Alaska Department of Fish and Game

Division of Game

AN ASSESSMENT OF WOLF PREDATION CONTROL ALTERNATIVES FOR PORTIONS OF INTERIOR ALASKA

A Report to the Board of Game

November 1985

EXECUTIVE SUMMARY

In response to a request from the Board of Game, the Division of Game has reviewed selected areas for data on the status of moose:wolf relationships, wolf hunting and trapping, methods of wolf predation control as alternatives to aerial shooting, and costs associated with some of the alternatives.

Moose:wolf ratios are low or very low in Units 19D, 12, 25D West, 20B, 21B, and 20E. Ratios are moderate overall in Units 20A and 20D, although portions of those units also have low ratios. Based on that information and other factors, the department recommends moose:wolf management actions be undertaken, in order of descending priority, in 25D West, 19D, 20B, 20E, 12, 20A, 20D, and 21B.

A review of 1984-85 wolf trapping effort and harvest indicates that there are substantial numbers of trappers in each unit, usually in proportion to the overall human population level. However, in most areas only a small proportion of the trappers consistently try to trap wolves, and an even smaller proportion are successful. Trappers who take more than 5 wolves per year are rare. Most trappers seek more easily caught, more abundant furbearers. Nevertheless, there are numbers of trappers who potentially could be effective wolf trappers if the economics of wolf trapping were attractive and they could learn the necessary skills.

Unreported take of wolves was apparently low or absent in most units, but in 20A and 20B it is suspected that a significant unreported take occurs.

The significance of the technique of using aircraft to "land and shoot" could not be documented from prior wolf-sealing records, but the practice is known to be used in most units, and is significant in 19D, 21B, 20A, and 20B. In an effort to provide some insight into the potential use of this technique, the number of trappers who use airplanes for access on the trapline (as opposed to access to and from the trapline) has been estimated. The numbers are not large, but harvest data suggest that in most areas more wolves would be taken if airplane-equipped trappers commonly used "land and shoot" techniques. Due to deep, prolonged snow cover in 1984-85, conditions were good for using this technique, but trappers did not take advantage of the opportunity.

Various alternatives to aerial shooting have been considered, to include: trapper education and assistance, habitat enhancement, wolf relocation (transplants), adjustments of seasons, and several other options. Interviews with Canadian provinces indicate that with few exceptions, where low moose (or caribou) populations exist and wolves (and sometimes bears) are present, the continued low prey populations are attributed to predation.

In most cases government agents shooting wolves from helicopters has proved most effective. Trapper education programs are of long standing in Canada and some habitat enhancement has been tried.

Trapper education and assistance in Alaska can be conducted and may help increase the numbers of wolves taken. However, considering the Canadian experience and the economics of wolf trapping, caution is urged in developing expectations that increased trapping may significantly improve moose:wolf ratios.

Various examples of habitat enhancement techniques and their costs have been reviewed. Wildfire, under the management plans now encompassing most of the state, offers the most promise for significant habitat improvement at reasonable cost. Other techniques, however, have been used successfully in appropriate situations. It has been noted in all units reviewed, that moose numbers are presently far below the carrying capacity of their existing food supply or range. Increased carrying capacity does not ensure population growth if some other factor is limiting the prey population. However, the importance of habitat enhancement to long-term maintenance of moderate to high moose populations has been noted.

Wolf relocation has been reviewed as a means of reducing wolf numbers in an area. Relocation is technically feasible if areas are suitable in terms of 1) presence of prey to support wolves; 2) few resident wolves; and 3) the concurrence of people living in the areas. Alaska has few areas that meet all of these criteria. An additional consideration is cost, which tends to increase rapidly as wolf density declines and remoteness increases.

Adjustment of the lengths of trapping seasons is an alternative for increasing the take of wolves by trappers, but the effectiveness of such changes is probably limited by the value of wolf furs, unless a bounty or other financial incentive is instituted. The department did recommend including October and April in the open season in areas where additional harvests are desired. Alternatives such as poison, bounties, and government trappers have been discussed briefly. The alternative of aerial control by the department, which has been extensively covered by past board reports, is briefly reviewed.

Cost estimates for wolf predation control programs under various options have been presented and a number of assumptions that are crucial to these estimates have been detailed. Basic data gathering costs are similar regardless of the management actions considered.

Given the low densities and downward trends of the moose populations in most areas reviewed, the decline of moose populations, possibly to extremely low levels, seems highly probable if no change in management strategies is undertaken.

CONTENTS

TABLES

FIGURES

APPENDICES

AN ASSESSMENT OF WOLF PREDATION CONTROL ALTERNATIVES FOR PORTIONS OF INTERIOR ALASKA

A Report to the Board of Game

November 1985

Alaska Department of Fish and Game

Division of Game

INTRODUCTION

This report reviews moose:wolf relationships, moose:wolf:bear relationships, and various management alternatives that could be considered for manipulating those relationships in Game Management Units 12, 19D, 20A, 20B, 20D, 20E, and 21B. Unit 25D West is covered in a separate report.

In response to the Board of Game's request, this report also covers the following: (1) current assessment of moose:wolf ratios; (2) current assessment of wolf hunting and trapping activities and wolf harvests; (3) a review of several alternatives to aerial shooting as a means of manipulating wolf numbers; and (4) a review of costs associated with the various alternatives to the extent they can be determined or projected for the situations under consideration.

The information presented was drawn from Department of Fish and Game records, from contacts with Canadian provinces where moose: wolf relationships present management concerns, and from various other sources (Appendix 1).

PRIORITIZATION OF AREAS FOR WOLF CONTROL

Moose:wolf Ratios

The Board of Game requested a listing of moose:wolf ratios showing their relative rank in the various areas under review. Rank was determined, as requested by the board, according to the apparent importance of bears as predators of moose in each area. Data on moose, wolves, and their habitats is summarized in Table 1.

Gasaway et al. (1984) noted that when the moose:wolf ratio falls below 20:1, predation is likely to be a significant factor limiting prey population size. Units 19D, 12, 25D, and 20E are presently in that condition. Portions of Units 20B, 21B, and probably 20A are in the same circumstances. Overall, Units 20A

and 20B have ratios above 20:1, largely due to previous wolf predation control programs.

Moose population estimates for 20A were updated in 1984. A wolf population estimate was completed in 1983-84 for the entire unit.

Ongoing moose population trend counts and assessments of wolf numbers in portions of 20B have kept information current for those portions of the unit.

However, updated moose population trend information is needed in western and eastern 20B. In 1984-85, the emphasis in gathering information on wolf numbers was on western 20B where wolves were removed in late 1984.

A combination of moose population trend counts, stratification of moose densities, and radio-tracking studies over the last 4 years has provided the basis for moose population estimates in Unit 25D. A wolf population assessment was completed in 1983-84. Moose density is extremely low in this unit (Table 1).

Table 2 reflects our best estimate of the moose:wolf relationship in 21B. The Nowitna area program was suspended following establishment of a federal refuge. Comprehensive moose and wolf population data have not been collected since 1980. Estimates given here are projections of 1980 data which reflect the probable trend of wolf numbers and the downward trend in moose production and survival as reflected in ongoing moose sex and age composition and trend counts.

The overall moose:wolf ratio in Unit 20D is relatively high, but in the northern portion the moose:wolf ratio is low. Moose numbers in the southern 1/4 to 1/3 of the unit have been increasing. In the northern portion, moose numbers are low and probably declining, with a probable moose:wolf ratio of 15-20:1, based on 1984-85 winter surveys of moose and wolves. Based on ecological similarities to adjacent Unit 20E, it is assumed that grizzly bears are significant moose predators in part of northern 20D.

Moose:wolf ratios are lowest in Unit 20E. Ongoing surveys and research have documented population densities of moose and of wolves in addition to documenting predation by both wolves and grizzly bears.

Moose population estimates in Unit 12 are based on population trend count data and sex and age composition survey data collected for several years. Wolf population estimates were also made in various parts of the unit over several recent years.

A comprehensive moose population assessment has not been made for Unit 19D. Portions of the area have been surveyed annually and densities found in nearby areas have been combined with the

Table 1. Moose and wolf densities in selected units.

Area	Total area in square miles	Estimated moose population	Moose density for selected areas[a]	Moose habitat in square miles	Moose density within the moose habitat[b]	Estimated wolf population	Wolf density for total area
12	8,500	2,500	1/3.4 mi^2 (0.29/mi^2)	5,000	1/2 mi^2 (0.50/mi^2)	205[c]	1/41 mi^2
19D	11,000	1,900	1/5.8 mi^2 (0.17/mi^2)	9,900	1/5.2 mi^2 (0.19/mi^2)	150	1/73 mi^2
20A	7,000	8,100	1/0.86 mi^2 (1.16/mi^2)	4,900	1/0.6 mi^2 (1.65/mi^2)	230	1/30 mi^2
20B	8,800	5,000	1/1.8 mi^2 (0.57/mi^2)	8,400	1/1.7 mi^2 (0.60/mi^2)	200	1/44 mi^2
20D	5,700	2,800	1/2.0 mi^2 (0.49/mi^2)	4,600	1/1.6 mi^2 (0.61/mi^2)	70	1/81 mi^2
20E	11,000	1,900	1/5.8 mi^2 (0.17/mi^2)	8,800	1/4.6 mi^2 (0.22/mi^2)	195	1/56 mi^2
21B	5,200	2,500	1/2.1 mi^2 (0.48/mi^2)	5,000	1/2 mi^2 (0.50/mi^2)	90	1/58 mi^2
25D W.	6,700	800	1/8.4 mi^2 (0.12/mi^2)	6,500	1/8 mi^2 (0.12/mi^2)	50	1/134 mi^2

[a] 1 moose/x mi^2 or (x moose/1 mi^2).

[b] 1 moose/x mi^2 or (x moose/1 mi^2).

[c] Wolf population estimate for entire unit was 200-210 for fall 1984. Wolf population estimate of 170-190 used in the priority ranking was for areas of moose habitat for fall 1985.

resulting information to develop population estimates. An extensive wolf survey in spring 1985 provided the basis for the present estimate, which does not include packs in adjacent units which probably range into 19D.

Department Assessment of Wolf Predation Control Priorities

Moose:wolf ratios are important indicators of the biological status of prey and predators. However, other factors may also affect decisions about what situations should be emphasized or given a higher priority for management actions. The department has reviewed the array of factors affecting priorities of management actions (Table 3) and offers the following recommendations and reasons for them.

1st priority--25D West

- Moose density is the lowest of the areas reviewed.
- The moose population is the least capable of supporting hunting by local people.
- Nonlocal hunters have been significantly restricted by regulation.
- Hunting by local residents has been restricted by regulation (Tier II).
- There is high local interest in, and effort to develop, a management plan that will increase moose numbers.
- Because prey and predators are at low densities, and because range is not limiting moose, removal of a relatively small number of wolves would provide some relief.

2nd priority--19D

- Moose density is the second-lowest of the areas reviewed.
- Regulations restrict access and discourage hunting by nonlocal people in a portion of the unit.
- Deep snow in 1984-85 probably caused further decline in moose numbers.
- Removal of a few key wolf packs would enhance moose survival in the most important hunting areas.
- Moose numbers are much lower than the habitat can support.

3rd priority--20B

- Moose numbers have increased significantly in central 20B and to some extent western 20B as a result, primarily, of past wolf predation control work.
- The increase in moose numbers is unlikely to be sustained without continued control of wolf numbers.
- Increased moose hunting opportunities in 20B reduce competition for moose elsewhere.

Table 2. Moose:wolf ratios in selected game management units.

I. Moose:wolf ratios in areas where wolves are the main predator in the system.

Rank	Area	Estimated moose:wolf ratio	Season	Wolf population estimate	Moose population estimate
1	19D	13:1	Fall 1985	150	1,900
2	12	14:1	Fall 1984	180	2,500
3	25D (West)	16:1	Fall 1984	50	800
4	20B	25:1	Fall 1985	200	5,000
5	21B	28:1	Fall 1984	90	2,500
6	20A	35:1	Fall 1984	230	8,100

II. Moose:wolf ratios in areas where wolves and bears exist in the same system, and where it is determined that predators are the primary limiting factor.

Rank	Area	Estimated moose:wolf ratio	Season	Wolf population estimate	Moose population estimate
1	20E	10:1	Fall 1985	195	1,900
2	20D	40:1	Fall 1984	70	2,800

- Improved hunting opportunities in part of western 20B are likely with continued wolf predation control, although little change has occurred in far-western 20B.
- Relatively good access and numerous potential wolf trappers are advantages in attempting to regulate moose:wolf ratios.

4th priority--20E

- Moose density is very low throughout the unit.
- The estimated moose:wolf ratio is the lowest of all areas considered.
- In addition to a very low moose:wolf ratio, grizzly bears are abundant and are known to be significant predators on moose.
- Although the moose population in a substantial part of the unit may have stabilized as the result of wolf predation control and increased grizzly bear harvest, moose numbers are probably declining as a result of cessation of wolf predation control in 1983.
- Hunting was controlled by Tier I regulation (residents only) and a short season in 1985.
- The moose population marginally or inadequately supports hunting by local/area people.
- Although moose hunting was closed entirely from 1977 through 1981, and habitat enhancement of major portions of prime moose range resulted from the extensive 1967 burn, moose numbers continued to decline at least until 1980-81.
- Relatively good access in portions of the unit and a few capable wolf trappers are advantages in attempting to regulate moose:wolf ratios.

5th priority--Unit 12

- Moose densities are very low in most of the unit, with a few small populations at moderate densities in portions of the unit.
- Moose numbers appear to be declining in most parts of the unit.
- Moose hunting opportunities are substantially limited by regulation.
- Good access to parts of the unit and some capable wolf trappers are advantages in attempting to regulate moose:wolf ratios.
- In addition to low moose:wolf ratios, grizzly bears are important moose predators in part of the unit.

6th priority--20A

- Previous wolf predation control efforts have put moose and caribou populations well on the way to recovery in 20A and adjacent portions of 20B.
- Although moose numbers are still increasing, the rate of increase has slowed considerably and may cease or reverse as wolf numbers continue to increase.

Table 3. Bases for wolf predation control priorities.

Area	1 Moose population density	2 Caribou population	3 Grizzly bear density	4 Moose: wolf ratio	5 Relative current moose harvest			6 Relative potential moose use			7 Habitat potential	8 Relative cost	9 Landowner constraints
					NR	R	L	NR	R	L			
12	L	L	M	14:1	M	M	M	M	M	M	G	3	3
19D	L	L	M	13:1	L	H	M	M	M	H	G	3	1
20A	M	M	M	35:1	M	M	L	H	H	L	G	5	1
20B	L	L	L	25:1	L	H	H	L	H	H	G	7	1
20D	L	L	M	40:1	L	H	H	M	H	H	M	5	1
20E	L	L	M	10:1	M	M	L	M	H	L	G	8	2
21B	L	L	L	28:1	L	H	L	L	H	L	G	9	4
25D	L	L	L	16:1	L	L	H	L	M	H	M	9	4

1 Density of moose within moose habitat more than 2.0 moose/mi² - high, 1.0-2.0 moose/mi² - moderate, less than 1.0 moose/mi² - low.

2 Relative to range potential or historical levels.

3 Relative to Interior grizzly bear population levels, not compared to coastal brown bear densities.

4 Fall 1984 or Fall 1985 as appropriate.

5 NR - nonresident
H=25% or more
M=10-24%
L=less than 10%

R - state resident
H=90% or more
M=75-90%
L=less than 75%

L - resident of unit or subunit
H=75% or more
M=50-75%
L=less than 50%

Percentages are % of the harvest.

6 Potential use is based upon proximity of human populations and general accessibility.

7 Long-term habitat potential expressed as good, moderate, or poor.

8 Relative cost to the department, 1-10 low to high.

9 Landowner restrictions 1-5, insignificant to prohibitive restrictions.

- Data on status of moose and wolf populations need updating through additional field studies.
- Unit 20A provides a substantial wildlife resource for the Fairbanks area, thus reducing competition in outlying areas.
- Excellent accessibility and a few capable wolf trappers are advantages in efforts to regulate moose:wolf ratios.
- Moose numbers should be sustained to take advantage of habitat enhancement resulting from recent wildfire and other disturbances.

7th priority--20D

- Very low density moose populations exist north of the Tanana River; moderate density south of the Tanana.
- A low moose:wolf ratio exists north of the Tanana River.
- Grizzly bear predation is probably a significant additive mortality factor in northeastern and southeastern 20D.
- Conservative regulations on hunting have not fostered moose population growth in northern 20D.
- South of the Tanana, moose numbers have increased significantly in response to wolf predation control and trapping.
- The Macomb Plateau caribou herd has not increased to its potential size; hunting is allowed only by Tier II permit.
- Moderate accessibility and a few capable wolf trappers are advantages in attempting to regulate moose:wolf ratios.

8th priority--21B

- Overall moose population density is low, but not as low as most other areas reviewed.
- The moose population trend is downward, based on data showing lower recruitment rates.
- The moose population is capable of sustaining hunting by most local/area and some nonlocal people. However, previous hunting opportunity was much greater for all.
- Relatively low probability exists for trapping being an effective wolf management tool in 21B.

An important factor affecting recommendations on the priority assigned to various areas is cost. If management plans to change the ratio of moose to wolves are undertaken, costs will be higher in remote areas than in areas closer to a base for logistical and staff support. This will be true regardless of the techniques chosen.

Other factors affect the choice of areas and the choice of management alternatives. The priority recommendations listed above attempt to emphasize situations where need is important,

there is a potential for success, and costs can be minimized. Assuming that whatever management actions chosen would be effective, the priorities would probably not change. However, some management alternatives may not be effective in a particular area, or perhaps not effective anywhere. The relative merits of alternatives to aerial shooting will be discussed in a later section of the report.

In the course of continuing discussions of prey and predator management, it is important to consider the question: What is likely to happen to moose populations if management practices are unchanged? The most probable answer, given the moose population trends and densities, is that moose populations will decline significantly in the forseeable future. There is very little, if any, possibility that moose numbers would remain as they are, even if human use were severely restricted. If it is considered important to avoid or reverse probable moose population declines, then the issue for the board and the department becomes the matter of how best to accomplish this change.

WOLF HUNTING AND TRAPPING EFFORT AND HARVEST

The magnitude of the 1984-85 reported wolf harvest in the 8 areas examined ranged from 6 (Unit 21B) to 39 (Unit 20B) (Table 4, Figures 1-8). Compared with 1983-84 (Table 5), the number of wolves sealed in 1984-85 increased in 20B and 25D; decreased in 19D, 20E, and 21B; and changed little in 12, 20A and 20D. The estimated unreported wolf harvest ranged from 0 (12, 19D) to 10-20 (20A, 20B); however, there is probably considerable variation in the accuracy of these estimates because it is easier in some areas for a harvested wolf to go undetected.

Current methods of taking wolves include ground shooting, trapping, snaring, and wolf control programs using aerial shooting as authorized by the board and implemented by the department. The proportion of wolves killed by these specific methods varied between years and among areas. During 1983-84 and 1984-85, wolves were killed in 19D most frequently by ground shooting; in 20D most frequently by snaring; and in 12 and 21B most frequently by trapping. In the other 4 areas, the primary method of take was not consistent between the 2 years. The number of wolves harvested by hunters/trappers using aircraft was not possible to assess from the 1984-85 sealing documents because "ground shooting" on the sealing form includes taking wolves with the use of aircraft (land and shoot) and without the use of aircraft. Instead, the number of hunters/trappers who used aircraft was estimated by area biologists or from trapper questionnaire responses in those specific areas. In 1984-85, ground shooting was the primary method of take by the public in 5 of the 8 areas. Records of wolves sealed include those taken by hunting, if any.

Usually those wolves were killed during the course of a hunting trip for other species, and the number taken by hunting is seldom a significant fraction of the total take.

Estimates of the number of trappers in the 8 areas ranged from 30 (19D) to 172 (20B); however, only 4 (19D) to 58 (20B) of these were wolf trappers. The highest numbers of successful trappers were in 25D, 20A, and 12, with 14, 12, and 12 trappers sealing wolves in these areas, respectively. In 7 of the 8 areas at least 50% of the successful trappers only took 1 wolf. Unit 12 and Units 19D, 20A, and 25D West each had 1 trapper who took 5 wolves or more.

The data in Tables 4 and 5 and Figs. 1-8 show that the numbers of trappers vary considerably among the units under review. In general, the estimated number of trappers in a unit is related to the overall human population in the unit, but in 25D (West) and 21B it appears that a higher proportion of people are trappers.

Theoretically, the numbers of trappers represent the number of potential wolf trappers. However, the data indicate that among trappers in the various units, the number of wolf trappers (those who regularly attempt to catch wolves) varies considerably.

In most units there are presently very few wolf trappers, and even fewer who actually caught and sealed wolves. Most trappers are opportunistic in trying to catch wolves; that is, they will make an attempt if chance arises in the course of other trapping. Wolf trapping is not very productive compared to trapping other species. Wolves are hard to catch because they are smart and big. In addition they range widely, and even in areas where numbers are relatively high, they are more dispersed than many other furbearers. Finally, compared to other furbearer species, the current pelt value of wolves is not considered great enough to offset the costs in time and money required to consistently catch them. These factors can reduce the effectiveness of programs designed to increase the take of wolves by trappers.

Tables 4 and 5 include estimates of the number of trappers who use aircraft as transportation while on their trapline, as compared with those who use aircraft as access to and from their trapline. These estimates give some indication of how many trappers may have the option of landing and shooting wolves. The numbers are rough estimates which probably represent a minimum of those who potentially could land and shoot wolves. Through winter 1984-85, taking wolves by this technique was recorded as "ground shooting" when wolves were sealed. A review of Tables 4 and 5 on "method of take" shows that the numbers of wolves taken by ground shooting were highly variable from area to area. The numbers of wolves taken are also relatively modest considering the estimated number of trappers equipped with airplanes, and the fact that 1984-85 was a particularly good winter for airplane use

Table 4. Wolf hunting and trapping efforts in selected areas of Interior Alaska, 1984-1985.

	12	19D[a]	20A	20B	20D	20E	21B	25D[b]
Harvest Effort								
Number of trappers[c]	50	30(12)	48	172	42	43	41	(44)
Number of trappers sealing any furbearer	54	33	36	75	25	19	13	107
Number of wolf trappers[c]	30	4(1)	30	58	22	25	8-10	(7)
Number of trappers sealing wolves	12	4	12	10	7	4	4	14 (6)
Number of trappers sealing only 1 wolf	8	2	7	8	1	2	3	10 (5)
Number of trappers sealing $\geq$ 5 wolves	1	1	1	0	0	1	0	2 (1)
Number of trappers using aircraft[c]	2+[d]	3(1)	10-20	10-20(10)[e]	7+	3+	3	3+
Harvest								
Wolf harvest by public (# sealed)	20	11(2)	22	13	18	11	6	25(10)
Wolf harvest by ADF&G (# sealed)	0	0	0	26	0	0	0	0
Estimated unreported harvest[c]	0	0	10-20	10-20(2+)[e]	6[c]	1	1	(3)
Estimated total harvest	20	11	32-42	49-59	24	12	7	28
Method of take:								
ground shoot	5	10	15	7	2	10	1	15(7)
trap	14	1	3	5	4	1	4	7(1)
snare	1	0	4	1	12	0	1	3(2)
aerial gunning	0	0	0	26	0	0	0	0(0)

Compiled by R. O'Connor and J. Ernest, 1 October 1985.

[a] Parentheses denote numbers which apply to Upper Kuskokwim Controlled Use Area only.
[b] Parentheses denote numbers which apply to 25D West only.
[c] Estimate from area biologist.
[d] Estimate from trapper questionnaires.
[e] Estimate for 20B west.

Table 5. Wolf hunting and trapping efforts in selected areas of Interior Alaska, 1983-1984.

	12	19D[a]	20A	20B	20D	20E	21B	25D[b]
Harvest Effort								
Number of trappers[c]	50	30(15)	--	--	43	43	--	(44)
Number of trappers sealing any furbearer	--	--	--	--	--	--	--	--
Number of wolf trappers[c]	30	6(2)	30	58	22	25	--	(7)
Number of trappers sealing wolves	11	6	11	9	9	16	5	8
Number of trappers sealing only 1 wolf	6	0	6	8	7	9	3	4(0)
Number of trappers sealing ≥ 5 wolves	1	1	1	1	1	0	1	1(0)
Number of trappers using aircraft[d]	--	4(2)	--	--	7[c]	--	3[c]	3
Harvest								
Wolf harvest by public (# sealed)	22	23(7)	23	13	16	27	10	16(0)
Wolf harvest by ADF&G (# sealed)	1	0	0	4	4	7	0	0
Estimated unreported harvest[c]	1[e]	0	10-20	10-20	6[c]	--	--	3
Estimated total harvest	24	23	33-43	37-47	26	34	10	19
Method of take:								
ground shoot	2	16	8	3	3	7	2	0
trap	19	6(7)	6	7	5	13	8	9(0)
snare	1	1	9	4	8	11	0	7(0)
aerial gunning	1	0	0	2	4	3	0	0
unknown	0	0	0	0	0	0	0	3(3)

Compiled by R. O'Connor and J. Ernest, 1 October 1985.

[a] [b] Parentheses denote numbers which apply to Upper Kuskokwim Controlled Use Area only.
[c] Parentheses denote numbers which apply to 25D West only.
[d] Estimate from area biologist.
[e] Estimate from trapper questionnaires.
1983-84 S&I Report - wolves.

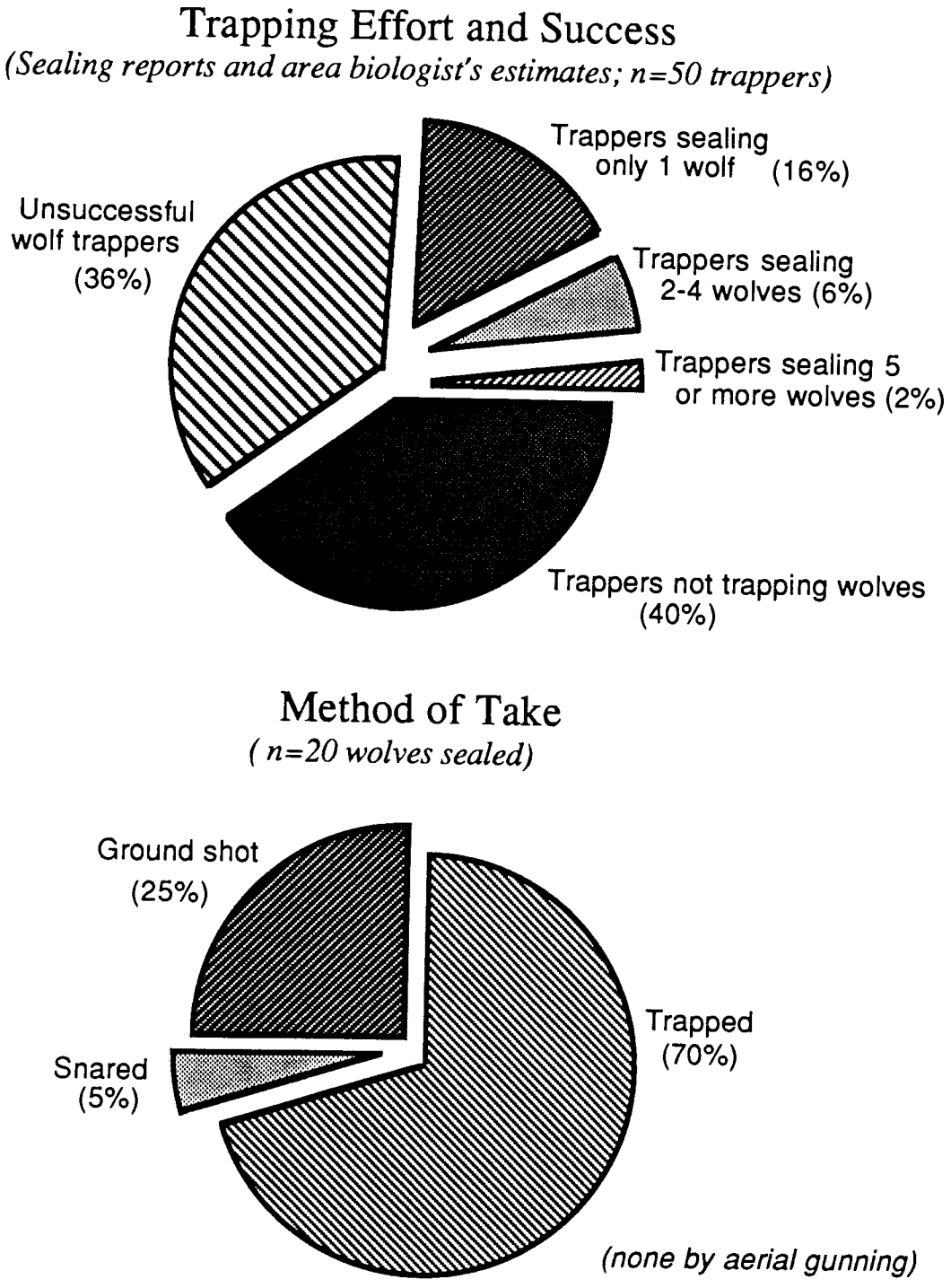

Fig. 1. Wolf trapping in Game Management Unit 12, 1984-85.

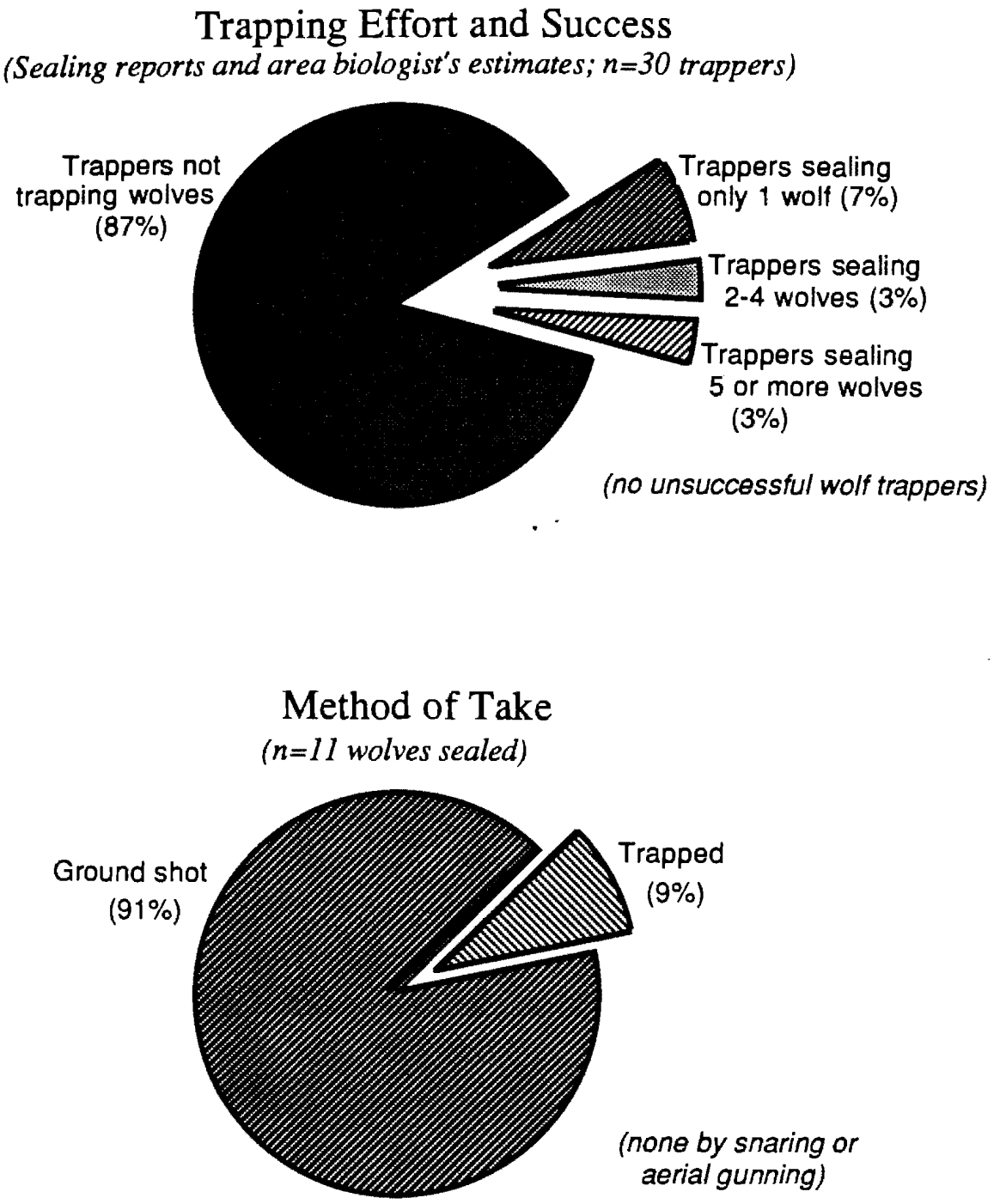

Fig. 2. Wolf trapping in Game Management Unit 19D, 1984-85.

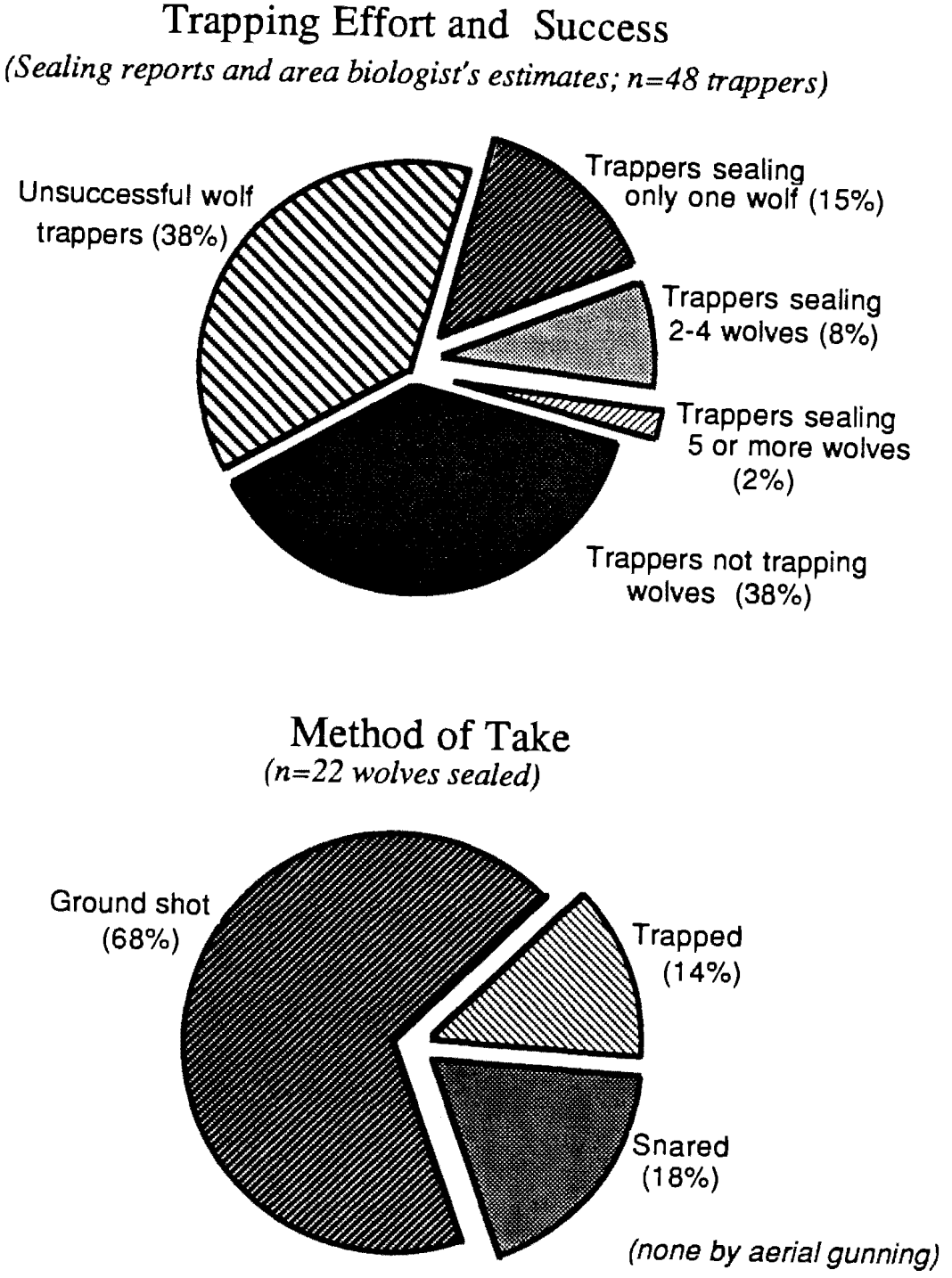

Fig. 3. Wolf trapping in Game Management Unit 20A, 1984-85.

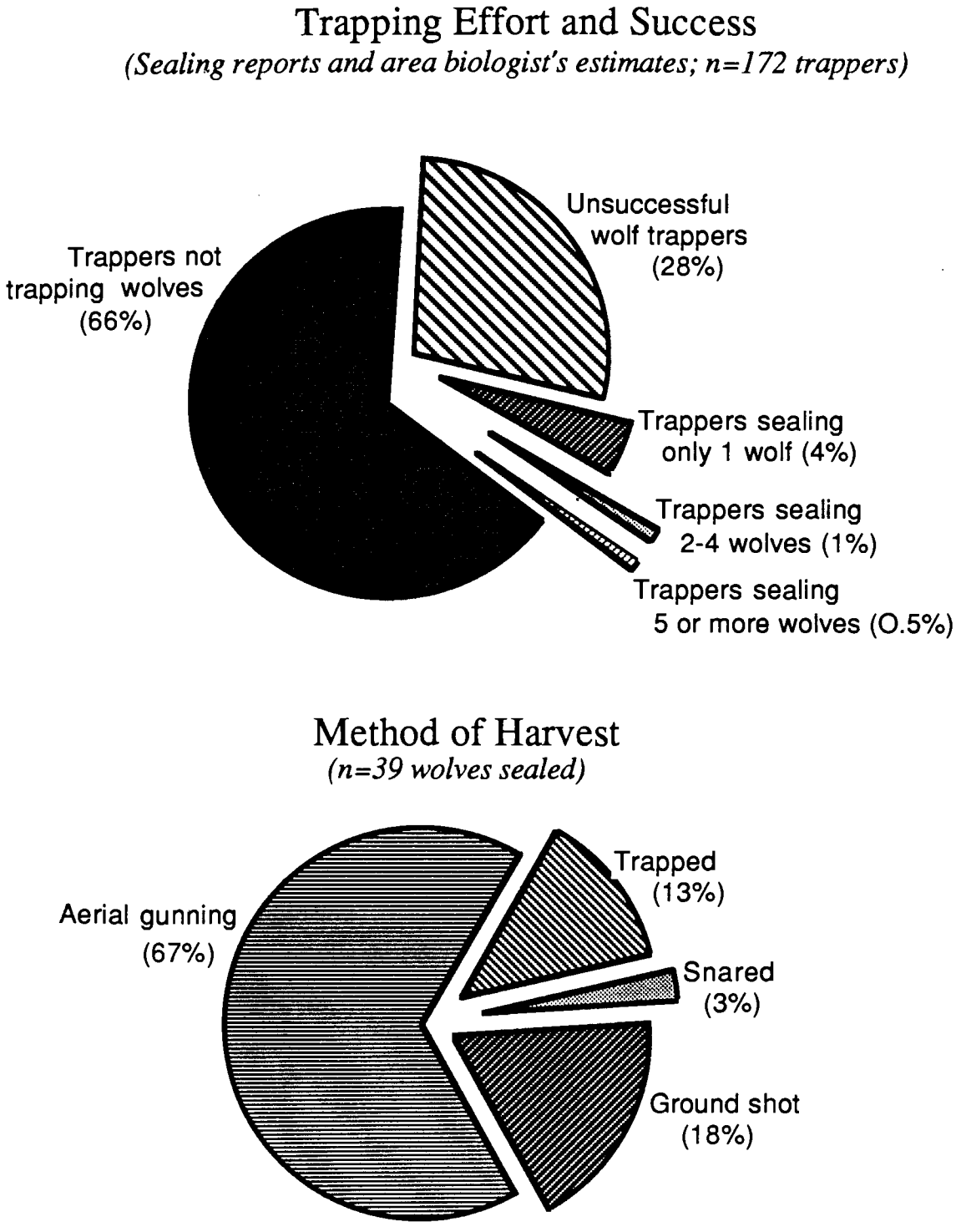

Fig. 4. Wolf trapping in Game Management Unit 20B, 1984-85.

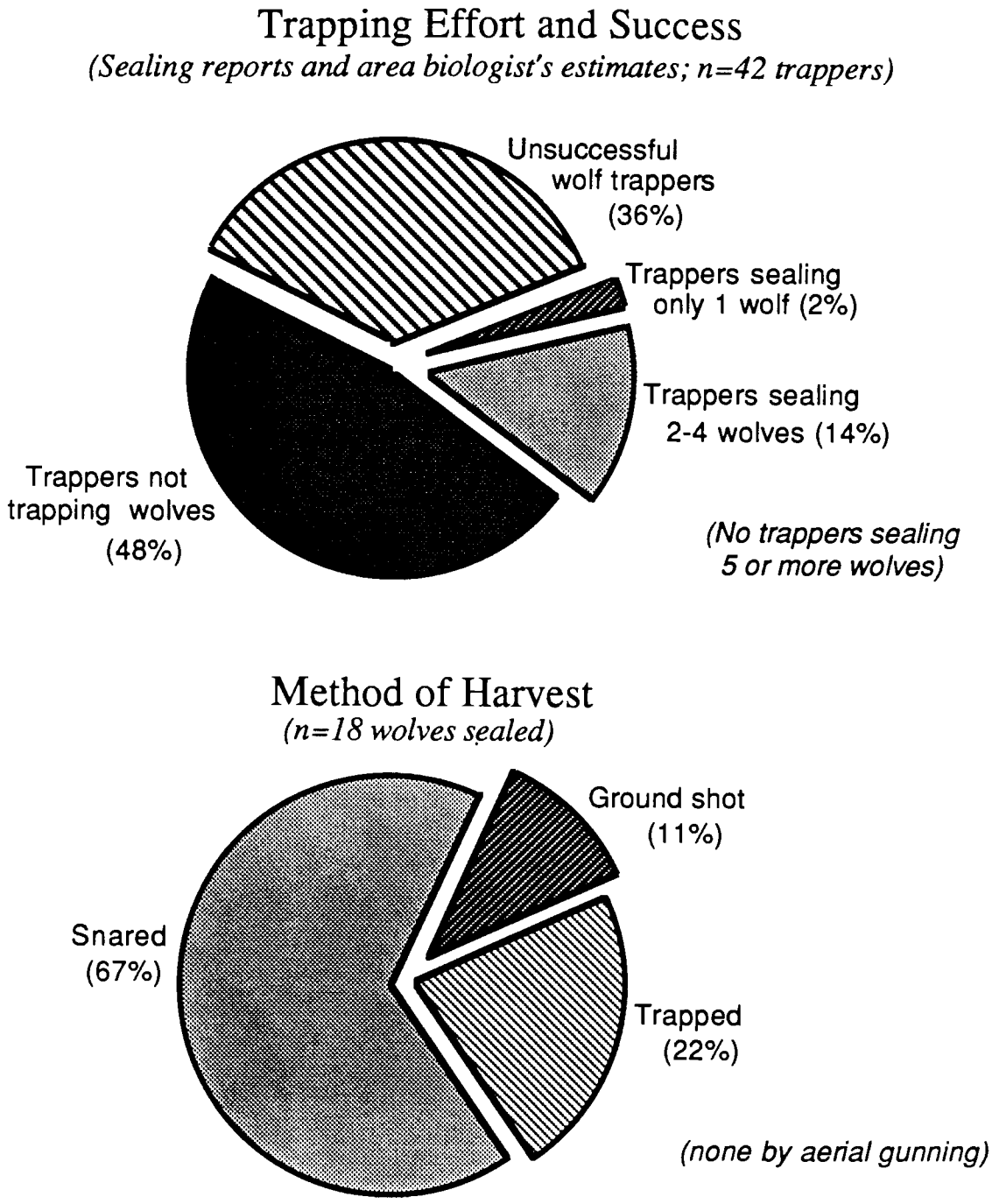

Fig. 5. Wolf trapping in Game Management Unit 20D, 1984-85.

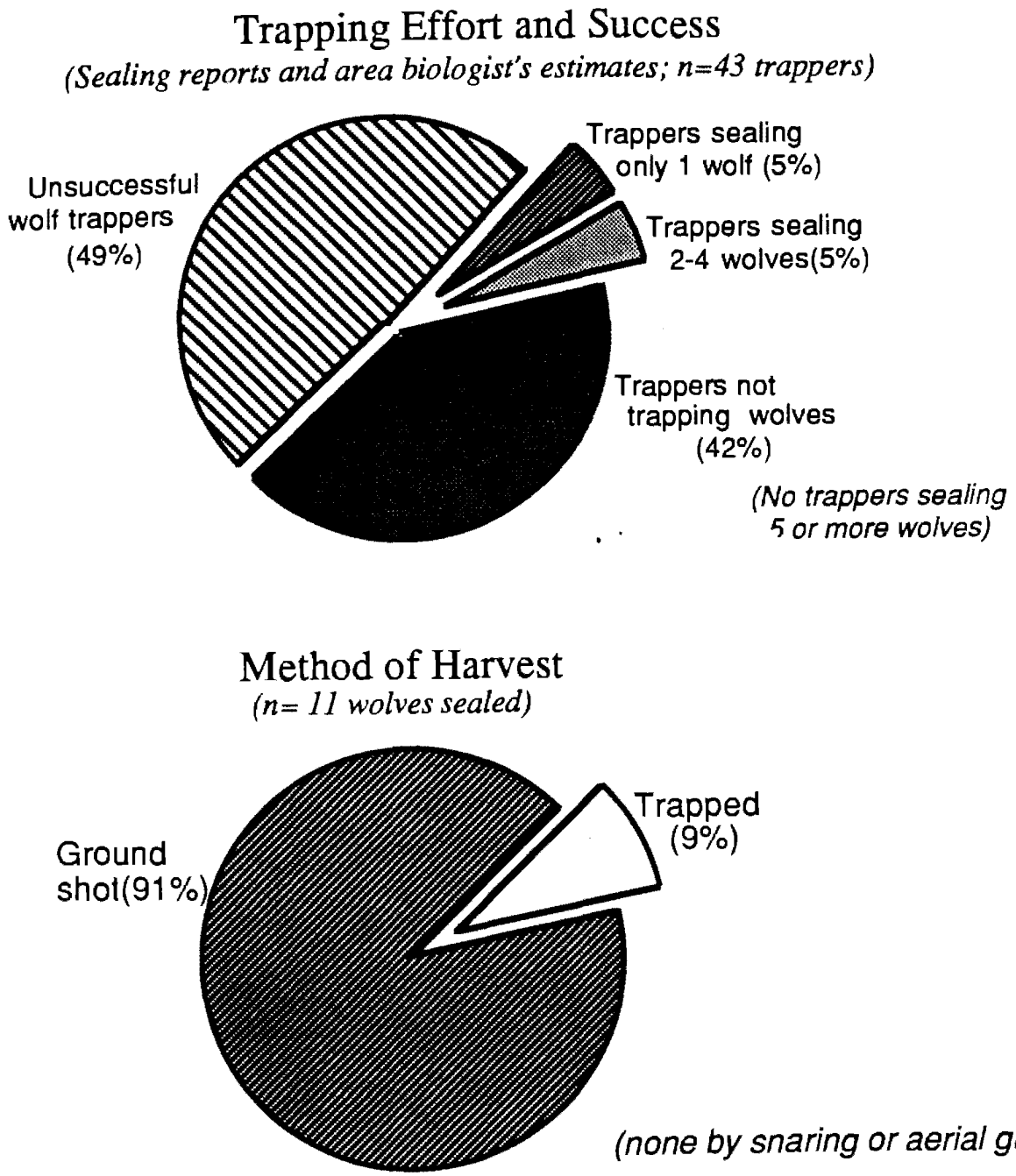

Fig. 6. Wolf trapping in Game Mangement Unit 20E, 1984-85.

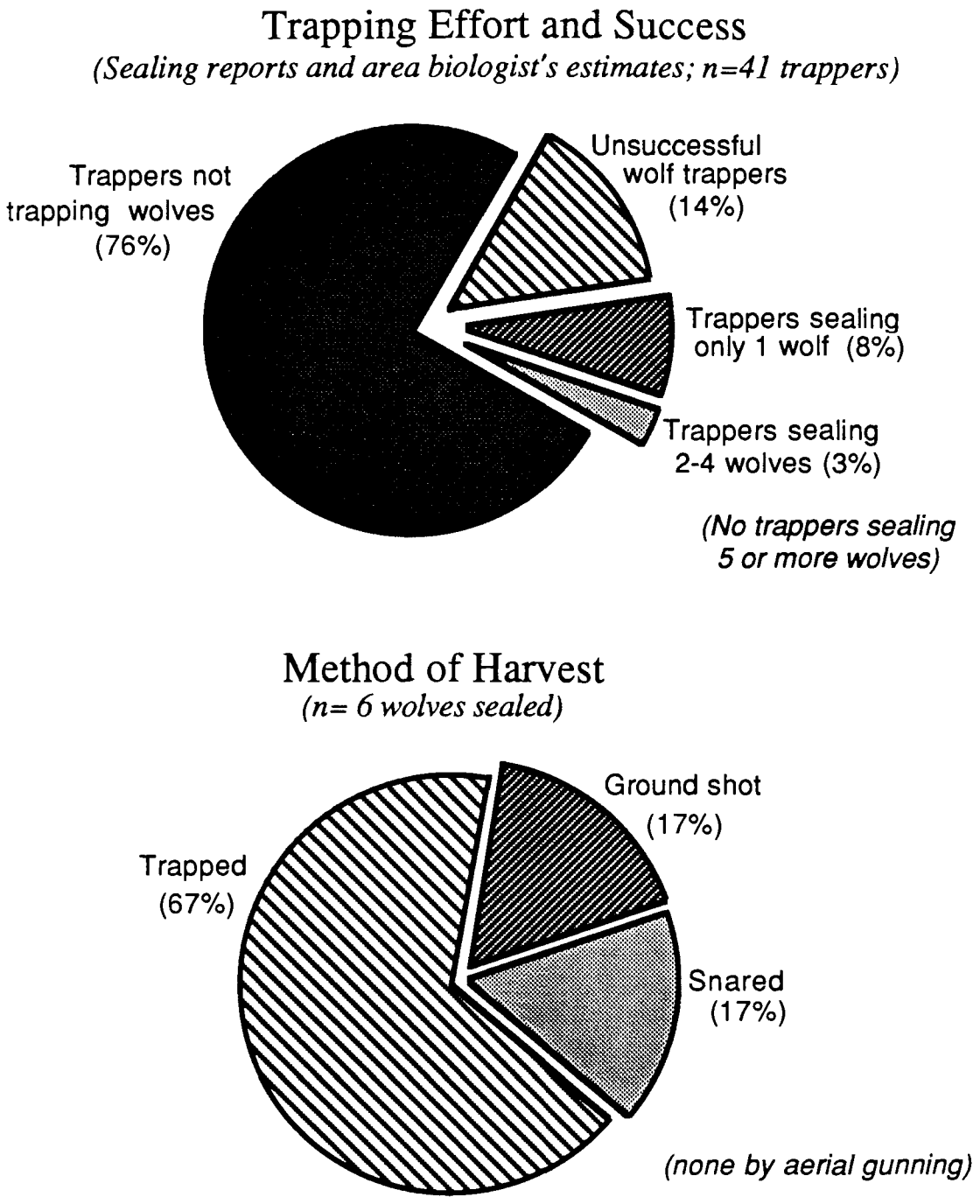

Fig. 7. Wolf trapping in Game Management Unit 21B, 1984-85.

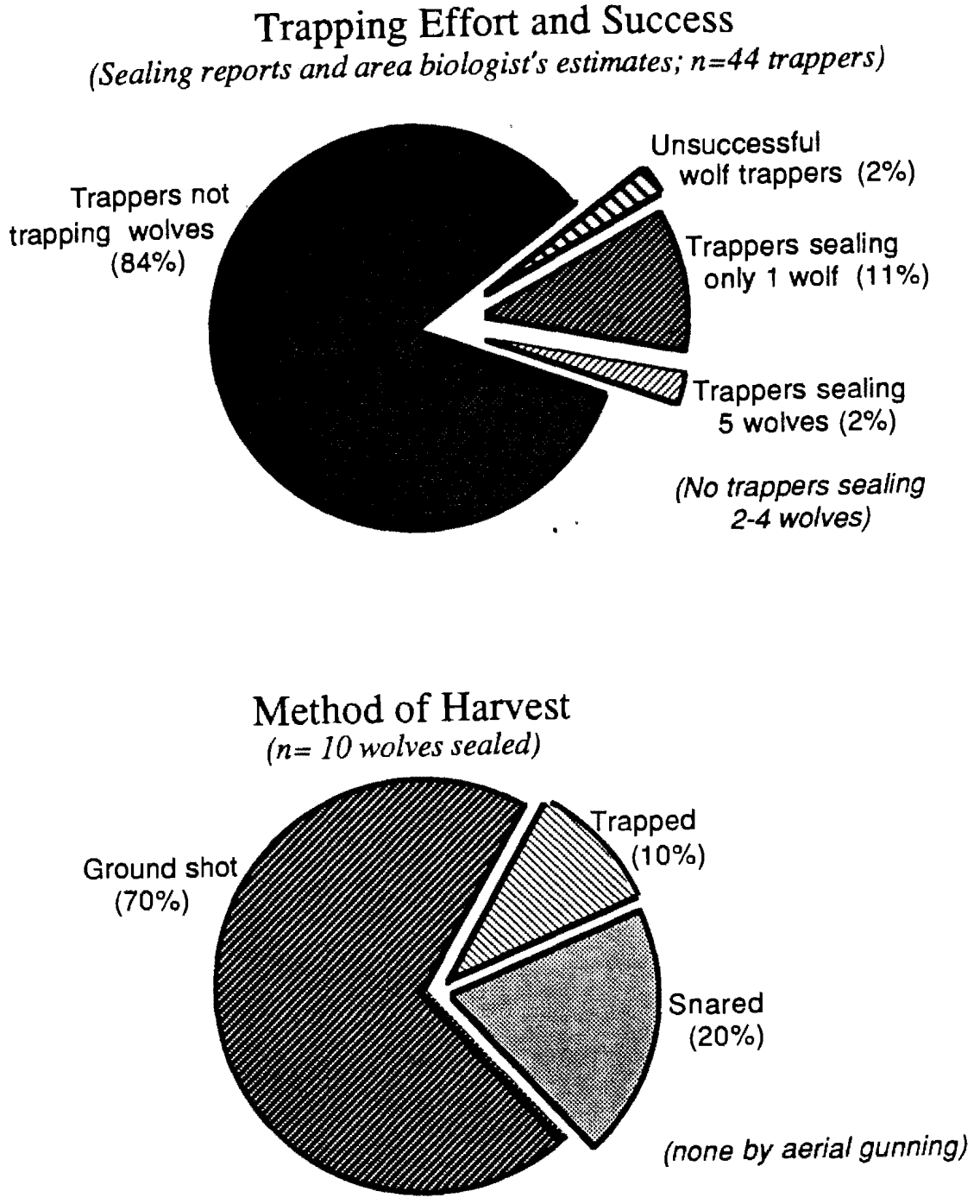

Fig. 8. Wolf trapping in GMU 25D West, 1984-85.

due to deep snow which improves both tracking and landing opportunities. Historic records of wolves trapped or shot throughout most of Alaska show great year-to-year variation. Generally, the number of wolves killed increased considerably in years of deep, prolonged snow cover.

Area biologists and Region III staff estimated the number of wolves killed but not sealed. This estimate depended upon the staff's knowledge of hunting and trapping activities in the respective units. In most units few or no unreported kills were known or suspected. In 20A and 20B, areas accessible to many people, the estimates were less certain and were larger. In these units the unreported take is probably highly variable and may depend on considerations as diverse as snow conditions, economic conditions, and the public's comprehension of current regulations.

PROGRAMS IN OTHER STATES AND PROVINCES

The board requested that we contact other jurisdictions with experience in predator control to determine methods used and results obtained. Appendix 1 contains the reports received, largely from Canadian provinces. It should be noted that information and conclusions are those of the Canadian officials. The information for these reports was derived largely from telephone interviews with biologists from the respective provincial departments.

At present there are small- or large-scale wolf predation control programs occurring in the Yukon Territory, British Columbia, Alberta, Manitoba, Saskatchewan, Ontario, and Quebec. In some areas these programs are intended to control depredations on livestock, while in others they are intended to benefit big game populations. Poison is currently being used primarily for livestock depredation control under stringent guidelines and is reportedly quite effective. Government personnel shooting wolves from helicopters has been the primary means of reducing wolf numbers in other areas. In most areas this was reported to be the only practical way to reduce wolf numbers sufficiently to accomplish management goals.

Although virtually all of the above-mentioned jurisdictions have used trapper education in an attempt to increase wolf harvests, the results have been disappointing in most cases. The lack of effectiveness is generally attributed to the low economic incentive and to the difficulty involved in successfully trapping wolves. The small number of trappers in more remote areas has made effective wolf reductions by trappers impossible. Although most jurisdictions plan to continue trapper education efforts,

and some are exploring ways of increasing the economic return for wolf trappers, it is apparent that aerial shooting, and in some areas trapping by government personnel, will be the primary means by which wolf numbers will be reduced in the future.

Black bear numbers have been or will be reduced in limited areas by various methods including foot snaring and shooting (Quebec, Manitoba), foot snaring followed by relocation (Idaho), and aerial shooting, trapping, and poisoning (Saskatchewan). In Washington and Oregon, black bear numbers are kept at low levels on private commercial forest lands by professional hunters and trappers hired by timber companies.

Attempts to reduce brown bear numbers have so far involved only liberalization of hunting regulations (Yukon). This has been largely ineffective due to low hunter interest, limited access, and difficult terrain.

ALTERNATIVES FOR WOLF CONTROL

The board requested that the department again explore the various alternatives to department-conducted aerial control. This section examines these alternatives and attempts to compare costs of each. No inference should be drawn that the department advocates any or all of the listed alternatives; no recommendations are made regarding one method over another. Where we have knowledge or experience on the probable results of a method, these are presented.

Trapper Education and Assistance

The purpose of this discussion is to explore the potential for affecting wolf management by improving trapper education and assistance. Wolves, particularly when they are not abundant, have proved to be one of the most elusive of all furbearers for Alaskan trappers. One reason for relatively low trapper harvest of wolves may be lack of the necessary skills; wolf trapping tends to be a specialty. Trapper education may therefore be effective in increasing success of trappers, just as various forms of assistance may tend to offset the economic drawbacks of wolf trapping. To the degree that such training or assistance increases public involvement and economic benefits from the resource, such programs may be considered worthwhile, even if public trapping does not fully replace the need for other management actions. It is highly unlikely, however, that increased take by public trappers will result in sufficient wolf harvests, in specific problem areas, to achieve and maintain biologically significant reductions in wolf numbers.

Trapper Distribution

For the affected units, the number of trappers in the various communities in each unit was derived from our trapper questionnaire mailout list, from sealing forms, and from estimates made by area biologists. Included are communities adjacent to affected units, if trappers from those areas trapped in the unit. Following are the number of communities and the expected number of trappers to whom a trapper education program could be delivered:

Unit	No. of communities	No. of trappers
12	4	50
19D	5	25
20A	4	48
20B	5	172
20D	2	42
20E	3	43
21B	3	41
25D West	4	37

It should be noted that trappers listed in this table are those who trap for any furbearer; the number of persons trapping wolves is less (Table 4).

Trapper Training Program

The department has developed and used a trapper education course directed toward trapping of canids. The course outline used in presenting this information and training to the public is presented in Figure 9.

Cost of Trapper Education

The department's past experience with the effects of trapper education on wolf trapping has been limited. The main instruction technique has been informal, illustrated talks to groups of trappers, given by an experienced wolf trapper currently employed by the department. The course outline is illustrated in Fig. 9. Presentations have been given in Fairbanks and Delta Junction. Several presentations have also been given to various groups in Yukon Territory at the invitation and expense of the Yukon Game Branch. The main costs of the talks in Alaska have been $200-$300 for travel and per diem and $200-$300 for wages. In addition, individual field instruction has occasionally been provided to interested trappers. Two articles on wolf trapping were published in The Alaska Trapper. These efforts were more or less an experiment to see how well the information could be conveyed and how much public interest existed. The results were encouraging.

A trapper education program, intended to increase the ability of numerous trappers to catch wolves, would require a much more systematic effort, including the means to instruct larger numbers of people efficiently. In addition to the cost of the videotape production discussed below, the principal costs would include salary, travel, per diem, and materials necessary to present workshops in communities, as discussed earlier. Additional effort would be required to reach isolated trappers with information (and possibly assistance, discussed below) since they are often proficient wolf trappers or have high potential to become proficient.

Although use of videotaped instruction should reduce the amount of personal instruction needed, it is most likely that at a minimum, one workshop should be held per year in each community where a program is in place. If all 30 communities listed were involved, a minimum of 15 weeks would be required to deliver information via workshops. Essentially, 6 months' work time would be required to carry out this part of the program, at a personnel cost of $20,000 to $25,000. Travel and per diem would add up to a similar amount, because the instructor would be traveling extensively. With the cost of equipment and materials added, the cost of delivering wolf trapping advice and assistance via workshops and associated personal contact to the areas involved would be on the order of $50,000 or more per year. If the program were implemented only in some of the units, the costs would be less, and would be in proportion to the number of communities, or locations, contacted. For example, if 50% of the communities were visited, cost of the program would probably be about $25,000. However, if the reduced effort were directed solely to remote units, allowance would have to be made for higher operating costs.

Other aids to trapper education may include the Alaska Trapper's Manual, scheduled for publishing and sale in 1986. A shorter version is due to be published by the Cooperative Extension Service in November 1985, and various other trapping instruction manuals are available commercially from trapper supply houses and, in some cases, Canadian provinces. Potential costs of supplying these materials have not been considered since they are available by purchase to interested trappers. State or private-agency purchase and distribution of appropriate literature is, however, an option.

Past department and private experience suggests that the most effective way to instruct trappers in wolf trapping techniques is to provide individual field instruction. However, this has not been considered financially feasible on a broad scale.

A Colorado private consultant in trapper education, who as a matter of interest reviewed the general trapper education needs relating to wolf management, pointed out that a similar program

in Colorado involving coyotes cost about $35,000, but was supplemented by considerable volunteer assistance and supported in part by agencies and institutions. He also ventured the opinion that Alaska may be looking at a minimum of $100,000 annually for a general trapper education program.

While trapping instruction is a valuable introduction to the subject of catching wolves, it is well to bear in mind the limited success of this approach in Canadian provinces (discussed earlier in this report). Also, there is almost certainly a need for direct transfer of information on wolf distribution, movements, and kill sites from the department to trappers if they are to substantially increase their effectiveness in catching wolves. Considering the collective experience of Canadian provinces with trapper education in relation to wolf management, and considering the practical matters affecting wolf trapping in Alaska, caution is urged in expectations of the effectiveness of trapper education and assistance as a means of managing moose:wolf relationships in the areas under review.

Costs of Trapper Assistance

Depending on the type or amount of assistance provided to trappers, costs may be significant. A basic requirement of any program to manage wolves (whether by trapping, aerial control, or other methods) is to obtain current data on wolves and their ungulate prey; the same amount and kind of data are needed for all programs. An initial aerial survey of wolves to determine minimum numbers of wolves and packs present will cost approximately $1 per square mile surveyed. Radio-collaring (2 wolves/pack) costs approximately $1,000 per wolf. Wolf survey flights to monitor location, numbers, travel, and biological data will cost $500-$900 per flight ($125/hr in a Super Cub).

We estimate that the biological and trapper assistance costs of conducting the Unit 25D West project to be $40,000 for the first year, with $26,000 annual costs thereafter. Costs for similar programs in the other affected units would vary from these figures; we could anticipate that programs in Units 20A, 20B, 20D, 20E, and 12 would be somewhat less expensive, although not significantly so. Programs in Units 21B and 19D would be more expensive because of the higher logistics costs involved.

Without knowing which options for trapper assistance or subsidy may be authorized, it is difficult to accurately predict total costs of a program. If private trappers were provided with snares, for example, costs for snares (at about $10 per snare) would probably run $3,000-4,000 per project, per year. Providing wolf traps would cost approximately $100 per trap. A provision for subsidy by way of bounties might increase project costs significantly, because bounties would probably have to be $300 or more per wolf to be effective.

Video Production

In 1983, production was begun on an instructional videotape about trapping foxes, coyotes, and wolves. When completed, the videotape will be used in conjunction with trapper education programs and will be available to teachers, schools, and organizations. The possibility of airing the program over the satellite network is being researched and will depend upon the finished length and quality of the videotape and availability of air time. Work on the videotape was discontinued in fall 1984 due to inadequate funds.

It is the department's intent to complete production of the trapper education video program in 1986. A schedule and list of costs for this effort are detailed in Table 6.

In summer 1985, the best of the videotape footage was reviewed by Region III Game staff to determine the adequacy of content. The original script was rewritten in October 1985. Videotaped footage will be used of different trap sets taken in Tok by the department's Public Communications Section (PCS) in fall, 1983. In addition, negotiations are underway to purchase rights to privately-produced film footage of wolf, coyote, and red fox. Such footage would be extremely difficult or prohibitively expensive for the department to videotape. A list of additional video scenes, such as shots of various traps, snares, and set diagrams, has been compiled and will be produced in a studio by PCS. Graphics are being prepared by staff.

After approval of the script, the narration will be recorded in Fairbanks at the University of Alaska's KUAC studio. Game Division staff will provide technical assistance. The staff will choose video footage to appear over the voice track and will create a "story board" to aid the final production.

A television production studio will be rented in Juneau to produce and record credits, and to electronically edit and assemble the videotape. The PCS videographer will provide necessary technical expertise.

Game staff members responsible for the content and accuracy of the script will assist with the final editing. In this way, attention can be paid to the finer points of trapping techniques displayed in the video and provide the most authoritative final product.

Once completed, the videotape will be duplicated and made available to the public. Costs will depend upon finished length of the product and the number of duplicate videotapes to be made. For this report, we have assumed the videotape will be about 45 minutes in length and that 6 copies will be made.

Table 6. Tentative schedule and list of expenses, trapper education video.

Time	Action	Costs
October 1985	Staff completes graphics for technical shots.	$50 (materials)
October 1985	Rights to usage of wolf, fox, coyote footage arranged and obtained.	$1,000 - $3,000
November 1985	Second draft of script completed with "story board."	
November 1985	Script approved and recorded at KUAC; 4 hrs @ $24/hr plus $34 recording tape.	$130
December 1985	Materials collected for technical shots and credits.	
January 1986	Two Game staff to Juneau for 1 week with all raw materials for final shots and editing.	≅$900 (travel) $1,000 (per diem)
January 1986	Editing (30 hrs studio rental @ $100/hr) (3/4' videotape blanks).	$3,000 + $200 (materials)
January 1986	Duplicating videotapes (4.5 hrs studio rental @ $100/hr plus 6 3/4" videotape blanks).	$450 + $150
		TOTAL: $ 6,880 - $8,880

Figure 9. Outline of wolf trapper education program.

A. INTRODUCTION
   1. Wolf Characteristics Related to Trapping
      a. senses
      b. wariness
      c. social behavior
   2. Wolf Trapping Problems
      a. large, strong traps and snares (expensive)
      b. cleanliness (odors)

B. PRESEASON PREPARATION
   1. Equipment Selection
      a. merits and drawbacks of traps and snares
      b. strong trapwire
      c. light snare suspension wire
      d. grapples, drags
      e. clean, cotton gloves
      f. waxed paper trap covering
      g. bait
   2. Equipment Preparation
      a. trap chain extension
      b. degreasing and boiling (deodorizing)
      c. airing and clean storage
   3. Wolf Set Selection
      a. well-used travel routes
      b. natural kills
      c. artificial bait stations

C. TRAP AND SNARE SETS
   1. Trap Sets
      a. cleanliness
      b. drag construction/solid ties
      c. trap covering
      d. trail sets
      e. track sets
   2. Snare Sets
      a. selection of snarable set location
      b. cleanliness
      c. combining snares for length
      d. placement pattern/multiple snares
         i. natural kills
         ii. artificial baits
      e. mechanics of setting/securing snares
         i. hoop size
         ii. hoop height
         iii. snowproofing
   3. Combination Trap/Multiple Snare Sets
      a. natural kills
      b. artificial baits
      c. philosophy of multiple catches

Figure 9. Continued.

D. MISCELLANEOUS HINTS/TIPS
   1. Clean Transport of Traps/Snares
      a. plastic garbage bags
      b. separation from bait, fuel
   2. Access Modes
      a. snowshoes
      b. dogteams
      c. snowmobiles
      d. highway vehicles
      e. aircraft
   3. Set Tips
      a. guide and stepping sticks
      b. head lift sticks
      c. setting dips in straight trail
      d. long distance set checking
   4. Marketing Tips
      a. pelting/fleshing/handling
      b. local buyers, auctions, taxidermists

Habitat Enhancement, Including Fire Management, as an Alternative for Wolf Control

Previous reports, implementation plans, and issue papers have addressed the importance of habitat management in managing moose and caribou populations. Moose numbers throughout the Interior are currently very low compared to population levels in the 1960's.

There is little conclusive evidence to indicate that moose populations were limited by their habitat when they were at higher levels. However, high moose density and reduced browse availability probably contributed to the extensive die-off during the severe winter of 1965-66 (Bishop and Rausch 1974). Studies have documented that moose more discernibly affected the habitat in the 1960's, and it was inevitable that the condition of the habitat would have limited many moose populations had they continued to increase.

Currently, moose population levels in the subject areas are not limited by the quantity and quality of the habitat. As a corollary, modification of the habitat would not necessarily improve survival of adult or calf moose significantly. Habitat improvement will increase the carrying capacity of an area, but will not increase the moose population if other factors are limiting. Nevertheless, a continuing program to improve habitat, using appropriate techniques for the various situations, is essential to sustain moderate or high moose numbers in the long term.

Fire Management as a Habitat Management Tool:

Over the long term, wildfire management has the greatest potential impact of any moose habitat manipulation/improvement technique, particularly in more remote areas in interior Alaska. A long history of wildfire suppression has resulted in long-term, gradual deterioration of the quality and quantity of moose habitat. Recent formulation of fire management plans which allow for a "let-burn" policy in certain areas and under certain circumstances provide the means whereby an increasing amount of habitat may be returned to a productive state. Fire management plans now are in force for much of the state.

As human input--cabins, agriculture, other developments--extend more widely into remote areas, the amount of land on which wildfire may be allowed to burn unchecked will inevitably diminish. As this occurs, the use of prescribed burns will become more important. The cooperative work between this department, other state agencies, private landowners, and the Bureau of Land Management (BLM) in managing fires will then become even more important. For a more detailed discussion of fire management in interior Alaska, refer to Appendix 2.

Fire may produce varying results, depending on intensity of burning, vegetation present, time of burning, and other factors. In an effort to better understand fire ecology, the department has conducted research on two recent fires in the Interior.

Blair Lakes Burn: A wildfire on the Tanana Flats approximately 40 miles south of Fairbanks burned 250,000 acres in 1980. The original habitat included herbaceous bog, low shrub, tall shrub, deciduous forest, and white and black spruce forests. Extensive stands of mature spruce, birch, and aspen forests had resulted in poor moose habitat in some areas.

The intensity of the burn varied from light to heavy. In areas of light burn, where either willows or aspen were originally present, suckers have rapidly sprouted and moose have moved in and heavily browsed these plants during the first 5 years after the fire. Browse availability in these lightly burned areas will be excellent for the next 15 years.

There has been little moose browsing in the more heavily-burned areas. In these areas the revegetation of browse species is much slower, dependent upon the original vegetation and availability of seeds and other reproductive materials. A heavy burn in spruce forests will not likely produce sufficient moose browse until after at least ten years. A heavy burn in aspen or birch could produce sufficient browse to support a larger moose population than that which is currently present.

Rosie Creek Burn: A wildfire during late May and early June 1983 burned over 8,600 acres in the Rosie Creek and Bonanza Creek areas approximately 25 miles southwest of Fairbanks. Ten acres in the burn were selected for intensive survey to determine browse availability, and use of certain plant species important for moose, after the fire. The study sites included light and heavily-burned areas in aspen, birch, and black and white spruce.

The fire has stimulated vigorous sprouting in the more lightly burned areas. Moose have moved into areas where aspen, birch, and willows have quickly sprouted from surviving roots. These areas should provide good moose habitat for the next 20 years or until the plants grow out of reach.

In all heavily-burned areas sprouting is much slower and good moose habitat will not be present for several years. In one heavily-burned black spruce area, birch and aspen seedlings are only a few inches tall. In a heavily-burned white spruce area, a few surviving aspen roots produced suckers up to 2-1/2 feet tall, most of which had not been browsed. Any heavy burn in a coniferous forest will likely change the plant community, and availability of browse species will be dependent upon the seed sources, other reproductive materials, and site conditions.

Extensive areas in the Rosie Creek Burn are being logged, and are being replanted in white spruce. Available moose browse will be very limited in these areas.

Costs of Habitat Improvement:

The department's recent experiences in moose habitat enhancement will illustrate that costs and effectiveness may vary by area and by techniques used. These projects have been, or are being, accomplished in Tok, Delta Junction, the Kenai Peninsula, and the Palmer area.

Crushing of vegetation is a habitat management technique which may be used in areas where prescribed fires are not possible. It has been used successfully in the Tok area. One hundred acres of decadent willows were crushed the first year and 300-400 acres the second year. The total cost of the crushing program to date is $23,000. The crushing program made browse immediately available during winter by bringing the edible tips within the reach of moose. The following growing season produced thousands of new willow sprouts available for browse. One and a half years after crushing, the new willows were 7-1/2 feet tall and provided an estimated 1,000 lbs of browse per acre.

On the Delta Bison Range, $90,213 (at $95 per acre) has been spent on clearcutting a mature black spruce forest, with the primary purpose to benefit bison by increasing usable habitat. More work needs to be done in cleanup work and the price is expected to run $125 per acre. These figures include surveying, chaining, and breaking. The objective is to produce native grasses to supplement those being planted. Selective cutting is being planned by the State Division of Forestry. Two sales are planned for commercial timber cutting of white spruce. Eighteen acres will be selectively cut in white spruce which have a dbh of 10 inches or greater. Thirty-five acres will be selectively cut in white spruce which have a dbh of 6-9 inches. Plans have also been developed on the Bison Range for a prescribed burn of 1,000 acres in black spruce. To date, $17,000 has been spent on that project. Another $20,000 is expected to be spent next year when, hopefully, the area will be burned. This prescribed fire is designed to create bison and moose habitat by returning the area to an early successional stage consisting of grasses, forbs, and young deciduous shrubs and trees.

Mechanical crushing of trees was initiated on the Kenai National Wildlife Refuge in late 1983. The purpose was to increase the area's capacity to support wintering moose by annually manipulating 2,000-3,000 acres of habitat through tree crushing and then burning the crushed areas where possible and practical. Treatment of up to 50,000 acres is planned over a 20-year period. Forage productivity and moose carrying capacity are greatly

enhanced in crushed areas for up to 25 years after treatment, with maximum moose use occurring 11-15 years after treatment. Based on a 25-year period, carrying capacity for moose will be at least 400% greater in crushed areas versus uncrushed areas of certain timber types. Moose numbers are expected to increase because, in that area, food apparently limits moose numbers. In 1983, 1,721 acres were treated at a cost of $67 per acre, for a total of $115,307. In 1984, 1,600 acres were treated at a cost of $35 per acre, for a total of $56,000.

In the Moose Creek Management Area of the Matanuska Valley, the habitat management objective is to continuously maintain 3,000-5,000 acres of early successional deciduous vegetation suitable for winter moose range. Since 1983, $10,000 has been spent to "chain" 150 acres of timber. Seventy-five acres of previously cut areas were scarified at a cost of $2,600. Access trails for timber harvest by the public were made at a cost of $4,400. One mile of trail costs approximately $1,500, which results in approximately 80 acres of cleared land at approximately $19 per acre. Scarification costs approximately $35 per acre. Rehabilitation costs on Moose Creek average approximately $55 per acre. In FY85, $20,000 was allocated and used for trail construction.

Habitat Conditions in Proposed Areas:

Habitat conditions in the units under consideration are discussed below and summarized in Table 7.

Habitat conditions in Unit 12: Between 35% and 40% of Unit 12 is not considered suitable habitat for moose due to its high, rocky nature. However, of the remaining area, only 10% or so should be considered "poor" due to its forested nature. Thus, 50% of Unit 12 is considered good moose habitat characterized by subalpine shrub communities, riparian willow stands, and other mixed habitats in various successional stages. Under the present plan (Alaska Fire Management Plan: Fortymile Planning Area), prospects for improved moose habitat conditions are bright. In 1983, the 45,000-acre Kennebec Fire in the Northway-Tetlin Flats area was initially allowed to burn under terms of the plan and converted much black spruce forest to a mosaic of herbaceous and deciduous vegetation types. In the Tok River moose winter range, the only lowland areas where browse-use rates were unacceptably and chronically high, mechanical crushing of 400 acres of overmature browse plants in 1982 and 1984 will produce an additional estimated 800,000-1,000,000 pounds of browse annually after 1985. Unit 12 could easily support twice the number of moose that it presently supports without adversely affecting the habitat.

Table 7. Moose habitat conditions in proposed wolf management areas.

Area	Percent good habitat	Percent moderate habitat	Percent poor habitat	Percent non moose habitat
12	30	20	10	40
19D	15	25	50*	10
20A	20	20	30	30
20B	5	45	45*	5
20D	15	35	30*	20
20E	30	20	30	20
21B	45	5	45*	5
25D West	25	30	40*	5

* Recent absence of wildfires has allowed degeneration of "good" and "moderate" habitat to poor category. Habitat improvement could shift large areas into the good and moderate categories.

Habitat conditions in Unit 19D: Much of the moose habitat in Unit 19D is under-utilized; this was particularly evident this summer following last winter's concentration of moose along major rivers from late December through early May because of the deep snows over most of the subunit. After checking numerous willow stands where moose were concentrated during winter, we were unable to detect any long-term damage to the willows. Most of the willows are under-used and growing to heights where they are no longer available as moose browse, which may constitute a greater problem than overuse.

Previous, extensive, McGrath-based fire-control efforts have resulted in relatively few areas in secondary successional stages. Although moose utilize these old burns, most areas appear under-used.

A more enlightened fire policy which will result in more natural fires being allowed to burn is now being followed. In Unit 19D, approximately 15% of the area is good moose habitat, 25% moderate habitat, and 60% poor habitat, mostly dense black or white spruce stands.

Habitat conditions in Unit 20A: Habitat conditions in Unit 20A were described by Gasaway et al. (1983) as a mosaic of shrub, young forest, climax bog, and mature black spruce on the lowlands, with spruce/birch/aspen forests grading into subalpine shrub communities with increasing elevation. Habitat conditions have not changed significantly since that time; we estimate that the present habitat could support at least 50% more moose than the present population.

Habitat conditions in Unit 20B: Extensive wildfire in the 1950's resulted in vastly improved browse conditions during the 1960's. Moose reached peak populations in this subunit in approximately 1965 and the impact of browsing on moose habitat was much greater than it is now. Browse usage was extremely light during the mid-1970's, reflecting the low populations of moose. Browse availability is not a limiting factor at this time, even though unit-wide the habitat is still degenerating due to previous fire suppression policies. Numerous small fires have occurred in the past 10-15 years, but the overall effect has probably not offset the general long-term reduction in carrying capacity.

The subalpine brush fields, riparian willow stands, recently burned uplands, and mixed habitats in various successional stages (5%) compose good moose habitat. The old-age black spruce, black spruce bogs, and alpine tundra (45%) are poor habitat. Older age deciduous forest and mixed deciduous forest (45%) are moderate quality habitat and compose a large percentage of the moose habitat. Fire or other processes could return vast amounts of moderate habitat to good habitat in only a few years.

Habitat conditions in Unit 20D: Moose habitat types in Unit 20D north of the Tanana River are similar to those in Units 20B and 20E. There have been far fewer areas burned in Unit 20D since the late 1950's than in Units 20B and 20E.

The north slopes of the Alaska Range in Unit 20D are similar in composition to the moose habitat described in Unit 12 and Unit 20A.

Habitat conditions in Unit 20E: Game Management Unit 20E encompasses approximately 11,000 mi^2 or roughly 7,000,000 acres in extreme eastern interior Alaska. It is drained by the Yukon, Charley, Fortymile, Seventymile, and Ladue River drainages. The topography is predominantly gently-rolling hills and valleys with most higher mountains in the northwestern portion of the area.

The area has had an active wildfire history with the 1912 Mosquito Flats fire (900,000 acres), the Yukon fire (400-500,000 acres), the Chicken fire (225,000 acres), and the Ladue fire (125,000 acres). All of these burns have produced good-to-excellent seral habitats for moose. Subalpine brush fields and tall, riparian stands of willow provide more stable seasonal habitats of excellent quality for moose. With the implementation of the Fortymile Interim Fire Management Plan in 1978 and the new Alaska Interagency Fire Management Plan: Fortymile Planning Area in 1983, approximately 60-70% of the area is experiencing a near-natural wildfire regime, ensuring that fire will maintain a productive seral habitat mosaic in the future.

Approximately 20% of the unit is alpine tundra or rocks and cannot be considered moose habitat. Approximately 30% of the unit is covered by old-age black spruce forest which is poor moose habitat. Of the remainder, 20% is moderately productive of moose browse and 30% is good-to-excellent moose habitat. Access for hunting (rivers, airstrips, and old fire trails) is greatest in those areas considered to be moderate-to-excellent moose habitat. Browse-use data indicate that moose are so scarce in the unit that less than 5% of available preferred species of willows is being used each year.

Habitat conditions in Unit 21B: Game Management Unit 21B is approximately 5,200 square miles, located along the Yukon River between Ruby and Tanana. The Nowitna River up to the Little Mud River and the Sulatna River up to the Ruby-Poorman Road are the main drainages. Smaller creeks drain the north bank of the Yukon River; Blind River and Boney Creek on the south bank of the Yukon are included in the subunit. The topography is mainly lowland alluvial river meanders with gently sloping forested hills south of the Yukon. The north bank of the Yukon is a steep escarpment terminating in alpine hills.

Approximately 5% of the unit is alpine tundra; 45% is white spruce meander forests with a successional mosaic of oxbow lakes, grass meadows with surrounding willow communities, cottonwood stands, and mature white spruce forests. The other 50% is composed of black spruce-bog lake habitat and drier black spruce on the sloping hills. The white spruce meander forest areas are excellent moose habitat supplying browse and protective cover. Black spruce areas are poor moose habitats except after fires; the resulting revegetation is often dominated by white birch.

Habitat conditions in Unit 25D West: Unit 25D West is composed largely of the Yukon Flats, bounded by well-drained uplands on the north and the west and the White Mountains on the south. The major vegetative cover types are: open water, wet meadows which occupy approximately 10% of the area, riparian willow (approximately 10%), shrub (approximately 5%), and deciduous forest (approximately 10%). Mixed deciduous forest and spruce forest is approximately 20%. Spruce forest is approximately 40%, and alpine tundra composes approximately 5% of the area. Riparian willow, shrub lands, and open water/wet meadows are good habitat. The older deciduous forest and mixed deciduous spruce forest are moderate-quality habitats. Old-age spruce, particularly black spruce and alpine tundra, compose the largest percentage of the area, and they are very poor-quality habitat.

Approximately 150 fire starts have been recorded over the last 30 years in this area. If these fires had been allowed to burn naturally, the percentage of moose habitat in the "good" category would be much higher in this subunit. A recently approved fire management plan for this area classifies approximately 80% of the area in categories other than full fire protection. The long-term potential for improving the moose habitat in this area is very good. Recent browse-use studies indicate that only 5-10% of the browse supply is currently being used.

Wolf Relocation

As an alternative to lethal methods of reducing wolf numbers, one goal of a wolf relocation effort should be to move wolves to an area where they will have a good chance of survival. Because packs are necessary for the survival of wolf populations, particularly in areas such as Alaska where wolves must rely primarily on large prey, a relocation effort should seek to maintain pack cohesiveness. Wolves often aggressively defend their home ranges against other wolves, so a release site should have few or no resident wolves. At the same time, the general area should provide adequate prey populations that can sustain additional predation. In addition, the type of prey should be similar to that in the original range so that a lengthy period of learning to successfully hunt a new type of prey is not required. Such a relocation would also have to be acceptable to local people.

Potential Areas for Relocation:

If an attempt is made to relocate wolves, the area would, ideally, have a low wolf density, prey types similar to the original area, and prey populations that could sustain additional predation. Areas within Alaska that currently have low wolf density relative to prey population status are limited to the North Slope, possibly the southern portions of the Brooks Range, possibly a few islands in southeastern Alaska, and one area in the Aleutian chain. In the northern areas the Western Arctic and Porcupine Caribou Herds have high populations and currently exist with wolf populations that are at moderate or low density. The lowest wolf densities exist in the western half of the North Slope. Although caribou populations are doing well in these areas, and could sustain additional predation, the status of moose and sheep is not as well known and research would be needed to determine what effects additional predation would have on these species.

Although the North Slope does have low densities of wolves, relocating wolves from interior Alaska to this area would demand a major adaptation on the part of the wolves. The most abundant prey in this area is migratory caribou. To rely on these animals as prey, it is often necessary for wolves to undertake seasonal movements outside their home range. It is generally unnecessary for wolves in the remainder of Alaska to use this strategy. Combined with the drastically different terrain and vegetation in this area, it is unlikely that Interior wolves transplanted to the North Slope would remain there for long, as discussed below.

Permanence of Transplants:

The results of limited studies in Minnesota, Michigan, and Alaska show that virtually all translocated wolves move considerable distances after they are released. The direction of travel is generally toward the area in which the wolves originated, suggesting that wolves have some homing ability. Wolves commonly move 50-200 miles from release sites. In addition, wolves that are captured and released together rarely stay together after release. The latter problem might be solved to some extent by holding the wolves in a pen at the release site for perhaps several weeks so they could adjust somewhat to their new surroundings. This would require that a secure fenced area be constructed at each release site and that personnel be available to look after the wolves during this period. Unless several enclosures were available, it would also lengthen the time required for a large number of animals to be released.

Based on the results of previous relocation efforts, it is probable that wolves relocated in Alaska would disperse considerable distances from any release site. Although the probability

of wolves returning to their original home is fairly small if they are moved a long distance (200 miles or more), it is likely the wolves would end up scattered and some distance from the release site in the general direction of their original home range.

Cost of Relocation:

To derive a gross cost estimate for relocating a number of wolves, we assumed a hypothetical example in which 50 wolves are to be captured in an area reasonably close to logistical support (e.g., Unit 20B) and released at a site 300 miles distant.

The cost of using helicopters to locate wolves for immobilization (the only practical way to capture large numbers of wolves in Alaska) has ranged in recent years from $500 to $1,000 per wolf. Because areas where wolf predation control has been recently considered are characterized by relatively dense cover, and because the goal of a predation control program makes it desirable to remove most or all members of each pack (rather than simply capturing 1-3 members for radio-collaring), the cost per wolf in a relocation effort would probably be $1,000 or higher. This and other estimated costs are listed below.

Activity	Cost	Comments
Capture 50 wolves	$50,000	Estimated cost of $1,000 per wolf, largely for fixed-wing and helicopter charter.
Transport wolves by helicopter to fixed-wing landing area.	8,750	Assumes an average of 30 min ($175) of helicopter time per wolf.
Transport wolves 300 miles to release site.		Assumes 8 wolves per trip.
(with State-owned Beaver aircraft)	4,935	
(with chartered Cessna 206)	6,300	
Total	$63,685-$65,050	

The cost of wolf relocation would vary, depending on the area from which wolves were taken. For example, costs to conduct such

an operation in Unit 19D would probably be at least 50% more than the figures cited above, due to the greatly increased cost of helicopter ferry and "down" time, added personnel costs, and other operating costs.

If rudimentary holding facilities were determined necessary and were built at the release site, an additional cost of perhaps $2,000-$5,000 per site would be added for materials and transportation. Because a relocation effort of this type has never been carried out under conditions like those in Alaska, results of any efforts should be monitored. Keeping track of relocation results would entail radio-collaring a number of the released wolves and monitoring their movements. Using the above example involving the relocation of 50 wolves, it would probably be necessary to radio-collar at least 25 of the 50 and ear-tag the rest. This effort would cost approximately $7,500 for equipment (25 collars at $300). If the wolves were aerially located every 2 weeks for 6 months, the cost would be approximately $12,000 (12 flights at $1,000) if the release occurred in a remote area in northern Alaska. Thus, a monitoring program would require approximately $19,500 for the first year.

None of the above costs include personnel costs. Compared with previous wolf reduction efforts, the major additional personnel requirements would be those entailed by handling and tending wolves during transport and release, constructing temporary holding facilities, and monitoring the results of the relocation effort.

In summary, we could expect that a program to translocate 50 wolves from a control area reasonably near Fairbanks to a location 300+ miles away would cost approximately $85,000 for the first year's effort, including follow-up monitoring.

Season Adjustments

Adjustment of the seasons for hunting or trapping wolves has been suggested as an alternative to aerial wolf control, or as one element of a program to increase public take of wolves.

Present trapping season for wolves in affected areas:
Units 12 and 20E - October 1-April 30
Units 19, 20A, 20B, 21B, 25D - November 1-March 31

Hunting season for wolves in affected areas:
Units 19, 20A, 20B, 21B, and 25D - August 10-April 30

Unless other incentives compensate, the public is unlikely to trap wolves when the fur is of little value, hence the general restriction to the period of time when pelts are prime. Some wolf pelts may be salable when taken in October and April;

consideration should be given to extending the trapping season to include October and April whenever an effort is made to increase public wolf trapping efforts.

Allowing trapping during the May-September period would not provide significant additional take of wolves by the public unless a substantial bounty were offered as an incentive. The inherent problems of bounty systems are detailed elsewhere.

Denning

Taking of wolf pups from the den could be an effective method of wolf population control, but has severe drawbacks and limitations. Trappers must have a financial incentive to pursue such a program (e.g., a bounty); effective control presupposes local knowledge of wolf denning sites, as well. If a "market" were established for wolf pups by allowing them to be kept as pets and exported, this might provide sufficient financial incentive without a bounty. Effectiveness of denning would likely vary with the area, depending on knowledge of den sites and willingness of local people to participate.

Poison

Appropriate predacides, properly administered, could be one of the most effective and cost-efficient methods of controlling wolf populations. Recent Canadian projects in which minimum lethal dose baits of compound 1080 were used, indicate such a method can be effective and relatively target-specific (i.e., few animals other than wolves are killed), and perhaps less costly than other methods.

British Columbia has used single-dosage baits of 13 mg 1080 (they intend to increase this dosage to 20 mg) for livestock depredation control, not for wildlife management purposes. Costs for their actions were about $40-50 per wolf removed, but this was in areas readily accessible by road. It is likely that similar use in Alaska, involving helicopter access to baited areas, would result in costs of $500-1,000 per wolf removed.

Professional Trappers

Hiring professional trappers to conduct wolf control could be relatively effective in some areas, particularly if summer trapping and denning were allowed. Such a system has the advantage of exerting trapping pressure in an area in spite of low economic return, a frequent weakness of public trapping efforts. The sale of usable pelts acquired by the department could, to a slight degree, offset costs of the operation.

The system would also be relatively expensive; salaries, per diem, transportation costs, and equipment would necessitate high

budgets. At this time, we are not sure of the availability of personnel with the requisite skills.

Bounties

A bounty on wolves could provide hunters and trappers with the necessary financial incentive to take wolves when their taking would not otherwise be financially rewarding. Bounties would be particularly important if we wished to encourage taking when the pelts are not valuable as fur, e.g., during summer trapping or from animals taken by denning.

Bounties, however, have been widely used in many states (including Alaska) for many species, and almost invariably have been found to be ineffective in significantly increasing take of the target populations. To be effective in specific wolf control programs, we would have to develop a system that would ensure that all animals under bounty actually were taken in the control area, an extremely difficult task. To be effective, bounties would have to be relatively high (probably at least $300), but the higher the bounty, the more difficult it would become to ensure that the system is not abused. Initiation of a bounty system would require legislative and board action.

Sterilization

The concept of controlling wolf populations by sterilizing breeding members of a pack has been discussed as an alternative to other means of control. Considerable doubt as to the practicality or effectiveness of this approach has been voiced, but we feel these questions cannot be answered conclusively unless a major research effort is mounted. Such a research effort, designed to determine practicality, methods, and effects (both sociological and behavioral) on wolves, would require expenditures (personnel and operating costs) estimated at $165,000 per year over a three- to five-year study.

Public Aerial Permits

In some past programs, many of the wolves taken in a control program were harvested by members of the public who took wolves from aircraft, under permits issued by the department. Cost to the department is relatively low, and is largely limited to costs of administering the permit system and reconnaissance flying to monitor the activities of permittees. As an example, 29 wolves were taken in Units 19A and 19B in 1979 by public aerial permittees at an approximate cost to the department of $5,700, including $4,000 spent on wolf surveys. One disadvantage to this system is the difficulty of ensuring that all wolves are taken from the target unit or area; another is the fact that hunting pressure tends to decrease as wolves become less abundant, and further removal may be necessary after public aerial hunting ceases.

Denning by Department Employees

A variation of an option mentioned earlier would be department employees only conducting denning for wolf predation control. Removal of all or most of the pups from a wolf population would cause a stabilization or gradual decline in the wolf population; a decline that would be more abrupt if adults were taken near the dens as well. Radiotelemetry would probably be necessary to locate a majority of dens in a unit, which implies that at least one wolf in each pack would be radio-collared. Initial efforts would, therefore, be relatively expensive; but in subsequent years, the costs would decline significantly. Because there is no known outlet for live pups (other than to private ownership as pets), pups taken would, presumably, have to be killed.

Aerial Shooting by State Employees

This option has been thoroughly discussed with the board in many past meetings, so will be mentioned here only in cursory fashion. costs of department operations in removing wolves have often been misinterpreted from past comments and reports which were prepared for the board. From 1975 through 1983, the Game Division spent about $850 per wolf taken, including personnel costs. If one reduces this figure by the value received for the sale of wolf pelts, the net costs were about $550-$600 per wolf. This option has been demonstrated to be effective in reducing wolf populations in approved control areas.

COSTS OF WOLF PREDATION CONTROL PROJECTS

The basic costs of obtaining adequate biological data on moose and wolves would be approximately the same regardless of what method was subsequently used to reduce wolf populations. Table 8 lists the approximate costs for obtaining adequate data on moose and wolves in the various subunits under consideration before any program could be initiated. The varying costs listed reflect the fact that in some subunits we presently have current data on one species or the other, and in some cases additional data are needed on both species.

Estimating the costs of projects to control wolf predation involves a host of variables--some known, some unknown, and some over which we have no control. Perhaps the most meaningful projections would be derived by taking one area project and, given certain assumptions, estimating the cost of conducting predation control. Specific assumptions are noted for each alternative method. It should be noted that in making these estimates the department is not advocating one method over another; the board will need to make decisions based on many factors.

Table 8. Estimated costs of obtaining biological data as a base for wolf predation control programs in selected units.

Area	Moose population data		Wolf population data		Total
	Operational	Personnel	Operational	Personnel	
Unit 12	$ 0	0	$1,500	$1,000	$ 2,500
Subunit 19D	15,000	$6,000	0	0	21,000
Subunit 20A	0	0	4,500	2,000	6,500
Subunit 20B	18,500	6,000	2,600	2,000	29,100
Subunit 20D	6,000	2,000	1,000	1,000	10,000
Subunit 20E	0	0	1,500	1,000	2,500
Subunit 21B	6,000	2,000	2,600	2,000	12,600
Subunit 25D West	0	0	0	0	0

We have selected Unit 19D as the example unit for the purposes of illustrating comparative costs of conducting wolf predation control under various alternatives.

The following assumptions apply to all alternative methods:

1. The calculations assume that only one alternative method is used at a time, when in practice several may be used simultaneously.

2. The assumed duration of all projects is three years.

3. It is assumed that all necessary biological data have been gathered prior to initiation of the project.

4. It is assumed that department funding and staffing is available to conduct the program as approved by the board.

5. It is assumed that effective control of predation by wolves has been achieved when the moose:wolf ratio is maintained at 30:1 or greater.

Trapper Education and Assistance

Assumptions:

1. The department would provide trapper education in McGrath, Telida, and Nikolai.

2. Local trappers would be willing to participate in the program.

3. Trapper education and assistance would result in 100% increase in trapper take harvest of wolves.

4. Weather would be reasonably "normal."

5. Cost of producing the trapper education video is not included in this analysis.

Costs of this option are summarized in Table 9. Costs for trapper education in this Subunit are estimated at $4,000 per year, largely involving travel and per diem. Trapper assistance includes radio-collaring 20 wolves the first year and ten per year in subsequent years at a cost of $1,000 each. It also includes eight monitoring flights per year at a cost of $900 plus personnel travel and per diem.

Probable Results:

Given the foregoing assumptions, the public take of wolves would increase to about 30 wolves annually which would raise the

moose:wolf ratio to about 13.4:1. Given that ratio, we would not expect to see a positive response by the moose population.

Habitat Improvement

Assumptions:

1. Six hundred acres of moose habitat would be rehabilitated per year for the three year project.

2. Rehabilitation would be done by crushing the external perimeters of areas and by burning.

3. That adequate heavy equipment would be available in McGrath.

4. That fire conditions would be favorable during project years.

5. That areas to be treated could accommodate prescribed fires.

Costs:

Costs are summarized in Table 9. These estimates are based on chaining 1/3 of the area (200 acres) using caterpillar tractors and anchor chain and burning the remaining 2/3 of the area using a helitorch for ignition.

Probable Results:

In the long run, this action would significantly improve moose habitat in the area, and increase potential for moose populations. However, it would not cause moose populations to increase if moose are being limited by other factors, such as wolf predation.

Wolf Relocation

Assumptions:

1. That 75 wolves would be removed in the first year and 40 wolves in each of the remaining two years.

2. That wolves would be captured by helicopter and dart gun, flown by helicopter to a staging area (McGrath), and then flown to release sites on the North Slope.

3. That attempts would be made to capture, transport, and release wolves as pack units.

Costs:

Costs are summarized in Table 9. The total is predicated upon a capture cost of approximately $1,000 per animal, costs of $13,000 for transporting wolves to the staging area, and costs of $9,870 for transport to the release site. These costs do not include monitoring of the wolves after release, an activity which we previously stated should be conducted.

Probable Results:

Given the above assumptions, the moose:wolf ratio in the area would increase to about 25:1 and should result in general stabilization and a probable increase of the moose population in the subunit. The results, as far as the transplanted animals are concerned, are far less certain. It is our judgement that there would be extensive movement of the wolves away from the release site, some fragmentation of packs, and probable high mortality.

Season Adjustments

Assumptions:

1. That the trapping season would be opened in October and April.

2. That trapping pressure would continue in these months at approximately the same level as exists now during the open season.

Costs:

No costs would accrue to the state.

Probable Results:

Given the low number of trappers in this unit who trap for wolves and the relatively low wolf harvest, it is highly unlikely that season extension would result in the additional taking of more than two or three wolves. The resulting impact on wolves or on the moose:wolf ratio would be negligible.

Public Denning with Bounty

Assumptions:

1. That the season in the unit would be opened year around.

2. That a $300 bounty would be paid on all wolves taken in this area, and only those taken during May through September.

3. That denning would be made legal.

4. That all wolves taken in the unit were sealed within the unit.

5. That this program would result in the removal of 40 wolves per year.

Costs:

Costs are summarized in Table 9. This estimate assumes bounty payments of $12,000 per year and costs of $3,000 per year for administrative costs, travel, and per diem.

Probable Results:

Given the above assumptions, the moose:wolf ratio would be increased slightly to about 17:1; impacts on both wolves and moose would be neglible. These impacts would vary somewhat depending upon whether most of the animals taken were pups or adults.

Poison

Assumptions:

1. That compound 1080 would be used in single-lethal-dose baits.

2. That poison would be administered by state employees under tightly-controlled conditions.

3. That this use would be legally authorized and all EIS requirements were met.

4. That 75 wolves would be removed the first year and 40 per year thereafter.

Costs:

Costs are summarized in Table 9. These costs were estimated on the basis of $1,500 for the cost of poison and baits, $15,000 for helicopter charter, $10,000 for fixed-wing aircraft charter, $14,000 for 4 month's permanent/seasonal salary, and $2,200 for per diem. Costs in years 2 and 3 would decline slightly because of a slightly lower need for helicopter and fixed-wing charter to take fewer wolves.

Probable Results:

The removal of this number of wolves per year would result in a change of the moose:wolf ratio to approximately 25:1 (a ratio

that would probably increase during the following 2 years). We would expect to see a general stabilization of the moose population, with a significant increase in certain areas. Public take of wolves would decrease.

Employment of Professional Trappers

Assumptions:

1. That expert trappers were available for hire.

2. That trapping would be conducted year around and would include denning.

3. That trappers would be provided with logistical support by the department.

4. That these new, personnel positions could be obtained.

5. That 40 to 50 wolves would be taken.

Costs:

Costs are summarized in Table 9. Included are costs for salary and benefits ($46,000 annually) of a Fish and Game Technician IV and operating costs of $17,500 during the initial year and $15,000 thereafter. It should be noted that these costs do not include monies which may be earned by the sale of pelts from harvested wolves.

Probable Results:

Given the above assumptions, and assuming that wolves would be taken in the specific areas desired, the moose:wolf ratio would increase to about 20:1. The moose population may stabilize, but no significant increase would be assured. Take by public trappers would decline.

Public Aerial Shooting

Assumptions:

1. That a limited number of aerial permits would be issued to qualified pilots/gunners.

2. That adequate enforcement would be available to ensure taking only in the target unit.

Costs:

Costs are summarized in Table 9 and include minor administrative costs and the cost of air charter for monitoring public activities.

Probable Results:

The probable take by the public under this system would probably vary from a low of 10-20% of the population to a high of 40-50%, depending upon the type of winter experienced. Most probable is that 20-30% of the wolf population would be removed, on the average, over the three-year life of the project. This method, without other forms of wolf removal, would therefore result in a probable harvest of 30 to 45 wolves annually which might raise the moose:wolf ratio significantly in some local areas. Without additional removal by other means, this probably would not result in significant, general improvement in the moose population status throughout the subunit.

Sterilization

We have insufficient information at this time to make assumptions or predict cost estimates for using this alternative as a control method.

Department Aerial Shooting

Assumptions:

1. That regulations governing this method remain the same as those that exist presently.

2. That operations would be conducted from November through April.

3. That the goal would be to remove 75 wolves the first year in this area by a combination of public take (trapping) and department aerial shooting. In years two and three, sufficient wolves would be removed by all methods to maintain a moose:wolf ratio of 30:1 or higher.

4. That radiotelemetry would be used as an aid in taking wolves.

Costs:

The costs in Table 9 are predicated upon our past experiences; an average cost per wolf removed by this method over a number of

areas has been about $850 per wolf. It should be noted that this is a gross cost which does not deduct the value of the sale of pelts.

Probable Results:

The removal of this number of wolves per year would result in a change of the moose:wolf ratio to approximately 25:1 (a ratio that would probably increase during the following two years). We would expect to see a general stabilization of the moose population, with a significant increase in certain areas. Public take of wolves would decrease.

Summary of Costs by Method of Control

While the costs projected in this analysis are only estimated based on our experience and that of other agencies, the order of magnitude of differences between methods should be valid. Variations between costs of given options between areas depend largely upon how close the area is to large urban centers where equipment and logistical support is available. Costs of some options (e.g., public denning) are virtually the same regardless of what area is being considered. Other options (e.g., trapper education, professional trappers, poison) may vary somewhat, being higher in the more remote areas. Finally, some options (e.g. habitat enhancement) may vary dramatically depending upon the distance of the project from urban centers or the road system.

Table 9. Summary of estimated costs of conducting wolf predation control in Unit 19D, under various options.

Option	ANNUAL COSTS* Yr. 1	Yr. 2	Yr. 3	Project cost*
Trapper education and assistance	42.6	32.6	32.6	107.8
Habitat enhancement	225.0	225.0	225.0	675.0
Relocation	97.9	53.0	53.0	203.9
Public denning/ bounty	15.0	15.0	15.0	45.0
Poison	42.7	40.0	40.0	122.7
Professional trappers	63.5	61.0	61.0	185.5
Public aerial shooting	5.0	5.0	5.0	15.0
Sterilization	without research, unknown			
Department aerial shooting	38.3**	38.3	38.3	114.9

* Costs do not include costs of obtaining base data on wolf and ungulate populations, which are estimated in this Unit to be 21.0 for any option (Table 8). Costs are in thousands.

** Calculated at gross cost of 0.85 per wolf removed, before value of pelt sales deducted.

ACKNOWLEDGMENTS

This report is the product of many people's efforts. Seldom acknowledged, but vital to any report by a public agency, is the assistance, support, and cooperation of the public. Those people who use and enjoy wildlife, who abide by regulations governing wildlife uses, and who provide information on their activities provided the basis for much of the information presented here.

Game Division staff who made significant efforts to prepare this report are Bob Hinman, Oliver Burris, Dale Haggstrom, Robin O'Connor, Cathie Harms, Bob Stephenson, Ed Crain, Jean Ernest, Carly Nuckols, Laura McManus, Sherrill Peterson, Lisa Ingalls, Roy Nowlin, Tim Osborne, Dave Johnson, Steve DuBois, Dave Kelleyhouse, Dan Grangaard, Dot Simpson, Bob Pegau, and Dick Bishop. In addition, Dan Timm, Jack Didrickson, and Nick Steen from Region II provided information on examples of habitat rehabilitation.

We also acknowledge the assistance of wildlife biologists from the Canadian provinces who provided summary comments on their agencies' experiences in managing predator:prey relations.

Dr. Major Boddicker of Colorado provided reports, comments, insights, and cost estimates of trapper education based on his broad experience in developing similar programs and predation control programs in other states.

LITERATURE CITED

Bishop, R. H., and R. A. Rausch. 1974. Moose population fluctuations in Alaska, 1950-1972. Nat. Can. (Que.) 101:559-593.

Gasaway, W. C., R. O. Stephenson, J. L. Davis, P. E. K. Shepherd, and O. E. Burris. 1983. Interrelationships of wolves, prey, and man in Interior Alaska. Wildlife Monographs No. 84. 50pp.

APPENDIX 1.

WOLF PREDATION CONTROL PROGRAMS IN CANADIAN PROVINCES

Yukon

In recent years, wolf populations have been reduced in two large areas in the Yukon. These efforts were intended to reverse declines in moose or caribou populations and have been closely monitored to obtain the maximum amount of information.

The primary means by which wolves were reduced was aerial shooting, done by government personnel in helicopters. This has proven to be the only practical way to accomplish significant reductions in a short period of time, given the remoteness of much of the area. Although poison was employed during one winter to reduce depredation on livestock around Whitehorse, it was not very effective and there is little likelihood that it will be used in the near future.

In addition to conducting wolf reduction efforts, the Yukon government has, in cooperation with the local trapper's association, sought to increase the trapper harvest of wolves through trapper education. Wolf trapping techniques have been described at publicized meetings in population centers near problem areas. Although trappers have shown considerable interest in these programs, the results have been somewhat disappointing in terms of contributing to management goals. Trapper harvest appeared to increase somewhat in areas with good access and where wolf numbers were high, but once wolf numbers had been reduced, wolf trapping effort declined. Thus, it appears that trappers will contribute little toward maintaining population reductions once they are achieved. In more remote areas, Yukon officials found that aerial shooting was the only method that could reduce wolf numbers significantly.

Because the pelt value of Yukon wolves is generally low, the government tried to increase the economic incentive for trappers by guaranteeing a minimum price of $200 for each pelt regardless of fur quality. Wolf pelts in many parts of Canada only bring approximately $100 on the commercial market. After 1 year, this arrangement was modified to stipulate that pelts must be properly handled to qualify for the program. However, this program will probably be discontinued this winter and instead, the government will aid trappers in finding and developing better markets for wolf pelts. This new approach will consist primarily of finding ways to increase sales to tourists since pelts generally have a greater value to them than to the fur garment industry. Although trapper education and pelt marketing efforts will continue, it is apparent that most predation-control programs will necessarily rely on government aerial shooting to be effective. In some areas radio-collared wolves are used to increase the efficiency and precision of wolf reduction efforts.

Predation by brown bears has proven to be an important mortality factor on moose, and in one area where wolf numbers have been reduced by 70%, bear predation is sufficient to prevent a measurable increase in moose numbers. Bear hunting rules and regulations have been liberalized to the extent possible but bear numbers remain high. The absence of an appreciable increase in harvest is attributed to low hunter interest, limited access, and difficult terrain. The territorial government is currently considering whether to take more active measures to reduce bear numbers. The Yukon government is also trying to redistribute hunting pressure on moose in an effort to satisfy local demands while minimizing hunting on declining populations.

Northwest Territories

Wolves are found throughout the Northwest Territories but at present relatively little is known about wolf-prey relationships in specific areas. In recent years the only identifiable predation problem involved a declining bison population on the Slave River lowlands. Research showed that wolf predation and excessive harvests were major factors causing the decline; the Northwest Territories government reduced wolf numbers by providing a $300 bounty on wolves in the area to encourage trapping, and by aerial shooting from helicopters. The aerial shooting occurred only in late winter after trappers had the opportunity to capture as many wolves as possible. The government's efforts to reduce wolf numbers were contingent upon a voluntary reduction in the number of bison killed by local hunters. When this did not occur, the control efforts were discontinued.

Elsewhere in the territory, caribou are generally increasing and the status of moose is unknown, although moose studies are beginning. Because of the mobility of caribou, and wolves that are dependent on them, caribou-wolf relationships are difficult to quantify with any precision. Wolf numbers are thought to have declined in some areas due to drastic changes in caribou movement patterns and, possibly, harvest of wolves by man.

There is only a small amount of trapping effort directed toward wolves, but large numbers are occasionally taken by shooting from the ground during winter. The terrain in much of the Northwest Territories is relatively open and wolves often concentrate around wintering caribou, which sometimes results in high harvests by local hunters.

Although wolf control around certain caribou herds has been advocated by some groups, government policy requires strong justification for such measures, and no programs have been implemented.

British Columbia

In British Columbia, wolf predation control programs have been carried out in recent years in the northern part of the province

to benefit moose, caribou, stone sheep, and elk. On Vancouver Island, programs are intended to improve deer populations. Other programs are conducted in areas where depredations on livestock occur.

The methods used to achieve control vary according to terrain and logistical limitations. For control of depredations on livestock, poison (compound 1080) and traps are used by government personnel, and in some cases private individuals are instructed in the use of traps and snares. On Vancouver Island, dense vegetation makes traps and snares the only effective methods of control, and the control effort is being made by government personnel. In the northern part of the province, terrain and logistical considerations have limited methods to one: aerial shooting from helicopters. In this area there is only a minimal effort by private individuals to trap wolves. Because of the roadless nature of this area, the difficulty of trapping wolves, and their relatively low pelt value, the prospects for increasing trapper effectiveness are very poor and increased trapper education is not thought to be worthwhile. Bounties have been considered but have not been instituted. Wolf reductions in the northern area have resulted in substantial increases in survival of moose calves and stone sheep lambs.

No consideration has been given to controlling bear numbers in British Columbia. Bear harvests are fairly high in the southern portion of the province; the effect of bears on big game in the northern areas is largely unknown at present.

Alberta

Wolves are distributed throughout the northern and western parts of Alberta, and at present, are abundant relative to big game prey. In areas where wolves and bears are common, moose, caribou, and elk numbers have declined to low levels and populations show low survival rates of young animals. Since the late 1960's, poison has been used to remove wolves from areas where livestock depredations are confirmed. An average of 76 wolves per year were killed by poisoning from 1972 through 1983. Although most big game populations have been low or declining for 10 to 15 years, the province is only now considering measures to temporarily reduce wolf numbers in some areas. Three limited areas are currently being considered for small-scale predation-control programs to rehabilitate moose, caribou, or elk populations. Management plans are currently being prepared for the province, and specific control measures may occur after these plans are completed. The potential for more extensive control is unknown. The techniques employed in these programs, if carried out, will probably include poisoning (with strychnine) and, in more open terrain, aerial shooting.

Alberta has an active trapper education program which includes permanent training programs. During 1982-83, education regarding

wolf trapping was emphasized in certain areas and several thousand wolf snares were provided to trappers. Although the wolf harvest increased somewhat in the following year, it then dropped again. The lack of appreciable success is attributed to the generally low pelt value of Alberta wolves. Many of the wolves are black, mange is common, and fur quality is not high, with an average pelt value of approximately $75. This provides little incentive for trappers. Although trapper incentives or bounties have been suggested by some as an effective means of increasing harvest, there are no government-sponsored incentives at present.

Manitoba

Wolves exist at moderate-to-high densities over approximately 80% of Manitoba. At present, big game populations in many areas are depressed; wolf predation control is being initiated in one area and will probably be extended to other areas in the future. The province has developed and approved a very specific wolf-control policy which outlines procedures to be followed in instituting predation control.

The province is beginning a predation control experiment to evaluate the costs and effectiveness of available techniques. Both wolf and black bear numbers will be reduced in a 2,000-mi^2 area to increase moose calf survival. During the coming winter, wolf numbers will first be reduced by a trapping effort involving both private and government trappers. The government will assist private individuals by providing expertise and some equipment. If the goal of a 75% reduction in wolf numbers is not reached by a predetermined date in midwinter, shooting from helicopters by government personnel will be employed to achieve the goal. If this also fails, then a federal permit to use poison (strychnine) will be sought and poison will be used to complete the program. Black bear numbers will be reduced in spring using foot snares. The results of this experiment will be used to design future predation control programs.

Although trapper education efforts have been strong in the past and will continue, the results of these efforts, with regard to wolf trapping, have not been encouraging. This is attributed to the difficulty involved, the lack of sufficient economic incentive, and also to a deep fear of wolves among Indian people in the region. It is likely that future wolf reduction efforts will be accomplished by the government using helicopters and, possibly, poison as well. Experience with the use of poison in Manitoba has shown that strict adherence to certain techniques will result in an extremely small loss of nontarget species.

Saskatchewan

Wolf distribution is limited to the northern half of the province. No intensive studies of wolves have been done. Wolf

numbers are not high and are thought to be controlled to a large extent by public trapping and by a government poisoning program that has been carried out annually along the forest fringe where livestock grazing is common. Approximately 100 wolves are removed annually by poisoning, which is carried out on a routine basis near public grazing areas and on a case-by-case basis in others. Shooting from helicopters is used in specific instances. The province has a strong trapper education program, which combined with high pelt value and reasonably good access to wolf habitat, has resulted in a significant annual harvest relative to existing populations. This is thought to have minimized undesirable effects of wolf predation on big game species. The wolf is classified only as a furbearer and there is no open hunting season.

Black bear predation on moose calves has been identified as a problem in some areas, and in one case bear numbers were reduced by trapping, aerial shooting, and poisoning to increase calf survival.

Ontario

There are no large-scale predation control programs currently underway in Ontario, although the province does have a policy which allows for predation control on a case-by-case basis. There is a limited amount of wolf control in connection with livestock depredation. This is done primarily with traps and snares. Also, a few wolves were recently removed from some small islands in Lake Superior to reverse declines in deer populations. This was effective in accomplishing the goals of the program.

Ontario has an active trapper education program, but there is relatively little trapping effort directed toward wolves because the economic return is low. As a result, trappers are thought to have a negligible impact on wolf populations. A bounty on wolves persisted until 1972 and appeared to significantly increase the level of harvest; during the 1950's and 1960's there were extensive control programs involving both aerial shooting and poisoning. At present the status of wolf-prey relationships over large areas is not well known because of financial limitations, but wolves are known to be a major factor influencing both moose and deer populations. If wolf predation control is attempted in the future, the means of achieving that control will probably be limited to aerial shooting by agency personnel, and trapping by individuals and the government. Both aerial shooting and poisoning were used in earlier control programs.

Quebec

Wolves exist at moderate-to-high densities over most of Quebec. Prior to approximately 1970 there was a bounty on wolves, which were reduced over wide areas by using poison and aerial shooting

from helicopters. Wolf populations have largely recovered since that time and are recognized as a major source of mortality among moose and deer populations.

At present, experimental wolf and black bear reductions are in progress in two areas to assess the effects of predation on moose and deer, respectively. A 75% reduction in wolf numbers has been achieved, primarily by shooting from helicopters in combination with a small amount of trapping, all by government personnel. Black bears have been removed from the moose study area using foot snares. In recent years there has also been localized wolf predation control around deer yards.

When a wolf predation problem has been identified through research, as required by policy, wolf reduction may be attempted. If such a program is attempted in the future, the first effort in the southern portion of the province would probably be to ask for help from trappers. The number of trappers in this area is thought to be sufficient to have some effect on wolf numbers, although there is normally little effort made to trap wolves. Aerial shooting by the public is not practical because of dense vegetation, and shooting from a helicopter by government personnel for management purposes is thought to be impractical because of adverse public sentiment. The methods that might be employed to control wolf numbers in the more remote, northern part of the province are unknown. A general trapper education program will be started this fall in Quebec; wolf trapping will be emphasized if increased wolf harvests are desired for management purposes.

Maritime Provinces and Labrador

Wolves have been extirpated from much of Canada east of Quebec. They are presently common throughout Labrador, but no wolf reduction programs are currently being considered or carried out.

APPENDIX 2.

ANTICIPATED IMPACTS OF THE ALASKA FIRE MANAGEMENT PLAN IN INTERIOR ALASKA

Prior to 1978, when the Fortymile Interim Fire Management Plan was implemented in extreme eastern interior Alaska, the Federal Alaska Fire Attack Policy guided fire suppression actions throughout most of Alaska. This policy generally called for the active suppression of all wildfires upon detection and within manning capabilities. Over 90% of all wildfires were suppressed during initial attack. This policy adversely affected long-term habitat quality in the Interior's ecosystem.

After nearly 30 years of active fire suppression, many areas in interior Alaska were typified by a greater proportion of spruce and mature hardwood forests and a lower proportion of herbaceous and brush habitats than would have been the case under a natural fire regime. Only wildfires which escaped initial attack efforts or fires occurring during severe burning years and could not be successfully attacked contributed to the maintenance of wildlife habitat diversity.

Historically, 1.5 to 2.0 million acres of Alaska's 220 million-acre Interior burned each year on the average until the 1940's. This meant, in general, that any given site would be burned once every 100 years or so. Obviously, some sites burned less often and others more often. Because of the habitat mosaic created by previous fires, many fires in later years were stopped naturally as they burned into areas where fuels had already been consumed. Satellite imagery in northern Yukon Territory confirms this phenomenon. The result of a natural fire regime in northern latitudes was a rich habitat mosaic which met the needs of all wildlife species which had evolved in the presence of fire.

Wildlife species such as rodents, foxes, sharp-tailed grouse, and moose invade and prosper in recently burned areas. Caribou, and spruce grouse prosper later when shrubs give way to mature deciduous and eventually spruce forests. Inevitably after 100-125 years, even the lichens so important to caribou eventually give way to mosses and the site must be reburned to warm and fertilize the soil and go through the vegetation succession process again to meet the needs, in turn, of the various species of wildlife.

In recognition of these crucial natural effects of wildfire, land and resource management agencies in Alaska agreed to develop a new, more enlightened policy for dealing with wildfires in Alaska. Hence the Fire Subcommittee, Alaska Land Manager's Cooperative Task Force was formed and is now known as the Alaska Interagency Fire Management Council. The Fortymile Interim Fire Management Plan of 1978 represented the first attempt at fire planning in Alaska. It was soon superseded by the greatly

improved Alaska Fire Management Plan which eventually was adopted statewide. Provisions of this plan now guide wildfire suppression activities of both the Alaska Fire Service, Bureau of Land Management, and State of Alaska, Division of Forestry.

Basically, the fire plan established 4 levels of wildfire suppression to be applied to lands within Alaska. Critical Protection is reserved for populated areas where human lives are at stake and mandates full initial and continuing attack of all fires. Full Protection is given to developments and economically important resource lands and calls for full initial and continuing attack of fires. Limited Action is the designation given to vast areas where humans and developments are scarce and where natural resources can be best managed by allowing a near-natural fire regime. Fires are not attacked initially, but are monitored to ensure they do not burn into areas of higher fire protection. Modified Action is a designation used extensively as buffers between areas receiving Full and Limited Designations. In Modified Action areas, fires receive initial attack early in each fire season, but not late in the season so some fire can be tolerated in Modified Action areas when risks are lower. Thus, Alaska has been zoned for fire suppression, concentrating fire suppression in areas needing protection and providing for a near-natural fire regime in other areas where fire is desirable. The vast majority of lands in interior Alaska received Limited and Modified designations. Although the planning was completed area by area over a 6-year period, the plans have already saved millions of dollars and have resulted in the burning of hundreds of thousands of acres of wildlands which would not have been allowed to burn without the plans. It would have taken over a decade and several million dollars to burn the same acreage with prescribed fires to benefit wildlife.

There is no doubt that opportunities for a natural fire regime will diminish in the future as human settlements and developments proliferate in Alaska. But in the meantime, wildfires will be able to perform their important natural functions in many vast and remote areas and their benefits will be realized for many decades in terms of wildlife diversity and productivity. The Alaska Board of Game is to be commended for its recognition of and continuous support for fire management planning over the past 8 years.

The next logical phase in the realm of fire policies and techniques for Alaska should emphasize the use of prescribed burning through continued interagency cooperation. If wildlife habitat in Alaska is to remain productive, fire must be used even in Full Protection areas where wildfires would pose unacceptable risks. The board will be kept apprised of all major accomplishments in the field of prescribed fire in Alaska.

Appendix 3.

ALASKA WOLF HARVEST 1977-85. Revision date:11/4/85

Unit	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85
1	41	48	35	42	29	37	49(51)	37
2	23	10	11	34	19	15	27	43
3	10	17	16	9	14	17	17	7
4	0	0	0	0	0	0	0	0
5	1	12(9)	10(11)	2(6)	6	11	9	14
6	3	6	0	2	1	1	2	3
7	19	12	6	10	12	4	11	5
8	0	0	0	0	0	0	0	0
9	26	17	21(19)	21	18	13	18	58
10	9	0	0	0	1	0	0	0
11	51	40	7	18	8	26	33	36
12	34	35	35	23	33	35	23	20
13	132	69	54(57)	48	55	90	116(118)	126
14	24	4	4	3	7	17	13	6
15	20	44	38	32	50	42	40	42
16	11	31	44	23	20	13	15	18
17	17	20	25	8	17	45	7	37
18	2	1	0	1	1	5	0	3
19*	53	81	44	48	53	34	39	105
20*	185	145	85	123	143	156	111	102
21	47	86	82(85)	78	38	96	54	145
22	3	5	4	4	4	4	5	10
23	64	50	18	55	17	47	45	56
24*	58	100	51	72	31	44	45	48
25*	45	37	74	56	68	63	47	69
26	39	36	15	42	39	9	4	26
Unk	0	0	0	0	0	0	0	0
Total	917	906	679	754	684	824	731	1,016

Note: Figures in parenthesis indicate numbers given in S&I report where counts differ from original sealing certificate file.

* The common boundary dividing Game Management Units 20 and 25 was moved southward in 1981.