the Unit 14 portion of this report.

Hunter/Trapper Harvest. Harvest averaged 25 wolves per year during 1996–1999 (Table 3), continuing an increasing trend since the late 1980s. During 1988–93 annual harvest averaged 7 wolves (Masteller 1994), and during 1993–96 annual averaged of 18 wolves (Masteller 1997). The proportion of wolves taken by shooting ranged from 31–54% in recent years, and was highest during the season when regulations allowed hunters to shoot the same day they had flown. The total number of trappers/hunters has generally been increasing, probably due to increases in human population, improvements in snowmachines and steady wolf pelt prices. However, the harvest can fluctuate significantly based on the efforts of a few experienced (and aging) wolf trappers.

Harvest Chronology. Most harvest typically occurs between December and March, but fall harvest has increased substantially in recent years (Table 4). As wolves become more numerous, more moose, sheep and caribou hunters report seeing and taking wolves. Winter harvest chronology is greatly affected by snow conditions.

Transport Methods. Most wolves are taken by people using snowmachines or aircraft to access their hunting or trapping areas (Table 5). The increase in harvest during fall is reflected in the relative increases in the percentage of hunters using boats, 4-wheelers, and aircraft.

HABITAT

Assessment

Moose populations in Unit 16B have been declining for over a decade, while in 16A moose numbers appeared stable (Griese in press). Many hunters report Dall sheep and caribou numbers are declining in the Alaska Range. Hare numbers increased substantially during 1996–1999, and beaver numbers have remained high. Heavy snow conditions in the Susitna Valley during winter 1999–2000 undoubtedly increased both moose vulnerability to wolves and moose starvation, providing plentiful carrion. Human density has increased slightly, but generally there are large areas with few permanent residents. Recreational development continues to increase, with more seasonal-use cabins, boating, and fishing.

CONCLUSIONS AND RECOMMENDATIONS

Our wolf population objective has not been met because we estimate the population is 3–4 times larger than the stated objective, and our objective does not (as in other units) specify a minimum number of wolves. This ambiguity may have important ramifications during intensive management discussions, as some members of the public may conclude we have been negligent by not attempting to hold the population near the objective range. I recommend discussions with local advisory committees and the Board of Game to clarify our population objective.

Our wolf human-use objective has been met, and no regulatory changes are recommended. Harvest rates, which were 15–30% annually during the report period, were well within sustainable rates (Ballard et al. 1987).

The wolf management goals for this area include conserving the wolf population, providing sustainable wolf harvest, and retaining "desirable" predator–prey ratios. With a growing population and relatively low harvest rates, the first 2 goals have been met. However, we have not defined desirable predator–prey ratios. With the increase in wolf numbers and decrease in moose numbers, the number of moose per wolf has declined from approximately 250:1 in 1993 to 70:1 in 1999. The latter is similar to other areas where moose populations were declining or stationary and predation (by both wolves and bears) was the suspected major factor limiting moose population growth (Gasaway et al. 1992). Good summer prey availability, harsh winter conditions increasing moose (and sheep and caribou) vulnerability, and potentially reduced wolf harvest rates because of lice may combine to further increase wolf density.

Managers must consider that Unit 16B is an "intensive management" area for moose and that the area currently supports 3 winter Tier II subsistence moose hunts. In the last decade subsistence hunters have been restricted to taking bulls only where cow harvest had been allowed in the past. As the moose population declines, there will undoubtedly be requests to control wolf populations. It will be important to define "desirable predator–prey ratio" using advisory committee and Board of Game input. If during intensive management discussions there is interest in reducing wolf numbers, it will be difficult to accomplish using current methods and means. The problem will be exacerbated if widespread pelt damage on wolves reduces trapper/hunter effort, further limiting methods for significant wolf harvest.

It is difficult to identify population trends without regular attempts to systematically assess population size. Because of the extraordinary efforts stemming from the louse infestation, we were able to develop a good minimum population estimate to compare with our systematic survey of 1993. It appears the population has at least doubled between 1993 and 1999 and that wolf numbers cannot accurately be estimated using only anecdotal and sealing information. Surveys should be conducted every 3 years to assess wolf numbers. Demographic and distribution information can be determined with simple reconnaissance flights when visibility and snow-tracking conditions are best, using 2–3 aircraft during a short period in early winter. This will require approximately $8,000 and appropriate technical staff time every 3 years. Current methodology (observations by staff, trappers, and the public) should suffice for distribution information.

The spread of the nonnative louse to the Susitna Valley is a very serious concern for managers. Six infested wolves, including 2 that had been treated in January 1999, were trapped in Unit 16 during winter 1999–2000. This indicates we were unsuccessful in eliminating lice from the area and that either ivermectin did not eliminate lice in these wolves, or (more likely) wolves were re-infested from untreated pack mates or feral dogs/hybrid wolves. In one instance an uncharacteristically small, unmarked, heavily-infested "wolf" was trapped on the Yentna River in the southwestern portion of Denali National Park and Preserve. With current high wolf densities, this parasite could spread rapidly within the Susitna Valley. Given natural dispersal rates for wolves (Mech et al. 1998), it is likely that lice will infest wolves in other parts of the state in the near future. Indeed, a wolf from the Deshka River Pack, treated for lice and marked in January 1999, was trapped near the Sanford River in Unit 11 during December 1999. The trapper reported the pelt showed loss of guard hairs between the shoulder blades, a typical sign of lice, but the presence of lice was not confirmed. Please refer to the Unit 14 recommendations for policy-related suggestions regarding louse infestations. Managers in other areas should be prepared to answer public inquiries regarding division policy in this matter.

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PREPARED BY:

Mark Masteller
Wildlife Biologist II

SUBMITTED BY:

Michael G. McDonald
Wildlife Biologist III

Table 1 Unit 16 fall wolf population estimates[a], 1994–98

Year	Population estimate	Packs (nr)	Basis of estimate
1994/95	57–79	11–13	Incidental observations, sealing records, reports from public
1995/96	46–75	11–13	same as above
1996/97	60–85	10–12	same as above
1997/98	75–110	12–15	same as above
1998/99	120–140	16–19	ADFG staff, wolf/lice project

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

Table 2 Probable wolf pack locations, minimum sizes, and sources of information for Unit 16, March 1999

Pack name/Location	Approximate Pack Size	Source
Unit 16A		
Tokositna River[a]	6	ADFG staff during wolf/lice project
Kahiltna River/Peters Hills	10	" "
Kahiltna Glacier	4	" "
Kroto Creek	5	" "
Moose Creek	5	" "
Unit 16B		
Upper Yentna River	8	ADFG staff during wolf/lice project
Lower Yentna/Lower Kahiltna	5	" "
Happy River	5	" "
Johnson Ck, Kichatna River	6	" "
Upper Skwentna River	5	" "
Eight-mile Ck/Talachulitna River	5	" "
Lake Creek	7	" "
Mt. Susitna/Alexander Creek[b]	10	" "
Beluga River	6	" "
Theodore River	15	" "
Chuitna/Chakachamna Rivers	4	Trapper obs., sealing data
Drift River	6	Trapper obs., sealing data
McArthur River	5	Trapper obs., sealing data

[a] Pack probably uses both Units 16A and 13E.

[b] Pack probably uses both Units 16B, 16A and 14A.

Table 3 Unit 16 wolf harvest, 1994–98

Regulatory year	Reported harvest				Method of take			
	M	F	Unk	Total	Trap/Snare	Shot	Unk	Successful Trapper/hunters
1994/95	14	14	0	28	11	17	0	17
1995/96	6	9	0	15	9	6	0	7
1996/97	13	12	1	26	12	14	0	14
1997/98	7	8	1	16	11	5	0	9
1998/99	13	19	2	34	18	16	0	22

Table 4 Unit 16 wolf harvest chronology, 1994–98

Regulatory year	Percent of Harvest							
	Aug.–Oct.	November	December	January	February	March	April	*n*
1994/95	7	0	14	61	11	7	0	28
1995/96	0	13	20	0	33	27	7	15
1996/97	35	4	4	31	15	7	4	26
1997/9	12	6	12	19	38	6	6	16
1998/99	33	3	3	15	27	18	0	33

Table 5 Unit 16 wolf harvest by transport method, 1994–98

Regulatory year	Percent of Harvest								
	Airplane	Dogsled Skis Snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1994/95	18	11	3	0	43	0	7	18	28
1995/96	27	0	0	0	73	0	0	0	15
1996/97	31	4	4	0	54	0	0	7	26
1997/98	12	0	0	0	88	0	0	0	16
1998/99	35	0	9	9	35	0	3	9	34

LOCATION

GAME MANAGEMENT UNIT: 17 A, B, and C (18,800 mi^2)

GEOGRAPHIC DESCRIPTION: Northern Bristol Bay

BACKGROUND

Wolves are common throughout the northern Bristol Bay area; however, we have no objective data on the 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. 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 collected harvest data from trappers when they brought their wolf pelts in for sealing. In 1988 we started sending 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 gained insight into wolf population trends and distribution incidental to moose and caribou surveys, as well as observations from local air taxi pilots.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Trapper reports and general observations indicate that the wolf population continued to increase during this reporting period. Wolf density peaked in Unit 17 from 1974 to 1977 but declined sharply by 1980. Rabies may have been a contributing factor. Densities seemed to increase again until 1989 when another rabies epidemic affected canid populations in the unit. Wolf populations began to increase again in 1992.

Population Size

The estimated 1998 fall wolf population in Unit 17A was 22–28 wolves in 6 to 8 packs; the Unit 17B population was 225–270 wolves in 16 to 22 packs; and the Unit 17C population was 110–165 wolves in 10 to 16 packs (Table 1).

Distribution and Movements

Wolves are present throughout the unit. Highest densities are along the major drainages of the Nushagak and Mulchatna Rivers. There is no evidence of transitory packs that follow the

Mulchatna caribou herd, although lone wolves are occasionally seen with the herd as it pioneers new areas. Packs have established territories and take advantage of caribou when they move through those territories.

MORTALITY

Harvest

Season and Bag Limit.

Hunting:	Unit 17	5 wolves	August 10–April 30
Trapping:	Unit 17	No Limit	November 10–March 31

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 all 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 was reinstated, but trappers were required to be more than 300' from their aircraft before shooting a wolf. In 1996 a referendum was passed prohibiting the take of wolves same day as airborne. In late winter of 1996–97, taking wolves the same day as airborne became illegal.

Hunter/Trapper Harvest. The wolf harvest in Unit 17 fluctuates greatly from year to year and is probably greatly dependent upon winter travel conditions. The past 5 year (1994/95–1998/99) annual average harvest (80) was twice the 1995–96 reported harvest of 41, but considerably less than the 1997–98 reported harvest of 107 (Table 2). During 1996–97, 24 hunter/trappers reported taking 53 wolves (35 males, 15 females, 3 sex not reported), with 12 taken in Unit 17A, 33 from 17B, and 8 taken in 17C. During 1997/98, 39 hunter/trappers reported taking 107 wolves (71 males, 35 females, 1 sex not reported), with 3 taken in Unit 17A, 56 from 17B, and 48 taken in 17C. During 1998–99, 39 hunter/trappers reported taking 78 wolves (50 males, 28 females), with 14 taken in Unit 17A, 38 from 17B, and 26 taken in 17C. Most were taken with firearms.

Harvest Chronology. Harvest chronology has been quite variable yearly. Most wolves were harvested in January and February (Table 3). In most years, harvest chronology reflects the suitability of snow conditions for tracking and travel rather than the availability of wolves. Harvest of wolves incidental to moose and caribou hunting activities during August and September has increased during the past few years, the result of increased numbers of hunters and wolves.

Transport Methods. Before 1992, aircraft were the most common means of transport of wolf hunter/trappers in Unit 17 (Table 4). With the prohibition of same-day-airborne taking of wolves in 1992–93 and after 1996–97, most wolves have been harvested by hunter/trappers using

snowmachines for transportation. The advent of larger, more reliable snowmachines has contributed greatly to the use of these machines when hunting and trapping wolves.

CONCLUSIONS AND RECOMMENDATIONS

Few data are available to interpret the status of the wolf population in Unit 17. General observations and public contacts suggest that the wolf population is healthy and is rebounding from the apparent 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 throughout the unit since the late 1980s. Although no packs are known to follow the Mulchatna caribou herd in Unit 17, most wolves appeared to take advantage of this rapidly increasing herd as they moved through their territories. It is logical to expect wolf populations to increase along with the prey densities. There is also movement into Unit 17 by wolves emigrating from Units 9 and 19.

The apparent cause of declines in wolf numbers in the late 1970s and late 1980s is unknown but rabies was suspected. There is no 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 that were trapped in Unit 17 area in 1991–92 were sent to the Alaska State Virology Laboratory for rabies tests. All were negative; however, the tests could not determine if the wolves had been exposed to rabies at one time and survived.

Same-day-airborne shooting of wolves was historically a 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 resulted in a shift to snowmachines for access. Recent developments in snowmachine technology have improved their effectiveness for assisting in wolf harvests.

If snow conditions are favorable, trappers are able to affect wolf numbers in Unit 17. This was evidenced in the winter of 1994–95, when excellent travel conditions resulted in a record harvest and an apparent reduction in the wolf population. Because of the relatively good accessibility, the abundance of hunters/trappers in the unit, and the health of the ungulate populations, no department-sponsored wolf reductions are recommended for Unit 17 at this time.

Aerial surveys of Unit 17 are needed to better quantify population density. Nearly constant winds cause fresh snow to drift rapidly, however, and good survey conditions seldom last more than 1 day. Survey efforts should be coordinated with department personnel in Units 9 and 19 to maximize the area surveyed while good conditions last.

PREPARED BY:
James D. Woolington
Wildlife Biologist III

SUBMITTED BY:
Michael G. McDonald
Assistant Management Coordinator

Table 1 Unit 17 fall wolf population estimates[a, b], 1991/92–1998/99

Year	Population estimate	Number of packs
1991/92	200–250	20–30
1992/93	250–350	20–30
1993/94	300–350	25–35
1994/95	400–475	30–40
1995/96	320–425	30–42
1996/97	320–425	30–42
1997/98	350–465	32–46
1998/99	350–465	32–46

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

[b]Estimates based on trapper questionnaire, incidental observations during moose and caribou surveys, and harvest data.

Table 2 Unit 17 wolf harvest, 1991/92–1998/99

Regulatory year	Reported harvest				Method of take (%)			Successful hunter/ trappers
	Male	Female	Unk	Total	Trap/snare	Shot	Unk	
1991/92	20	9	8	37	9 (24%)	28 (76%)	0 (--)	20
1992/93	12	5	2	19	4 (21%)	15 (79%)	0 (--)	14
1993/94	29	16	10	55	0 (--)	55 (100%)	0 (--)	21
1994/95	75	35	11	121	33 (27%)	88 (73%)	0 (--)	34
1995/96	26	15	0	41	15 (27%)	26 (63%)	0 (--)	18
1996/97	35	15	3	53	9 (17%)	44 (83%)	0 (--)	24
1997/98	71	35	1	107	17 (16%)	86 (80%)	4 (4%)	39
1998/99	50	28	0	78	9 (12%)	68 (87%)	1 (1%)	39

Table 3 Unit 17 wolf harvest chronology percent by time period, 1991/92–1998/99

Regulatory year	Harvest period						
	December	January	February	March	April	Unknown/Other	n
1991/92	5%	32%	30%	22%	--	11%	37
1992/93	5%	21%	53%	11%	--	10%[a]	19
1993/94	22%	27%	16%	26%	4%	6%[b]	55
1994/95	14%	7%	32%	17%	--	30%[c]	121
1995/96	2%	20%	49%	22%	--	--	41
1996/97	9%	43%	28%	9%	--	9%	53
1997/98	12%	27%	39%	7%	--	15%	107
1998/99	19%	32%	19%	14%	--	15%	78

[a]Includes 1 wolf (5%) harvested in August and 1 wolf (5%) harvested in October.

[b]Includes 3 wolves (6%) harvested in September.

[c]Includes 2 wolves (2%) harvested in August, 8 (7%) in September, 1 (1%) in October, 21 (17%) in November, and 4 (4%) harvested at unknown times.

Table 4 Unit 17 wolf harvest percent by transport method, 1991/92–1998/99

Regulatory year	Percent of harvest								
	Airplane	Dogsled Skis Snowshoes	Boat	3- or 4-Wheeler	Snow machine	ORV	Highway vehicle	Unk	N
1991/92	70%	--	--	--	30%	--	--	--	37
1992/93	5%	5%	--	--	84%	--	5%	--	19
1993/94	36%	2%	--	2%	58%	--	--	2%	55
1994/95	29%	10%	2%	--	60%	--	--	2%	121
1995/96	19%	5%	--	--	49%	--	--	--	41
1996/97	28%	--	--	--	72%	--	--	--	53
1997/98	18%	--	--	--	74%	--	--	8%	107
1998/99	12%	1	1	--	83%	--	--	3%	78

LOCATION

GAME MANAGEMENT UNIT: 18 (46,000 mi^2)

GEOGRAPHIC DESCRIPTION: Yukon–Kuskokwim Delta

BACKGROUND

Observations from trappers, fur buyers, and agency biologists indicate that wolf numbers have increased considerably in Unit 18, particularly along the main stem of the Yukon River and in the Kilbuck Mountains east of Bethel. The distribution and abundance of wolves in Unit 18 reflect the distribution and abundance of moose and caribou. The reported wolf harvest has increased considerably during this reporting period.

MANAGEMENT DIRECTION

MANAGEMENT GOALS AND OBJECTIVES

- Establish and maintain viable wolf populations in Unit 18.
- Monitor harvests through the sealing program, contacts with the public, and an annual trapper questionnaire.
- Explain regulations to local hunters and trappers and promote compliance with regulations.
- Monitor the size and population status of wolves and wolf packs in Unit 18.
- Minimize adverse interactions between wolves and the public.
- Develop updated population management objectives in consultation with the public and other agencies.

METHODS

No aerial surveys were planned or completed to determine the status of wolves in Unit 18. We observed wolves and wolf tracks during aerial surveys for other species. We discussed reports of wolf activity with other agency personnel, trappers, hunters, and local pilots. We held frequent discussions regarding wolf activity with the largest fur buyer in the area and with one particularly successful wolf trapper. A questionnaire that included questions regarding wolves was sent to area trappers.

We collected harvest information predominantly from sealing records. We continued to support license vendors and fur sealers in Unit 18. Public notices were sent to Unit 18 villages with information regarding fur-sealing requirements. Information and education media occasionally highlighted the topic of wolves.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

During the 1992–94 reporting period there were more reports of wolf activity than at any time since the 1930s. Trappers and hunters continued to report increasing numbers of wolves during the 1994–1996 reporting period. Unit 18 residents who ventured into adjacent Unit 19 also reported increasing wolf numbers.

The number of wolves in Unit 18 continued to increase through this reporting period. Within Unit 18, packs exist along the entire lower Yukon drainage, along the upper river portion of the main stem of the Kuskokwim, and throughout the mountain ranges east of Bethel. Overall, the estimated size of the Unit 18 wolf population increased during the reporting period. Beginning in 1996, the population ranged from 75–100 animals in 8–10 packs, and at the end of the reporting period we estimate there were 150–200 animals in 15–20 packs (Table 1).

Population Composition

We have no survey data or information to determine the composition of the wolf population in Unit 18.

Distribution and Movements

Observations reported by department staff and the public indicate several wolf packs occupy the entire length of the Yukon River in Unit 18. They also are throughout the Kilbuck Mountains and within the Kuskokwim River drainage near the Unit 19A boundary.

Resident packs are established along the Yukon River, where moose are available throughout the year. Along the main stem of the Kuskokwim River, resident packs are only in the most upriver portions of Unit 18 near the Unit 19 boundary.

In the Kilbuck Mountains, resident packs exist, but at lower densities than the resident packs along the Yukon River. However, this should not imply there are fewer wolves in the Kilbuck Mountains. With the seasonal influx of caribou from adjacent Units 17 and 19, we see an increase in wolf numbers. Wolves that arrive with the seasonal arrival of caribou probably do not stay in Unit 18 year round, but they are included in the population estimates because they contribute heavily to the harvest.

Wolves are occasionally encountered on the flats between the Kuskokwim River and the Kilbuck Mountains. They are nearly always associated with caribou and are probably as transient through the area as the caribou.

MORTALITY

Harvest

Seasons and Bag Limits

1996-1997 to 1998-1999 Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 18		
Residents and Nonresidents:		
Trapping - no limit	10 Nov–31 Mar	10 Nov–31 Mar
Hunting - 5 wolves	10 Aug–30 Apr	10 Aug–30 Apr

Board of Game Actions and Emergency Orders. There were no Board of Game actions regarding wolves for Unit 18 during this reporting period. However, there was legislative action to change the nonresident wolf tag fee from $175 to $30. This change first took effect for the 1998–1999 hunting season.

Hunter/Trapper Harvest. Sealing certificate data indicate the following wolf harvest for Unit 18: 29 during the 1996–1997 regulatory year, 43 in 1997–1998, and 45 in 1998–1999. The highest harvest during the decade preceding this reporting period was 17 in 1988–1989 and the average harvest was just under 6 from 1985–1986 through 1995–1996. Clearly, recent harvests have increased dramatically (Figure 1).

Most of the harvest occurred in the Kuskokwim drainage. In 1996–1997, 5 wolves were taken in the Yukon drainage, and 24 were taken in the Kuskokwim drainage. In 1997–1998, 6 wolves were taken in the Yukon drainage, and 37 were taken in the Kuskokwim drainage. In 1998–1999, 13 wolves were taken in the Yukon drainage and 32 were taken in the Kuskokwim drainage. This reflects the distribution of caribou abundant in the mountains east of the Kuskokwim during the years of this reporting period. It also reflects the distribution of caribou hunters who opportunistically take wolves. Of the wolves taken where the method of harvest is known, 10, 11, and 22 were shot rather than trapped in 1996–1997, 1997–1998, and 1998–1999, respectively (Table 2).

In 1996–1997, 9 males, 17 females, and 3 wolves of unknown sex were harvested. In 1997–1998, 29 males, 7 females, and 7 wolves of unknown sex were harvested. In 1998–1999, 24 males, 13 females, and 11 wolves of unknown sex were harvested. While it is not apparent that one sex is more vulnerable to harvest than the other on an annual basis, it is interesting to note that from 1985–1986 through 1998–1999, there were significantly more males ($n = 94$) taken than females ($n = 53$) in Unit 18 (Table 2).

Be aware that these data are derived from sealing certificates and consequently represent an absolute minimum estimate of wolf harvest. Many wolves caught in Unit 18 are neither sold nor sealed. Wolf ruffs are highly prized as parka trim, and the local domestic demand for wolf pelts is very high. Local residents generally prefer stiffer home-tanned wolf pelts for parka ruffs. We believe that most of the wolves harvested in Unit 18 are sealed, but a significant portion of the harvest remains unreported.

Permit Hunts. There were no permit hunts for wolves in Unit 18 during the reporting period.

Hunter/Trapper Residency and Success. Alaska residents harvested all of the wolves taken during this reporting period. Only one resident lived outside Unit 18. One trapper had unknown residency.

Harvest Chronology. The highest reported harvests have historically been in February; the second highest harvests have been in March (Table 3). During this reporting period there was a high harvest in January. This pattern is explained by the usual timing of snow accumulation and the improvement in travel conditions. Trapping is hampered by low snow, alternating freezing and thawing temperatures, and few hours of daylight. The intensity of caribou hunting and the subsequent incidental harvest of wolves are also dependent upon travel conditions. By January and through February, travel conditions usually improve.

Transport Methods. Snowmachines are used for transportation to harvest wolves. Only rarely are other methods used. In 1996–1997, a wolf was taken in September by a hunter using a boat. During March of the same season, a wolf was taken by a person using skis/snowshoes. Both of these wolves were probably taken incidental to other activities. In 1998–1999, 2 wolves were taken by a trapper using a dog team to run his trapline.

Other Mortality

No information is available on natural mortality of wolves in Unit 18.

HABITAT

Assessment

Extensive riparian, upland, and tundra habitats are available in Unit 18 to support much larger populations of moose, caribou, and muskoxen. Increased numbers of moose and caribou in the Yukon and Kuskokwim drainages have already resulted in an increase in the number of wolves in Unit 18. However, there are still large areas of vacant habitat suitable for moose, caribou, and muskoxen. As these habitats are utilized by ungulates, wolf populations will benefit.

Enhancement

There were no habitat enhancement activities for wolves in Unit 18 during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

There were no nonregulatory management problems or issues associated with wolves in Unit 18 that were identified during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

Wolf numbers have increased dramatically in Unit 18 in response to greater availability of ungulates. Moose along the Yukon River have increased in numbers and range to the point

that wolf packs are established from the Unit 18 boundary at Paimiut all the way to the Yukon River Delta. Wolves have also increased in the Kilbuck Mountains in response to a seasonal influx of caribou. Many of the wolves that use the eastern portion of Unit 18 leave the unit as caribou leave.

The current population estimate is 150–200 wolves in 15–20 packs for Unit 18. This estimate includes wolves that use adjacent game management units when caribou are not available in Unit 18.

Current management strategies in Unit 18 are designed to increase the numbers of caribou, moose, and muskoxen. An indirect result of increasing ungulate populations is increased availability of prey for wolves. Excessive human harvest is the principal factor limiting ungulate population growth in Unit 18. This is especially true for moose along the main stem of the Kuskokwim and muskoxen trying to colonize the mainland. For these ungulate populations to grow and become established, wolves may need to be harvested at sufficiently high levels to minimize predation on ungulates.

PREPARED BY

Roger J. Seavoy
Wildlife Biologist III

SUBMITTED BY:

Peter J Bente
Survey–Inventory Coordinator

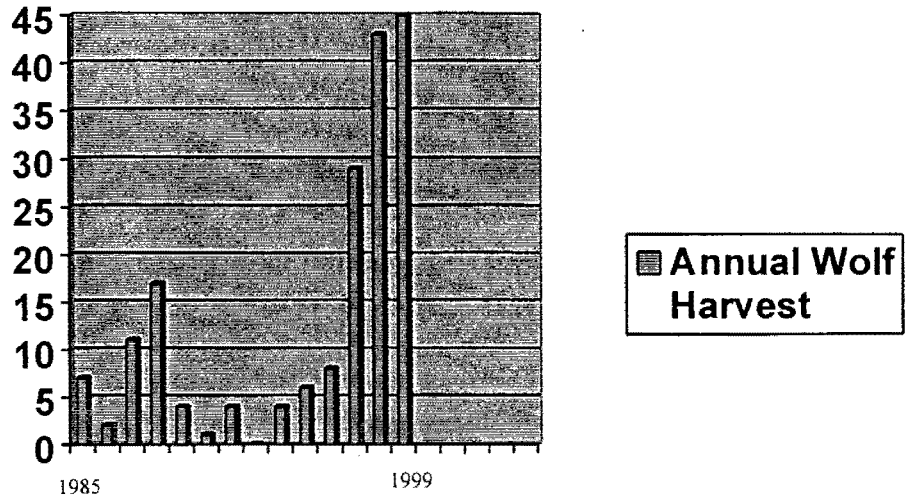

Figure 1 Annual Unit 18 wolf harvest 1985–1986 through 1998–1999

Table 1 Unit 18 fall wolf population estimates[a], 1985–1986 through 1998-1999

Regulatory year	Population estimate	Packs
1985–1986	25–50	5–7
1986–1987	25–50	5–7
1987–1988	25–50	5–7
1988–1989	50–75	6–7
1989–1990	50–75	6–7
1990–1991	75–100	6–7
1991–1992	75–100	6–7
1992–1993	75–100	6–7
1993–1994	75–100	6–7
1994–1995	75–100	6–7
1995–1996	75–100	8–10
1996–1997	75–100	10–15
1997–1998	100–150	12–18
1998–1999	150–200	15–20

[a]The basis for this estimate comes from incidental observations, reports from the public, sealing records, and trapper questionnaire results.

Table 2 Unit 18 wolf harvest, 1985–1986 through 1998–1999

Regulatory	Reported harvest			Method of take			Number successful
Year	M	F	Unknown	Trap/Snare	Shot	Unknown	trap/hunt
1985–1986	1		6	6	1		2
1986–1987	2				2		2
1987–1988	4	4	3	5	5	1	6
1988–1989	11	6					7
1989–1990	2	2					2
1990–1991	1			1			1
1991–1992	2	2		4			2
1992–1993	0	0		0			0
1993–1994			4				?
1994–1995	3		3	4	2		4
1995–1996	6	2		5	1	2	3
1996–1997	9	17	3	17	11	1	18
1997–1998	29	7	7	27	11	5	10
1998–1999	24	13	8	23	22		18

Table 3 Unit 18 wolf harvest chronology by time period, 1985–1986 through 1998–1999

	Harvest period						
Regulatory year	Nov	Dec	Jan	Feb	Mar	April	*N*
1985–1986	6	1					7
1986–1987		2					2
1987–1988		1	5	3	2		11
1988–1989		5	1	4	7		17
1989–1990			1	1	2		4
1990–1991				4			1
1991–1992					4		4
1992–1993							0
1993–1994			2		2		4
1994–1995		4		1	1		6
1995–1996	1			6	1		8
1996–1997	2	5	4	17			29[a]
1997–1998	3	1	12	20	2		43[b]
1998–1999	4	6	3	5	15	10	45[b]
Totals	16	25	28	61	36	10	181

[a]includes one wolf shot during the hunting season in September
[b]includes unknown month of harvest

LOCATION

GAME MANAGEMENT UNITS: 19A, B, C, and D and 21A and E (59,756 mi^2)

GEOGRAPHIC DESCRIPTION: Drainages of the Kuskokwim River upstream from the village of Lower Kalskag; Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage; the entire Innoko River drainage; and the Nowitna River drainage upstream from the confluence of the Little Mud and Nowitna rivers

BACKGROUND

Wolves play multiple roles in the economy and ecology of the upper Kuskokwim region. As furbearers, they provide pelts for personal use by subsistence-based residents and are harvested by trappers for commercial sale of their pelts. Hunters consider wolves to be a trophy big game animal, but also a competitor for moose.

Harvest of wolves in the upper Kuskokwim and middle Yukon drainages has been governed by regulations that have changed frequently in response to public controversies that arose primarily over wolf control programs in other regions of the state. Harvests dropped after the cessation of bounties in 1967. Also, the Federal Airborne Hunting Act of 1972 eliminated the common practice of shooting wolves from airplanes. However, the Department of Fish and Game continued to issue aerial shooting permits to members of the public until 1983 as part of specific management programs.

Few wolves were taken by aerial shooting in Unit 19, with the exception of the 1978–1979 season when 29 were reported killed using this method. Only 4 wolves, other than those taken in 1978–1979, were taken under the authority of aerial permits during 1972–1983. Most harvest (67%) during that period occurred by land-and-shoot hunting, and the kill was 32–81 annually (Pegau 1984). Hunting of wolves by land-and-shoot continued until the 1992–1993 season when all same-day-airborne hunting was prohibited. Beginning in the 1994–1995 season, same-day-airborne taking of wolves was permitted for holders of a trapping license if trappers moved more than 300 ft from the aircraft before shooting a wolf. A public ballot initiative that passed in November 1996 repealed that "land and walk" regulation, again prohibiting all same-day-airborne hunting of wolves beginning in late February 1997.

Wolf predation plays a significant role in the population dynamics of moose, the primary ungulate species sought by subsistence hunters throughout the upper Kuskokwim drainage. As early as 1980 biologists recognized moose densities were low in the upper Kuskokwim. At the time, the situation was characterized as a "predator problem." The problem was aggravated during 1989–1995 by 4 "severe" winters with deep, persistent snow. In the early 1990s residents reported declining moose numbers; and in 1994, with the aid of the Tanana Chiefs Conference, local residents met with officials from the Alaska Department of Fish and Game

to discuss predator control options. Local residents favored wolf control programs designed to reduce wolf numbers and increase moose for subsistence use. The Board of Game adopted a wolf control program for Unit 19D East in 1995 and reauthorized the same plan with updated population numbers in January 2000. However, no plan has been implemented.

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 and 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 on 30 October 1991 and revised on 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.
- 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 wolf predation control programs as directed by the commissioner and Board of Game.
- Provide for a sustained annual harvest rate of up to 30% from the combined wolf population of Units 19, 21A, and 21E, except where greater harvest rates are mandated by approved wolf predation control implementation plans.
- Provide trapper education programs to increase trapper skills, ethics, and regulatory compliance.

- Conduct an aerial survey of the wolf population in Unit 19D East during late winter 1999.
- Cooperate with any ongoing wolf studies conducted by the US Fish and Wildlife Service.
- Continue to refine annual wolf population estimates in the area, based on incidental sightings, hunter interviews, trapper questionnaires, and evaluation of sealing documents.
- Monitor harvests through sealing records and trapper questionnaires.
- By March 1998 develop a proposal to conduct research on low-density wolf-prey population dynamics in Unit 19D East.
- Model the potential effects of wolf predation on prey populations in all subunits.

METHODS

We completed population surveys using a Sample Unit Probability Estimator (SUPE) method (Becker et al. 1998) during spring 1995 and spring 1997 in a 5200-mi^2 segment of Unit 19D East. Unit 19D East includes that portion of Unit 19 within the Kuskokwim River drainage upstream from the Salatna River, not including the Takotna River drainage upstream from its confluence with the Nixon Fork River. We obtained additional information about wolf pack sizes and territory boundaries from conversations with wolf hunters and trappers.

We estimated wolf population size using a combination of information from Unit 19D East surveys, harvest records, and hunter/trapper interviews and questionnaires. Estimates were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY99 = 1 Jul 1999 through 30 Jun 2000).

We gathered harvest statistics largely from sealing documents, although we also used Fur Acquisition Reports and Fur Export Reports. I assumed that >90% of the annual wolf harvest was reflected on sealing documents because most of the wolves harvested from western Interior Alaska are sold (versus used domestically for garments). During the sealing process, information was collected on specific location and method of take, date, sex, color of pelt, estimated size of the wolf pack, and transportation. Harvest data were summarized by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We estimated fall wolf population in all subunits at 1200–1300, 1300–1500 and 1400–1600 during RY96, RY97, and RY98, respectively (Table 1). Trapper questionnaires indicated wolves were moderate to abundant during RY96–RY99, with a stable to increasing population trend.

We estimated a wolf density of 24.6–41.2 wolves/mi^2 (9.5–15.9 wolves/1000 km^2) (90% CI) in Unit 19D East during spring 1995 using the SUPE method over 5200 mi^2. Using the same method over the same area, we estimated 7.8–14.0 wolves/mi^2 (3.0–5.4 wolves/1000 km^2) during spring 1997. This indicated a 67% decline in the wolf population within 2 years. This was consistent with a prediction drawn from the prey biomass versus wolf density relationships seen in other parts of Alaska and North America (Fuller 1989) (i.e., 6.7–11.4 wolves/mi^2 or 2.6–4.4 wolves/1000 km^2).

Wolf population declines demonstrated in Unit 19D East were apparently limited to that subunit. Populations elsewhere in the management area remained stable or increased during recent years based on analyses of trapper questionnaires, sealing certificates, and incidental observations. However, no other population estimation surveys have been completed.

Population Composition

No data were available concerning the sex composition of the wolf population except sex ratios reported on sealing documents from the harvested segment of the population. Those sex ratios in the harvest were not significantly different from 1:1 during RY94–RY95, and we suspect the population at large also contained nearly equal sex ratios.

Distribution and Movements

Wolves are present throughout all subunits. The harvest was well distributed, as were wolf tracks and incidental sightings. Good habitat and potential ungulate prey exist throughout the management area.

MORTALITY

Harvest

Season and Bag Limit.

Unit/Bag Limit/Special Restrictions	Resident/Nonresident Open Seasons
RY96	
Units 19, 21A, and 21E.	
HUNTING: 5 wolves. No hunting wolves same day as airborne.	10 Aug–30 Apr
TRAPPING: No limit. Must be greater than 300 ft from aircraft on same day as airborne, until 7 March 1997 (then same-day-airborne was prohibited)	1 Nov–30 Apr
RY97	
Units 19, 21A, and 21E.	
HUNTING: 5 wolves. No hunting wolves same day as airborne.	10 Aug–30 Apr

Unit/Bag Limit/Special Restrictions	Resident/Nonresident Open Seasons
TRAPPING: No limit. No hunting wolves same day as airborne.	1 Nov–30 Apr
RY98	
Units 19, 21A, and 21E.	
HUNTING: 5 wolves. No hunting wolves same day as airborne.	10 Aug–30 Apr
TRAPPING: No limit. No hunting wolves same day as airborne.	1 Nov–30 Apr
RY99	
Units 19, 21A, and 21E.	
HUNTING: 5 wolves. No hunting wolves same day as airborne.	10 Aug–30 Apr
TRAPPING: No limit. No hunting wolves same day as airborne.	1 Nov–30 Apr

Board of Game Actions, Emergency Orders, and Legislative Actions. During the January 1998 Board of Game Meeting, the board authorized a reduction in the price of nonresident wolf tags from $175 to $30, and an elimination of the nonresident tag fee in units where Wolf Control Implementation Plans have been approved. Therefore, the fee required for nonresident wolf hunting was eliminated in all of Unit 19.

The Board of Game authorized a Wolf Control Implementation Plan in 1995 and reauthorized an updated version of the same plan in January 2000. Updates to the plan included revisions to the population estimates and the corresponding population goals. The major population changes since the first plan were a decrease in the moose density and a decrease in wolf population size. Neither plan has been implemented. During January 2000, the board also authorized the use of snowmobiles to pursue wolves in areas with current Wolf Control Implementation Areas.

During March 2000 the board increased the wolf hunting bag limit in Unit 19D from 5 during the season to 10 wolves per day with no season limit. The start of the trapping season was also changed to 1 October from 1 November, with the "snare only of 3/32" or larger" stipulation already in regulation for April and October wolf trapping seasons.

Hunter/Trapper Harvest. In all subunits, 177 wolves were reported taken during RY96, a harvest rate of approximately 14% (Tables 2, 3, and 4). The reported harvest during RY97 was 96 (6.7 % harvest rate). During RY98, 153 wolves (10% harvest rate) were reported taken. The average harvest for RY94–RY98 was 107, which is slightly up from RY89–RY93 average of 97. Overall, wolf harvests increased. This was expected because trappers increased their efficiency by adapting to changing regulations governing trapping methods and because they took advantage of wolf trapping education programs (Whitman 1997).

Hunter Residency and Success. Local trappers and hunters took most of the annual wolf harvest. Hunters/trappers using airplanes for access typically traveled from the south side of the Alaska Range to take wolves in Units 19 and 21 in past years, but because of the aircraft-use restrictions in effect, this transportation mode and method of hunting has decreased. The proportion of the annual wolf harvest taken by local hunters and trappers increased. Nonresidents take most of the wolves during the autumn months incidental to hunting other big game species.

Success rates by wolf hunters/trappers are difficult to determine. One indicator may be the mean number of wolves taken per successful hunter/trapper (Table 2). This number varies annually and shows no clear trend.

Harvest Chronology. Most reported wolf harvest occurred during February and March (Table 3). March continued to have the highest wolf harvests, probably due to access and weather constraints during other times of the year. Increased day length in March, coupled with adequate snow cover to allow tracking wolf packs and subsequent landing of aircraft or overland transport by snowmachine combine to facilitate the greater harvests during that month. However, with current restrictions on the use of aircraft, we anticipate future harvests will become more equally distributed throughout the winter.

Hunters, during the fall, are taking greater numbers of wolves than previously observed. During RY94–RY98, hunters took an average of 16.8 wolves during August and September, while during RY89–RY93 hunters took an average 6 wolves during the same time period (Table 3). This increase can probably be attributed to several factors including increased populations, increased hunter awareness of the effects of wolf predation, reduction or elimination of tag fees (1998), and increased interest in wolf harvest by guided hunters.

Transport and Harvest Methods. As Whitman (1997) predicted, the method of transportation used by trappers to harvest wolves has shifted from primarily aircraft during RY89–RY91 to snowmachines during RY92–RY98, with the exception of RY95 when trappers using aircraft took more wolves than trappers using snowmobiles (Table 5). Despite the shift in transport methods, aircraft remain an important method of transport for many wolf trappers. Other methods of transport, such as dog team and snowshoes, were less important.

Other Mortality

Natural mortality of nondispersing wolves is relatively low. During RY99, a trapper noted one a case of a wolf being crippled by a blow to the spine. The wolf was found paralyzed from the hips back; and, after skinning, a large contusion was noted just anterior of the pelvis. Injuries and mortality inflicted during predatory attempts on moose are probably the largest component of natural mortality. Cases of nonspecific mortality have also been noted, but the amount of information on this type of mortality is small.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

A major challenge faced by managers is collecting survey and inventory information on wolf populations. Aerial surveys to estimate population size require proper climatic conditions, a high level of tracking ability by pilot/observer teams, and adequate funding.

CONCLUSIONS AND RECOMMENDATIONS

Wolf harvests have remained stable in the absence of same-day-airborne taking of wolves. This occurred because of increased trapper education on effective methods of trapping wolves. However, the proportion of the estimated wolf population being harvested has declined. Trapping is not regulating the wolf population. Some trapper incentive programs will undoubtedly increase harvest in small areas, but will not reduce overall wolf numbers. Recent regulatory changes by the Board of Game will likely have little effect on the overall harvest of wolves.

Objectives will be modified for the next reporting period to reflect increased efforts in public education and to reflect the Board of Game's adoption of a wolf predation control implementation plan that may remain in effect for up to 5 years beginning 1 July 2000.

Our objective will be to provide for a sustained annual harvest rate of up to 30% from the combined wolf population of Units 19, 21A, and 21E, except where greater harvest rates are mandated by approved wolf predation control implementation plans.

Recommended activities to achieve our objective are to:

- Conduct wolf predation control programs as directed by the commissioner and Board of Game.
- Provide trapper education programs to increase trapper skills, ethics, and regulatory compliance.
- Conduct an aerial survey of the wolf population in Unit 19D East during late winter 2001.
- Cooperate with any other agencies conducting wolf studies within the area.
- Continue to refine annual wolf population estimates in the area, based on incidental sightings, hunter interviews, trapper questionnaires, and evaluation of sealing documents.
- Monitor harvests through sealing records and trapper questionnaires.

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PREPARED BY:

Toby A Boudreau
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Mark E McNay
Wildlife Biologist III

Table 1 Units 19, 21A, and 21E autumn wolf population estimates[a], regulatory years 1985–1986 through 1998–1999

Regulatory year	Population estimate	Number of packs	$\bar{x}$ Wolves/Pack
1985–1986	660–780	110–129	6.0
1986–1987	670–780	107–136	6.0
1987–1988	665–770	76–95	8.4
1988–1989	710–815	72–88	9.5
1989–1990	720–940	72–91	10.2
1990–1991	720–940	72–91	10.2
1991–1992	720–940	72–91	10.2
1992–1993	750–950	71–92	10.4
1993–1994	970–1000	72–90	12.2
1994–1995	1568–1768	170–200	9.0
1995–1996	1200–1768	170–200	8.0
1996–1997	1200–1300	150–170	7.8
1997–1998	1300–1500	160–180	8.2
1998–1999	1400–1600	170–190	8.3

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

Table 2 Units 19, 21A, and 21E wolf harvest, regulatory years 1985–1986 through 1998–1999

Regulatory year	Reported harvest				Method of take			$\bar{x}$ Wolves/ Trapper
	M	F	Unk	Total	Trap	Shot	Unk	
1985–1986	26	29	0	55	24	31	0	2.2
1986–1987	50	38	4	92	24	68	0	4.2
1987–1988	114	97	9	220	29	189	2	3.8
1988–1989	89	68	21	178	12	165	1	3.6
1989–1990	105	86	12	203	27	161	5	3.4
1990–1991	102	87	6	195	12	183	0	3.1
1991–1992	57	62	15	134	25	109	0	2.4
1992–1993	22	13	15	50	24	24	2	1.9
1993–1994	48	45	5	98	42	51	5	2.2
1994–1995	124	92	22	238	93	142	3	2.7
1995–1996	75	45	1	121	43	77	1	2.9
1996–1997	73	76	3	152	84	56	12	2.7
1997–1998	49	41	6	96	61	33	2	2.0
1998–1999	84	62	7	153	82	71	0	2.1
% of Total	51%	42%	7%	100%	30%	69%	1%	100%

Table 3 Units 19, 21A, and 21E wolf harvest chronology, regulatory years 1985–1986 through 1998–1999

Regulatory year	Harvest period										Total harvest
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Unk	
1985–1986	0	2	0	2	11	14	21	5	0	0	55
1986–1987	0	1	0	8	5	5	38	34	1	0	92
1987–1988	1	5	0	5	9	37	53	87	18	5	220
1988–1989	2	3	1	4	7	15	14	118	2	12	178
1989–1990	1	8	0	7	21	30	25	108	3	0	203
1990–1991	0	5	1	1	9	21	43	116	0	0	195
1991–1992	0	2	0	1	19	19	35	57	1	1	134
1992–1993	1	5	0	4	1	3	12	21	3	0	50
1993–1994	2	7	0	4	10	21	13	35	3	3	98
1994–1995	4	12	2	4	31	42	60	67	16	0	238
1995–1996	0	1	1	6	2	17	31	54	9	0	121
1996–1997	1	16	0	15	27	27	28	36	1	1	152
1997–1998	4	21	0	8	15	6	22	18	2	0	96
1998–1999	3	24	3	2	14	26	26	51	3	1	153
% of Total:	1%	5%	<1%	4%	12%	14%	20%	40%	3%	1%	100%

Table 4 Units 19, 21A, and 21E wolf harvest by subunit, regulatory years 1985–1986 through 1998–1999

Regulatory	Unit 19						Unit 21			
year	A	B	C	D	Z	Subtotal	A	E	Subtotal	Total
1985–1986	2	2	5	31	0	40	12	3	15	55
1986–1987	8	16	22	29	0	75	17	0	17	92
1987–1988	55	56	13	15	3	142	45	33	78	220
1988–1989	6	32	40	32	0	110	44	24	68	178
1989–1990	26	46	41	21	0	134	64	5	69	203
1990–1991	41	11	44	32	0	128	42	25	67	195
1991–1992	20	22	49	20	1	112	7	15	22	134
1992–1993	14	5	11	3	2	35	9	6	15	50
1993–1994	6	19	37	22	0	84	7	7	14	98
1994–1995	45	42	61	38	0	171	9	43	52	238
1995–1996	19	27	19	18	0	83	4	34	38	121
1996–1997	12	18	32	18	8	88	34	30	64	152
1997–1998	14	14	7	24	3	62	24	10	34	96
1998–1999	42	38	13	19	0	112	18	23	41	153
5-yr $\bar{x}$	26	28	25	27	2	107	19	25	44	151

Table 5 Units 19, 21A, and 21E harvest by transport method, regulatory years 1989–1990 through 1998–1999

Regulatory year	Transport method				Total
	Aircraft	Snowmobile	Dog Team/snowshoe	Other	
1989–1990	161	35	1	6	203
1990–1991	162	24	1	8	195
1991–1992	109	2	14	9	134
1992–1993	9	29	1	11	50
1993–1994	49	36	1	12	98
1994–1995	64	115	2	57	238
1995–1996	85	26	0	10	121
1996–1997	40	68	11	33	152
1997–1998	28	41	8	19	96
1998–1999	42	98	0	13	153

LOCATION

GAME MANAGEMENT UNITS: 20A, 20B, 20C, 20F, and 25C (39,228 mi^2)

GEOGRAPHIC DESCRIPTION: Lower Tanana Valley, Central Yukon Valley

BACKGROUND

Wolf population size and harvest vary substantially both spatially and temporally within this management area. Fluctuations in wolf numbers primarily result from variation in prey availability and wolf control programs; whereas, fluctuations in harvest result from variation in wolf numbers and access.

Human consumptive use of caribou, moose, and sheep dominates interest in wildlife within these subunits, partly because of their proximity to Fairbanks, the second largest concentration of people in the state. During the last 25 years, Alaska Department of Fish and Game (ADF&G) conducted wolf predation control programs in Units 20A (autumn 1975–spring 1982 and Oct 1993–Nov 1994) and 20B (autumn 1979–spring 1986) to increase moose and caribou populations. The most recent program (in Unit 20A) followed a density-dependent caribou population decline (10,700 to 3600) that was exacerbated by unfavorable weather and predation.

Because of the interest in consumptive use, ADF&G staff continue intensive investigations on predator–prey relationships, especially in Unit 20A (Gasaway et al. 1983; Boertje et al. 1996) In addition, within Denali National Park and Preserve (DNP&P) in adjacent Unit 20C, a 14-year wolf study continues because of interest in the animal as predator, wilderness symbol, and fundamental component of a naturally regulated system (Adams et al. 1995; Mech et al. 1995; Meier et al. 1995).

Besides the attention the wolf receives as a predator and wilderness symbol, trappers continue the long tradition of harvesting this economically and culturally significant furbearer.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

ADF&G will manage wolf populations 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. We recognize the aesthetic value of observing wolves in their natural environment as an important human use of wolves.

We also recognize that integral to wolf management is the premise that wolf populations are renewable resources that can be harvested and manipulated to enhance human uses of other resources. Management may include both the manipulation of wolf population size and total protection of wolves from human influence.

Management Objectives

Objectives during this reporting period were to:

- Monitor harvest through sealing certificates.
- Conduct aerial surveys in Units 20B, 20C, 20F, and 25C.
- Monitor the wolf population in Unit 20A by maintaining radio collars in wolf packs, including packs inhabiting the flats.
- Assist wolf research efforts in Unit 20A.

METHODS

Population Size

During this reporting period we conducted intensive wolf population surveys in Unit 20A. We conducted aerial surveys in Unit 20A throughout winters 1996–1997 through 1998–1999. More specifically, we estimated wolf numbers from radiocollared packs in the foothills and extrapolated to the Tanana Flats to obtain overall Unit 20A annual population estimates. This work was conducted as part of ongoing wolf research in the unit (McNay 1999).

We collected miscellaneous observations and reports for all areas. We also collected additional information for Unit 20B while conducting lynx/hare surveys, moose surveys, and other reconnaissance flights. However, extrapolations from earlier or adjacent surveys provide the primary basis for estimates in areas other than Unit 20A. We used data from radiotelemetry surveys in Denali National Park to estimate wolf numbers in Unit 20C.

Harvest

We used wolf sealing certificate data to determine annual harvests. During the sealing process, information was collected on specific location and method of take, date, sex, color of pelt, estimated size of the wolf pack, and transportation. Harvest data were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY99 = 1 Jul 1999 through 30 Jun 2000).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size

In early winter 1996 we estimated 650–900 wolves in 85–130 packs for all subunits. In early winter 1997, we estimated 675–925 wolves in 85–130 packs. In early winter 1998, we estimated 700–950 wolves in 85–130 packs. While these totals vary, they only reflect new information for Units 20A and 20C (Table 1). The ranges represent the combined subjective minimum and maximum estimates for each subunit.

Wolf population trends in Units 20A and 20C differed substantially during the reporting period. Wolf numbers in Unit 20A increased after wolf control was suspended in 1994 and approached precontrol levels by 1998 (Table 1). By contrast, researchers in Denali National Park and Preserve documented a sharp decline in the wolf population in southern Unit 20C in 1994. The wolf population then stabilized at that lower level during 1994–1998. Lower estimates reflect those observations.

MORTALITY

Harvest

Season and Bag Limit. Smith (1994) summarized the history of regulations pertaining to same-day-airborne and land-and-shoot taking of wolves in Alaska. The hunting and trapping regulations for Units 20 and 25C during this reporting period were:

Units and Bag Limits	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Units 20A, 20B, 20C, 20F, and 25C		
RY96		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. A wolf may be shot same day airborne if caught in a trap or snare, or trapper is more than 300 ft from airplane.	1 Nov–30 Apr	1 Nov–30 Apr
RY97–RY99		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. A wolf may be shot same day airborne if caught in a trap or snare.	1 Nov–30 Apr	1 Nov–30 Apr

Board of Game Actions and Emergency Orders. In June 1993 the Board of Game authorized same-day-airborne shooting of wolves, provided the person attempting to take a wolf had a trapping license and was at least 300 ft from the airplane. During November 1996, this method of take was prohibited through a statewide ballot referendum (effective 25 February 1997).

Hunter/Trapper Harvest. Wolf harvest in all subunits during RY96–RY98 was similar (annual mean = 165 wolves) to that reported for RY91–RY95 (annual mean = 154 wolves). This generally was the case for all subunits except Unit 25C, where the mean annual harvest was 8 wolves during RY96–RY98, but was 15 wolves during RY91–RY95.

Wolf harvest varied considerably among years. Excluding years in which wolf control was conducted (i.e., 1993 and 1994), area-wide wolf harvest increased in RY96 (209) to its highest level since at least RY85, fell in RY97 (113) to its lowest level since RY89, and then increased again to a near record high in RY98 (173). This general pattern was apparent in all subunits. Evidence suggests that these oscillations were not likely related to fluctuations in wolf numbers, but rather to other unidentified factors (e.g., weather, snow conditions, trapping pressure). In Unit 20A the percentage of the estimated fall wolf population harvested by hunters and trappers fell from 33% in RY95 and RY96 to 20% in RY97 (ME McNay, ADF&G, unpublished data), despite an apparent increase in the wolf population (Tables 1 and 2).

Harvest Chronology. Midwinter trapping continued to provide most of the harvest (Table 3). April accounted for 1.6% (8 of 495) of the wolves taken by the public during RY96–RY98.

Method of Take and Transport Methods. Trapping and snaring continued as the leading methods of take (Table 2). Airplanes and snowmachines continued to be the most popular types of transportation (Table 4).

CONCLUSIONS AND RECOMMENDATIONS

Management objectives during this reporting period were not quantitative, and therefore, can only be subjectively evaluated. We made progress on all of them, except conducting aerial surveys in Units 20B, 20C, 20F, and 25C. We monitored harvest, conducted aerial surveys in Unit 20A, monitored the Unit 20A population using radiotelemetry, and assisted wolf research efforts in Unit 20A. During the next reporting period, new objectives will be formulated that are quantitative.

Wolf research in Unit 20A should be recognized as important to intensive management statewide. We do not know whether the wolf population will reach the theoretical density that the number of prey can support. If the wolf population does reach its potential, the current success in moose management will be short-lived. To date, we have not reaped the harvest benefits of the moose population growth because the public desires higher moose densities, or fears that predation and cow harvests will cause a moose population decline. Those concerns are understandable given the history of the effects of predation and cow harvests in Unit 20A during the 1970s (Gasaway et al. 1983). To gain public support for more aggressive harvest of enhanced moose populations, we need a clear strategy for management of enhanced predator–prey systems. Forming a viable management strategy hinges on a thorough understanding of wolf predation, weather, and competition for food among moose.

If the wolf population does not reach its potential, we can continue to recommend increased ungulate harvests. However, in that scenario we still need to determine what factors regulate the wolf population in order to maintain that regulation. In RY98 hunters and trappers harvested an estimated 30% of the autumn 1998 wolf population in Unit 20A. So, harvest could potentially regulate the wolf population at a level that allows high moose harvests. Alternatively, social or complex food-related factors may result in regulation of the wolf population. The theoretical wolf densities expected from the current prey biomass have not

been observed in the Interior. Further, wolf harvest intensity may influence the operation of such density-dependent factors. Similar questions apply to wolf–caribou relationships (Dale 1997).

In the near term, I recommend maintaining current Unit 20A seasons and bag limits to evaluate harvest trends under current regulations and trapping effort. Similarly, there seems little need to recommend changes for other units. However, we receive numerous comments regarding the April trapping/hunting season. Concerns over fur quality and the pregnancy status of adult females will probably continue to generate proposals. Because trappers take so few wolves in April, little biological rationale exists for or against April seasons.

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PREPARED BY:

Donald D Young
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Mark E McNay
Wildlife Biologist III

Table 1 Units 20A, 20B, 20C, 20F, and 25C fall wolf population estimates, 1985–1998

Unit	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
	1993	281	20–25	Radiotelemetry and aerial surveys (mountains), extrapolation (Tanana Flats) [b]
	1994	193	20–25	Radiotelemetry and aerial surveys (mountains), extrapolation (Tanana Flats)[b]
	1995	198	20–25	Radiotelemetry and aerial surveys (mountains), extrapolation (Tanana Flats)[b]
	1996	207	20–25	Radiotelemetry and aerial surveys (mountains), extrapolation (Tanana Flats)[b]
	1997	227	20–25	Radiotelemetry and aerial surveys (mountains), extrapolation (Tanana Flats)[b]
	1998	268	20–25	Radiotelemetry and aerial surveys (mountains), extrapolation (Tanana Flats)[b]
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
	1993	150–225	20–30	1992 extrapolation
	1994	150–225	20–30	1992 extrapolation
	1995	150–225	20–30	1992 extrapolation
	1996	150–225	20–30	1992 extrapolation
	1997	150–225	20–30	1992 extrapolation
	1998	150–225	20–30	1992 extrapolation

Table 1 Continued

Unit	Year	Population estimate[a]	Number of packs	Basis of estimate
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
	1993	200–320	25–40	Denali National Park data and extrapolation
	1994	150–200	25–40	Denali National Park data and extrapolation
	1995	150–200	25–35	Denali National Park data and extrapolation
	1996	150–200	25–35	Denali National Park data and extrapolation
	1997	150–200	25–35	Denali National Park data and extrapolation
	1998	150–200	25–35	Denali National Park data and extrapolation
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	
	1993	75–125	10–20	1992 extrapolation
	1994	75–125	10–20	1992 extrapolation
	1995	75–125	10–20	1992 extrapolation
	1996	75–125	10–20	1992 extrapolation
	1997	75–125	10–20	1992 extrapolation
	1998	75–125	10–20	1992 extrapolation
25C	1985			

Table 1 Continued

Unit	Year	Population estimate[a]	Number of packs	Basis of estimate
	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 Unit 20B
	1991			
	1992	75–125	10–20	Density extrapolation
	1993	75–125	10–20	1992 extrapolation
	1994	75–125	10–20	1992 extrapolation
	1995	75–125	10–20	1992 extrapolation
	1996	75–125	10–20	1992 extrapolation
	1997	75–125	10–20	1992 extrapolation
	1998	75–125	10–20	1992 extrapolation

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

[b] M McNay, Alaska Department of Fish and Game, unpublished data.

Table 2 Units 20A, 20B, 20C, 20F, and 25C wolf harvest, regulatory years 1985–1986 through 1998–1999

Unit	Regulatory year	Reported harvest				Method of take			
		M	F	Unk	Total	Trap/ Snare	Shot	Unk/ Other	Wolf control
20A	1985–1986				24	17	7	0	0
	1986–1987				37	33	3	1	0
	1987–1988	19	13	4	36	30	5	1	0
	1988–1989	17	11	4	32	23	9	0	0
	1989–1990	20	10	1	31	21	9	1	0
	1990–1991	31	20	5	56[a]	10	44	2	0
	1991–1992	35	28	4	67	43	24	0	0
	1992–1993	30	25	2	57	49	6	2	0
	1993–1994	66	83	11	160[b]	47	11	4	98
	1994–1995	34	29	3	66[b]	25	4	1	36
	1995–1996	37	21	1	59	52	5	2	0
	1996–1997	36	26	0	62	49	11	2	0
	1997–1998	20	19	2	41	29	11	1	0
	1998–1999	29	37	10	76	67	9	0	0
20B	1985–1986				57	20	5	0	32
	1986–1987				6	5	1	0	0
	1987–1988	8	10	0	18	17	1	0	0
	1988–1989	20	13	1	34	31	3	0	0
	1989–1990	18	16	1	35	28	6	1	0
	1990–1991	5	6	0	11	8	3	0	0
	1991–1992	25	23	8	56	41	13	2	0
	1992–1993	27	17	3	47	38	9	0	0
	1993–1994	48	53	2	103	90	7	2	0
	1994–1995	27	21	2	50	33	17	0	0
	1995–1996	19	25	1	45	36	9	0	0
	1996–1997	41	40	2	83	74	9	0	0
	1997–1998	29	19	1	49	40	8	1	0
	1998–1999	30	29	4	63	53	10	0	0
20C	1985–1986				8	6	0	0	0
	1986–1987				4	1	2	0	0
	1987–1988	7	5	1	13	8	3	2	0
	1988–1989	5	4	0	9	8	1	0	0
	1989–1990	8	8	1	17	11	5	1	0
	1990–1991	21	22	3	46	18	25	3	0
	1991–1992	16	5	0	21	13	8	0	0
	1992–1993	11	5	1	17	12	4	1[a]	0
	1993–1994	13	14	2	29	33	3	0	0
	1994–1995	8	3	0	11	10	2	0	0

Table 2 Continued

Unit	Regulatory year	Reported harvest M	F	Unk	Total	Method of take Trap/ Snare	Shot	Unk/ Other	Wolf control
	1995–1996	4	3	1	8	7	1	0	0
	1996–1997	15	21	1	37	25	8	4	0
	1997–1998	5	5	0	10	8	1	1	0
	1998–1999	15	6	6	27	26	1	0	0
20F	1985–1986				2	2	0	0	0
	1986–1987				2	2	0	0	0
	1987–1988	1	1	3	5	1	4	0	0
	1988–1989	2	3	0	5	5	0	0	0
	1989–1990	10	2	2	14	11	2	1	0
	1990–1991	2	5	0	7	6	0	1	0
	1991–1992	4	6	0	10	7	2	1	0
	1992–1993	0	2	0	2	1	1	0	0
	1993–1994	7	3	0	10	11	3	0	0
	1994–1995	2	5	0	7	2	5	0	0
	1995–1996	0	1	0	1	0	1	0	0
	1996–1997	2	5	3	10	7	3	0	0
	1997–1998	5	6	0	11	7	4	0	0
	1998–1999	2	0	0	2	2	0	0	0
25C	1985–1986				2	2	0	0	0
	1986–1987				2	0	1	1	0
	1987–1988	5	5	0	10	10	0	0	0
	1988–1989	2	1	0	3	0	3	0	0
	1989–1990	3	4	0	7	0	7	0	0
	1990–1991	8	4	0	12	1	10	1	0
	1991–1992	2	5	0	7	3	4	0	0
	1992–1993	18	9	1	28	27	1	0	0
	1993–1994	10	9	0	19	16	3	0	0
	1994–1995	10	3		13	10	3	0	0
	1995–1996	7	2	1	10	8	1	1	0
	1996–1997	10	5	2	17	15	2	0	0
	1997–1998	0	1	1	2	2	0	0	0
	1998–1999	2	1	2	5	4	1	0	0
Combined	1985–1986				93				
	1986–1987				51				
	1987–1988				82				
	1988–1989				83				
	1989–1990				104				
	1990–1991				132				
	1991–1992				161				

Table 2 Continued

Unit	Regulatory year	Reported harvest M	F	Unk	Total	Method of take Trap/ Snare	Shot	Unk/ Other	Wolf control
	1992–1993				151				
	1993–1994				321				
	1994–1995				148				
	1995–1996				123				
	1996–1997				209				
	1997–1998				113				
	1998–1999				173				

[a] One killed by other wolves.
[b] Includes wolf control removal.

Table 3 Units 20A, 20B, 20C, 20F, and 25C wolf harvest chronology, regulatory years 1985–1986 through 1998–1999

Unit	Regulatory year	Harvest periods			*n*
		Aug–Oct	Nov–Jan	Feb–Apr	
20A	1985–1986	2	11	11	24
	1986–1987	0	24	9	33
	1987–1988	3	22	11	36
	1988–1989	4	11	17	32
	1989–1990	8	13	10	31
	1990–1991	5	27	24	56
	1991–1992	7	36	24	67
	1992–1993	4	31	22	57
	1993–1994	15	91	37	143[a]
	1994–1995	5	52	7	64[a]
	1995–1996	4	38	15	57
	1996–1997	4	36	21	61
	1997–1998	6	20	15	41
	1998–1999	9	35	28	72
20B	1985–1986	1	9	15	25
	1986–1987	0	5	1	6
	1987–1988	0	9	9	18
	1988–1989	2	27	5	34
	1989–1990	4	18	13	35
	1990–1991	1	7	3	11
	1991–1992	7	25	24	56
	1992–1993	6	26	15	47
	1993–1994	2	60	39	101
	1994–1995	10	26	13	49
	1995–1996	4	29	11	44
	1996–1997	4	49	30	83
	1997–1998	7	23	19	49
	1998–1999	9	28	26	63
20C	1985–1986	0	3	3	6
	1986–1987	0	3	0	3
	1987–1988	2	8	2	12
	1988–1989	1	10	0	11
	1989–1990	0	8	9	17
	1990–1991	2	19	25	46
	1991–1992	0	12	9	21
	1992–1993	0	7	10	17
	1993–1994	1	12	16	29
	1994–1995	2	4	5	11
	1995–1996	1	1	5	7

Table 3 Continued

Unit	Regulatory year	Harvest periods			*n*
		Aug–Oct	Nov–Jan	Feb–Apr	
	1996–1997	2	11	24	37
	1997–1998	0	8	1	9
	1998–1999	1	17	9	27
20F	1985–1986	0	1	1	2
	1986–1987	0	1	1	2
	1987–1988	0	2	3	5
	1988–1989	0	1	3	4
	1989–1990	2	5	7	14
	1990–1991	0	4	3	7
	1991–1992	0	6	5	11
	1992–1993	0	1	1	2
	1993–1994	1	6	3	10
	1994–1995	0	1	6	7
	1995–1996	1	0	0	1
	1996–1997	2	4	4	10
	1997–1998	3	3	5	11
	1998–1999	0	2	0	2
25C	1985–1986	0	1	1	2
	1986–1987	0	0	1	1
	1987–1988	0	9	1	10
	1988–1989	0	1	2	3
	1989–1990	2	0	5	7
	1990–1991	3	6	3	12
	1991–1992	0	1	6	7
	1992–1993	1	10	17	28
	1993–1994	2	7	10	19
	1994–1995	1	7	5	13
	1995–1996	0	5	5	10
	1996–1997	2	11	4	17
	1997–1998	0	0	2	2
	1998–1999	0	2	3	5
3-year total (1996–1998)		49 (10%)	249 (51%)	191 (39%)	

[a] Includes wolf control removal.

Table 4 Units 20A, 20B, 20C, 20F, and 25C wolf harvest by transport method, regulatory years 1985–1986 through 1998–1999

Unit	Regulatory year	Harvest by transport method									
		Airplane	Dogsled, skis, snowshoes	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Horse	Unk	*n*
20A	1985–1986	7	8	0	0	5	0	0	0	4	24
	1986–1987	5	0	0	2	28	0	0	0	0	35[a]
	1987–1988	9	1	0	1	24	0	1	0	0	36
	1988–1989	14	0	0	0	17	1	0	0	0	32
	1989–1990	4	0	0	1	17	0	3	1	5	31
	1990–1991	42	1	0	1	10	0	1	0	1	56
	1991–1992	25	2	0	2	34	1	2	0	1	67
	1992–1993	21	3	0	0	30	0	0	0	2	56
	1993–1994	16	0	0	1	37	0	0	0	6	62[d]
	1994–1995	5	2	0	0	21	0	2	0	0	30[c]
	1995–1996	5	4	0	0	46	0	2	0	2	59
	1996–1997	15	3	1	0	39	0	3	1	0	62
	1997–1998	0	3	0	1	27	1	7	1	1	41
	1998–1999	10	1	1	2	52	1	1	2	6	76
20B	1985–1986	5	1	0	0	14	0	2	0	3	25[b]
	1986–1987	2	0	0	0	4	0	0	0	0	6
	1987–1988	2	0	0	0	16	0	0	0	0	18
	1988–1989	5	0	1	1	26	0	1	0	0	34
	1989–1990	9	0	1	0	15	1	5	4	0	35
	1990–1991	2	2	0	1	6	0	0	0	0	11
	1991–1992	10	1	1	1	34	1	4	0	3	55
	1992–1993	6	1	1	0	34	1	3	0	1	47
	1993–1994	4	2	0	1	81	0	4	0	11	103
	1994–1995	8	0	1	1	32	0	7	0	1	50
	1995–1996	1	2	1	1	37	0	1	0	1	45
	1996–1997	11	7	1	0	54	1	8	0	1	83
	1997–1998	2	1	0	3	36	0	6	0	1	49
	1998–1999	1	3	0	2	46	0	10	0	1	63
20C	1985–1986	0	3	0	0	2	0	1	0	0	6
	1986–1987	0	2	0	0	1	0	0	0	0	3[c]
	1987–1988	3	0	0	3	5	0	1	0	1	13
	1988–1989	3	0	1	2	2	0	1	0	0	9[c]
	1989–1990	9	0	0	0	7	0	0	1	0	17

Table 4 Continued

Unit	Regulatory year	Harvest by transport method									
		Airplane	Dogsled, skis, snowshoes	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Horse	Unk	*n*
	1990–1991	22	10	0	0	5	0	3	0	6	46
	1991–1992	7	2	0	0	12	0	0	0	0	21
	1992–1993	1	4	0	0	10	0	0	0	0	15
	1993–1994	12	4	0	0	12	0	1	0	0	29
	1994–1995	3	3	1	0	3	0	1	0	0	11
	1995–1996	0	0	0	1	6	0	0	0	0	7
	1996–1997	1	2	1	0	29	0	0	0	4	37
	1997–1998	2	2	0	0	5	0	0	0	1	10
	1998–1999	0	7	1	0	17	0	0	0	2	27
20F	1985–1986	0	0	0	0	0	0	0	0	0	0
	1986–1987	0	2	0	0	0	0	0	0	0	2
	1987–1988	3	1	0	0	1	0	0	0	0	5
	1988–1989	0	0	0	0	4	0	1	0	0	5
	1989–1990	0	0	2	0	7	0	0	5	0	14
	1990–1991	0	2	0	0	5	0	0	0	0	7
	1991–1992	0	0	0	0	8	0	2	0	0	10
	1992–1993	0	0	0	0	1	0	1	0	0	2
	1993–1994	1	1	1	1	6	0	0	0	0	10
	1994–1995	5	1	0	0	1	0	0	0	0	7
	1995–1996	0	0	0	1	0	0	0	0	0	1
	1996–1997	0	2	1	0	5	0	2	0	0	10
	1997–1998	1	0	1	0	7	0	2	0	0	11
	1998–1999	0	0	0	0	2	0	0	0	0	2
25C	1985–1986	0	1	0	0	0	0	0	0	1	2
	1986–1987	0	0	0	0	0	0	1	0	0	1
	1987–1988	0	4	0	0	6	0	0	0	0	10
	1988–1989	2	1	0	0	0	0	0	0	0	3
	1989–1990	5	0	0	2	0	0	0	0	0	7
	1990–1991	5	1	0	1	1	1	2	0	1	12
	1991–1992	4	0	0	0	2	0	1	0	0	7
	1992–1993	13	0	0	0	15	0	0	0	0	28
	1993–1994	10	0	0	1	4	1	3	0	0	19
	1994–1995	0	0	1	0	11	0	1	0	0	13
	1995–1996	1	0	0	0	8	0	0	0	1	10

Table 4 Continued

Unit	Regulatory year	Harvest by transport method									
		Airplane	Dogsled, skis, snowshoes	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Horse	Unk	*n*
	1996–1997	6	0	0	1	10	0	0	0	0	17
	1997–1998	0	0	0	0	2	0	0	0	0	2
	1998–1999	2	0	0	0	2	0	1	0	0	5

[a] Excludes 1 Denali National Park wolf.

[b] Excludes 28 wolves taken by Alaska Department of Fish and Game (ADF&G).

[c] Excludes 2 Denali National Park wolves.

[d] Excludes 98 wolves taken by ADF&G.

[e] Excludes 36 wolves taken by ADF&G.

LOCATION

GAME MANAGEMENT UNIT: 20D (5637 mi^2)

GEOGRAPHIC DESCRIPTION: Central Tanana Valley near Delta Junction

BACKGROUND

Wolves are present throughout Unit 20D where their primary prey are moose, caribou, and Dall sheep. Wolf and prey numbers were high in Unit 20D during the 1960s. The wolf population was an estimated 200–250 at that time (38.3–48.2 wolves/1000 mi^2 or 14.8–18.6 wolves/1000 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 issuing aerial shooting permits to the public. From fall 1979 to spring 1983, 105 wolves were removed by trappers, ADF&G staff, and hunters with permits for aerial shooting. Most wolves were taken in southern and eastern Unit 20D (ADF&G 1983). Since the wolf reduction program ended in spring 1983, all wolf harvest 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 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 and 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:

- 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 wolf predation control reduction programs as directed by the commissioner and the Board of Game.

- Manage harvest to maintain a population of between 15 and 125 wolves, the population objective set by the Board of Game.

- Provide trapper education programs to improve trapper skills, ethics, and regulatory compliance.

- Model the potential effects of wolf predation on ungulates within Unit 20D.

METHODS

We estimated wolf population size using aerial surveys; observations of packs with radiocollared wolves; interviews with local trappers, hunters, and pilots; and information about pack size recorded on fur sealing certificates. Aerial surveys were conducted by flying major rivers, creeks, exposed ridges, and other locations and searching for wolf tracks. When tracks were located, the number of wolves and their direction of travel were determined. Survey information was recorded on topographic maps. Information from interviews with reliable local pilots, hunters, and trappers was also used to determine pack size. Wolves harvested during the winter were added to spring pack size if known, to estimate fall pack size prior to hunting and trapping season. In some cases, fall pack size was known for packs observed during that time period. The total number of wolves estimated in the subunit was increased by an additional 10% that were assumed to be lone wolves not associated with a pack.

One wolf pack, the 100-Mile Creek pack resides primarily in eastern Unit 20A but was included in the Unit 20D population estimate. The 100-Mile Creek pack ranges well into Unit 20D and is trapped by several trappers in Unit 20D. Therefore, I calculated a "pack equivalent" for the 100-Mile Creek pack by multiplying estimated pack size by 20% (the estimated amount of time the pack spends in Unit 20D) to calculate a pack equivalent that was added to the Unit 20D population estimate. Population data were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY99 = 1 Jul 1999 through 30 Jun 2000).

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. Harvest data were summarized by regulatory year.

Unit 20D was subdivided into 2 areas using the Tanana River as the boundary. The portion of Unit 20D south of the Tanana River is southern Unit 20D. The portion of Unit 20D north of the Tanana River is northern Unit 20D.

Wolves from some northern Unit 20D packs were radiocollared as part a research project being conducted in the Fortymile Nonlethal Predation Control Area. Dominant wolves within some of these packs were also sterilized and other members of the packs were relocated to areas outside of Unit 20D. Boertje and Gardner (2000) reported methods and results for this project.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The fall 1996 wolf population met the management objective and was estimated at 96–107 in 14 packs, including "loners" (Table 1). This is slightly lower than the fall 1995 estimate of 116–128 wolves. The number of wolves in southern Unit 20D was 32–40 in 6 packs. This estimate includes a "pack equivalent" of 2 wolves from the 100-Mile Creek pack. Northern Unit 20D had an estimated 54–57 wolves. An additional 9–10 were added to the unit estimate for an assumed 10% "loners." This population estimate resulted in an estimated density of 18.3–20.5 wolves/1000 mi^2 (7.1–7.9 wolves/1000 km^2) in the unit.

The fall 1997 wolf population met the management objective and was estimated at 117–122 in 13 packs, including "loners" (Table 1). The number of wolves in southern Unit 20D was estimated at 31–34 in 5 packs. This estimate includes a "pack equivalent" of 3 wolves from the 100-Mile Creek pack. Northern Unit 20D had an estimated 75–77 in 8 packs. An additional 11 wolves were added to the estimate for an assumed 10% "loners" in the unit. This population estimate resulted in an estimated density of 22.5–23.6 wolves/1000mi^2 (8.7–9.1 wolves/1000 km^2) in the unit.

The fall 1998 population estimate was incomplete because no estimate was calculated for southern Unit 20D due to poor spring survey conditions. Therefore, the only estimate was for northern Unit 20D, which was 56–58 wolves in 8 packs (Table 1). Because a unitwide population was not estimated, it was not possible to determine if the population objective was achieved. The significant reduction in the northern Unit 20D population estimate from fall 1997 was due in large part to 2 large packs being trapped by trappers and being treated in the Fortymile Nonlethal Predation Control Program. The Indian-Tibbs pack had 10 wolves in fall 1997 but had 5 wolves trapped, 3 relocated, and the remaining 2 sterilized during winter 1997–1998. The Black Mountain–Harper pack had 6 wolves trapped, 3 relocated, and the remaining 2 sterilized. In fall 1998 these 2 packs had 2 and 3 wolves, respectively.

Distribution and Movements

Wolves from several packs in northern Unit 20D were radiocollared as part of the Fortymile Caribou Herd Nonlethal Predation Control Program. Boertje and Gardner (2000) reported movements of these wolves.

MORTALITY

Harvest

Season and Bag Limit.

Unit/Bag Limit/ Special Restrictions	Resident Open Seasons	Nonresident Open Seasons
Unit 20D		
RY96		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. No same-day-airborne shooting of wolves, except wolves caught in a trap or snare, or further than 300 ft from the airplane at the time of taking. No trapping with a steel trap or with a snare smaller than 3/32" in diameter during April or October.	15 Oct–30 Apr	15 Oct–30 Apr
RY97		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. A wolf may be shot same day airborne if caught in a trap or snare. No trapping with a steel trap or with a snare smaller than 3/32" in diameter during April or October.	15 Oct–30 Apr	15 Oct–30 Apr
RY98		
HUNTING: 5 wolves. No wolf hunting same-day-airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. A wolf may be shot same day airborne if caught in a trap or snare. No trapping with a steel trap or with a snare smaller than 3/32" in diameter during April or October.	15 Oct–30 Apr	15 Oct–30 Apr

Board of Game Actions and Emergency Orders. The Alaska Board of Game took no actions and no emergency orders were issued during this reporting period.

During November 1996, a statewide ballot initiative resulted in repeal of a 1993 Board of Game regulation that authorized trappers to take wolves same-day-airborne if wolves were at least 300 ft from airplanes. The same-day-airborne repeal became effective 25 February 1997.

Hunter/Trapper Harvest. Hunters and trappers reported taking 28 wolves in RY96, 41 in RY97, and 25 in RY98 (Table 2). The mean annual harvest of 31 wolves during RY96–RY98 was lower than during the previous 3 years. During RY96–RY98, 56% of harvested wolves were male, 36% were female, and 7% were unknown sex.

Trappers and hunters took more wolves from southern than from northern Unit 20D during RY96–RY98. This likely occurred because road access is better in southern than in the northern part of the unit. In RY96, 64% of wolves were taken in southern Unit 20D, compared to 36% from northern Unit 20D (Table 3). In addition, 4 wolves from the Black Mountain-Harper Pack in northern Unit 20D were relocated to an area outside the subunit (Boertje and Gardner 2000). In RY97, 59% of wolves were harvested from southern Unit 20D, and 41% were taken from northern Unit 20D. Also, 6 wolves were relocated outside of the unit from northern Unit 20D packs. Three of these wolves were relocated from the Indian/Tibbs pack, and 3 came from the Black Mountain-Harper Pack. During RY98, 52% of harvested wolves were taken from southern Unit 20D, and 48% came from northern Unit 20D. One wolf was relocated from the Black Mountain-Harper pack in northern Unit 20D.

Most wolves were taken each year by trapping and snaring. Seventy-nine percent, 98% and 96% were taken in traps or snares during RY96, RY97, and RY98, respectively (Table 2). In RY96, trappers were allowed to shoot wolves same-day-airborne if the wolf was over 300 feet from the aircraft. However, only 1 of the 6 wolves reported taken by shooting that year was taken with the aid of an airplane.

The RY96 harvest rate for trappers and hunters was 26–29% of the estimated fall wolf population. When the 4 wolves relocated from northern Unit 20D are added to the harvest, an estimated 30–33% of the wolves were removed from the unit. During RY97, trappers and hunters took 34–35% of the estimated fall population. Adding 6 wolves relocated from the unit to the harvest results in an estimated 39–40% of the wolves being removed. No harvest rate was calculated for RY98 because the population estimate was incomplete during that year.

The National Research Council (1997) reported that determining sustainable levels of wolf harvest is difficult, but estimates of sustainable rates of harvest vary from less than 30% up to 40% of early winter populations. Harvest and relocation of Unit 20D wolves did not exceed 40% of the estimated population during this reporting period. However, 2 packs in northern Unit 20D have been reduced in size and the dominant pair sterilized, which may delay the recovery time for these packs.

Harvest Chronology. There were no significant changes in wolf harvest chronology during RY96–RY98. Most wolves were harvested during November through March (Table 4).

Transport Methods. Snowmachines and highway vehicles were the most common mode of transportation used by trappers and hunters who harvested wolves (Table 5). Snowmachines were used to take 49% of the wolves during RY96–RY98, and highway vehicles were used to take 27%.

CONCLUSIONS AND RECOMMENDATIONS

Wolf management objectives established by the Alaska Board of Game were met during this reporting period. Recent harvest rates combined with experimental relocation of wolves from Unit 20D have been near or possibly exceeded maximum sustainable levels. Because the Alaska Board of Game has determined that human use of moose and Macomb caribou in Unit 20D is the preferred use, and have adopted a wolf control implementation plan for wolves in Unit 20D, the current rate of harvest is acceptable until the wolf population is reduced to the lower limit of the population objective. No regulatory changes are recommended at this time.

The only quantifiable objective during this reporting period was to manage harvest to maintain a population of between 15 and 125 wolves. Other objectives were not quantifiable and, therefore, could not be readily evaluated. During the next report period they will be defined as activities and management direction will be to:

MANAGEMENT GOALS

- 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 OBJECTIVE

- Manage harvest to maintain a population of between 15 and 125 wolves.

MANAGEMENT ACTIVITIES

- Conduct wolf predation control reduction programs as directed by the commissioner and the Board of Game.
- Provide trapper education programs to improve trapper skills, ethics, and regulatory compliance.

- Model the potential effects of wolf predation on ungulates within Unit 20D.

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PREPARED BY:
Stephen D DuBois
Wildlife Biologist III

SUBMITTED BY:
Roy A Nowlin
Regional Management Assistant

REVIEWED BY:
Mark E McNay
Wildlife Biologist III

Table 1 Unit 20D fall wolf population estimate, regulatory years 1996–1997 through 1998–1999

Area	Regulatory year		
	1996–1997	1997–1998	1998–1999
Southern Unit 20D[a,b]	32–40	31–34	–[c]
Northern Unit 20D[d]	54–57	75–77	56–58
Unit 20D Subtotal	86–97	106–111	–[c]
Estimate 10% "loners"	9–10	11	–[c]
Unit 20D Total	96–107	117–122	–[c]
Estimated wolves/1000 km^2	7.1–7.9	8.7–9.1	

[a] Includes a "pack equivalent" calculation for the 100-Mile Creek pack which overlaps eastern Unit 20A.

[b] Unit 20D south of the Tanana River.

[c] No estimate due to poor spring survey conditions.

[d] Unit 20D north of the Tanana River.

Table 2 Unit 20D wolf harvest, regulatory years 1985–1986 through 1998–1999

Regulatory	Reported harvest			Estimated harvest		Method of take				
year	M	F	Unk	Unreported	Illegal	Trap/snare	Shot	SDA[a]	Unk	Total
1985–1986	17	10	1	0	0	19	0	9	0	28
1986–1987	11	7	0	0	0	18	0	0	0	18
1987–1988	5	7	0	0	0	11	1	0	0	12
1988–1989	5	12	4	0	0	20	1	0	0	21
1989–1990	2	4	0	0	0	4	2	0	0	6
1990–1991	8	13	2	0	0	6	4	13	2	23
1991–1992	4	3	2	0	0	3	5	1	0	9
1992–1993	8	9	5	0	0	16	6	0	0	22
1993–1994	17	27	4	0	0	37	10	0	1	48
1994–1995	16	9	0	0	0	24	1	0	0	25
1995–1996	16	24	1	0	0	39	1	0	1	41
1996–1997	17	10	1	0	0	22	6	0	0	28[b]
1997–1998	22	15	4	0	0	37	3	0	1	41[c]
1998–1999	14	9	2	0	0	24	1	0	0	25[d]

[a] SDA refers to animals taken by hunters the same day hunters were airborne.
[b] An additional 4 wolves were relocated from northern Unit 20D to another area.
[c] An additional 6 wolves were relocated from northern Unit 20D to another area.
[d] An additional 1 wolf was relocated from northern Unit 20D to another area.

Table 3 Unit 20D Wolf harvest by location, regulatory years 1996–1997 through 1998–1999

Regulatory year	North of Tanana River	South of Tanana River
1996–1997	10	18
1997–1998	17	24
1998–1999	12	13

Table 4 Unit 20D wolf harvest chronology, regulatory years 1985–1986 through 1998–1999

Regulatory year	Harvest periods											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Unk	*n*
1985–1986		0	0	0	4	3	4	5	8	2	2	28
1986–1987		0	0	0	0	2	8	2	6	0	0	18
1987–1988		1	0	0	4	0	1	6	0	0	0	12
1988–1989		0	0	0	0	5	5	10	0	1	0	21
1989–1990		0	1	0	0	3	0	0	2	0	0	6
1990–1991		0	0	2	2	0	0	3	16	0	0	23
1991–1992		0	2	0	0	2	1	1	3	0	0	9
1992–1993		1	1	0	2	8	0	4	3	2	1	22
1993–1994		0	5	0	6	11	6	4	16	0	0	48
1994–1995		0	1	0	0	3	6	8	6	1	0	25
1995–1996		0	0	0	9	7	8	7	9	1	0	41
1996–1997	0	2	2	1	6	4	4	7	1	0	0	27
1997–1998	1	0	1	0	9	9	8	3	9	1	0	41
1998–1999	0	0	0	0	6	8	4	5	2	0	0	25

Table 5 Unit 20D wolf harvest by transport method, regulatory years 1985–1986 through 1998–1999

Regulatory year	Harvest by transportation method									
	Airplane	Dogsled, skis, snowshoes	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk	*n*
1985–1986	10	0	0	0	16	0	1		1	28
1986–1987	1	1	0	0	16	0	0		0	18
1987–1988	1	5	0	0	4	0	1		1	12
1988–1989	0	0	0	0	21	0	0		0	21
1989–1990	0	0	0	0	4	1	0		1	6
1990–1991	15	0	0	0	4	1	3		0	23
1991–1992	1	0	0	0	6	0	2		0	9
1992–1993	10	0	0	1	8	1	0		2	22
1993–1994	7	0	0	0	34	0	5		2	48
1994–1995	0	1	0	0	17	0	6		1	25
1995–1996	1	2	0	2	22	1	13		0	41
1996–1997	1	2	0	1	13	1	9		0	28
1997–1998	0	4	0	0	22	0	6	9	0	41
1998–1999	0	3	0	1	11	0	10	0	0	25

LOCATION

GAME MANAGEMENT UNIT: 20E (10,680 mi^2)

GEOGRAPHIC DESCRIPTION: Fortymile, Ladue, and Charley River drainages

BACKGROUND

Since the 1940s wolf numbers in Unit 20E have fluctuated due to federal and state wolf control programs, harvest pressure, and ungulate densities. Murie (1944) reported that wolves were abundant in the region during the 1940s but were rapidly reduced by a federal predator reduction program during 1948–1960 (Gasaway et al. 1992). Wolves were killed by poison, cyanide guns, disrupting dens, year-round trapping, and aerial shooting. Once the control program ceased in 1960, wolves again became abundant in Unit 20E. The wolf population subsequently declined during the mid-1970s after the area's moose and caribou populations declined to low levels (Gasaway et al. 1992).

Between 1975 and 1981 the wolf population was stable and lightly harvested ($\bar{x}$ = 11% annual harvest rate). During 1981–1983 a wolf control program was conducted by the Alaska Department of Fish and Game (ADF&G) in a 6000-mi^2 area primarily located in Unit 20E. The combination of wolf control and public trapping reduced the wolf population by 73% by spring 1983. Subsequent harvest by public hunters and trappers maintained the population below precontrol size through 1986. Increased wolf productivity occurred following control efforts, indicating wolves were nutritionally limited by the initial low moose and caribou densities (Gasaway et al. 1992). During the late 1980s the wolf population in Unit 20E increased by approximately 17% annually, reaching an estimated 231 wolves in 1990. Between 1990 and 1995 wolf numbers fluctuated but overall remained stable.

Historically the wolf population in Unit 20E has been lightly harvested. However, during some years, moderate to high harvests caused population declines in accessible areas. Wolf trapping intensity is primarily affected by the fur market but it also is effected by trapping methods and means. When marten and lynx fur prices are high, most area trappers spend little time trapping wolves. Also, trapping pressure in Unit 20E was higher when land-and-shoot taking of wolves was legal because more nonlocal trappers traveled to the area. During 1995 and 1996, wolf harvest was higher due to a privately funded wolf harvest incentive program designed to increase wolf kill within the summer and winter ranges of the Fortymile caribou herd.

The effects of the 1981–1983 wolf control program were difficult to interpret because the program was terminated prematurely and adequate removal rates were not obtained. Moose and caribou numbers did increase, but these increases may have been related to factors other than wolf control. Adult moose and caribou survival increased, but calf survival did not. However the wolf control area did not overlap any of the caribou herd's calving range. Gasaway et al. (1992) concluded that in Unit 20E wolf predation on moose calves was not a detectable source of additive mortality when grizzly bears were abundant.

Since the early 1980s wildlife agencies in Alaska and Canada experienced difficulties in 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 the trapper, wolves are a prized and important furbearer, and many trappers do not want to see management programs that cause large population declines. To some hunters, wolves are viewed as competitors. Those hunters feel wolves should be controlled to allow for more human use of ungulate resources. In contrast, others view wolves as a symbol of wilderness and believe wolves and their prey should be naturally regulated with little human influence.

Those philosophical differences concerning wolf management have caused heated disagreements and divisiveness between wildlife proponents. Most of the local residents in Unit 20E and adjacent Unit 12 support an intensive management program designed to increase caribou and moose numbers. Following the premature stoppage of the 1981 wolf control program and Governor Hickel's decision in 1992 to rescind a wolf control program scheduled to begin in 1993, it was evident any program designed to help ungulate populations recover in Unit 20E must include a diversity of public views concerning wildlife management and must include all of the responsible agencies.

In February 1994 the Fortymile Management Team was created. It included 14 public members representing a wide range of special interest groups and 5 management agencies. The team agreed to the goal of trying to manage for the recovery of the Fortymile caribou herd using a series of management steps designed to conserve habitat, reduce caribou harvest, and reduce wolf predation. The team developed a plan which recommended a combination of public trapping and state conducted nonlethal wolf control to reduce wolf predation on Fortymile caribou. The Alaska Board of Game adopted the implementation plan during spring 1996, and Governor Knowles allowed the nonlethal wolf control program to begin in fall 1997.

MANAGEMENT DIRECTION

Management Goals

Wolf populations throughout Interior Alaska 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, scientific studies and education. 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 options range between manipulation of wolf population size and 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 Board of Game on 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.
- 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

The following objectives were developed by the Fortymile Caribou Management Team to be followed during the 5-year nonlethal wolf control. New objectives will be developed following termination of the plan in 2001.

- Monitor wolf numbers, population characteristics, and harvests.
  - Monitor harvest through sealing records and trapper questionnaires.
  - Conduct fixed-wing aerial surveys during the winter in selected areas.
  - Radiocollar and monitor selected packs.
- Provide for the maximum harvest of wolves in western Unit 20E.
  - Through seasons and bag limits, allow for the greatest harvest to occur within and near the Fortymile caribou herd.
- Reduce the number of wolves on the Fortymile caribou herd's calving and summer range by relocating all members of up to 15 packs other than the dominate pair and controlling fertility among dominant pairs.
  - Monitor relocated wolves to determine survival, homing instinct, and establishment of territory.
  - Monitor sterilized wolves to determine pack size, territory size and usage, and kill rates.
  - Close trapping if the wolf population in the control area is reduced to 30 wolves.

METHODS

Estimating Wolf Population Size

Between fall 1991 and fall 1999 aerial wolf surveys (Stephenson 1978; Gasaway et al. 1983), standard radiotelemetry techniques, wolf observations by area pilots and trappers, and sealing documents 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. Population data were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY99 = 1 Jul 1999 through 30 Jun 2000).

Wolf Population Characteristics

Within the Fortymile caribou herd's range, we captured 253 wolves between 1991 and 1999. Before November 1997 all wolves captured were radiocollared to help us evaluate wolf movements and numbers. Usually 2–3 wolves were radiocollared per pack. Since November 1997 we have relocated 82 wolves from 15 packs and radiocollared 30 of these wolves. We have sterilized 34 adult wolves (19 females and 15 males) and radiocollared all of them to evaluate the efficacy of fertility control, determine if the sterilized pair maintained their alpha status and territory, and monitor the pairs' movement patterns. Wolves captured outside of the nonlethal control treatment area were part of packs we were using as control packs to evaluate the effects of relocation and sterilization. Blood samples and body measurements were routinely taken from all captured wolves. Radiocollared wolves were located periodically during the year to determine pack and territory size, movement patterns, and population demographics.

Nonlethal Wolf Control

In November 1997 we began relocating all subordinate wolves and sterilizing the 2-parent wolves in 15 packs most accountable for Fortymile caribou calf mortality. Wolves to be relocated or sterilized were captured using methods outlined in Boertje and Gardner (2000). Relocated wolves were moved >100 miles from their original territory in 1997 and >200 miles during 1998–2000 to minimize the chance for their return. These wolves were released in areas that supported ungulate densities as high or higher than in their original territory. The dominant wolves were sterilized by veterinary surgeons. The males were vasectomized and the females were tubal ligated to retain gonadal cycling. The sterilized wolves were kept overnight for observation to ensure the wolves were completely recovered from the immobilizing drug before release. The sterilized wolves were released at or near the point of capture.

Harvest Monitoring

We determined harvest statistics 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 size of the wolf pack, and transportation. Harvest data were summarized by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We conducted thorough fall wolf surveys in most of Unit 20E during RY91, RY92, RY95, and RY96–RY98. Based on those surveys, the population seemed to have declined during RY90 but increased slowly until RY95 to 227–238 wolves (Table 1). The population remained relatively stable between fall RY95 and fall RY97 but probably declined slightly by fall RY98 due to a combination of nonlethal wolf control and public trapping.

Causes of the reduced count during RY91 are not known. Total reported harvest during RY90 was not high enough to explain the reduction. Survey conditions during RY91 were good in most areas of the subunit and our detection rate should have been comparable to other years.

During RY95 wolf numbers west of the Taylor Highway in Unit 20E, north of the Tanana River in Unit 20D, and along the Salcha River in Unit 20B declined slightly following an intensive private wolf trapping effort to help recovery of the Fortymile caribou herd. Most of the harvest that occurred in Unit 20E was along the Taylor Highway and along the Middle and Mosquito Fork Rivers. Overall, harvest rate was about 57% and caused the subunit density to drop from about 7.1 to 6.8 wolves/1000 km^2. Harvest rates have been below sustainable levels since RY95.

During RY97 and RY98, pack size was reduced to 2 sterilized wolves in 6 packs in western Unit 20E, 3 packs in eastern Unit 20D along the Unit 20E border, 4 packs within Unit 20B, and 1 pack in Unit 25C. This was due to a combination of public trapping and ADF&G relocations. These efforts caused a slight decline in the subunit's wolf population and a 78% reduction within the 14 wolf pack territories. One additional wolf territory will be treated in winter RY99.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Seasons	Nonresident Open Seasons
Regulatory year 1996		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. A wolf may be shot same day airborne if caught in a trap or snare, or trapper is over 300 ft from airplane. (This regulation was changed by a initiative disallowing wolves to be shot the	15 Oct–30 Apr	15 Oct–30 Apr

Units and Bag Limits	Resident Open Seasons	Nonresident Open Seasons
same day airborne unless the wolf was in a trap or snare.) No trapping with a steel trap or a snare smaller than 3/32 inch in diameter during April or October.		
Regulatory year 1997		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. No trapping with a steel trap or a snare smaller than 3/32 inch in diameter during April or October.	15 Oct–30 Apr	15 Oct–30 Apr
Regulatory year 1998		
HUNTING: 5 wolves. No wolf hunting same day airborne.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit. No trapping with a steel trap or a snare smaller than 3/32 inch in diameter during April or October.	15 Oct–30 Apr	15 Oct–30 Apr

Board of Game Actions and Emergency Orders. In November 1996, Alaskan voters passed an initiative which prohibited same-day-airborne hunting of wolves, fox, lynx, and wolverine. This initiative became effective on 25 February 1997. An initiative to ban the use of snares to catch wolves failed in November 1998.

During their spring 1997 meeting, the board adopted the Fortymile Nonlethal Wolf Control Implementation Plan (Plan). Before nonlethal control activities began, Governor Knowles reviewed the Plan in relation to public acceptance, economic value, and scientific merit. He ruled in favor of the Plan and allowed the nonlethal wolf control plan to begin in November 1997.

During their spring 1998 meeting, the board designated the Unit 20E moose population within the Fortymile and Ladue River drainages and the Fortymile caribou herd as important for high levels of human consumptive use under the intensive management law (AS 16.05.255[e]-[g]). This designation means that the board must consider intensive management if regulatory action to significantly reduce moose or caribou harvest in Unit 20E becomes necessary because the population is depleted or has reduced productivity. Wolf control has been

identified by the legislature as an important management tool consistent with the intent of the intensive management law.

Hunter/Trapper Harvest. The reported annual Unit 20E wolf harvest was 54, 36, and 17 wolves during RY96, RY97, and RY98, respectively (Table 2). Average annual harvest during the previous report cycle (RY93–RY95) was 64 wolves, which was 1.8 times the current report period average and was 2.6 times the average harvest during RY88–RY92. During RY96–RY98 the estimated harvest rate was 8–24%, which is below the sustainable harvest of 25–30% of the estimated fall population.

Elevated harvest during RY95 and RY96 in portions of Unit 20E was due to the Fortymile Caribou Calf Protection Program, which was developed by trappers to assist the recovery of the Fortymile caribou herd. To stimulate harvest, this group paid $400.00/wolf caught within the range of the Fortymile Herd. This payment approximately doubled the market value of wolf pelts and was instrumental in increasing the harvest. The trappers who administered this program were against implementation of the nonlethal wolf control program, believing that the trapping program was all that was necessary to benefit herd growth. When the nonlethal wolf control program was adopted by the Board of Game in spring 1997, the trapping group decided to end the privately supported trapping program, and in addition, one of the primary fur buyers in the Interior decided not to purchase any wolves trapped in Unit 20E. These decisions were the primary causes for reduced wolf capture during RY97 and RY98. It is unfortunate this split between trappers and the Fortymile caribou recovery program occurred. The program benefited from their participation.

Trappers continued to use snares and traps as the primary methods to catch wolves in Unit 20E (Table 2). During RY96–RY98, 3–6 wolves were taken by hunters primarily incidentally to moose or caribou hunts during the fall hunting season.

Harvest Chronology. During RY96 and RY97, the average percent wolf harvest during August and September (wolf hunting only), November through March (snaring, trapping, and hunting), and October and April (snaring only) was 7%, 87%, and 6%, respectively (Table 3). Most harvest occurred during December and January. Historically, most harvest occurred during December through February. During the 2 years of the Fortymile Caribou Protection Plan, trappers who shifted their lines to western Unit 20E did so near the end of marten season (Feb) and were not totally operational until mid to late February resulting in a greater harvest during March.

Transport Methods. Most successful wolf trappers used snowmachines in Unit 20E (Table 4). Airplanes were used by a small number of trappers to access areas not trapped by land-based trappers. The number of wolves caught by trappers using airplanes for transportation was primarily dependent on market price for wolves, lynx, and marten. During years of high marten or lynx prices, these trappers reduced their wolf trapping efforts unless wolf pelt prices were also high. Most wolves taken by trappers using highway vehicles were taken along the southern half of the Taylor Highway between Chicken and the Alaska Highway.

HABITAT

Assessment

Prey availability dictates wolf habitat use, therefore, preferred wolf habitat occurs with a greater ungulate prey base. Because of the migratory behavior of caribou and their fidelity to calving grounds, there are temporal high densities of caribou available to certain wolf packs. Since winter 1997, the Nelchina and Mentasta caribou have primarily wintered in Unit 20E adding 25,000–40,000 caribou into the unit. Almost all Unit 20E wolf packs have thousands of caribou available to them throughout the winter. Between May and October, only the Fortymile Herd is in Unit 20E, and it is concentrated in certain areas. During this period, most packs must rely on moose or small mammals as their primary prey. Moose densities in Unit 20E are low (0.2–0.9 moose/mi^2, $\bar{x}$ = 0.46 moose/mi^2) (Gardner 2000). Those moose densities in conjunction with the temporal availability of caribou cannot support a large wolf population. Based on prey availability, wolf habitat currently is poor to moderate, but the habitat could support high populations of prey and wolves if environmental conditions or management actions allowed the ungulate populations to increase substantially.

Human development is not currently a problem for wolves in the area. Habitat quality for ungulates is currently not a limiting factor for any ungulate prey species.

Enhancement

Since the early 1970s, the Upper Tanana/Fortymile ecosystem has contained low density wolf and ungulate populations. To enhance the Fortymile caribou herd, nonlethal wolf control was implemented in November 1997. To enhance the moose population, 3 different prescribed burns during 1998 and 1999 were ignited and burned 95,000 acres. Also, 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.

NONREGULATORY MANAGEMENT PROBLEM/NEEDS

Effects of nutrition, weather, harvest, disease, and predation on Fortymile caribou herd growth have been studied since the mid-1970s (Davis et al. 1978; Boertje et al. 1987, 1988; Valkenburg and Davis 1989; Boertje and Gardner 1996). These studies documented that predation was the major factor limiting recovery of the herd primarily by causing high calf mortality during summer. Wolves and grizzly bears were identified as the primary predators. Between 1994 and 1998, wolves were responsible for 48–59% of herd mortality and grizzly bears were responsible for 22–24%.

In order for the Fortymile Herd to increase, reducing predation (especially on calves) was necessary. Results from 2 wolf control programs conducted in Yukon indicated that decreasing the number of wolves on the summer range would be sufficient to cause a decrease in the calf mortality rate.

During the mid-1990s population objectives for increasing the herd gained public support because most of the herd's traditional range was abandoned as herd size declined in the early

1970s and because the herd decline was in part a result of past management mistakes. In 1994, citizens from Dawson, Yukon and Tok, Alaska desiring management action to increase the herd approached the department to begin a Fortymile Caribou Management Plan. As a result, a diverse international planning team was developed in 1995 that included 13 public members and representatives from 5 state, federal, and territorial agencies. The Fortymile Caribou Management Team recommended multiple, simultaneous actions to reduce predation, including public trapping and nonlethal wolf control conducted by ADF&G.

Following are the proposed objectives, actions, and the desired outcomes:

Objective

- During 1997–2001, reduce wolves in 15 packs that inhabit the Fortymile caribou summer and calving ranges through harvest by the public and governmental, nonlethal predator control.

Actions

- Increase harvest of wolves by the public within the herd's summer and calving ranges.

- Reduce these 15 packs to the alpha pair by public trapping and government-conducted relocation of the remaining subordinate wolves. Subordinate wolves were moved at least 100 miles from their territory to areas that supported as high or higher ungulate populations.

- Sterilize the alpha male by vasectomy and the alpha female by tubal ligation to maintain pack size at 2 wolves.

Desired Result

- Reduce wolves to a level that will allow the caribou herd to grow at a moderate rate (5–10% annually).

If the ongoing wolf reduction techniques are successful, the wolf population within the summer range will be reduced by 70–80%. Wolf reductions of 69–85% resulted in dramatic increases in caribou numbers in Central Alaska (16% per year; Gasaway et al. 1983; Boertje and others 1996) and Eastcentral Yukon (18% per year; Farnell and Hayes, unpublished data). Under average environmental conditions, this level of wolf reduction on the Fortymile Herd's calving range is expected to result in herd growth of 5–10%. Under favorable conditions, growth rate could exceed 10%, based on herd population data from the 1980s and modeling (Boertje and Gardner 1996). Lower growth rates are expected in the Fortymile program compared to results in Central Alaska and Eastcentral Yukon because only a portion of the summer range is being controlled, while the entire herd range was controlled in the other 2 programs.

It is still too early in the program to ascertain effects of nonlethal control on caribou herd growth. However, we have collected preliminary data on wolf relocation and sterilization that

may be helpful for answering questions from managers. The majority of questions the department received prior to conducting wolf relocation had to do with 1) return rates of relocated wolves, 2) mortality rate of relocated wolves, and 3) the availability of suitable relocation sites.

Based on results from relocating wolves in Minnesota (Fritts et al. 1985), it appeared 100 miles away from the original territory was sufficient to keep them from returning. Also, average distances female and male wolves dispersed from their original territory was 71 and 53 miles, respectively, in Unit 13 (Ballard et al. 1997). We found that relocation distances of 100 miles was not sufficient for wolves >17 months old but was for wolves 11–13 months old. Over 50% of the > 17-month-old wolves returned within 3–8 months when moved 100–125 miles away from their original territory. None of the 11- to 13-month-old wolves returned after being moved 100–150 miles. Beginning in 1998, we moved all wolves older than 18 months >200 miles away from their territory and none has returned.

Various studies conducted in Alaska reported mortality rates for dispersing wolves of 40–70% (Peterson and others 1984; Ballard and others 1997). The mortality rate for wolves relocated from the Fortymile area was 56%. Trapping was the primary cause of mortality, similar to the other studies. It appears that moving subordinate wolves will not cause an increase in mortality if they are moved at the age when most wolves naturally disperse to areas that support prey densities as high or higher than the original territory.

Our preliminary data indicate that relocating wolves mimics natural dispersal in terms of wolf behavior and mortality and, in combination with trapping, highly effective in reducing wolf numbers. Socially however, relocating wolves is difficult. The initial reaction from most people when asked to accept wolves is, "No thank you we have plenty of wolves in our area already." In only 2 cases did we find suitable places to move wolves without considerable effort. In all other cases, we had to conduct numerous public meetings before acceptance. Each year we faced the possibility of not finding enough sites to move 30 wolves. If a relocation program is to be successful in other areas of the state it will take a much greater commitment by the state. It will be imperative that the Board of Game and the director and regional supervisors take a much greater role working with the area biologists and other agencies in finding suitable areas.

Prior to the sterilization program, many members of the public questioned if the sterilization surgeries were safe, would the surgery be successful, and would the sterilized alpha pair be able to defend their territory against larger packs. We have sterilized 34 wolves (15 males; 19 females) without any complications. The wolves were released the day after surgery and all joined their packs within a day. We have monitored 13 sterilized packs through 1–2 denning periods, and none have had pups. As of February 2000, all 14 pairs have maintained their territories. Five of the sterilized wolves have died since November 1997; 4 have been killed by other wolves and 1 was trapped. In Denali National Park, 11% of the annual wolf mortality was due to other wolves (Mech and others 1998). The highest annual mortality rate due to wolves within the sterilized sample was 10%.

Wolf sterilization appears to be a viable technique to maintain wolf packs at 2 wolves. Sterilization is not a wolf reduction tool, but it is useful for maintaining the population at a desired level.

CONCLUSIONS AND RECOMMENDATIONS

The wolf population in Unit 20E is currently at a moderate density and is limited by low prey abundance. Prior to RY92, harvest by humans was below sustained harvest rates and did not affect overall wolf population growth. Market prices and private incentive programs prompted area trappers to select for wolves, and as a result, harvest increased and caused a wolf population decline in the central and western portions of the subunit during RY94–RY96. Following RY96, wolf harvest declined substantially and was not a limiting factor to population growth. Nonlethal wolf control in combination with public trapping has reduced wolf numbers within 14 pack territories located in portions of Units 20E, 20D, and 20B by 78%. The effects of this program on caribou, moose, and Dall sheep population growth will be analyzed and presented in future management and research reports.

Preliminary data indicates that wolf relocation mimics natural dispersal in terms of wolf behavior following release, and is an effective tool in reducing wolf numbers. Political and social opposition will limit its wide scale use. Wolf sterilization is safe and is effective in maintaining pack size at a desired level. The sterilized pairs in the Fortymile Nonlethal Wolf Control Area maintained their territories and experienced normal mortality rates.

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PREPARED BY:

Craig L Gardner
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Mark E McNay
Wildlife Biologist III

Table 1 Unit 20E fall wolf population estimates[a], regulatory years 1988–1989 through 1998–1999

Regulatory year	Population estimate[b]	Number of packs	Mean pack size[c]	Basis of estimate
1988–1989	173	32	4.9	Aerial survey, observations, reports
1989–1990	205	33	5.6	Aerial survey, observations, reports
1990–1991	231	33	6.3	Aerial survey, observations, reports
1991–1992	169–184	31	5.1	Aerial survey, observations, reports, radiocollars
1992–1993	194–214	32	5.7	Aerial survey, observations, reports, radiocollars
1993–1994	200–224	34	5.7	Aerial survey, observations, reports, radiocollars
1994–1995	192–204	34	5.3	Aerial survey, observations, reports, radiocollars
1995–1996	227–238	34	6.2	Aerial survey, observations, reports, radiocollars
1996–1997	220–230	34	6.0	Aerial survey, observations, reports, radiocollars
1997–1998	221–236	34	6.0	Aerial survey, observations, reports, radiocollars
1998–1999	195–225	34	5.6 (6.2)[d]	Aerial survey, observations, reports, radiocollars

[a] Fall estimate = pretrapping season population.

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

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

[d] In parentheses is mean pack size for all packs not affected by the nonlethal wolf control program.

Table 2 Unit 20E wolf harvest, regulatory years 1988–1989 through 1998–1999

	Reported harvest						Method of take							Successful	
Regulatory Year	M	(%)	F	(%)	Total[a]	% Autumn population[b]	Trap or snare	(%)	Shot	(%)	SDA[c]	(%)	Unk	Trappers and hunters	Wolves/ person
1988–1989	2	(22)	7	(78)	9	5	7	(78)	2	(22)			6	6	1.5
1989–1990	7	(54)	6	(46)	15	7	12	(80)	3	(20)			10	10	1.5
1990–1991	15	(63)	9	(37)	24	10	12	(52)	5	(22)	6	(26)	1	13	1.8
1991–1992	13	(68)	6	(32)	19	11	14	(77)	1	(5)	3	(17)	1	10	1.9
1992–1993	28	(49)	28	(49)	57	28	52	(95)	3	(5)	0	(00)	2	21	2.7
1993–1994	34	(57)	26	(43)	68	32	55	(90)	6	(10)	0	(00)	7	21	3.2
1994–1995	24	(63)	14	(37)	39	20	29	(74)	8	(21)	2	(05)	0	16	2.4
1995–1996	37	(51)	39	(49)	84	37	80	(95)	3	(4)	1	(01)	0	18	4.6
1996–1997	24	(44)	23	(43)	54	24	48	(89)	6	(11)			0	15	3.6
1997–1998	16	(44)	20	(56)	36[d]	16	32	(89)	3	(8)			0	10	3.5
1998–1999	9	(53)	6	(35)	17	8	12	(71)	5	(29)			0	9	1.9

[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 RY88 and RY89 and beginning in RY97.

[d] One wolf was accidentally killed during a capture operation; it was only included in the total take.

Table 3 Unit 20E wolf harvest chronology, regulatory years 1988–1989 through 1998–1999

Regulatory year	Harvest periods																		
	Aug	(%)	Sep	(%)	Oct	(%)	Nov	(%)	Dec	(%)	Jan	(%)	Feb	(%)	Mar	(%)	Apr	(%)	n^a
1988–1989	0	(0)	1	(11)	0	(0)	0	(0)	2	(22)	2	(22)	3	(33)	1	(11)	0	(0)	9
1989–1990	0	(0)	2	(13)	1	(7)	2	(13)	3	(20)	6	(40)	1	(7)	0	(0)	0	(0)	15
1990–1991	3	(15)	2	(10)	0	(0)	0	(0)	2	(10)	4	(20)	3	(15)	2	(10)	4	(20)	24
1991–1992	0	(0)	1	(6)	1	(6)	2	(11)	4	(22)	4	(22)	5	(28)	1	(6)	0	(0)	19
1992–1993	0	(0)	3	(5)	1	(2)	1	(2)	6	(11)	13	(23)	18	(32)	10	(18)	5	(9)	57
1993–1994	2	(3)	3	(5)	4	(6)	8	(13)	18	(29)	8	(13)	12	(19)	6	(10)	1	(2)	68
1994–1995	3	(8)	2	(5)	3	(8)	3	(8)	7	(18)	5	(13)	9	(23)	7	(18)	0	(0)	39
1995–1996	1	(1)	1	(1)	4	(5)	12	(14)	11	(13)	10	(12)	24	(29)	15	(18)	5	(6)	84
1996–1997	0	(0)	4	(7)	0	(0)	1	(2)	15	(28)	14	(26)	4	(7)	13	(24)	3	(6)	54
1997–1998	0	(0)	2	(6)	0	(0)	3	(8)	8	(22)	14	(39)	3	(8)	5	(14)	0	(0)	36
1998–1999	0	(0)	4	(24)	0	(0)	0	(0)	2	(12)	4	(24)	3	(18)	4	(24)	0	(0)	17

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

Table 4 Unit 20E wolf harvest by transport method, regulatory years 1988–1989 through 1998–1999[a]

Regulatory year	Harvest by transport method															
	Airplane	(%)	Dogsled, skis, or snowshoes	(%)	Boat	(%)	3- or 4-Wheeler	(%)	Snowmachine	(%)	ORV	(%)	Highway vehicle	(%)	Unk	n
1988–1989	1	(11)	1	(11)	0	(0)	1	(11)	6	(67)	0	(0)	0	(0)	0	9
1989–1990	1	(7)	5	(33)	0	(0)	0	(0)	7	(47)	1	(7)	1	(7)	0	15
1990–1991	8	(33)	1	(4)	0	(0)	2	(9)	10	(43)	0	(0)	2	(9)	1	24
1991–1992	4	(24)	1	(6)	0	(0)	1	(6)	10	(59)	0	(0)	1	(6)	2	19
1992–1993	6	(11)	6	(11)	0	(0)	0	(0)	41	(72)	0	(0)	4	(7)	0	57
1993–1994	16	(24)	0	(0)	0	(0)	1	(1)	31	(46)	0	(0)	19	(28)	1	68
1994–1995	14	(36)	0	(0)	0	(0)	0	(0)	23	(59)	0	(0)	2	(5)	0	39
1995–1996	11	(13)	3	(4)	0	(0)	1	(1)	67	(80)	0	(0)	2	(2)	0	84
1996–1997	5	(9)	0	(0)	1	(2)	1	(2)	43	(83)	1	(2)	1	(2)	2	54
1997–1998	1	(3)	0	(0)	0	(0)	1	(3)	22	(61)	0	(0)	11	(31)	0	36
1998–1999	2	(12)	0	(0)	0	(0)	1	(6)	6	(35)	0	(0)	8	(47)	0	17

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

LOCATION

GAME MANAGEMENT UNITS: 21B, 21C, 21D (20,655 mi^2)

GEOGRAPHIC DESCRIPTION: Yukon River drainage above Paimiut to Tozitna River, including Koyukuk River up to Dulbi Slough

BACKGROUND

Wolves were present when humans first settled the area and are an important part of the local culture. They are throughout Unit 21 in all habitat types, even near human settlements. Populations have fluctuated depending upon the availability of prey species and wolf harvest by humans.

Unit 21D and the lowlands of Unit 21B have more wolves than Unit 21C. In Unit 21D wolf numbers were probably lower before the early 1940s because moose were scarce and caribou availability fluctuated. Immigration of moose coincident with federal wolf control rapidly increased the moose population. In the mid-1950s, moose densities were estimated to be similar to current estimates (3–9 moose/mi^2) in the Koyukuk lowlands near Three-day Slough. When federal wolf control ceased, wolf numbers increased. Local residents believe wolf numbers are presently higher than historic levels. In Units 21B and 21C, wolf populations may be lower than in the early 1900s due to lower densities of moose in those areas.

Each year many wolf pelts taken for personal use are not sealed; therefore, actual harvest is higher than reported on sealing certificates or on export and acquisition documents. Personal use includes making wolf parka ruffs that are presented by local families as gifts to others at traditional potlatches. Additionally, many local residents make a conscious effort to increase their wolf harvest for personal uses when moose are scarce because they feel wolves are competitors for moose meat.

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. Management may include manipulation of wolf population size and 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.

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

- Provide for 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 uses, conservation and management of wolves, their prey, and habitat in Alaska.

MANAGEMENT OBJECTIVE

- Provide for a sustained annual harvest rate of no more than 30% from the combined wolf population of Units 21B, 21C and 21D.

Related Management Activities

- Monitor harvest through sealing records and trapper questionnaires.

- Monitor wolf numbers and population characteristics through interviews with trappers, hunters, pilots, and by evaluation of sealing documents.

- Participate in trapper education to enhance trapper skills and ethics and to increase regulatory compliance.

- Cooperate with any ongoing wolf studies conducted by the US Fish and Wildlife Service (FWS).

- Model the potential effects of wolf predation on ungulates in each unit.

METHODS

We worked cooperatively with FWS to estimate the late winter wolf population and pack size using aerial surveys. In February 1994, a Sample Unit Probability Estimator (SUPE) survey (Becker et al. 1998) was conducted in Unit 21D. The unit was divided into 760 sample units of 16 mi^2 each, and each unit was classified into 1 of 3 density strata; high, medium, or low. The probability of sighting wolf tracks after a fresh snowfall was used to estimate the population. Once tracks were sighted they were followed until wolves were sighted and counted. SUPE surveys were also conducted during March 1996 in Unit 21B and during March 2000 primarily in Unit 24, but along the common boundary of Unit 21D.

A wolf reconnaissance survey was flown in the northern portion of Unit 21D in March 1999 using SUPE methodology. However, we were unable to satisfy assumptions required for application of the technique because of poor snow conditions. Therefore, a minimum estimate for the area was developed from the data (ADF&G files, Galena, 7 May 1999).

Fall wolf population and pack size was estimated for Unit 21D by adding overwinter mortality (26%, Spindler 1992) and hunting mortality to the late winter population estimates. Late winter estimates and fall population estimates were the same in Units 21B and 21C because no overwinter mortality data was available and harvest was relatively small in those subunits. Population data were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY99 = 1 Jul 1999 through 30 Jun 2000).

We cooperated with FWS to determine wolf pack distribution and movements during 1989–1995. Katnik (1997) described radiotelemetry methods employed in that study.

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. Trapper interviews were also used to monitor harvest. Data were summarized by regulatory year.

We conducted wolf snaring and trapper education courses during RY99 in local villages to improve trapper skills and knowledge of wildlife management issues.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Wolf population estimates increased during RY91–RY95 (Table 1), but some of the increase resulted from better survey information and extrapolation of density estimates from surveyed areas to unsurveyed areas.

We completed a SUPE survey in Unit 21D (12,113 mi^2) during 8–16 March 1994. Of 760 sample units, 66.6% of the highs, 33% of the medium, and 14% of the low stratum were flown and searched for wolf tracks. We observed 173 wolves (or distinct tracks). The estimated unit population was 220–292 ($\bar{x}$ = 256; 80% CI ± 14.2%) with a density of 18.1–24.3 wolves/1000 mi^2 (7.0–9.4 wolves/1000 km^2) ($\bar{x}$ = 21.2 wolves/1000 mi^2 or $\bar{x}$ = 8.2 wolves/1000 km^2). The number of single wolves was 6.5% of the total. We also estimated 49.3 ± 6.1 packs.

We completed an aerial reconnaissance survey during March 1999 in the northern portion of Unit 21D. Eighty-seven wolves were seen, along with distinct tracks of 39 additional wolves, indicating 126 wolves in 20 packs with a density of 32.1 wolves/1000 mi^2 (12.4 wolves/1000 km^2). We also completed a SUPE survey in adjacent Unit 24 during March 2000 that included part of the area surveyed during 1999 in Unit 21D. In the Unit 24 survey, the population estimate was 147.8 wolves (± 32.2; 90% CI) over a 4175-mi^2 survey area for a density of 35.5 wolves/1000 mi^2 (13.7 wolves/1000 km^2). Using data from both Unit 21D and Unit 24, I estimated the late winter 2000 wolf population in all of Unit 21D was 309–445 wolves ($\bar{x}$ = 377) in 37–55 packs (9.8–14.2 wolves/1000 km^2).

We completed a SUPE survey in Unit 21B (4871 mi^2) during 15–17 March 1996 to estimate wolf population. Of the 307 sample units, 59% of the highs, 30% of the medium, and 15% of the low stratum were flown and searched for tracks. The estimate was 56–80 wolves ($\bar{x}$ = 68; 80% CI ± 17.8%), with a density of 11.4–17.4 wolves/1000 mi^2 (4.4–6.7 wolves/1000 km^2; $\bar{x}$ = 5.4). Although no surveys were completed in Unit 21B during this reporting period, trapper reports, incidental field observations (M Spindler, FWS, personal communication) and local resident comments suggested the population increased. Using the annual rate of growth

observed in Unit 21D of 3.4%, I estimated the Unit 21B population was 56–96 wolves ($\bar{x}$ = 76 wolves) in 9–15 packs. Using the estimate upper confidence limit, this estimate indicates an increase of 13.6% between late winter 1996 and late winter 2000.

Unit 21C was not surveyed. During the previous reporting period, the fall density was 12.9–18.1 wolves/1000 mi^2 (5–7 wolves/1000 km^2) (Woolington 1997). Based on this information, I estimated the Unit 21C late winter population was 48–66 wolves in 6–10 packs.

The total population during fall in all 3 subunits likely increased during RY96–RY98. Using all data sources, estimates were 345–524, 379–623, and 413–722 during RY96, RY97 and RY98, respectively. The number of packs during those regulatory years were estimated to be 52–68, 52–74, and 52–80, respectively.

Distribution and Movements

Beginning in 1986, 50 wolves were radiocollared in 25 packs on the Koyukuk National Wildlife Refuge (NWR) and the Nowitna NWR. Wolves were collared at Dalki River, Upper Dulbi River, Lower Dulbi River, Nayuka River, Nowitna River mouth, Monzonite Hills, Ham Island, Three-day Slough, Bishop Rock, Happy Slough, Bonanza Creek, North Creek and Bear Creek. On the Kaiyuh Flats the density was 28.5 wolves/1000 mi^2 (11 wolves/1000 km^2); on the Koyukuk lowlands north of Galena (including Three-day Slough) the density was 20.7 wolves/1000 mi^2 (8 wolves/1000 km^2); and in the Nowitna drainage the density was 18.1 wolves/1000 mi^2 (7 wolves/1000 km^2) (Spindler 1992).

Telemetry data showed that most packs occupied territories of 250–500 mi^2 (Katnik 1997). Some packs vacated their initial home ranges and moved to adjacent areas, but they were not followed long enough to see if they returned to their initial ranges. Several wolves that were pack members or were alone when collared, moved large distances during the study. One wolf moved south 40 miles and then returned north.

Wolf distribution in the Katnik (1997) study, was evaluated with respect to moose distribution and riparian habitat. Not surprisingly, he found that wolf packs spent disproportionately greater amounts of time in both riparian and nonriparian area that had high moose densities. Additionally, they spent disproportionately less time in nonriparian areas with medium or low moose densities. However, wolf packs did not necessarily spend more time in the high-density moose areas of their established territories (Katnik and Spindler 1998), possibly due to the behavioral activity of maintaining territory boundaries. Rivers and small drainages apparently provided important travel routes throughout wolf territories, but low sample sizes precluded definitive evaluation of wolf distribution relative to habitat.

MORTALITY

Harvest

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Seasons	Nonresident Open Seasons
Units 21B, 21C, and 21D		
Hunting: 5 wolves.	10 Aug–30 Apr	10 Aug–30 Apr
Trapping: No limit.	1 Nov–30 Apr	1 Nov–30 Apr

Board of Game Actions and Emergency Orders. In RY94 the board continued the ban on same-day airborne hunting but allowed taking wolves the same-day airborne under trapping regulations if the trapper moved 300 ft from the aircraft before taking a free-ranging wolf. Beginning RY97 this provision of same-day airborne harvest was eliminated in the trapping regulations as well. Beginning RY95 the trapping season was extended through April.

Hunter/Trapper Harvest. Hunters and trappers reported harvesting 34, 31, and 60 wolves during RY96, RY97, and RY98, respectively (Table 2). Most of the wolves were taken in Unit 21D. The actual number harvested was probably higher because most village residents seal only those wolf pelts that are sent to a commercial tannery or sold to a fur buyer. This unreported harvest likely averaged 20 wolves/year.

In December 1999, ADF&G sponsored 2 wolf-snaring clinics. Twenty-one trappers from Galena and 18 trappers from Huslia attended the 2-day clinics. Snaring techniques, snare building instruction, leghold trapping techniques and fur handling were presented. Supplies were available for snare construction, and participants built and took home >300 wolf snares. Participants were sent follow-up mailings regarding sources of trapping and snaring supplies. They were also registered for the statewide trapper questionnaire.

Harvest Chronology. Most wolves were harvested in January, February and March during RY94–RY98 (Table 3). Increased sightings and incidental harvest during the fall moose hunting seasons was probably due to higher wolf densities.

Transport Methods. Most wolves were taken using snowmachines for transportation during RY94–RY98 (Table 4).

CONCLUSIONS AND RECOMMENDATIONS

The total wolf population in the reporting area increased during RY96–RY98 because moose populations increased through 1996 in most of the area. However, individual subunits varied. Densities probably increased in Units 21B and 21D and were unchanged in Unit 21C.

Total harvest in all 3 subunits during RY98 was a maximum of 80 wolves, which was probably 11–19% of the population. Therefore, the first management objective to provide for a sustained annual harvest rate of no more than 30% of the wolf population was met. However, if the wolf population continues to grow unchecked, moose numbers are expected to decline. Moose are an important resource for local subsistence hunters. Additionally,

because moose are the primary prey species in this area, a reduction in their numbers will subsequently cause a decline in wolves.

All of the other management objectives were also met during the reporting period. Harvest monitoring was an important part of the wolf management program. It included the statewide sealing system, trapper questionnaires, and trapper interviews. Trapper education courses were effectively utilized. All of the wolf radiotelemetry work was concluded during the reporting period, and we cooperated extensively with the FWS in those efforts. Finally, although a definitive model of wolf predation dynamics was not fully completed, we applied the PredPrey computer model (McNay and DeLong 1998) in several scenarios. Work with the PredPrey model will be continued.

I recommend continued trapper education programs to improve harvest reporting and to increase trapper skills, ethics, and knowledge. I also recommend more radiotelemetry studies and continued spring population estimation surveys to improve our understanding of wolf populations. Within the Koyukuk/Nowitna NWR in Units 21B and 21D, radiotelemetry studies have improved wolf population estimates and increased our information about wolf predation on moose.

Management direction for the next reporting period will be as listed below:

Management Goals

- Ensure long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.
- Provide for 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 uses, conservation and management of wolves, their prey, and habitat in Alaska.

Management Objectives

- Maintain a fall density of 18–23 wolves/1000 mi^2 (7–9 wolves/1000 km^2).
- Provide for a total annual harvest of 85–105 wolves.
- Increase trapper participation in statewide trapper survey by at least 1% annually.

Management Activities

- Conduct surveys to estimate population size and density.
- Model the potential effects of wolf predation on ungulates in each unit.
- Monitor harvest through sealing records and trapper questionnaires.

- Monitor wolf numbers and population characteristics through interviews with trappers, hunters, pilots, and by evaluation of sealing documents.

- Conduct trapper education clinics.

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PREPARED BY:

Glenn W Stout
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Mark E McNay
Wildlife Biologist III

Table 1 Unit 21B, 21C, and 21D fall wolf population estimates[ab], regulatory years 1988–1989 through 1998–1999

Regulatory year	Population estimate	Number of packs
1988–1989	305–330	42–52
1989–1990	295–340	40–55
1990–1991	295–335	54–58
1991–1992	285–340	50–53
1992–1993	295–365	50–53
1993–1994	395–505	49–57
1994–1995	339–432	49–57
1995–1996	311–425	52–62
1996–1997	345–524	52–68
1997–1998	379–623	52–74
1998–1999	413–722	52–80

[a] Fall estimate = pretrapping season population.

[b] Based on Alaska Department of Fish and Game/US Fish and Wildlife Service sample unit probability estimator surveys, wolf reconnaissance aerial surveys, hunter/trapper reports, sealing records, incidental observations and assumed density of 12.9–18.1 wolves/1000 mi^2 (5–7 wolves/1000 km^2 in unsurveyed areas).

Table 2 Units 21B, 21C, 21D wolf harvest, regulatory years 1988–1989 through 1998–1999

Regulatory year	Reported harvest				Estimated unreported harvest	Total estimated harvest	Method of take			
	M	F	Unk	Total			Trap/snare	Shot	SDA[a]	Unk
1988–1989	5	6	0	11	20	31	3	2	5	1
1989–1990	14	15	0	29	20	49	7	3	19	0
1990–1991	14	4	3	21	20	41	9	12	0	0
1991–1992	22	14	4	40	20	60	19	18	1	2
1992–1993	20	11	4	35	20	55	15	16	0	4
1993–1994	31	23	1	55	20	75	38	16	0	1
1994–1995	17	11	7	35	20	55	11	18	6	0
1995–1996	16	28	3	47	20	67	29	18	0	0
1996–1997	15	18	1	34	20	54	26	8	0	0
1997–1998	12	19	0	31	20	51	19	12	0	0
1998–1999	38	21	1	60	20	80	35	25	0	0

[a] Wolves taken by hunters the same day they were airborne. In regulatory years 1994–1995 through 1996–1997 this includes wolves taken by trappers using aircraft for transportation.

Table 3 Units 21B, 21C, and 21D wolf harvest chronology percent by time period, regulatory years 1991–1992 through 1998–1999

Regulatory year	Harvest periods							n[a]
	Aug–Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1991–1992	2	2	9	18	45	23	0	44
1992–1993	2	0	0	14	24	57	2	49
1993–1994	2	0	29	23	29	17	0	52
1994–1995	8	14	6	8	17	44	3	36
1995–1996	6	3	9	17	11	43	11	35
1996–1997	9	18	9	15	24	26	0	4
1997–1998	21	3	7	17	28	24	0	29
1998–1999	14	9	12	14	29	21	5	58

[a] Includes harvest from records received after total harvest was calculated.

Table 4 Units 21B, 21C, 21D wolf harvest percent by transport method, regulatory years 1991–1992 through 1998–1999

Regulatory year	Harvest percent by transport method								
	Airplane	Dogsled, Skis, Snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk	n[a]
1991–1992	41	32	11	2	2	0	0	11	44
1992–1993	6	0	0	0	86	0	0	8	49
1993–1994	0	2	2	0	88	0	0	8	52
1994–1995	19	3	5	0	49	0	0	24	37
1995–1996	0	3	6	0	91	0	0	0	35
1996–1997	0	3	6	0	88	0	3	3	34
1997–1998	0	19	16	0	61	0	0	3	31
1998–1999	2	2	10	0	85	0	0	2	60

[a] Includes harvest from records received after total harvest was calculated.

LOCATION

GAME MANAGEMENT UNIT: 22 (25,230 mi^2)

GEOGRAPHIC DESCRIPTION: Seward Peninsula and the adjacent mainland drained by all streams flowing into Norton Sound.

BACKGROUND

Wolves were scarce throughout Unit 22 for much of this century. From the late 1890s, when reindeer herding was introduced to the Seward Peninsula, until statehood in 1959, wolf numbers were actively suppressed by predator control programs and bounties intended to protect reindeer. In the 1960s, after government sponsored predator control ended, wolf numbers in Unit 22 gradually increased and wolves expanded their range westward across the Seward Peninsula (Pegau 1971 and Grauvogel 1979). By 1980, wolf sign was reported in all major drainages in Unit 22, but reported sightings were generally of individual animals or small groups of 2 to 3 wolves. At the time the Unit 22 wolf population was estimated at fewer than 100 wolves (Grauvogel 1980). Throughout the 1980s and 1990s, reported observations and data from sealing certificates indicate wolf numbers and pack sizes have gradually increased. Wolves are most abundant in Units 22A and 22B where caribou from the Western Arctic caribou herd (WACH) have wintered since the 1980s.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain viable wolf populations in Unit 22.
- Minimize adverse interactions between wolves and the public.

MANAGEMENT OBJECTIVES

- Maintain license vendors and fur sealers in all Unit 22 villages.
- Monitor wolf harvest through the fur sealing program, annual hunter/trapper questionnaires and big game harvest surveys conducted annually in selected Unit 22 villages.
- Improve compliance with current sealing requirements through public communication and education.
- Assess population status and trends utilizing sealing records, hunter/trapper interviews and questionnaires, village harvest surveys and observations by staff and the public.
- Cooperate with reindeer herders to evaluate methods for reducing adverse interactions between wolves and reindeer.

METHODS

No surveys or studies have been conducted in Unit 22 to assess wolf numbers, distribution or movements. Limited information concerning wolf distribution, population trends, harvest, and human use are obtained annually from sealing certificates and observations by staff, reindeer herders, and other local residents. During the 1998–1999 regulatory year, two other methods of collecting information about wolf harvest and abundance were initiated in Unit 22; big game harvest surveys were conducted in two Unit 22 villages and fur-harvest questionnaires were sent to hunter/trappers throughout the unit.

POPULATION STATUS AND TREND

Population Size

The size of the Unit 22 wolf population is unknown. Wolf densities are highest in Units 22A and eastern 22B. Since the 1980s, Survey and Inventory reports have noted a gradual increase in wolves in those units, particularly during winter months, associated with wintering WACH caribou in the Nulato Hills and on the base of the Seward Peninsula (Machida 1997). Since 1996, caribou have extended their winter range onto the central Seward Peninsula and observations and harvests of wolves from the central and western parts of Unit 22 indicate wolf numbers have increased concurrently. We believe that wolf numbers increase seasonally during the winter months when WACH caribou are present, but increasingly, wolves have become permanent residents of the unit.

In 1998–1999, Unit 22 participated for the first time in the statewide trapper survey program. To better assess harvest and abundance of wolves and other furbearers, questionnaires were sent to hunter/trappers who sealed furs harvested in the unit. Respondents from Units 22A and 22B reported that wolves were common and numbers seem to be increasing. Respondents from the remainder of the unit reported that wolves were scarce but most thought numbers were increasing.

Predation by wolves has not previously been considered a significant factor in ungulate mortality, but that may change if pack numbers and sizes continue to increase.

Population Composition

We have no survey data or information to determine the composition of the wolf population in Unit 22.

Distribution and Movements

Seasonal ranges occupied by caribou and reindeer likely influence the distribution of wolves in Unit 22. Higher wolf numbers are distributed in Units 22A and 22B than in the western portions of Unit 22. In past years, radiocollared wolves from other locations in Alaska have been observed or harvested in Unit 22 indicating that immigration of wolves from other areas occurs in Unit 22.

MORTALITY

Harvest

Season and Bag Limits. The season and bag limits were the same for all regulatory years in the reporting period.

1996–1997 to 1998–1999 Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 22		
Residents and Nonresidents:		
Trapping - no limit	1 Nov–30 Apr	1 Nov–30 Apr
Hunting - 5 wolves	10 Aug–30 Apr	10 Aug–30 Apr

Board of Game Actions and Emergency Orders. There were no Board actions or emergency orders affecting wolf hunting or trapping in Unit 22 during the reporting period.

Hunter/Trapper Harvest. The reported harvest during the reporting period ranged from 25 to 51 wolves (Table 1). The high harvest in 1998–1999 probably resulted largely from excellent snow conditions in spring 1999 that allowed hunters and trappers long periods of snowmachine access for wolf hunting and trapping. In contrast, in spring 1997, an early breakup ended snowmachine travel by late March and half as many wolves were harvested in 1996–1997. Sex composition of the reported harvest during the 3-year reporting period was as follows: 65% males, 26% females, and 9% sex unknown (n = 105). As in previous years, the majority of wolves were harvested in Units 22A and 22B. Throughout much of the 1990s, small wolf harvests have come from Units 22C and 22D, but not until 1998–1999 were wolves reported taken in Unit 22E (Table 2). In 1998–1999, 67% more hunter/trappers reported harvesting wolves in Unit 22 than ever before: 30 individuals sealed wolves compared to the previous high of 18.

The magnitude of unreported wolf harvest each year in Unit 22 is thought to be substantial and fur sealing data provides only a minimum estimate of harvest. Although fursealing agents are available in all Unit 22 villages, often hunter/trappers seal only those pelts that will be commercially tanned or sold to furbuyers. Many wolf hides are home tanned and used locally and people see no reason to seal them. In April 1999, village-based harvest surveys were conducted for the first time in two Unit 22 villages to obtain better harvest information on big game species, including wolves. Surveys in Koyuk and Shaktoolik showed that in 1998–1999, 23 wolves were harvested by Koyuk residents and 19 wolves were taken by Shaktoolik residents. Twenty two percent of the wolf harvest in Koyuk and 58% of the Shaktoolik harvest was sealed (Table 3). The total known wolf harvest from Unit 22 during 1998–1999, including wolves that were sealed and those taken by Koyuk and Shaktoolik residents and not sealed, was 77 wolves.

Permit Hunts. There were no permit hunts for wolves in Unit 22 during the reporting period.

Hunter Residency and Success. Sealing certificate data indicate that residents of Unit 22 harvested 94% of the wolves taken during the reporting period. Residents from Unit 22A and 22B harvested most of the wolves. Two wolves were taken by residents of adjoining Unit 18, 2 were taken by other Alaska residents and 2 were taken by nonresidents.

Harvest Chronology. Wolf harvest in Unit 22 occurs primarily in the winter months when snow machines can be used for transportation, hides are prime and wolves are most abundant due to the presence of caribou. During this reporting period, 91% of the harvest occurred between November and April, 8% in September and 1% in October.

Harvest Methods. Most of the wolf harvest in Unit 22 is by subsistence and recreational hunters or is done opportunistically by local residents while engaged in other activities. There are few serious trappers in Unit 22. During the reporting period, 75% (n = 105) the wolves were shot, 15% were trapped or snared and the method of harvest was unknown for the remaining 10% (Table 1).

Transport Methods. During the reporting period, 91% of hunter/trappers reported using snowmachines for transportation. During snow-free months, nine wolves were taken by individuals using airplanes, highway vehicles, boats and four-wheelers for transportation.

Other Mortality

There were no observations of other mortality factors affecting wolves in Unit 22 during the reporting period.

HABITAT

Assessment and Enhancement

There were no habitat assessment activities or habitat enhancement projects for wolves in Unit 22 during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

There were no nonregulatory management issues to report related to wolves in Unit 22 during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

Although quantitative data are not available, wolf densities are increasing throughout Unit 22 and are highest in Units 22A and 22B. The expansion of the WACH caribou winter range on the Seward Peninsula is thought to be responsible for the increase. If this trend continues, wolf predation may increasingly become a factor affecting moose management.

Participation in the statewide Trapper Questionnaire program was beneficial by providing impressions about abundance of wolves and other furbearers from numerous hunters/trappers throughout the unit.

Big game harvest surveys proved to be an effective method of gathering more accurate harvest information from selected villages compared to what we have obtained in the past. This program should be continued annually by surveying additional villages and repeating those previously surveyed to look at annual variations in harvest. A more active information and education program, emphasizing the importance of harvest information to wildlife management, may improve compliance with sealing requirements.

Quantitative data on wolf populations of Unit 22 are lacking. It would be beneficial to initiate wolf surveys in the unit 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 hunting or trapping regulations for wolves are recommended at this time.

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PREPARED BY:

Kate Persons
Wildlife Biologist III

SUBMITTED BY:

Peter Bente
Survey-Inventory Coordinator

Table 1 Reported Unit 22 wolf harvest for regulatory years 1985–1986 through 1998–1999

Regulatory year	Reported harvest				Method of take			Total successful
	M	F	Unk.	Total	Trap / Snare	Shot	Unk.	Trapper / hunters
1985–1986	0	1	2	3	0	3	0	1
1986–1987	4	2	2	8	1	7	0	5
1987–1988	8	6	10	24	14	10	0	8
1988–1989	11	8	2	21	1	20	0	9
1989–1990	28	13	2	43	0	43	0	14
1990–1991	14	11	6	31	5	26	0	11
1991–1992	21	13	20	54	3	51	0	18
1992–1993	14	7	6	27	4	17	6	11
1993–1994	24	8	2	34	2	24	8	16
1994–1995	15	2	7	24	1	23	0	16
1995–1996	19	8	5	32	0	29	3	16
1996–1997	19	4	2	25	3	21	1	18
1997–1998	16	11	2	29	7	16	6	14
1998–1999	33	12	6	51	6	42	3	30

Table 2 Reported wolf harvest by unit, 1990–1991 through 1998–1999

Regulatory year	Harvest 22A	Harvest 22B	Harvest 22C	Harvest 22D	Harvest 22E
1990–1991	21	8	0	2	0
1991–1992	43	9	0	2	0
1992–1993	13	11	2	1	0
1993–1994	23	11	0	0	0
1994–1995	13	9	2	0	0
1995–1996	15	16	1	0	0
1996–1997	15	10	0	0	0
1997–1998	19	9	1	0	0
1998–1999	25	18	2	2	4

Table 3 Wolf harvest by residents of Koyuk and Shaktoolik, 1998–1999

Village	Wolf harvest reported on village surveys	Number of households reporting wolf harvest on village surveys	Number of wolves sealed	Number of hunters who sealed wolves	Percent of village wolf harvest reported by sealing certificate
Koyuk	23	10	5	3	22%
Shaktoolik	19	14	11	6	58%

but were still 48%–50% lower than the peak harvest of 408 moose in 1986. Additionally, the number of individuals hunting moose in Unit 22 has declined significantly in recent years. In 1997, only 423 people reported hunting for moose, the fewest since the mid 1970s. In 1998, the number of hunters increased to 510 but is still 61% below the peak of 1,292 hunters in 1983. Declining numbers of moose in easily accessible areas is largely responsible for the reduction in hunter effort and harvest. Although the size of the harvest and the number of hunters has declined in Unit 22 during recent years, hunter success rates have remained fairly constant and relatively high over the last 14 years, ranging from 39–50%. Hunter success was 48% for the 1997–1998 season and 41% for the 1998–1999 season (Table 1).

Compliance with license and harvest reporting requirements by Nome residents is believed to be high, but harvest reporting by village residents has always been incomplete. During this reporting period, the department and Kawerak Inc. initiated a village based harvest assessment program to obtain more accurate big game harvest data from Unit 22 villages. In April 1999 household surveys were conducted in Koyuk and Shaktoolik. In April 2000 White Mountain, Elim and Shaktoolik households were surveyed, but results from the spring 2000 surveys are not available for this report. In 1999 Koyuk residents reported harvesting 23 moose. Half the households that reported hunting moose were successful. In 1999 Shaktoolik residents reported 21 moose harvested and 62% of the households that hunted moose were successful. Only 9% (2 moose) of the moose taken by Koyuk residents and 5% (1 moose) of the moose harvested by Shaktoolik residents were reported with harvest ticket hunt reports (Georgette 1999). Similar reporting patterns likely exist in other villages, indicating that actual harvest is likely significantly higher than reported harvest in Unit 22.

Since the early 1990s when antlerless moose seasons were shortened, the reported cow harvest in Unit 22 has been small. In 1997–1998 3% (6 cows) of the reported harvest was cows and in 1998–1999 6% (13 cows) of the harvest was cows (Table 1). No cows were reported taken Koyuk and Shaktoolik households interviewed during 1999 big game harvest surveys. Some unreported cow is known to occur, but we believe that most hunters prefer to harvest bulls and take cows when that is all they can readily find.

The presence of wintering Western Arctic herd caribou in Units 22A and 22B in 1997–1998 and 1998–1999 and in Unit 22B in 1999–2000, may have reduced the demand for moose during the winter months.

Permit Hunts. There were no permit hunts for moose in Unit 22 during the reporting period. A registration permit hunt for up to 20 antlerless moose in Unit 22C is planned for the 2000-2001 regulatory year.

Hunter Residency and Success. No residency calculations were made for the 1997–1998 regulatory year because a local vendor failed to return overlays for the harvest tickets they issued and the residency of 17% of 1997–1998 hunters is unknown. During 1998–1999 Unit 22 residents accounted for 73% of the harvest (Table 3). The proportion of the harvest attributable to local residents has remained remarkably constant during the last 9 years, ranging from 70–74% of the harvest. Alaska residents accounted for 89% of the reported harvest during the 1998–1999 regulatory year.

Harvest Chronology. Most of the hunter effort and reported harvest (83% during 1997–1998 and 85% during the 1998–1999) occurred during August, September, and October when access by roads and rivers is most favorable (Table 4). Some hunting activity also occurred during December and January when snow machine access is possible and antlerless moose hunting is allowed in December in parts of Units 22B and 22D. Only in Unit 22E does this harvest pattern differ, with most of the harvest occurring during January, February and March when hunting is possible by snowmachine. There are no roads in Unit 22E and river access to moose habitat is limited. Similar harvest patterns were reported by Nelson (1995) and Machida (1996) for the previous reporting periods.

Data from 1999 village harvest surveys in Koyuk and Shaktoolik indicate that the majority of village harvest occurs in August and September (82% in Koyuk and 90% in Shaktoolik). Respondents indicated that moose are seldom hunted after late September because the meat is considered unpalatable during the rut.

Transport Methods. Hunters using highway vehicles, off-road vehicles and four wheelers, boats equipped with jet units, and snow machines accounted for over 90% of the harvest in Unit 22 during the reporting period (Table 5). Only 2% of successful hunters reported using aircraft for access. Typically few hunters in Unit 22 use aircraft for access since suitable landing sites are few.

The number of moose harvested by hunters using only highway vehicles for transportation has declined steadily over the last decade. Hunters using highway vehicles accounted for 30% of the harvest (90 moose) during the 1991–1992 season. During this reporting period, hunters using highway vehicles accounted for 17% of the harvest (35 moose) in 1997–1998 and 19% of the harvest (40 moose) in 1998–1999. Moose densities are now very low along the road corridor and hunters often must travel to areas far from the road system for successful hunts.

During this reporting period, 32% of successful hunters used boats, 31% used four wheelers, and 13% used snowmachines. Four-wheel-drive four wheelers, which became widely available during the late 1980s, have improved access to remote areas, particularly in areas characterized by open terrain, such as Unit 22D. In Unit 22E, the use of four wheelers (20%) and boats (20%) increased, but snow machines are still the most frequently used mode of transportation (52%) for moose hunting.

Other Mortality

No surveys were attempted to determine natural mortality rates of Seward Peninsula moose. The winter of 1997–1998 was mild with little snow accumulation until April. Moose appeared to come through the winter in good condition. In late April and early May of 1999 much of Unit 22 received heavy snowfall. For a period of about 1 month, browse availability was significantly reduced. Moose appeared to go into this period in good condition, but some moose, particularly in Unit 22C, appeared gaunt by the time the snow receded. The winter of 1999–2000 was colder than average with little snow fall until mid January. Moose remained dispersed at higher elevations until snow accumulation late in January drove them to the river bottoms. Snow accumulation for the remainder of the season was average and moose observed during spring surveys generally were lively and appeared in good condition. In some years severe winter weather and limited availability of winter browse have resulted in high

over-winter mortality rates, but these factors are not thought to be significant during this reporting period.

We believe that bear density in Unit 22 has increased over the last decade. Throughout this reporting period, heavy snowfall and accumulation late in the spring likely facilitated predation on adult moose by bears. Staff and hunters observed numerous bears feeding on moose carcasses in April and May though it is unknown in most cases whether bears killed or scavenged. In several cases kills were observed, two by large boars and one by a sow with two 2 or 3 year old cubs. Wolves are also becoming more numerous on the Seward Peninsula, especially in areas occupied by wintering caribou from the Western Arctic herd. It is probable that predation, particularly by bears, contributes significantly to the stabilization or decline of moose populations in many parts of the unit.

HABITAT

Assessment

No browse surveys or quantitative range assessments were undertaken to determine availability and quality of winter range in Unit 22. During winters of heavy snow accumulation, winter ranges have been heavily browsed. When willows in lowland riparian habitats are not available to moose because of heavy snowfall, moose are forced to browse on large-diameter, less nutritious willow branches. This occurred in the late 1980s and early 1990s and more recently in the winter of 1994–1995 when over-winter mortality was believed to have been substantial, particularly in Units 22B and 22D. During the winters of 1998–1999 and 1999–2000 staff noted the riparian habitat in the small drainages of Unit 22C was heavily browsed. Because snow accumulation did not drive large numbers moose into these river bottoms until relatively late in the season, over-winter mortality is not thought to have been excessive. However, repeated, increasingly heavy use of riparian habitat in Unit 22C raises concerns that the carrying capacity may be exceeded.

Enhancement

There were no habitat enhancement activities conducted in Unit 22 during the reporting

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

There were no nonregulatory management issues considered in Unit 22 during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

The moose population on the Seward Peninsula grew steadily in size from the 1960s, through the early 1980s and began to decline during the late 1980s and early 1990s. Data from censuses and surveys during the late 1980s show the population reached a maximum size of 7000–10,000 moose on the Seward Peninsula. Subsequent declines caused by winter mortality, reduced productivity, low recruitment and increased predation reduced the population size to between 5000 and 7000 animals (Nelson 1995). Noticeable declines in density are evident in portions of Unit 22, particularly in Units 22B and 22D.

Low recruitment rates found in Units 22A, 22B and 22D indicate a widespread problem with calf survival in the unit. In a large portion of Unit 22 it is likely that harvest and natural mortality are exceeding recruitment.

Preliminary results from the research study in western Unit 22B indicate several factors are contributing to low recruitment in that portion of the unit. Most of the calf mortality occurred during the summer months, much of it during the first month after birth. Predators, especially bears, are believed to be increasing in numbers in the area, and are probably responsible for most of these losses. However, the factors of a population dominated by older aged cows, frequent severe winter snow conditions, and poor winter range quality may be acting in combination to lower productivity and produce calves that are less vigorous at birth and with subsequent lowered survival (Persons 1998). Some or all of these factors may influence recruitment in other parts of the unit.

Concern about declining moose numbers in the most accessible parts of Units 22B and 22D, led to closure of the antlerless season in Unit 22B and portions of Unit 22D. Effective for the 2000-2001 regulatory year, the resident bull season was shortened in Unit 22B and the nonresident season was shortened in both Units 22B and 22D. More substantial reductions in hunting opportunity were not recommended because natural factors such as weather, range and predation are probably affecting moose abundance more than hunting. However, additional restrictions may be needed if we detect further declines. Efforts have been made and should continue to educate the public about the population decline and the importance of abiding by the new regulations. Additionally, brown bear hunting regulations were liberalized in Unit 22. Further liberalization of brown bear regulations may be recommended if current regulatory changes do not result in a noticeable reduction in bears in the unit.

Unit 22C is the only portion of Unit 22 where recruitment estimates remain high and the population appears to be increasing. Concern about over-utilization of limited winter habitat and the low bull:cow ratio in Unit 22C led to establishment of a registration hunt for up to 20 antlerless moose during the 2000-2001 season. After an updated population estimate is obtained from the 2001 census planned for Unit 22C, the number of antlerless permits may be revised.

More frequent moose density estimates throughout the unit would be desirable. Presently, if weather is not a factor, each subunit is censused at best, once every 5 years. This is not often enough to identify and respond promptly to downward trends. Consideration should be given to initiating more frequent, less precise censuses over larger areas to get more timely information on population trends. Although we do not believe that low bull:cow ratios are influencing productivity in Unit 22, it has been 5 years since fall composition surveys have been completed. Composition surveys in the most heavily hunted drainages of Units 22B, 22C and 22D should be made a priority if conditions are suitable.

Interest in hunting moose in Unit 22 was moderate throughout the 1970s. Hunter effort and harvest peaked in the mid 1980s when the moose population was at it height. As moose densities, harvest and effort decreased, hunter success rate has remained fairly constant and relatively high, from 39%–50% over the last decade (Table 1).

The number of bulls along the road system is now low. Since their introduction during the 1980s, the use of four wheelers has become extremely popular among Seward Peninsula residents, and their use has allowed hunters to expand the amount of area available for hunting. Because of open terrain throughout much of Unit 22, moose are very vulnerable to hunters, particularly during the rutting period. To increase moose densities in areas accessible to hunters, more regulatory restrictions may be necessary, including but not limited to, antler size restrictions for bulls, shorter seasons, and vehicle access restrictions. The department should work closely with the public, Advisory Committees and the Regional Advisory Council to ensure that recommendations and future regulations will be acceptable to the widest possible range of users.

Compliance with regulations and harvest reporting is thought to be reasonably high in the Nome area. However, illegal and unreported harvest remains a problem in the remainder of the unit where some residents do not acquire licenses and/or harvest tickets prior to hunting or moose are taken out of season. Public education programs and a visible enforcement effort must be maintained to gain compliance with current regulations. The community-based, big game harvest assessment program started in 1999 should be continued and expanded to provide more accurate estimates of moose harvest and subsistence use of moose by village residents.

If staff time and money permit, assessment of moose habitat in Units 22B and 22C should be initiated. It would be desirable to examine critical wintering areas and determine the quantity and quality of available browse and ultimately determine the carrying capacity for the most heavily hunted portions of the unit.

In summary, the following actions are recommended:

- Conduct more frequent, less precise censuses over larger areas to get more timely information on population trends
- Resume fall composition surveys in Units 22B, 22C and 22D
- Expand the community-based, big game harvest assessment program
- Work with the public to ensure recommendations and future regulations will be acceptable to the widest possible range of users
- Begin habitat assessment of critical wintering areas in Units 22B and 22C

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PREPARED BY:
Kate Persons
Wildlife Biologist III

SUBMITTED BY:
Peter Bente
Survey-Inventory Coordinator

Table 1 Unit 22 historical moose harvest by sex, hunter effort, and success rate for regulatory years 1969–1999

Regulatory year	Males	Females	Unknown sex	Total harvest	Total hunters[a]	Percent success
1969–1970	69	1	2	72	182	40
1970–1971	70	0	1	71	139	51
1971–1972	59	0	1	60	168	36
1972–1973	44	0	0	44	99	44
1973–1974	103	32	1	136	317	43
1974–1975	149	72	1	222	479	46
1975–1976	136	0	2	138	389	25
1976–1977	186	51	3	240	611	39
1977–1978	151	88	5	244	457	53
1978–1979	198	97	2	297	596	50
1979–1980	193	75	2	270	760	36
1980–1981	156	71	1	228	492	46
1981–1982	225	72	1	298	696	43
1982–1983	244	100	0	344	904	38
1983–1984	291	68	46	405	1292	31
1984–1985	298	91	6	395	1086	36
1985–1986	279	92	3	374	876	43
1986–1987	306	101	1	408	892	46
1987–1988	286	20	4	310	775	40
1988–1989	332	36	7	375	748	50
1989–1990	208	82	0	290	713	41
1990–1991	280	70	0	350	700	50
1991–1992	207	95	0	302	656	46
1992–1993	217	72	0	289	645	45
1993–1994	225	21	1	247	553	45
1994–1995	201	10	0	211	486	43
1995–1996	169	13	3	185	469	39
1996–1997	176	20	2	198	456	43
1997–1998	197	6	0	203	423	48
1998–1999	195	13	3	211	510	41

[a]Minimum known number of hunters.

Table 2 Unit 22 short yearling recruitment surveys, spring 1991–2000

Survey area	No. calves	No. adults	Total	Percent calves
Unalakleet, Egavik, Tagoomenik, Shaktoolik, Ungalik (Unit 22A)				
2000	14	160	174	8
Fish River (Unit 22B)				
1991	12	202	214	6
1993	11	227	238	5
1994	15	255	270	6
1995	16	384	400	4
Niukluk River (Unit 22B)				
1991	30	319	349	9
1995	13	133	146	9
1997	6	77	83	7
2000	9	81	90	10
Koyuk River (Unit 22B)				
1999	21	208	229	9
2000	19	223	242	8
Snake River (Unit 22C)				
1993	15	63	78	19
1994	18	39	57	32
1999	33	92	125	26
2000	21	98	119	18
Lower Kougarok River (Unit 22D)				
1991	14	103	117	12
1994	33	153	186	18
1995	42	227	269	16
2000	16	168	184	9
Kuzitrin/Noxapaga River (Unit 22D)				
1991	23	191	214	11
1994	16	71	87	18
2000	14	203	217	6
Kuzitrin Below Bridge (Unit 22D)				
2000	17	271	288	6
American River (Unit 22D)				
1995	51	248	299	17

Table 3 Residency and success of moose hunters in Unit 22, regulatory years 1997–1998 and 1998–1999

Regulatory	Residency of successful hunters					Residency of unsuccessful hunters				
Year/Unit	Unit[a]	State[b]	Nonresident	Unknown	Total	Unit[a]	State[b]	Nonresident	Unknown	Total
1997–1998										
22A	17	2	3	0	22	36	2	4	0	42
22B	33	16	14	9	72	32	10	7	3	52
22C	14	5	0	8	27	25	7	0	4	36
22D	37	9	3	16	65	61	6	4	5	76
22E	14	0	1	1	16	3	0	0	0	3
22 unknown	0	1	0	0	1	8	2	0	1	11
Total	115	33	21	34	203	165	27	15	13	220
1998–1999										
22A	12	3	1	0	16	50	3	8	0	61
22B	38	6	14	0	58	54	14	5	0	73
22C	31	8	0	0	39	37	9	1	2	49
22D	63	17	8	1	89	90	11	7	1	109
22E	9	0	0	0	9	2	1	0	0	3
22 unknown	0	0	0	0	0	4	0	0	0	4
Total	153	34	23	1	211	237	38	21	3	299

[a] Resident of Unit 22
[b] Other Alaska resident

Table 4 Chronology of Unit 22 moose harvest, regulatory years 1997–1998 and 1998–1999

Regulatory year/ Unit	Month of harvest									
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Unknown	Total
1997–1998										
22A	4	15	0	0	2	0	0	0	1	22
22B	5	43	9	9	3	2	0	0	1	72
22C	0	26	0	0	0	0	0	0	1	27
22D	10	41	9	1	2	1	0	0	1	65
22E	4	2	1	0	3	1	1	4	0	16
Unknown	0	0	0	0	0	0	0	0	1	1
Total	23	127	19	10	10	4	1	4	5	203
1998–1999										
22A	6	9	0	0	1	0	0	0	0	16
22B	3	33	9	7	5	1	0	0	0	58
22C	0	38	0	0	0	0	0	0	1	39
22D	4	67	7	0	7	3	0	0	1	89
22E	2	1	0	0	0	2	0	4	0	9
Total	15	148	16	7	13	6	0	4	2	211

Table 5 Means of transportation reported by successful Unit 22 moose hunters, regulatory years 1995–1999

Regulatory Year/Unit	Aircraft	Horse	Boat	3 or 4 Wheeler	Snowmobile	Off-road vehicle	Highway vehicle	Unknown	Total
1995–1996									
22A	0	0	19	4	1	0	0	0	24
22B	8	0	10	18	11	2	1	2	52
22C	0	0	0	9	0	2	5	1	17
22D	6	0	19	19	10	2	18	2	76
22E	0	0	0	3	12	0	0	0	15
Unknown	0	0	0	0	0	0	0	1	1
Total	14	0	48	53	34	6	24	6	185
1996–1997									
22A	2	0	7	0	1	0	0	0	10
22B	4	0	7	26	14	2	5	3	61
22C	0	0	4	4	0	3	14	0	25
22D	2	0	15	29	14	1	21	1	83
22E	0	0	2	0	17	0	0	0	19
Total	8	0	35	59	46	6	40	4	198
1997–1998									
22A	0	0	16	3	2	0	1	0	22
22B	3	0	22	26	11	1	7	2	72
22C	1	0	2	9	0	3	10	2	27
22D	1	0	22	21	3	1	17	0	65
22E	1	0	4	3	7	0	0	1	16
Unknown	0	0	1	0	0	0	0	0	1
Total	6	0	67	62	23	5	35	5	203
1998–1999									
22A	0	0	10	6	0	0	0	0	16
22B	3	0	16	21	16	1	1	0	58
22C	0	0	11	6	0	3	19	0	39
22D	1	0	26	30	10	2	20	0	89
22E	0	0	1	2	6	0	0	0	9
Total	4	0	64	65	32	6	40	0	211

LOCATION

GAME MANAGEMENT UNIT: Unit 23 (43,000 mi^2)

GEOGRAPHIC 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 predator control programs to protect reindeer and caribou (McKnight 1973). After statehood, liberal hunting and trapping regulations, which allowed aerial shooting and same-day-airborne hunting (SDA), replaced these practices. High fur prices in the mid 1970s attracted nonlocal hunters to Unit 23 and stimulated local hunter and trapper efforts. As a result, wolf harvests were high when snow conditions were favorable for aircraft and snowmachines. During the 1980s, regulatory restrictions on aircraft and low fur prices reduced the harvest of wolves. Today, use of aircraft for hunting is prohibited throughout Unit 23. Local residents using snowmachines harvest most wolves in Unit 23.

In the middle Kobuk River, during May 1990, Ballard (1993) estimated a density of 1 wolf/50 mi^2 (80% CI 37–74 mi^2) using a line-intercept track-sampling technique. Extrapolating this density to all of Unit 23 yields a population estimate of 869 wolves (80% CI, 580–1169). Local biologists and residents recognize 4 geographic areas where wolf densities need to be separately assessed: 1) Northern Seward Peninsula west of and including the Buckland drainage; 2) upper Kobuk River drainage; 3) Noatak, Wulik and Kivilina river drainages to Cape Lisburne, and 4) lower Kobuk and Selawik river drainages. This unit-wide estimate should be viewed as a crude approximation of actual abundance. Given the abundance of caribou and presence of moose and sheep in Unit 23 and the remoteness of much of the unit, we expect wolf numbers to be regulated largely by natural factors.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Management goals are to maintain viable populations of wolves in Unit 23, provide hunting and viewing opportunities, and minimize adverse interactions between wolves and people.

MANAGEMENT OBJECTIVES

Management objectives are to maintain the furbearer-sealing program and explore alternate harvest reporting systems.

METHODS

We estimated harvests from fur sealing certificates. We also collected incidental observations of wolves from staff and local residents. In 1998–1999 a modified version of the statewide trapper questionnaire was mailed to a sample of unit residents. Trappers who sealed a furbearer within the last 3 years or individuals knowledgeable about wolves were asked about

abundance and population trends. Also, in 1998–1999, individual households were surveyed in Shungnak as part of a community based harvest assessment project. The department (Division of Wildlife Conservation and Subsistence Division) and Maniilaq Association conducted the project (Georgette 1999).

No quantitative population data were collected during this reporting period.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Based on the responses of trappers and staff observations, there has been no significant change in wolf abundance during this reporting period. Late and low snowfall accompanied by high winds led to poor travel and tracking conditions during 1997–1998 and 1998–1999 making hunting difficult.

Population Composition

We have no survey data or information to determine the composition of the wolf population in Unit 23.

Distribution and Movements

Wolves occupy all potential habitat in Unit 23. The movements and distribution of wolves are influenced by caribou, especially during the winter (Ballard 1993). During this reporting period significant numbers of caribou overwintered in the upper Kobuk River.

MORTALITY

Harvest

Season and Bag Limit. There were no changes in the season and bag limit for wolves during this reporting period.

1996–1997 to 1998–1999 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 23		
Residents and Nonresidents:		
Trapping - no limit	1 Nov–15 Apr	1 Nov–15 Apr
Hunting - 5 wolves	10 Aug–30 Apr	10 Aug–30 Apr

Board of Game Actions and Emergency Orders. The Board of Game did not take any action that affected wolf hunting or trapping in the Unit 23. However, the state Legislature and voters acted on several issues during the reporting period. During the 1997 legislative session a bill (HB 26) passed which decreased the nonresident tag fee to $30.00 and the nonresident alien wolf tag fee to $50.00. The new tag fees became effective January 1, 1998. In November 1997

state voters passed a Ballot Measure 3, which restricted wolf control programs and prohibited the use of aircraft for hunting and trapping the same day they were used for transport. This change became effective Feb 25, 1998. The previous restriction, requiring trappers to be 300 ft from the aircraft before shooting, had been in effect since the 1994–1995 regulatory year. A ballot initiative that would have eliminated use of snares for trapping wolves was defeated during November 1998.

Hunter/Trapper Harvest. Hunters reported harvesting 61 wolves during 1996–1997, 23 during 1997–1998, and 30 during 1998–1999 (Table 1). The lower harvests in 1997–1998 and 1998–1999 are attributed to late snow and poor tracking and travel conditions. Hunters continued to harvest wolves most heavily in the Kobuk River drainage, but also took wolves on the northern Seward Peninsula, Noatak and Selawik river drainages (Table 2). Wolf harvest patterns on the northern Seward Peninsula are related to recent overwintering of caribou on the peninsula.

We estimate less than 10% of the actual wolf harvest is reported by local residents. Recent community harvest assessment studies (Georgette 1999) indicate this percentage may be even lower. One wolf was reported taken by upper Kobuk River residents through the department's sealing program. This is in contrast to 18 wolves reported during household interviews of just one village. Local use of hides, low compliance with license requirements, and confusion over sealing requirements contribute to low reporting rates for furbearers in Unit 23.

Permit Hunts. There were no permit hunts for wolves in Unit 23 during the reporting period.

Hunter Residency and Success. Twenty-three hunters reported harvesting wolves in 1996–1997. Two hunters were nonresidents, 1 was a nonlocal Alaska resident; and the rest were residents of Unit 23. Of 12 hunters in 1997–1998, 9 were local residents, 2 were nonlocal residents and 1 was a nonresident. In 1998–1999, 10 local residents, 2 nonlocal residents (Shishmaref and Anchorage) and 1 nonresident reported harvesting wolves. All nonresident hunters harvested wolves opportunistically in the fall under a hunting license.

Harvest Chronology. Most wolves were harvested during the winter and early spring (December through March) (Table 3). Despite the lower harvest in 1997–1998 and 1998–1999, the annual chronology of harvest did not vary. The only wolves taken outside this time period tended to be by the few nonresidents who took wolves while hunting moose or caribou.

Transport Methods. Hunters primarily used snowmachines to harvest wolves (Table 4). As expected, use of aircraft was minimal following closure of Unit 23 to same-day-airborne wolf hunting. Some individuals continued to use aircraft to shoot wolves incidental to other hunting activities. Ground shooting rather than trapping continues to be the most common method to harvest wolves in Unit 23 (Table 5).

Other Mortality

There were no reports of wolf mortality due to causes other than hunting or trapping. The last documented outbreak of rabies in wolves was 1989–1990. Without ongoing studies we doubt we would be able to detect the occurrence of a rabies outbreak in Unit 23 wolves.

An outbreak of canine distemper in the winter of 1996–1997 killed approximately 200–300 dogs in the region. Symptoms were first reported in sled dogs outside of Kotzebue. An aggressive vaccination program began and was thought to be responsible for containing the outbreak to the Kotzebue vicinity. The village of Noatak experienced no distemper outbreak during the winter months when mortality was highest in Kotzebue, but did have several cases 5 months later (June). This indicated that either the outbreak had not been contained or a wild host existed. Canine distemper is a highly contagious virus (Zarnke 1981). Natural transmission occurs primarily through direct contact of body fluid. Known hosts include; dogs, foxes, wolves, weasels, mink, marten, otter, and bear. Stephenson (1982) documented the presence of distemper in wolves in arctic regions. The suspected mortality rate for wolves exposed to the disease is over 50%. We know distemper can be transmitted between foxes and dogs (Don Ritter, Alaska State Public Health Lab, Fairbanks Alaska, personal communication). It is possible wolves were affected by this distemper outbreak.

HABITAT

Assessment and Enhancement

There were no habitat assessment activities or habitat enhancement projects for wolves in Unit 23 during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

There were no nonregulatory management issues to report related to wolves in Unit 23 during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

Previous federal restrictions eliminated the practice of same-day-airborne hunting of wolves in over 60% of Unit 23 before restrictions in state regulations were imposed. Elimination of hunting wolves with aircraft has changed the pattern and level of harvest. Now, fewer wolves are taken by hunters using snowmachines typically within a day's travel of the region's villages. The greatest reduction in harvest resulting from this change is in remote areas such as the upper Noatak River.

We recommend a continued effort be placed on monitoring rabies and encouraging investigators to explore the relationship between canine distemper and wolf population dynamics. With high ungulate populations in Unit 23 (primarily caribou) diseases such as rabies, distemper and parvovirus are likely to significantly affect wolf numbers.

Since harvest of wolves in Unit 23 is primarily by snowmachine, it will continue to be greatly influenced by snow and travel conditions. Extrapolating harvest data to other years should be done with caution. Hunting conditions should be documented along with harvest.

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PREPARED BY:

Lee Anne Ayres
Wildlife Biologist II

SUBMITTED BY:

Peter J. Bente
Survey-Inventory Coordinator

REVIEWED BY:

Jim Dau
Wildlife Biologist III

Table 1 Reported wolf harvest from sealing certificates for Unit 23, 1974–1975 through 1998–1999

Regulatory year	Males	Females	Unknown	Total
1974–1975	–	–	50	50
1975–1976	–	–	142	142
1976–1977	–	–	157	157
1977–1978	–	–	65	65
1978–1979	–	–	50	50
1979–1980	12	6	0	18
1980–1981	33	17	0	50
1981–1982	10	7	0	17
1982–1983	25	19	4	48
1983–1984	30	14	2	46
1984–1985	45	20	0	65
1985–1986	10	8	1	19
1986–1987	23	10	1	34
1987–1988	52	33	9	94
1988–1989	42	36	5	83
1989–1990	27	25	5	57
1990–1991	17	15	13	45
1991–1992	30	22	6	58
1992–1993	28	32	11	71
1993–1994	30	17	3	50
1994–1995	24	19	10	53
1995–1996	35	25	3	63
1996–1997	30	18	13	61
1997–1998	6	12	5	23
1998–1999	11	10	9	30

Table 2 Wolf harvest by drainage in Unit 23, 1974–1975 through 1998–1999

Regulatory year	Kivalina	Noatak	Kobuk	Selawik	N. Seward	Unknown	Total
1974–1975	3	5	22	20	0	0	50
1975–1976	2	9	78	53	0	0	142
1976–1977	0	26	28	82	1	10	157
1977–1978	0	3	25	20	1	70	65
1978–1979	7	4	11	15	1	30	50
1979–1980	1	2	9	4	2	0	18
1980–1981	2	3	11	24	3	7	50
1981–1982	1	10	3	3	0	0	17
1982–1983	1	11	6	21	8	1	48
1983–1984	0	9	7	21	7	2	46
1984–1985	1	16	20	21	3	4	62
1985–1986	0	11	4	2	2	0	19
1986–1987	2	5	6	18	0	2	34
1987–1988	0	27	41	11	15	0	94
1988–1989	1	12	28	39	0	3	83
1989–1990	3	10	27	2	15	0	57
1990–1991	0	7	18	15	5	0	45
1991–1992	2	8	30	4	13	1	58
1992–1993	2	11	30	15	4	9	71
1993–1994	0	17	28	3	2	0	50
1994–1995	1	12	26	7	7	0	53
1995–1996	0	11	27	18	7	0	63
1996–1997	6	9	24	15	7	0	61
1997–1998	0	2	17	0	0	4	23
1998–1999	0	6	12	1	10	0	30

Table 3 Chronology of wolf harvest for Unit 23 from 1993–1994 through 1998–1999

Reg. year	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Unknown	Total
1993–1994	1	2	0	3	11	7	5	6	10	5	50
1994–1995	0	1	0	10	3	8	8	14	9	0	53
1995–1996	0	2	0	6	5	2	1	37	9	1	63
1996–1997	0	2	2	4	14	7	12	14	0	6	61
1997–1998	0	1	0	0	5	0	5	2	6	4	23
1998–1999	0	2	0	1	5	6	7	7	1	1	30

Table 4 Number of hunters and method of transport to harvest wolves in Unit 23, 1985–1986 through 1998–1999

Reg. year	Hunters	Airplane	Snowmachine	Boat	Unk.	Dogteam	Total harvest
1985–1986	12	8	7	0	4	0	19
1986–1987	17	20	9	0	5	0	34
1987–1988	32	48	40	2	4	0	94
1988–1989	29	10	70	0	3	0	83
1989–1990	25	11	32	2	12	0	57
1990–1991	23	4	32	0	9	0	45
1991–1992	25	9	47	0	2	0	58
1992–1993	24	2	69	0	0	0	71
1993–1994	24	2	44	0	4	0	50
1994–1995	21	1	52	0	0	0	53
1995–1996	20	1*	62	1	0	0	63
1996–1997	23	5	48	3	0	5	61
1997–1998	12	1	18	0	4	0	23
1998–1999	13	2	28	0	0	0	30

*boat also used

Table 5 Methods of harvesting wolves in Unit 23, 1985–1986 through 1998–1999

Reg. year	Ground shooting	Trapping	Snaring	Unknown	Total harvest
1985–1986	14	2	0	3	19
1986–1987	26	4	0	4	34
1987–1988	90	2	0	2	94
1988–1989	72	9	0	2	83
1989–1990	45	8	0	4	57
1990–1991	32	3	3	7	45
1991–1992	43	7	0	8	58
1992–1993	69	2	0	0	71
1993–1994	44	4	0	2	50
1994–1995	41	12	0	0	53
1995–1996	42	19	0	2	63
1996–1997	50	11	0	0	61
1997–1998	12	7	0	4	23
1998–1999	20	8	0	2	30

LOCATION

GAME MANAGEMENT UNIT: 24 (26,055 mi^2)

GEOGRAPHIC DESCRIPTION: Koyukuk River drainage above Dulbi River

BACKGROUND

Wolves are present throughout Unit 24. Historically, abundance in Unit 24 fluctuated in response to the availability of prey and, more recently, to human harvest of wolves. Numbers were low in the Brooks Range during the late 1800s because densities of moose, caribou, and Dall sheep were low (Campbell 1974). Prey populations increased during the early 1900s, leading to concurrent increases in wolf numbers. Now wolves are more numerous than in the 1970s but probably not as abundant as during the 1940–1950s (Woolington 1997).

There were probably fewer wolves in the southern portion of the unit before the 1940s than exist now because a stable prey base was absent. At that time, moose populations were still expanding into this area, and the availability of caribou varied widely between years. Federal wolf control efforts probably reduced the limiting effect of wolf predation on local moose populations, and moose numbers increased rapidly. When wolf control ceased, the abundance of moose allowed wolf numbers to increase. Wolf numbers are presently as high in southern Unit 24 as at any known time.

Reported wolf harvests during 1988–1998 were 30–119 wolves per year and averaged 72 wolves annually. The local demand for wolf pelts used as parka ruffs and gifts at funeral potlatches has traditionally been high. Additionally, local residents of the area perceive wolves as direct competitors for moose and often make a conscious effort to increase the wolf harvest when moose seem scarce.

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 both manipulation of wolf population size and 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 below:

- 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

During the reporting period 1 July 1993–30 June 1996, the following objectives were in place:

- In the southern part of Unit 24 (south of Hughes; 6150 mi^2), the objective is to manage a stable fall wolf population with a density of approximately 21 wolves/1000 mi^2 (8 wolves/1000 km^2) to sustain an annual harvest of approximately 30 wolves.

- In the central part of the unit (Hughes to Bettles), reduce wolf density to 10 wolves/1000 mi^2 (4 wolves/1000 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 (GAAR), maintain a stable fall wolf density of approximately 21 wolves/1000 mi^2 (8 wolves/1000 km^2), to sustain an annual harvest of 30 wolves, while providing for nonconsumptive uses within the GAAR.

Woolington (1997) proposed modification of those management objectives to more accurately reflect the current regulations and policies regarding wolf management in Unit 24. The Board of Game did not adopt an implementation plan for control of wolf predation. Therefore, management was directed to maintain a sustainable harvest and accommodate nonconsumptive uses. Wolf population fluctuations were expected as wolves responded to change in the availability of their ungulate prey. Management objectives and related activities for this reporting period are listed below:

- Provide for a sustained annual harvest rate of no more than 30% from the combined wolf population of Unit 24.

- Monitor harvest through sealing records and trapper questionnaires.

- Monitor wolf numbers and population characteristics through interviews with trappers, hunters, pilots, and by evaluation of sealing documents.

- Conduct an aerial survey to estimate wolf pack sizes and number of packs in central Unit 24 during late winter 1998.

- Participate in trapper education to enhance trapper skills and ethics and to increase regulatory compliance.

- Cooperate with ongoing wolf studies conducted by the US Fish and Wildlife Service (FWS).

- Model the potential range of effects of wolf predation on ungulates in each subunit.

METHODS

We worked cooperatively with FWS to estimate the late winter wolf population and pack size using aerial surveys. In March 2000, a Sample Unit Probability Estimator (SUPE) survey (Becker et al. 1998) was conducted in the southern portion of Unit 24. The probability of sighting wolf tracks after a fresh snowfall was used to obtain population estimates. Once tracks were sighted they were followed until wolves were sighted and counted (ADF&G files, Galena, 5 May 2000). Population data were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY99 = 1 Jul 1999 through 30 Jun 2000).

A wolf reconnaissance survey was flown in a limited area of Unit 24 and the northern portion of Unit 21D in March 1999 using SUPE methodology. However, we were unable to satisfy assumptions required for application of the technique because of poor snow conditions. Therefore, a minimum estimate for the area was developed from that survey (ADF&G files, Galena, 7 May 1999).

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. Trapper interviews were also used to monitor harvest. Data were summarized by regulatory year.

We conducted wolf snaring and trapper education courses during RY99 in local villages to improve trapper skills and knowledge of wildlife management issues.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Wolves are throughout the unit in all habitat types and often near human settlements. The number of wolves varies, depending on 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.

A series of geographically overlapping surveys completed during late winters 1994 through 2000 indicated the wolf population may have increased in the southern portion of Unit 24 and adjacent Unit 21D. The SUPE survey completed during March 2000 in the southern portion of Unit 24 indicated there were 148 wolves (± 32, 90% CI) over a 4175 mi^2 survey area for a

density of 36 wolves/1000 mi^2 (14 wolves/1000 km^2). The reconnaissance survey completed during March 1999 in southern Unit 24 and adjacent Unit 21D indicated a density of 32 wolves/1000 mi^2 (12 wolves/1000 km^2). A 1994 survey in adjacent Unit 21D indicated a density of 23 wolves/1000 mi^2 (9 wolves/1000 km^2)

During RY95, the estimated Unit 24 fall population was 405–540 wolves (Table 1). It was derived by plotting known pack locations and by assuming a density of 15–21wolves/1000 mi^2 (6–8 wolves/1000 km^2) for unknown areas. No new information about unknown areas was obtained during this reporting period. Therefore, the same density was used for these areas when we estimated the unitwide population during RY96–RY99.

The unitwide fall population likely did not change during RY96–RY99. In the northern portion of the unit, there were likely 155–206 wolves, with a density of 6–8 wolves/1000 km^2. In the central portion of the unit there were probably 103–155 wolves, with a density of 4–6 wolves/1000 km^2. In southern Unit 24 the SUPE indicated 116–180 wolves. Therefore, the estimated fall population for the entire unit was 374–541 during the reporting period.

Distribution and Movements

Radiotelemetry of wolves in the Kanuti National Wildlife Refuge indicated that 85–100 wolves in 9–11 packs used the refuge during fall (Zirkle 1995). Packs roamed over 2556–4059 mi^2, and average pack size was 4. All wolves that were pups or yearlings when collared, dispersed from the area and were not followed.

Packs are known to migrate into Unit 24 during the winter with the Western Arctic caribou herd. These wolves are mostly found in GAAR and in the Upper Huslia and Hogatza Rivers (D James, ADF&G, personal communication). Unpredictability of these migrations is responsible for most of the variation of the wolf population estimates for the GAAR portion of the unit.

Mortality

Harvest

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Seasons	Nonresident Open Seasons
Unit 24		
HUNTING: 5 wolves.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit.	1 Nov–30 Apr	1 Nov–30 Apr

Board of Game Actions and Emergency Orders. At their 1993 meeting, the board continued the ban on same day hunting of wolves, but allowed taking wolves the same day as airborne under trapping regulations, provided the trapper moved 300 feet from the aircraft before taking a free-ranging wolf. Beginning RY97, the provision of same-day airborne harvest was

eliminated in the trapping regulations as well. Beginning RY95, the trapping season was extended through April. Wolves could be taken under either hunting or trapping regulations.

Hunter/Trapper Harvest. Hunters and trappers reported harvesting 88, 56, and 36 wolves during RY96, RY97 and RY98, respectively (Table 2). The actual number harvested was probably higher because most village residents seal only those wolf pelts that are sent to a commercial tannery or sold to a fur buyer. Hunting and trapping conditions vary from year to year, which effects harvests. Under good conditions the estimated unreported harvest can be up to 80 wolves/year, but under poor conditions unreported take can be 50 wolves/year (Woolington 1997).

Harvest Chronology. Wolves were generally taken in January, February, and March during RY94–RY98 (Table 3). The exception was RY97 when November and December were also important months. Like nearby Unit 21D, incidental harvest in the fall increased slightly, possibly due to increased sightings during the fall moose season.

Transport Methods. Most wolves were taken using snowmachines for transportation during RY94–RY98 (Table 4). No other trends in transportation methods were apparent.

CONCLUSIONS AND RECOMMENDATIONS

The unitwide wolf population was stable during this reporting period and has shown little change since RY93. However, numbers in various sections of the unit probably fluctuated. Wolf numbers were highest and probably increased in the southern portion of the unit (south of Hughes). They were moderate and stable in the central portion of the unit (Bettles to Hughes), and variable with some declines in the north (north of Bettles).

Our objective to provide for a sustained annual harvest rate of no more than 30% of the unitwide population was met during RY97 and RY98. However, during RY96 harvest was 27–40% of the population.

Most other management objectives were met during the reporting period. Harvest monitoring was an important part of the wolf management program. It included the statewide sealing system, trapper questionnaires, and trapper interviews. Trapper education courses were also effective. Wolves were radiocollared and tracked by the Kanuti NWR during the reporting period. We cooperated with the FWS in those efforts. An aerial wolf survey was planned but not completed in the central portion of the unit due to persistently poor survey conditions. Finally, although a definitive model of wolf predation dynamics was not fully completed, we applied the PredPrey computer model (McNay and DeLong 1998) in several scenarios. Work with the PredPrey model will be continued.

I recommend an aerial survey be conducted to determine wolf densities in the central portion of Unit 24. I also recommend continued monitoring of radiocollared packs in the Kanuti area to improve population estimates and to provide information on predation rates. Additionally, I recommend federal and state biologists work closely with local residents to improve harvest reporting compliance.

The management goals, objectives, and activities for the next reporting period will be as listed:

Management Goals

- Ensure long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.
- Provide for 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 uses, conservation and management of wolves, their prey, and habitat in Alaska.

Management Objectives

- Maintain a fall density of 13–23 wolves/1000 mi^2 (5–9 wolves/1000 km^2).
- Provide for a total annual harvest of 112–162 wolves.
- Increase trapper participation in statewide trapper survey by at least 1% annually.

Management Activities

- Conduct surveys to estimate population size and density.
- Model the potential effects of wolf predation on ungulates in each unit.
- Monitor harvest through sealing records and trapper questionnaires.
- Monitor wolf numbers and population characteristics through interviews with trappers, hunters, pilots, and by evaluation of sealing documents.
- Conduct trapper education clinics.

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PREPARED BY:

Glenn W Stout
Wildlife Biologist II

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Mark E McNay
Wildlife Biologist III

Table 1 Unit 24 fall wolf population estimates[a], regulatory years 1988–1989 through 1999–2000

Regulatory year	Population estimate[b]	Number of packs
1988–1989	420–450	55–60
1989–1990	400–440	55–60
1990–1991	400–440	55–60
1991–1992	420–450	68–70
1992–1993	388–415	51–55
1993–1994	405–540	58–66
1994–1995	405–540	58–66
1995–1996	405–540	58–66
1996–1997	374–541	58–66
1997–1998	374–541	58–66
1998–1999	374–541	58–66
1999–2000	374–541	58–66

[a] Fall estimate = pretrapping season population.

[b] Basis of estimate: Alaska Department of Fish and Game, National Park Service, and US Fish and Wildlife Service aerial surveys; hunter/trapper reports; sealing records; and incidental observations.

Table 2 Unit 24 wolf harvest, regulatory years 1988–1989 through 1998–1999

Regulatory year	Reported harvest				Estimated unreported harvest	Total estimated harvest	Method of take			
	M	F	Unk	Total			Trap/snare	Shot	SDA[a]	Unk
1988–1989	38	32	6	76	50	126	16	20	39	1
1989–1990	17	9	4	30	60	90	25	3	0	2
1990–1991	16	24	2	42	60	102	22	20	0	0
1991–1992	42	39	4	85	55	140	70	15	0	0
1992–1993	41	32	6	79	80	159	43	35	1	0
1993–1994	48	37	4	89	60	149	62	27	0	0
1994–1995	52	28	9	89	60	149	68	14	6	1
1995–1996	52	55	12	119	60	179	88	29	2	0
1996–1997	45	38	5	88	60	148	73	13	0	2
1997–1998	32	20	4	56	50	106	46	9	0	1
1998–1999	19	12	5	36	50	86	31	5	0	0

[a] Animals taken by hunters the same day hunters or trappers were airborne.

Table 3 Unit 24 wolf harvest chronology percent by month, regulatory years 1991–1992 through 1998–1999

Regulatory year	Harvest periods							n[a]
	Aug–Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1991–1992	7	14	18	22	25	8	6	85
1992–1993	3	1	8	7	32	50	0	92
1993–1994	7	7	20	10	25	26	7	92
1994–1995	7	6	8	18	33	27	1	83
1995–1996	7	13	21	13	25	8	13	107
1996–1997	8	10	15	22	30	16	0	88
1997–1998	9	15	35	15	20	7	0	55
1998–1999	6	11	17	22	22	22	0	36

[a] Includes harvest records received after total harvest was calculated.

Table 4 Unit 24 wolf harvest percent by transport method, regulatory years 1991–1992 through 1998–1999

Regulatory year	Percent of harvest								n[a]
	Airplane	Dogsled, Skis, Snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk	
1991–1992	18	51	32	0	0	0	0	0	85
1992–1993	3	0	0	0	89	1	4	2	92
1993–1994	3	4	3	0	83	0	1	5	92
1994–1995	16	0	6	1	73	0	3	1	88
1995–1996	3	7	2	2	69	3	4	10	107
1996–1997	3	0	3	0	90	0	1	2	88
1997–1998	4	5	2	0	86	0	2	2	56
1998–1999	0	3	6	3	72	0	17	0	36

[a] Includes harvest records received after total harvest was calculated.

LOCATION

GAME MANAGEMENT UNIT: 25A, 25B, 25D, 26B, and 26C (73,756 mi^2)

GEOGRAPHIC DESCRIPTION: Eastern Interior, Eastern Brooks Range, and Central and Eastern Arctic Slope

BACKGROUND

Wolves are 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. Wolves are generally less abundant than in other parts of the Interior 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. US Fish and Wildlife Service (FWS) biologists studied the movements and denning habits of 11 wolf packs in the northern Arctic National Wildlife Refuge (ANWR) in Unit 26C in 1984 and 1985 (Garner and Reynolds 1986). Subsequent aerial surveys and incidental observations further documented widespread 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. Wolf surveys covering portions of Unit 25D were done in March 1992, 1997 and 1999, and in 25D and part of Unit 25B in 2000, but no surveys were conducted in Unit 25A.

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 within 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 and total protection of wolves from human influence. All human uses might not occur 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. These goals are listed below:

- 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 that 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

The Board of Game has not adopted an implementation plan for control of wolf predation in any of these units, although this may occur in the future. Therefore, management is currently directed at maintaining a sustainable harvest and accommodating nonconsumptive uses of wolves. Fluctuations in wolf populations are expected as numbers respond to changes in the availability of ungulate prey and other environmental factors. Objectives during this reporting period are listed below (see page 248 of this report).

- Conduct a wolf census in Units 25A, 25D East, and 25D West by 1999.

- Using computer modeling, evaluate effects of wolf predation on moose in Unit 25D.

METHODS

Population estimates in Unit 25 were based on aerial track surveys completed late winter 1983, 1984, 1992, 1996, 1998 and 2000. Population estimates in a large part of Units 25A, 25B, 26B and 26C were based on earlier surveys, incidental observations of wolves by agency personnel and the public, and extrapolation of survey results. Aerial track surveys were conducted during late winter with PA-18 Super Cub or Scout aircraft flown at 400–500 ft above ground level and generally occurred 3–5 days after snowfall.

Wolves harvested by trappers and hunters were sealed to monitor harvest. Information recorded for each wolf included date and location of kill, name of trapper or hunter, 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. Data were summarized by regulatory year (RY = 1 Jul through 30 Jun, i.e., RY99 = 1 Jul 1999 through 30 Jun 2000).

RESULTS AND DISCUSSION

Population Status and Trend

Population density is low relative to other parts of the Interior where prey are more abundant. Wolf populations in Units 25A, 25B, 25D, 26B and 26C appeared to be relatively stable, but data on population trends are limited, except in Unit 25D.

Population Size

Estimates from surveys, hunter observations, and harvest data indicated that 65–85 packs, including 470–570 wolves, were present in Units 25A, 25B, and 25D in fall 1988. These

estimates were increased to 72–93 packs including 520–634 wolves in fall 1992. They are still considered representative, based in part on the results of recent surveys in Unit 25.

Wolf population density in western Unit 25D was estimated at 7.3–9.1 wolves/1000 mi^2 (2.8–3.5 wolves/1000 km^2) in 1983 and 1984 (Nowlin 1985). A 1992 aerial survey encompassing most of Unit 25D indicated wolf density averaged about 8.8–10.6 wolves/1000 mi2 (3.4–4.1 wolves/1000 km^2). Aerial surveys in 1997 and 1999 resulted in estimates of 12.2–14.5 wolves/1000 mi^2 (4.7–5.6 wolves/1000 km^2) in 25D West, and 9.6–11.1 wolves/1000 mi^2 (3.7–4.3 wolves/1000 km^2) in western and central 25D. Average pack size was 5–7 wolves in most of the area.

A March 2000 survey indicated there were at least 125–133 wolves in 13,800 mi^2 (35,700 km^2) in southern Unit 25B and eastern Unit 25D, or a density of 9.1–9.8 wolves/1000km^2 (3.5–3.8 wolves/1000 km^2). Groups included 1–13 wolves and averaged 4.6. Excluding 6 groups numbering <3 wolves resulted in an average estimated pack size of 5.3 (n = 23). A total of 65 wolves (26 black and 39 gray or white) were observed.

There were an estimated 150–215 wolves in 22–32 packs in Units 26B and 26C, indicating a fall wolf density of 5.7–8.3 wolves/1000 mi^2 (2.2–3.2 wolves/1000 km^2). Resident packs are rare on the coastal plain in the northern portion of these subunits (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. Several wolves dispersed as far as 500 miles from their home range (Garner and Reynolds 1986).

MORTALITY

Harvest

Season and Bag Limit. The 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.

Units/Bag Limits/Special Restrictions	Resident/Subsistence Open Season	Nonresident Open Season
RY93		
Units 25A, 25B, and 25D		
HUNTING: 5 wolves.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit.	1 Nov–31 Mar	1 Nov–31 Mar
Units 26B and 26C		

Units/Bag Limits/Special Restrictions	Resident/Subsistence Open Season	Nonresident Open Season
HUNTING: 10 wolves.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit.	1 Nov–15 Apr	1 Nov–15 Apr
RY94		
Units 25A, 25B, and 25D		
HUNTING: 5 wolves.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit.	1 Nov–30 Apr	1 Nov–30 Apr
Units 26B and 26C		
HUNTING: 10 wolves.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit.	1 Nov–30 Apr	1 Nov–30 Apr

* All units: Wolves could be taken by shooting same day airborne if caught in a trap or snare.

RY95–RY98		
Units 25A, 25B, and 25D		
HUNTING: 5 wolves.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit.	1 Nov–30 Apr	1 Nov–30 Apr
Units 26B and 26C		
HUNTING: 10 wolves.	10 Aug–30 Apr	10 Aug–30 Apr
TRAPPING: No limit.	1 Nov–30 Apr	1 Nov–30 Apr

* All units: Wolves could be taken by shooting same day airborne if caught in a trap or snare.

Board of Game Actions and Emergency Orders. The Board of Game took no actions and no emergency orders were issued during this reporting period.

Hunter/Trapper Harvest. Annual wolf harvests in the reporting area were relatively stable during RY96–RY98 (51–71) (Table 1). Most of the harvest occurred in Units 25A and 25D. Harvests in both areas were moderate compared to historic levels. The Unit 26B harvest was relatively high in RY92 and RY94 but has subsequently declined. Few wolves were harvested in Unit 26C, probably because of limited access and low wolf density.

Wolves were reported taken in scattered locations in Unit 25 including parts of the Coleen, Sheenjek, Hodzana, and Chandalar drainages in Unit 25A; 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 trans-Alaska 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. Harvests generally included more males than females. Some unreported harvest occurs, primarily in Units 26B and 26C, where hides are often used in clothing and handicrafts (Whitten 1988).

In Units 26B and 26C, wolves were taken primarily by shooting from the ground. Most wolves harvested in Unit 25 were taken with traps or snares. The occurrence of snared and trapped wolves in the harvest has changed little over the years. However, the proportion taken by the land-and-shoot method involving aircraft has changed. This was the predominant harvest method before the 1988 prohibition on same-day-airborne hunting.

Harvest Chronology. Most reported wolf harvest occurred from November through March, although a few wolves were taken in August or September (Table 2).

Transport Methods. Over most of the reporting area, snowmachines were the most common method of access, and their use has changed little over the years (Table 3). In Unit 26B most hunters and trappers used highway vehicles to reach the area by the Dalton Highway. Individuals using snowmachines or aircraft took a few wolves.

Natural Mortality

The relatively low density of wolves in the reporting area is consistent with the relative scarcity of resident prey. Moose populations are generally at low density, and caribou are only seasonally abundant in certain areas because of their wide-ranging migrations.

Small packs, small litters, and low pup survival are characteristic of wolf populations in areas where prey are relatively scarce. Garner and Reynolds (1986) reported that 8 of 11 packs studied in ANWR included 5 or fewer wolves, with low pup production and survival. Summer pup survival rates for packs of <5 wolves were 23–25%, while larger packs had nearly 100% pup survival.

Predation by other wolves and rabies (Zarnke and Ballard 1987) are probably the major causes of natural mortality among adult wolves in northeastern Alaska. Rabies in wolves is generally confined to coastal areas in northern and western Alaska, including Units 26B and 26C.

CONCLUSIONS AND RECOMMENDATIONS

Wolves continue to be widely distributed in northeastern Alaska, and the number of wolves harvested was low relative to population size. Reported harvests accounted for no more than 7–11% of the estimated population in Units 25A, 25B, and 25D and 13–19% in Units 26B and 26C. Harvests were well below the maximum sustainable level of 30–35% generally reported for wolf populations. However, when ungulate:wolf ratios are low, as in Units 25 and 26, sustainable wolf harvests can be lower. Wolf population density continues to be relatively low compared to areas where prey is more abundant. I recommend continued monitoring of wolf populations, particularly in the most important moose hunting areas in Units 25B and 25D, in view of recent declines in moose populations on the north slope and in eastern Unit 25D and low sheep populations in the eastern Brooks Range, as well as generally low moose density in

other parts of the area. Likewise, the status of prey populations should be closely monitored in these areas.

The high number of predators relative to prey indicates that predation is a major factor affecting prey population dynamics. Population modeling exercises using the PredPrey model recently developed by Alaska Department of Fish and Game (McNay and DeLong 1998) were used to explore effects of predation by wolves and bears on moose populations on the Yukon Flats. These simulations indicate that wolf predation plays an important role in limiting moose numbers, which are likely to remain near a low-density equilibrium unless predation is reduced.

People throughout the study area and especially in Units 26B and 26C could be better informed of the requirement to seal wolf pelts. We should continue efforts to develop and maintain fur sealing officers in communities in the region.

Objectives during this reporting period were not quantifiable and, therefore, could not be readily evaluated. Those objectives were redefined as activities, additional activities were added, and a new objective was formulated. Therefore, during the next reporting period, management direction has been rewritten to include the following goals, objective, and activities:

Management Goals

- 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 Objective

- Provide for a sustained annual harvest rate of no more than 30% from the combined wolf population of Units 25A, 25B, 25D; and no more than 30% of the combined wolf population of Units 26B and 26C.

Management Activities

- Monitor harvest through sealing records and trapper questionnaires.

- Continue to evaluate the effects of wolf predation on moose in Unit 25D using computer modeling.

- Monitor wolf numbers and population characteristics outside survey areas through interviews with trappers, hunters, and pilots and by evaluation of sealing documents.

- Participate in trapper education to enhance trapper skills and ethics and improve compliance with regulations.

- Conduct periodic wolf population surveys in Units 25B, 25D East, and 25D West.

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PREPARED BY:

Robert O Stephenson
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Mark E McNay
Wildlife Biologist III

Table 1 Units 25A, 25B, 25D, 26B, and 26C wolf harvest, regulatory years 1987–1988 through 1998–1999

Regulatory	Reported harvest				Method of take		
year	M	F	Unk	Total	Trap/snare	Shot	Unk
Unit 25A							
1987–1988	14	16	0	30	7	23	0
1988–1989	2	6	2	10	6	4	0
1989–1990	5	9	0	14	8	6	0
1990–1991	15	6	2	23	18	5	0
1991–1992	7	11	7	25	14	11	0
1992–1993	20	7	0	27	11	16	0
1993–1994	8	10	0	18	15	3	0
1994–1995	7	10	0	17	17	0	0
1995–1996	7	8	0	15	11	4	0
1996–1997	9	8	0	17	17	0	0
1997–1998	5	11	0	16	13	3	0
1998–1999	11	7	1	19	15	4	0
Unit 25B							
1987–1988	4	1	1	6	5	1	0
1988–1989	3	4	5	12	12	0	0
1989–1990	3	1	1	5	4	1	0
1990–1991	2	2	1	5	4	1	0
1991–1992	7	5	1	13	13	0	0
1992–1993	7	7	1	15	14	1	0
1993–1994	6	1	5	12	11	1	0
1994–1995	4	9	3	16	16	0	0
1995–1996	5	9	0	14	12	2	0
1996–1997	5	5	0	10	9	1	0
1997–1998	8	6	0	14	14	0	0
1998–1999	5	5	1	11	10	1	0
Unit 25D							
1987–1988	2	2	2	6	6	0	0
1988–1989	0	0	2	2	2	0	0
1989–1990	6	5	1	12	9	3	0
1990–1991	14	10	0	24	6	18	0
1991–1992	8	11	0	19	9	10	0
1992–1993	2	1	8	11	9	1	1
1993–1994	10	7	2	19	17	2	0
1994–1995	18	12	2	32	31	1	0
1995–1996	12	5	0	17	11	6	0
1996–1997	12	6	1	19	16	3	0
1997–1998	10	1	1	12	8	4	0
1998–1999	2	1	2	5	4	1	0
Unit 26B							

Table 1 Continued

Regulatory year	Reported harvest				Method of take		
	M	F	Unk	Total	Trap/snare	Shot	Unk
1987–1988	2	1	0	3	0	3	0
1988–1989	12	3	0	15	7	7	1
1989–1990	4	7	0	11	3	7	1
1990–1991	15	9	1	25	0	24	1
1991–1992	10	4	3	17	6	10	1
1992–1993	14	11	6	31	5	26	0
1993–1994	17	11	2	30	10	20	0
1994–1995	11	5	0	16	4	12	0
1995–1996	9	3	1	13	2	11	0
1996–1997	14	10	0	24	4	15	5
1997–1998	4	3	0	7	0	7	0
1998–1999	8	7	2	17	1	16	0
Unit 26C							
1987–1988	1	1	0	2	0	2	0
1988–1989	3	0	0	3	0	3	0
1989–1990	1	0	0	1	0	1	0
1990–1991	7	4	1	12	2	10	0
1991–1992	3	2	0	5	0	5	0
1992–1993	3	3	0	6	3	3	0
1993–1994	0	0	0	0	0	0	0
1994–1995	4	1	0	5	2	3	0
1995–1996	1	1	0	2	0	2	0
1996–1997	1	0	0	1	1	0	0
1997–1998	2	0	0	2	1	1	0
1998–1999	6	5	0	11	2	9	0

Table 2 Units 25A, 25B, 25D, 26A, and 26B wolf harvest chronology percent by time period, regulatory years 1987–1988 through 1998–1999

Regulatory year	Harvest periods										
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Unk	*n*
Unit 25A											
1987–1988	3	7	0	3	7	7	7	67	0	0	30
1988–1989	0	30	0	10	10	0	10	40	0	0	10
1989–1990	0	21	0	21	14	29	14	0	0	0	14
1990–1991	0	4	0	0	26	13	17	39	0	0	23
1991–1992	8	0	0	12	12	16	12	36	4	0	25
1992–1993	7	4	0	15	7	0	4	59	4	0	27
1993–1994	0	17	0	5	11	39	17	0	0	0	18
1994–1995	0	0	0	12	6	18	23	41	0	0	17
1995–1996	0	27	0	13	33	0	27	0	0	0	15
1996–1997	0	0	0	0	6	18	12	35	29	0	17
1997–1998	0	19	0	0	12	6	0	62	0	0	16
1998–1999	0	16	0	0	26	21	5	32	0	0	19
Unit 25B											
1987–1988	0	0	0	17	17	33	17	17	0	0	6
1988–1989	0	0	0	17	50	8	17	8	0	0	12
1989–1990	0	0	0	20	60	0	0	20	0	0	5
1990–1991	0	0	0	0	20	20	0	60	0	0	5
1991–1992	0	0	0	0	69	8	15	8	0	0	13
1992–1993	0	0	0	0	7	33	27	33	0	0	15
1993–1994	0	0	0	8	25	6	0	8	0	0	12
1994–1995	0	0	0	19	0	44	19	19	0	0	16
1995–1996	0	14	0	0	7	36	29	14	0	0	14
1996–1997	0	10	0	0	30	20	30	10	0	0	10
1997–1998	0	0	0	29	14	7	50	0	0	0	14
1998–1999	0	0	0	0	55	0	9	36	0	0	11
Unit 25D											
1987–1988	0	0	0	0	50	33	17	0	0	0	6
1988–1989	0	0	0	0	50	0	50	0	0	0	2
1989–1990	0	0	0	0	42	0	25	33	0	0	12
1990–1991	0	8	0	0	8	8	0	75	0	0	24
1991–1992	0	0	0	0	0	5	21	74	0	0	19
1992–1993	0	0	0	9	18	0	64	0	9	0	11
1993–1994	0	0	0	0	32	26	10	26	5	0	19
1994–1995	0	0	0	25	0	16	22	28	3	6	32
1995–1996	0	0	0	6	23	29	6	35	0	0	17
1996–1997	0	0	0	16	32	26	10	5	10	0	19
1997–1998	0	17	0	0	58	0	8	0	17	0	12
1998–1999	0	0	0	0	0	0	80	20	0	0	5

Table 2 Continued

Regulatory year	Harvest periods										
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Unk	*n*
Unit 26B											
1987–1988	0	0	0	0	0	0	33	33	33	0	3
1988–1989	0	13	0	7	33	0	0	40	7	0	15
1989–1990	18	18	0	27	18	9	0	9	0	0	11
1990–1991	16	8	0	4	0	4	0	4	64	0	25
1991–1992	18	6	0	0	24	12	0	18	24	0	17
1992–1993	3	0	0	0	0	0	3	58	36	0	31
1993–1994	7	13	0	3	0	3	33	23	17	0	30
1994–1995	0	44	0	6	12	0	0	19	19	0	16
1995–1996	0	0	0	8	15	8	15	8	46	0	13
1996–1997	0	4	0	0	17	13	13	46	8	0	24
1997–1998	43	0	0	14	0	0	14	0	29	0	7
1998–1999	6	0	0	0	0	6	18	47	24	0	17
Unit 26C											
1987–1988	50	0	0	0	0	0	0	0	50	0	2
1988–1989	0	67	0	0	0	0	0	0	33	0	3
1989–1990	100	0	0	0	0	0	0	0	0	0	1
1990–1991	25	0	0	25	0	0	0	0	50	0	12
1991–1992	100	0	0	0	0	0	0	0	0	0	5
1992–1993	17	33	0	0	0	0	0	50	0	0	6
1993–1994	0	0	0	0	0	0	0	0	0	0	0
1994–1995	20	40	0	0	0	0	0	40	0	0	5
1995–1996	0	50	0	0	0	0	0	50	0	0	2
1996–1997	100	0	0	0	0	0	0	0	0	0	1
1997–1998	0	0	0	0	0	0	0	50	50	0	2
1998–1999	9	0	0	0	0	0	0	36	55	0	11

Table 3 Units 25A, 25B, 25D, 26B, and 26C harvest percent by transport method, regulatory years 1987–1988 through 1998–1999

Regulatory year	Method of transportation								
	Airplane	Dogsled, Skis, Snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk	*n*
Unit 25A									
1987–1988	73	7	3	0	17	0	0	0	30
1988–1989	10	20	10	0	60	0	0	0	10
1989–1990	21	29	0	0	36	0	14	0	14
1990–1991	0	13	4	0	70	0	0	13	23
1991–1992	8	8	0	0	72	0	0	12	25
1992–1993	11	0	0	0	78	0	4	7	27
1993–1994	11	0	6	0	83	0	0	0	18
1994–1995	24	0	0	0	76	0	0	0	17
1995–1996	13	47	0	0	40	0	0	0	15
1996–1997	0	0	0	0	100	0	0	0	17
1997–1998	12	19	0	0	69	0	0	0	16
1998–1999	16	0	0	0	84	0	0	0	19
Unit 25B									
1987–1988	0	17	0	0	67	0	17	0	6
1988–1989	0	17	0	0	83	0	0	0	12
1989–1990	60	0	0	40	0	0	0	0	5
1990–1991	20	0	0	0	80	0	0	0	5
1991–1992	0	0	0	0	100	0	0	0	13
1992–1993	7	13	0	0	67	0	0	13	15
1993–1994	0	42	8	0	50	0	0	0	12
1994–1995	0	6	0	0	75	0	0	19	16
1995–1996	0	7	14	0	79	0	0	0	14
1996–1997	0	10	10	0	80	0	0	0	10
1997–1998	0	57	0	0	43	0	0	0	14
1998–1999	9	9	0	0	73	0	0	9	11

Table 3 Continued

Regulatory year	Method of transportation								
	Airplane	Dogsled, Skis, Snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk	*n*
Unit 25D									
1987–1988	0	0	0	0	100	0	0	0	6
1988–1989	0	0	0	0	100	0	0	0	2
1989–1990	8	0	0	0	92	0	0	0	12
1990–1991	54	0	0	0	46	0	0	0	24
1991–1992	58	0	0	0	42	0	0	0	19
1992–1993	9	0	0	0	82	0	9	0	11
1993–1994	11	0	0	0	89	0	0	0	19
1994–1995	9	0	0	0	91	0	0	0	32
1995–1996	0	0	0	0	100	0	0	0	17
1996–1997	5	0	0	0	95	0	0	0	19
1997–1998	33	0	0	0	67	0	0	0	12
1998–1999	0	0	0	0	100	0	0	0	12
Unit 26B									
1987–1988	33	0	0	0	0	0	33	33	3
1988–1989	13	0	0	0	47	0	33	7	15
1989–1990	18	0	0	9	0	0	64	9	11
1990–1991	12	0	0	0	16	0	20	52	25
1991–1992	18	6	0	0	24	0	53	0	17
1992–1993	3	0	0	0	13	0	84	0	31
1993–1994	10	0	0	0	40	0	48	3	
1994–1995	38	0	6	0	6	0	44	6	16
1995–1996	0	0	0	0	46	0	39	15	13
1996–1997	0	17	0	0	37	0	25	21	24
1997–1998	43	0	0	0	0	0	57	0	7
1998–1999	6	0	0	0	35	0	24	35	17
Unit 26C									

Table 3 Continued

Regulatory year	Method of transportation								
	Airplane	Dogsled, Skis, Snowshoes	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk	*n*
1987–1988	50	0	0	0	0	0	0	50	2
1988–1989	67	0	0	0	33	0	0	0	3
1989–1990	100	0	0	0	0	0	0	0	1
1990–1991	25	0	0	0	75	0	0	0	12
1991–1992	60	0	40	0	0	0	0	0	5
1992–1993	50	0	0	0	50	0	0	0	6
1993–1994	0	0	0	0	0	0	0	0	0
1994–1995	60	0	0	0	40	0	0	0	5
1995–1996	50	0	0	0	50	0	0	0	2
1996–1997	100	0	0	0	0	0	0	0	1
1997–1998	0	0	0	0	100	0	0	0	2
1998–1999	9	0	0	0	91	0	0	0	11

LOCATION

GAME MANAGEMENT UNIT: Unit 26A (56,000 mi^2)

GEOGRAPHIC 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 abundant. Wolf numbers were greatly reduced by federal wolf control during the 1950s and by public aerial hunting during the 1960s. Following the ban on aerial wolf hunting in 1970 and land-and-shoot aircraft hunting of wolves in 1982, wolf populations increased, especially in the mountains and foothills of the Brooks Range. Wolves are less abundant on the coastal plain because of the seasonal scarcity of caribou, outbreaks of rabies, and their vulnerability to hunters in the open country.

The reported annual harvest of wolves in recent years has ranged from 13 to 60 animals, but the actual annual harvest has ranged from approximately 50 to 120. The pelts of most 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 the winter.

Trent (1988) surveyed a 16,848 km^2 (6480 mi^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. Carroll (1994) surveyed a 23,293 km^2 (8955 mi^2) using a Traditional Track Count method and a 10,343 km^2 (3994 mi^2) area around Umiat using a Track Intercept Probability technique in 1992 and estimated the density of wolves to be 4.2 wolves/1000 km^2. A Sample Unit Probability Estimator (SUPE) was used in 1994 to count wolves in the 10,343 km^2 (3994 mi^2) study area around Umiat and the density was estimated at 4.1 wolves/1000 km^2.

Stephenson and James (1982) estimated the wolf population size for Unit 26A at 144–310 wolves in 1982. In 1993 it was estimated that there were 240–390 wolves (1.8–2.9 wolves/1000 km^2) in 32 to 53 packs in Unit 26A (Carroll, 1997).

MANAGEMENT DIRECTION

MANAGEMENT GOALS AND ACTIVITIES

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 by interviewing

knowledgeable people in the villages and working with the North Slope Borough (NSB) to develop a more effective harvest-monitoring program.

- Interview hunters, guides, and pilots to collect harvest and population status information.

2 Determine impact of wolves on Unit 26A moose.

- 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

A Sample Unit Probability Estimator (SUPE) sample design was used to census wolves in a 10,343 km^2 area bordered by the Colville, Killik, and Itkillik rivers and Gunsight Mountain. Surveys were flown using a PA-18 and a Scout aircraft on 15 and 16 April 1998. The study area as divided into 4 x 4 mile sample units. The units were classified into high, medium and low categories; according to the likelihood they contained fresh wolf tracks. We randomly selected units to be surveyed, with proportionally the most units in the "high" category surveyed, "medium" second, and "low" third. We attempted to fly surveys 2 days after a snowfall. Each selected unit was searched thoroughly to determine whether or not fresh wolf tracks were present. When tracks were found we followed them to determine how many wolves were in the pack, and what course the wolves had followed since the last snowfall. A population estimate for the area was obtained using the number of wolves counted and by determining the probability of observing wolf tracks on the survey, which is a function of the number and category of sample units containing wolf tracks. To prepare accurate estimates, a researcher must not miss any wolf tracks in the selected sample units, correctly identify all sample units that a set of tracks passes through, and correctly enumerate the number of wolves in the packs (Becker, 1998).

We collected harvest data from sealing certificate records and informal discussions with knowledgeable village residents. Harvest data for some villages was obtained through the NSB Harvest Documentation Program that maintains monitoring in North Slope villages. In past years we have obtained composition data from wolf carcasses collected by hunters at Anaktuvuk Pass.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We estimated the number of wolves in Unit 26A in 1993. Assuming that most of the coastal plain has a lower wolf density than the foothill region where we surveyed, we estimated that 240–390 wolves (1.8–2.9 wolves/1000 km^2) in 32 to 53 packs were resident in Unit 26A.

A SUPE sample design was used to census wolves in a 10,343 km^2 area bordered by the Colville, Killik, and Itkillik rivers and Gunsight Mountain on 15 and 16 April 1998. Lack of fresh snow and wind blown snow conditions resulted in poor tracking conditions in the southern half of the study area. We concentrated our efforts on the northern 5000 km^2 . Only 7 wolves were seen in 2 packs, resulting in an estimate of 8 wolves, with a confidence range of 5–11 at the 90% level. A density estimate was calculated at 1.6 wolves per 1000 km^2 in the 5000 km^2 area.

Results of surveys indicate the density of wolves increased from approximately 2.6 wolves/1000 km^2 in 1987 to 4.2 wolves/1000 km^2 in 1992 and 4.1 wolves/1000 km^2 in 1994. Although our 1998 survey was incomplete it was apparent that the density of wolves had declined in the area (Table 1).

The number of wolves seen during moose surveys has also declined in recent years. During the spring 1991 moose census 29 wolf sightings were recorded in 39 hours of flight in Unit 26A. During the 1995 survey, 16 wolves were observed during 35 hours of flight. We did not see any wolves during moose counts in 1998 and 1999.

The most likely reason that wolf numbers in the study area have decreased in recent years is a reduced prey base. The Unit 26A moose population declined by 75% between 1992 and 1996. In addition, very few caribou from either the Teshekpuk Herd or the Western Arctic Herd have wintered in the area between Umiat and Anaktuvuk Pass in recent years. It is also possible that disease could have been a factor in the decline in wolf numbers.

In order to assist with the recovery of the 40 Mile Caribou Herd, North Slope residents agreed to have 15 wolves relocated from the Tok area to the North Slope. At the request of local residents the wolves were not collared, so it will be difficult to monitor the survival of the wolves.

Population Composition

US National Park Service and department staff collected necropsy data on wolves harvested at Anaktuvuk Pass from the winters of 1985–1986 to 1992–1993. 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.

Of 52 carcasses examined during 1991–1992, 35 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%) were trapped.

Of the 48 carcasses examined at Anaktuvuk Pass during 1992–1993, 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%) were trapped. All were gray.

No composition data was available from Anaktuvuk Pass after 1993. 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 in the southern portion of Unit 26A in the Brooks Mountain Range and foothills and along the Colville River system. However, residents have seen wolves in increasing numbers on the coastal plain during recent years. Wolves often move toward areas of high caribou concentration. For instance, during the winters of 1990–1991 and 1993–1994, many caribou concentrated near Anaktuvuk Pass, which attracted wolves and resulted in a large wolf harvest.

MORTALITY

Harvest

Season and Bag Limit.

Area	Bag limit	Season
Unit 26A:		
Trapping	No limit	1 Nov–15 Apr
Hunting	10 wolves	10 Aug–30 Apr

Board of Game Actions and Emergency Orders. The Board of Game had made it legal under trapping regulations to shoot a wolf the same-day-airborne if the wolf is either caught in a trap or snare or over 300 feet from the airplane at the time of taking. In 1999 a citizen referendum made it illegal to hunt wolves the same-day-airborne.

Hunter/Trapper Harvest. During the 1996–1997 season, 21 wolves were sealed. Twelve (57%) were males and 9 (43%) were females. Seventeen (81%) were gray, 3 (14%) were black, and 1 (5%) was white. During 1997–1998, 16 wolves were sealed. Twelve (75%) were males and 4 (25%) were females. Eleven (69%) of the wolves were gray and 5 (31) were black. During 1998–1999, 15 wolves were sealed. Nine (60%) were males, 5 (33%) were females, and 1

(7%) was unknown. Ten (67%) of the wolves were gray, 2 (13%) were black, and 3 (20%) were white. (Table 2)

With the assistance of department personnel, the NSB Department of Wildlife Management began a Harvest Documentation Project in 1995. The NSB found during 1994–1995 that at least 59 wolves were harvested in Anaktuvuk Pass while 17 were sealed. Eighteen were harvested in Nuiqsut, 2 in Atqasuk, and 8 in Kaktovik while none were sealed in any of those villages (Brower and Opie 1996,1997; Hepa and Brower, 1997).

Permit Hunts. There were no permit hunts for wolves in Unit 26A during the reporting period.

Hunter Residency and Success. In 1996–1997, 3 North Slope residents harvested 18 wolves, 1 nonlocal state resident harvested 2 wolves, and 1 wolf was reported harvested by a nonresident hunter. During 1997–1998, 4 North Slope residents harvested all 16 wolves. In 1998–99, 8 North Slope residents harvested 14 wolves and a nonresident harvested 1 wolf. There is no information on the number of unsuccessful hunters.

Method of Take, Transportation, and Chronology. The method of take, transportation, and chronology are summarized in Tables 3 and 4. During 1996–1997, 6 (29%) animals were ground shot and 15 (71%) were trapped. Twenty (95%) animals were taken by hunters using snowmachines for transportation and 1 (5%) was taken by a hunter using aircraft. The chronology of harvest was August 1, October 1, December 1, January 4, February 11, and March 2.

During 1997–1998, all 16 animals were ground shot and were taken by hunters using snowmachines for transportation. The chronology of harvest was November 2, December 5, January 3, February 1, March 5, and April 3.

During 1998–99, all 15 animals were ground shot. Thirteen (87%) animals were taken by hunters using snowmachines for transportation, and 2 (5%) were taken by hunters using aircraft. The chronology of harvest was August 1, September 1, January 1, February 4, March 5, and April 3.

Other Mortality

We have no information to report on other sources of mortality.

HABITAT

Assessment

Unit 26A contains extensive open habitat and a large seasonal prey base available to wolves. The Western Arctic caribou herd (WACH), which numbers over 450,000 animals, seasonally occupies parts of Unit 26A and a portion of this herd remains throughout the winter. The Teshekpuk Lake Caribou Herd (TLH) numbers over 25,000 animals, and most of this herd remains in the unit during most years.

The Colville River moose population numbered approximately 1600 by 1991 but declined by

75% between 1992 and 1996; this consistent prey base has been greatly reduced but is now recovering. Dall sheep are preyed upon in mountainous regions, but also declined in the 1990s. Snowshoe hares have moved into the Colville River system during the 1990s and increased dramatically, providing another food source for wolves.

Petroleum exploration and development may affect some wolf habitat. Hunter/trappers have reported that wolves move out of areas of Unit 26A when seismic exploration is taking place.

Enhancement

There were no habitat enhancement activities for wolves in Unit 26A during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

The results of wolf population surveys indicate that the density of wolves in the southeast corner of the Unit 26A increased from 2.6 wolves/1000 km^2 in 1986 to 4.2 wolves/1000 km^2 in 1992 and 4.1 wolves/1000 km^2 in 1994, but declined to 1.6 wolves/1000 km^2 in 1998. The number of wolves seen during moose surveys has also declined.

Wolf numbers in the study area have decreased because of a reduced prey base. The Unit 26A moose population declined by 75% between 1992 and 1996. In addition, very few caribou from either the Teshekpuk Herd or the Western Arctic caribou herd have wintered in the area between Umiat and Anaktuvuk Pass since 1997.

We have not conducted counts in other areas of Unit 26A, but the number of wolves sealed throughout the unit has decreased in recent years. Assuming that hunting pressure has stayed the same, this would indicate that there has been a decline in the wolf population throughout Unit 26A. Hunter/trapper harvest and disease in the wolf population have also contributed to the decline in wolf numbers.

Because many North Slope residents tan their wolf pelts at home and do not have them sealed, the department's wolf sealing program does not provide accurate harvest information. Department personnel have been assisting the NSB develop a harvest documentation system that is more acceptable to local residents. Harvest monitors have been hired in each village and are collecting harvest information for several species. During 1994–1995 the NSB found that at least 59 wolves were harvested in Anaktuvuk Pass while 17 were sealed and that 18 were harvested in Nuiqsut while none was sealed. We will have more accurate harvest information if the NSB program continues and becomes established in more North Slope villages.

A wolf management plan for the North Slope was developed during 1992 and 1993. In developing the management plan, public meetings were held in North Slope villages, and local governments and federal management agencies were consulted. Most local people agreed that 1) a moderate level of harvest of wolves should continue, 2) wolf pelts are highly prized and are 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 become too large, local people could use ground hunting methods to control the populations.

Wolf predation has been a factor for both Dall sheep and moose populations in Unit 26A. Sheep populations declined in number throughout the Brooks Range in the early to mid 1990s, and hunters reported finding the remains of many sheep that apparently were killed by wolves in the mountains. The Colville River moose population also declined by 75% between 1992 and 1996. Several factors were involved in this decline, one of which is wolf predation. The moose population has begun to increase since 1997 while the density of wolves has been low. It is difficult to determine whether the wolf density is driving the moose population fluctuation or if the wolves immigrated to the area in response to high moose and caribou numbers and left when the numbers of prey animals declined. We will continue to conduct wolf and moose surveys to monitor the impact of hunters on wolves and the combined impact of hunters, bears, and wolves on moose.

In order to assist with the recovery of the 40 Mile Caribou Herd, North Slope residents agreed to have 15 wolves relocated from the Tok area to the North Slope. At the request of local residents, the wolves were not collared, so it will be difficult to monitor the survival of the wolves.

Although the wolf population has declined in Unit 26A, I recommend no changes in bag limits or seasons at this time. The decline in wolf density in the study area appears to be more related to a reduced prey base than it is to hunting pressure. The Unit 26A moose population is currently recovering. Caribou movements are variable, but if in the future caribou become more plentiful in the area, wolf numbers will also be more abundant. Because aerial and land-and-shoot hunting are 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 and mountains of the Brooks Range probably will not be heavily hunted or trapped. Hunters from other North Slope villages range over much of the coastal plain where wolves probably will not become plentiful.

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PREPARED BY:

Geoff Carroll
Wildlife Biologist III

SUBMITTED BY:

Peter J. Bente
Survey-Inventory Coordinator

Table 1 Wolf population estimates for Unit 26A and the Colville River study area, 1982–1998

	Colville River Study Area[a]		Unit 26A		
Year	Wolves per 1000 km^2	Number of packs	Population estimate	Number of packs	Basis of estimate
1982			144–310		TTC survey[b] and extrapolation to rest of unit.
1986	2.6	2			TTC survey[b]
1987	2.7–3.2	4–5			TTC survey[b]
1990			145–350	14–30	Past surveys and interviews with pilots and 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 interviews with pilots and hunters.
1994	4.1–4.3	8–10			SUPE survey[d]
1998[e]	1–2.2	2			SUPE survey[d]

[a] Colville Study Area - southeast portion of Unit 26A bordered by the Colville, Killik, and Itkillik Rivers and the Brooks Range.
[b] Traditional Track Count survey.
[c] Track Intercept Probability survey.
[d] Sample Unit Probability Estimator surveyee
[e] Incomplete survey due to poor snow cover.

Table 2 Sex and color of wolves from reported harvests and estimated unreported harvest, Unit 26A, 1989–1999

Regulatory year	Sex			Color			Estimated unreported harvest	Total reported harvest
	% Male	% Females	% Unknown	% Gray	% Black	% White		
1988–1989	38	62		100	0	0		13
1989–1990	71	29		64	29	7	48	14
1990–1991	66	34		83	13	3	82	30
1991–1992	67	28		72	22	6	37	18
1992–1993	59	30	11	79	17	3	42	29
1993–1994	65	32	3	72	17	11	37	60
1994–1995	73	27	0	89	6	5	32	47
1995–1996	42	58	0	85	9	6	41	19
1996–1997	57	43	0	81	14	5	40	21
1997–1998	75	25		69	31	0	30	16
1998–1999	60	33	7	67	13	20	28	15

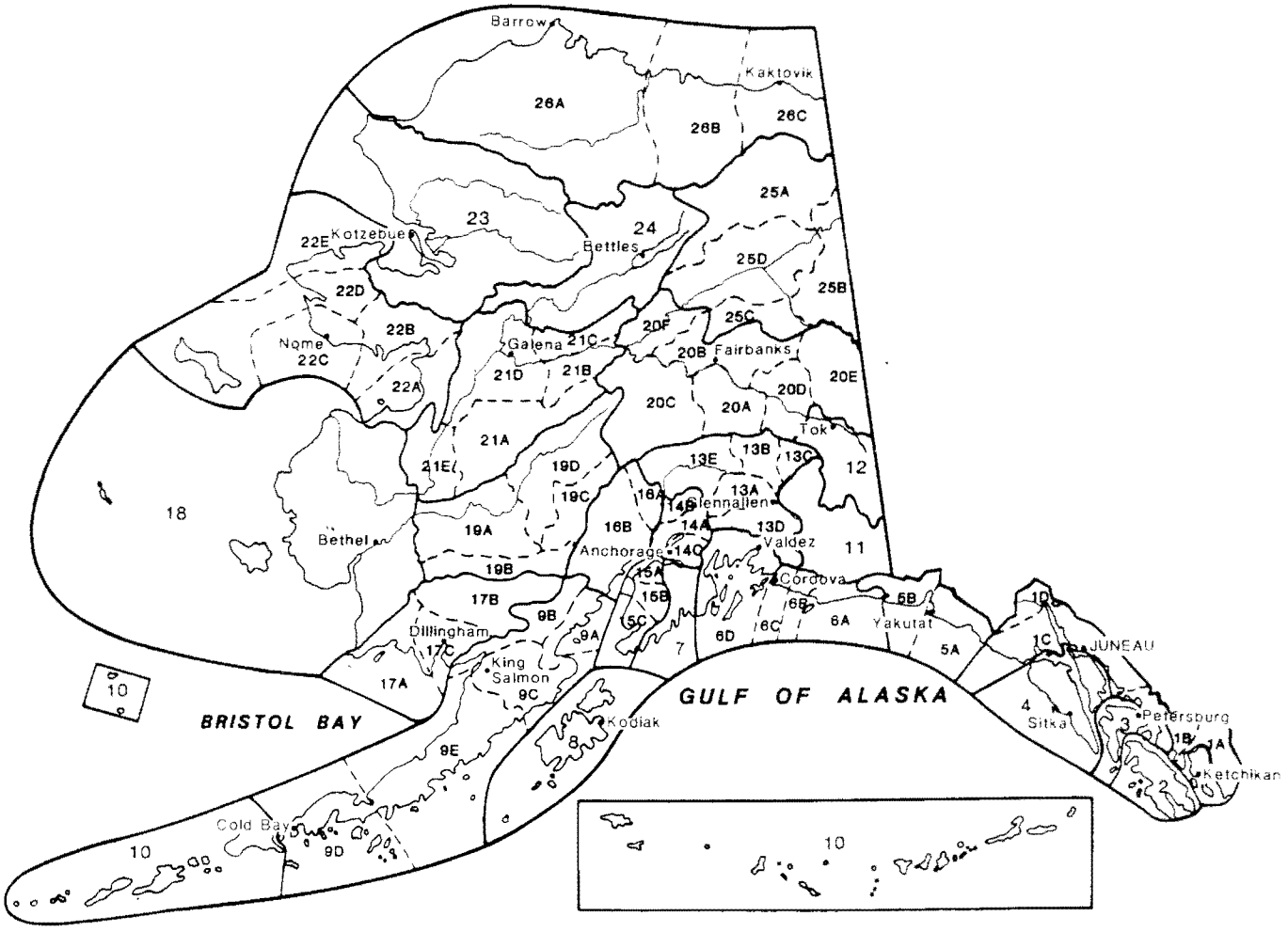
Table 3 Method and transportation percent of reported wolf harvest, Unit 26A, 1988–1999

Regulatory	Method of take (%)				Transportation method (%)				Total reported
Year	Trap	Rifle	Snare	Unknown	Aircraft	Snowgo	ORV	Boat	harvest
1988–1989	15	85				100			13
1989–1990	64	36			15	85			14
1990–1991	20	80			3	90	7		30
1991–1992	39	61			6	94			18
1992–1993	30	63		7	7	89	4		29
1993–1994	33	66	1		8	85	0	7	60
1994–1995	7	90	3		28	72			47
1995–1996	21	74	5			95		5	19
1996–1997	71	29			5	95			21
1997–1998	0	100			0	100			16
1998–1999	0	100	0		13	87			15

Table 4 Chronology for reported wolf harvest in Unit 26A, 1988–1999

Regulatory	Month											
year	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Unknown	Total
1988–1989	1				1		2	9				13
1989–1990		2		1	2	2	2	5				14
1990–1991		1			3			22	4			30
1991–1992		1				2	1	11	3			18
1992–1993		2		2	2			18	4		1	29
1993–1994	2	5		1	4	2	5	29	12			60
1994–1995	2	2		3	5	2	10	13	10			47
1995–1996		1		3				11	1	3		19
1996–1997	1		1		1	4	11	3				21
1997–1998				2	5	3	1	5				16
1998–1999	1	1				1	4	5	3			15

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.

Craig Flatten Chris Farmer checks the radio collar of a wolf on Heceta Island