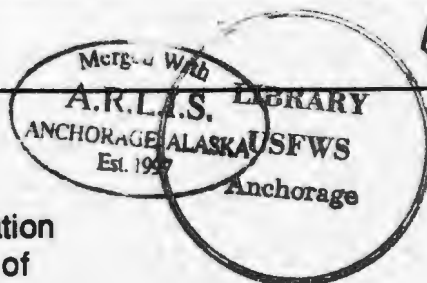


Alaska Department of Fish and Game
Division of Wildlife Conservation



Federal Aid in Wildlife Restoration
Annual Performance Report of
Survey-Inventory Activities
1 July 1991 - 30 June 1992

MOOSE

Susan M. Abbott, Editor

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Illustration by Sue Arthur

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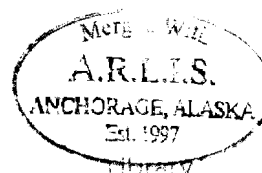
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PROJECT TITLE: Southeast Moose Population and Habitat Management

Overview: Moose are found on the mainland coast and some islands in 11 discrete populations that are managed separately: Unuk-Chickamin River valleys, Stikine River, Thomas Bay, Unit 3 islands, Taku River, Berners Bay, Chilkat Range, Chilkat Valley, Yakutat Forelands, Nunatak Bench, and Malaspina Forelands.

Project Location: Subunit 1A and Unit 2 (8,911 mi²)
Subunit 1A - Ketchikan area, including mainland areas draining into Behm and Portland Canals

Unit 2 - Prince of Wales and adjacent islands, islands south of Sumner Strait and west of Kashevarof Passage and Clarence Strait

Project Objectives:

1. Maintain a posthunting population of 35, annual harvests of 3 bulls by 20 hunters (15% success rate), in 90 days of hunting effort.
 - a. Monitor the moose harvest, conduct aerial surveys as opportunities arise, and collect anecdotal information from hunters.
2. Obtain and verify public reports of moose observations on Prince of Wales Island.
 - a. Solicit public reports of moose sightings or sign, travel to areas where moose sightings or sign occur, confirm or refute reports, and determine the sex and age structure and distribution of moose on Prince of Wales Island.

Work Accomplished During the Project Segment Period: We monitored the Subunit 1A moose harvest by using harvest ticket reports. We did not conduct hunter surveys during the report period in Subunit 1A or Unit 2.

Progress Towards Meeting Project Objectives: The moose population in Subunit 1A is very small, and few people hunt there. The annual harvest has varied from 0 to 8. During 1991, an estimated 40 hunters killed 3 bull and 1 cow moose in the Unuk River drainage (7.5% success). The hunter killing the cow was cited for illegally shooting a cow in a bulls only area. Hunters spent an estimated 237 days hunting moose in Subunit 1A.

Twice as many hunters hunted in Subunit 1A during 1991 than identified in our objectives. Likewise, the number of hunting days was over twice as high as specified by our objectives, and the success rate was half of what we had specified.

Moose fecal pellets collected near Ball's Lake in Unit 2 were received at the Ketchikan office during May 1992, and one moose was reportedly hit by a truck in the same area the previous November. The moose was apparently not killed in the incident, and hair collected at the site was verified as being that of moose by criminologists at the Alaska

State Trooper's lab in Anchorage. A cow moose was reportedly observed near Angel lake during October 1991.

Project Location: Subunit 1B and Unit 3 (5,900 mi²)
Southeast Alaska mainland from Cape Fanshaw to Lemesurier Point and islands of the Petersburg, Kake, and Wrangell areas

Project Objectives:

Subunit 1B

Stikine River Area: Maintain a posthunting population of 450 moose; annual harvests should be about 40 from 300 hunters expending 2,100 days of effort, with a success rate of 13% in Subunit 1B South of LeConte Bay.

Thomas Bay Area: Maintain a posthunting population of 200 moose; annual harvests should be about 20, from 160 hunters expending 675 days of effort, with a success rate of 12% in Subunit 1B North of LeConte Bay.

Unit 3

Wrangell Island: Project objectives for the newly created moose season in this area are under review.

Work Accomplished During the Project Segment Period: The Stikine River area of Subunit 1B was monitored closely in the field during hunting season. We tried to interview every hunter and examine every moose carcass. We took jaw and antler measurements from each moose examined, and estimated ages. Data collected were reconciled with the moose harvest ticket reports. One aerial survey was attempted but cancelled because of high winds.

In the Thomas Bay area of Subunit 1B, hunters and carcasses were monitored closely in the field. Registration permits were checked and all hunters were required to turn in their reports. All moose carcasses were checked for antler requirements, and the age of each moose was estimated.

On Wrangell and Mitkof islands in Unit 3, we monitored the hunt using the harvest ticket reports. ADF&G complemented this with checks of local information sources.

Progress Towards Meeting Project Objectives: In the Stikine River area, an estimated 275 hunters and killed 24 bulls. Weather seemed to reduce hunter participation as fewer hunters were in the field late in the season. One cow was found dead during the season but no determination of cause of death was possible. The 1991 harvest was the third consecutive year of decline in harvest.

The Thomas Bay hunt was restricted to spike/fork or 50" antlered bulls only. We issued permits to 182 people, and 123 hunted. Hunters killed 15 bulls, 4 of which were illegal. Because of the high incidence of illegal kills, the season was closed by emergency order on the ninth day.

In Unit 3, Wrangell Island was open for the second year with a spike/fork 50" season. An estimated 25 hunters participated and 2 legal spike/fork yearling bulls were killed. One illegal bull was also killed. Mitkof Island was opened this year for the first time with a season and bag limit similar to Wrangell Island. Mitkof Island was closed on the ninth day as 3 of the 7 bulls taken were illegal.

Public meetings were held in Wrangell and Petersburg to discuss moose management. Wrangell hunters now seem willing to accept some restriction in the season. Petersburg hunters want more severe penalties for illegal kills.

Project Location: Subunit 1C (7,562 mi²)
Southeast Alaska mainland, and islands of Lynn Canal and Stephens Passage between Cape Fanshaw and the latitude of Eldred Rock, including Sullivan Island and drainages of Berners Bay.

Project Objectives and Activities:

- 1) Subunit 1C moose management objectives
 - a. Taku River area

Post-hunt moose numbers	150
Annual hunter kill	20
Number of hunters	100
Hunter-days of effort	450
Hunter success	20%
 - b. Berners Bay area

Post-hunt moose numbers	90
Annual hunter kill	8
Post-hunt bull:cow ratio	25:100
Number of hunters	10
Hunter-days of effort	30
 - c. Chilkat Range area

Post-hunt moose numbers	150
Annual hunter kill	10
Number of hunters	65
Hunter-days of effort	195
Hunter success	15%

2. Subunit 1C moose management activities:
Conduct winter sex and age composition surveys and monitor harvest.

Work Accomplished During the Project Segment Period: We issued 316 registration and 10 drawing permits for two hunts covering three management areas in Subunit 1C. One hundred ninety two hunters participated in both hunts. Permit results are shown in the following table:

<u>Management Area</u>	<u>Success</u>	<u>Days Hunted</u>
Chilkat Range	14%	160
Taku River	17%	245
Berners Bay	100%	14

We conducted aerial surveys in the Berners Bay area. We counted 62 moose in 1.2 hours (50 moose/hour). We did not determine bull:cow and calf:cow ratios because we flew the survey after antler drop.

Progress Towards Meeting Project Objectives: Population objectives for the Berners Bay herd were partially met. With 61 moose observed during the fall survey, the estimated post-hunt moose population of 90 was exceeded. All 10 permittees took moose, thus the objective of 80% success was surpassed. However, the desired number of hunters, hunter-days of effort was not reached.

Chilkat Range objectives were partially achieved. The kill of 14 exceeded the goal of 10, and 114 rather than 65 hunters hunted; 514 hunter-days were expended rather than 195; and a success rate of 12% exceeded the goal of 15%. Because no survey was conducted, the post-hunt population objective was not measurable.

Except for hunter success (18% compared to the goal of 17%), most population objectives for the Taku River population were not met. Objectives for number of hunters (68), hunter days expended (251), and number of moose killed (12) all were not met. No aerial surveys were conducted, so the post-hunt size of the population is unknown.

Project Location: Subunit 1D (2,670 mi²)
Southeast Alaska mainland north of the latitude of Eldred Rock,
excluding Sullivan Island and drainages of Berners Bay.

Project Objectives and Activities:

- 1) Subunit 1D moose management objectives:

Post-hunt moose numbers	450
Post-hunt bull:cow ratio	25:100
Annual hunter kill	30

Number of hunters	250
Hunter-days of effort	500
Hunter success	12%

- 2) Subunit 1D moose management activities:
Conduct winter sex and age composition surveys, monitor harvest.

Work Accomplished During the Project Segment Period: Tier II permits were not issued during autumn 1991. Severe winter conditions and apparent poor condition of the moose herd precluded a hunt this year. We flew an aerial survey of the known winter range in the Chilkat drainage in mid-December.

Progress Towards Meeting Project Objectives: In the wake of the severe 1990-91 winter and in light of poor aerial survey results, no Tier II permits were issued for the 1991 hunt. A survey flown in December 1991 indicated low bull:cow and calf:cow ratios, and a second winter of deep snow in most of the known winter range followed. Consequently, an emergency order closing the 1992 moose season was issued during the report period. If 1992 fall surveys indicate moose numbers are adequate to resume the hunt, the Tier II system now in place will make existing objectives related to days of hunter effort and number of hunters attainable.

Project Location: Unit 5 (5,770 mi²)
Cape Fairweather to Icy Bay, eastern Gulf of Alaska coast

Project Objectives and Activities:

1. Unit 5 moose management objectives
 - a. Yakutat Forelands

Post-hunt moose numbers	850
Annual hunter kill	70
Post-hunt bull:cow ratio	20:100
Number of hunters	250
Hunter-days of effort	1,025
Hunter success	28%
 - b. Nunatak Bench

Post-hunt moose numbers	50
Annual hunter kill	5
Number of hunters	10
Hunter-days of effort	60
Hunter success	50%
 - c. Malaspina Forelands

Post-hunt moose numbers	250
Annual hunter kill	25
Post-hunt bull:cow ratio	20:100
Number of hunters	50
Hunter-days of effort	200
Hunter success	50%

2. Unit 5 moose management activities:
Do winter sex and age composition surveys and monitor harvest.

Work Accomplished During the Project Segment Period: We analyzed harvest and hunter data from registration permit reports. Hunts were monitored by Department of Wildlife Conservation staff and Fish and Wildlife Protection officers. Because of staff vacancies and poor weather, we did not conduct aerial surveys in Unit 5 during the report period.

Progress Towards Meeting Project Objectives: In the Yakutat Forelands, we estimate the post-hunt moose population was achieved. However, hunter kill (52), number of hunters (176), and hunter-days of effort (586) were below objectives. In the Nunatak Bench area in Subunit 5A, no hunt was held and no surveys were conducted, so it is unknown how close we may be to population objectives. Previous surveys there indicated a hunt may be possible in the near future.

In Subunit 5B, the Malaspina Forelands, the existing population is estimated at 250 animals. None of the objectives were met for this population. The lack of a survey precludes determining if the desired bull:cow ratio was reached in either subunit.

Segment Period Project Costs:

	<u>Personnel</u>	<u>Operating</u>	<u>Total</u>
Planned	\$32.2	\$21.3	\$53.5
Actual	\$32.2	\$21.3	\$53.5
Difference	0.0	0.0	0.0

Submitted by:

W. Bruce Dinneford
Management Coordinator

Project Title: Southcentral Alaska Moose Population Management

Project Location: Unit 6 (10,150 mi²)
Prince William Sound and north Gulf of Alaska Coast

Project Objectives: Maintain observed moose densities of between 1.8 and 2.0 moose/mi² and bull:cow ratios of 30:100.

Work Accomplished During the Project Segment Period: Staff completed population censuses during 22-23 January in Subunit 6B and during 17-19 December in Subunit 6C. Confidence intervals around estimates were calculated at the 90% level. In Subunit 6B, we estimated the population at 321 moose (CI 286-356) for a density of 1.2 moose/mi². There were 17% calves (CI 9%-26%) in the population. In Subunit 6C, the population estimate was 240 (CI 212-268) for a density of 1.2 moose/mi². Also, there were 23% calves (CI 20%-25%) and 5% yearling bulls (CI 4%-5%). We collected no population data in Subunits 6A or 6D.

The total reported harvest in Unit 6 was 196 moose (125 males, 69 females, and 2 unspecified). In Subunit 6A, 186 hunters took 74 males, 44 females, and 2 moose of unknown sex for a hunter success rate of 43%. In Subunit 6B, 209 hunters harvested 35 males and 12 females under drawing and registration permit hunts for a success rate of 22%. In Subunit 6C, 37 hunters took 15 males and 13 females under drawing permit hunts for a success rate of 76%. One male was taken in Subunit 6D.

The registration hunt for antlered moose in Subunit 6B was monitored by field checks of hunters. An emergency order closed the hunt on 19 September. A harvest of 30 antlered moose was allowable, and 35 were reported killed. The 5 animals taken in excess of the allowable harvest were killed during the 48-hour period between issuance of the closure and its effective date.

Progress Towards Meeting Project Objectives: Density in Subunits 6B and 6C of 1.2 moose/mi² was below the unitwide objective of 1.8-2.0 moose/mi². This difference was because of changes in population survey methods rather than a decline in the moose population. Completion of the census allowed a more reliable density estimate than obtained previously. Density objectives should be revised to reflect changes in survey methods. Surveys next year should be concentrated in Subunit 6A.

Project Location: Units 7 and 15 (8,400 mi²)
Kenai Peninsula

Project Objectives: Maintain the existing moose population with a posthunting sex ratio of no less than 15 bulls:100 cows.

Work Accomplished During the Project Segment Period: We surveyed two of the 32 count areas in Unit 7 excluding the Portage and Placer River drainages during the 1991 fall sex and age composition surveys. We classified 113 moose with ratios of 26 calves:100 cows and 27 bulls:100 cows. Calves accounted for 16.5% of all moose observed. Because a census has not been conducted a population estimate could not be accurately determined for Unit 7. However, total moose observed during recent fall surveys suggest the moose population in Unit 7 is between 1,000 and 1,500 animals. Increased logging activities in Unit 7 to combat spruce bark beetles may provide increased visibility and access to moose hunters. Habitat quality may also be affected when overstory is removed. Further attention may be warranted to monitor effects of logging on moose in Unit 7.

Based on preliminary harvest reports, 537 hunters reported hunting in Unit 7 during 1991 and harvested 59 bull moose. Hunters in Unit 7 were restricted by regulation to bulls with spike/fork or 50 inch antlers. Of successful hunters 27 (46%) reported taking spike/fork bulls (less than 35") compared to 26 (44%) hunters who harvested large bulls (greater than 39") defined as a 50 inch antler spread or having three brow tines on at least one antler. Six reports indicated either unknown size or illegal classification. Two moose were reported with antler spreads greater than 60 inches.

Progress Toward Meeting Project Objectives: Winter conditions in Unit 7 during 1991-92 were moderate to severe resulting in less than normal over-winter moose survival. The selective harvest program initiated in 1987 apparently increased the bull:cow ratio. The current bull:cow ratio (27:100) obtained from 2 count areas meets the management objective of at least 15:100. Management of Unit 7, however, should follow Unit 15 to avoid major shifts of hunting pressure.

Project Location: Units 9 and 10 (36,250 mi²)
Alaska Peninsula and Unimak Island

Project Objectives: Project objectives for Units 9 and 10 are to: 1) maintain existing moose densities in areas with moderate (0.5-1.5 moose/mi²) or high (1.5-2.5 moose/mi²) densities; 2) increase low-density populations (where habitat conditions are not limited) to 0.5 moose/mi² by 1995; and 3) maintain sex ratios of at least 25 bulls:100 cows in medium to high density populations and at least 40 bulls:100 cows in low density areas.

Work Accomplished During the Project Segment Period: We surveyed only 1 trend area (King Salmon Creek) because of poor snow conditions and weather. We observed 131 moose and ratios were 47.5 bulls and 16 calves per 100 cows.

Preliminary tally of harvest reports and Naknek registration permits show reported total kills of 5, 46 (including 1 cow), 62 (including 5 cows) and 82 for Subunits 9A, 9B, 9C and 9E, respectively.

Progress Towards Meeting Project Objectives: Poor calf recruitment continues to hamper population expansion in low density areas. Efforts to monitor moose density within trend count areas were confounded during winter 1991-92 by poor snow conditions and poor flying weather. A sizable portion of the moose population in the northern half of the Naknek River drainage moved into the Branch River drainage in 1989. Surveys of this area in 1990 and 1991 showed no significant return of moose. Because only 131 moose were counted in November 1991 and because moose densities remain relatively low south of the Naknek River, the December registration permit hunt was restricted by emergency order to antlered animals only for the entire drainage. The bull:cow ratio measured during the 1991 composition survey in the Naknek River drainage was still within the management objectives. Until a significant increase in moose densities is documented, ADF&G will not support antlerless moose hunting in the Naknek River drainage. Although no survey was conducted in the Branch River drainage, moose densities appear high, and antlerless hunting will continue.

Project Location: Unit 11 (12,800 mi²)
Wrangell Mountains

Project Objectives: Maintain the existing moose population with a posthunting sex ratio of no less than 15 adult bulls:100 cows.

Work Accomplished During the Project Segment Period: A fall sex and age moose count was conducted in 1991. We counted 115 moose at a rate of 29 moose/hour. The bull:cow ratio was 91 bulls:100 cows. Calves comprised 9% of the moose counted.

Preliminary harvest figures indicated hunters killed 42 moose in Unit 11 during the 1991-92 season. Of these, nonresidents took 3 (7%) moose. Hunter success was 27%. The average hunt lasted 7.6 days. Harvest chronology figures show 79% (n = 33) of the take occurred during the September 1-15 state sport season, while 21% (n = 9) occurred during the remaining portion of the September 1-20 federal subsistence season for local residents. The mean antler size in the harvest was 40.2 inches.

We commented on proposals on land use patterns, access, and development with appropriate and administering agencies when applicable. Discussion about annual review and proposed changes in the Copper River Fire Management Plan occurred with participating agencies and land owners.

Progress Towards Meeting Project Objectives: Composition data in Unit 11 indicated moose numbers were relatively low with an observed density of 0.4 moose/mi². The number of moose counted per hour of survey time during fall composition counts decreased from 51 in 1990 to 29 in 1991. The overall bull:cow ratio was 91 bulls:100 cows with the adult bull:cow ratio at 89 adult bulls:100 cows, which greatly exceeds the minimum bull:cow objective for this unit. Calf production and/or survival in 1991 was

higher than observed the previous year but was still considered low. Composition data suggests that recruitment into the population has been low since 1989. The decline in both calf recruitment and the number of adults observed leads to the conclusion that moose numbers declined in Count Area 11 over the past year.

The moose harvest increased by 35% in Unit 11 during 1991. This increase was attributed to lengthening the moose season from 5 to 15 days for the state sport hunt. The season was lengthened because of the low harvest during the 5 day 1990 sport season. Because much of Unit 11 is remote and access restrictions imposed by the National Park Service prevent reasonable access, large portions of the unit remain unhunted for moose. Moose harvests are concentrated in areas of reasonable access such as in proximity to the Chitina-McCarthy and Nabesna roads or adjacent to the few airstrips where aircraft can be used for hunting purposes. The current harvest level is considered sustainable and it appears that human harvests have minimal impact on moose numbers in the unit because only bulls are harvested and the total take is very low.

Wolves were abundant in Unit 11 during the winter 1991-92. Wolf predation on moose continues to be high because of high wolf numbers and a scarcity of alternate prey. The Mentasta caribou herd has been moving out of Unit 11 into Unit 12 to winter. Snow depths in Unit 11 averaged 31.3" during the 1991-92 winter, 24% above the 1967-92 average of 25.2 inches. Using the winter severity index, this winter was classified as severe and was the fourth consecutive severe winter for much of Unit 11.

There has been little progress in improving moose habitat in this unit. Most of Unit 11 is included in Wrangell-St. Elias National Park and Preserve. Habitat improvement work, including controlled burning to benefit a single species, is prohibited under National Park regulations. However, this unit is included in the Copper River Fire Management Plan and, if a wild fire occurs, there will be only limited suppression activities except in areas of human habitation.

Project Location: Unit 13 (23,400 mi²)
Nelchina Basin

Project Objectives: To increase the moose population to an estimated 25,000 by 1995 with a posthunting sex ratio of no less than 15 adult bulls:100 cows.

Work Accomplished During the Project Segment Period: We conducted fall sex and age moose counts in 10 count areas located throughout the unit. We counted 6,295 moose at a rate of 58 moose/hour. The overall bull:cow ratio was 25 bulls:100 cows with 19 adult bulls:100 cows. Calves comprised 11.7% of the herd.

We conducted a moose census in Subunit 13B during late November that resulted in a population estimate of 4,644 moose. The bull:cow ratio was 18 bulls:100 cows and calves comprised an estimated 13.9% of the subunit's moose population.

Snow depths were recorded throughout the Nelchina Basin and a winter severity index for moose calculated. This was the fourth consecutive winter classified as severe because of deep snow pack.

Hunters killed 686 moose in Unit 13 during the 1991-92 season. A breakdown of the moose harvest shows that hunters took 584 bulls during the state-regulated fall season. Hunters also took 102 bulls under a federally regulated fall subsistence hunt held on federal land in Unit 13 for unit residents.

Land use proposals were commented on as to potential impacts on moose habitat and the Copper River Fire Management Plan was reviewed.

We conducted an aerial survey in early June 1992 to determine initial calf production. The observed calf:cow ratio was 51.4:100 with a 25% twinning rate. Overwinter survival of last year's calves was higher than in the previous year.

Progress Towards Meeting Project Objectives: Moose numbers are estimated to have declined 25% to 30% over much of Unit 13 between 1987 and 1991. This decline follows a 9-year period (1978-87) when moose numbers increased at approximately 5% per year. Although the overall unitwide adult bull:cow ratio observed during fall 1991 surveys still exceeds the stated objective of 15 adult bulls:100 cows, the number of yearling bulls observed was low, suggesting decreased bull recruitment and future declines in the bull:cow ratio. Calf production and/or survival was low again in 1991.

Adult and calf mortality attributable to both deep snow conditions and predation was not as high as in the previous 3 winters, but was still well above that observed during the mid-1980s when moose numbers were increasing. Moose numbers in Unit 13 are expected to decline as long as wolf predation remains at current levels and if severe winters continue.

The current bull harvests increased by 33% from previous year's take in part because the fall moose season was lengthened from 5 to 7 days. Moose seasons were reduced from a 20-day length to prevent overharvesting of bulls following a series of severe winters with increased mortality. Harvests increased in both the state general hunt and the federal registration subsistence hunt for federal lands.

The largest forest fire in recent years occurred in 1991 when 5,500 acres burned on the west side of Tazlina Lake in Subunit 13D. This lightning caused wildfire started in an area with a limited suppression classification; initial attack did not occur and a let-burn policy was followed. Because this fire caused no human injury or property damage, future

suppression activity by Alaska Department of Natural Resources will hopefully allow more wildfires to burn without initial suppression. Because of the size and remoteness of the unit, wildfire is virtually the only means of enhancing moose habitat.

Project Location: Unit 14 (6,600 mi²)
Subunit 14A
Upper Cook Inlet

Project Objectives: Maintain the existing moose population with a posthunting sex ratio of no less than 20 bulls:100 cows.

Work Accomplished During the Project Segment Period: We censused the moose population in Subunit 14A during 1-6 December 1991. The population (N=1472) was estimated at $5,885 \pm 706$ (12%). The bull:cow ratio was estimated at $13.7 \pm 3.4:100$ (25%). Calves represented $25.7\% \pm 2.0$ (7.5%) of the population. We collected late winter age composition data on 25 February in the Knik River valley (n = 121) where calves represented 21% of observed moose, and on 10 April in the Palmer/Wasilla area (n = 546 moose) calves represented 14% of observed moose. Calves comprised 15% of the moose observed in all areas combined.

As of 30 June, 2,858 people reported hunting bulls in the 1-20 September general season, and 490 (17%) were successful. Of the 100 individuals holding antlerless moose permits, 39 were successful, 48 were unsuccessful, and 13 did not hunt.

During 1 July 1991 - 30 April 1992, 15 moose were killed by trains on the Alaska Railroad. During 1 October 1990 - 2 April 1991, 154 moose were killed by automobiles in Subunit 14A. The number of moose thought to have been killed illegally was 15-20, while 2 were reported killed in defense of life and property.

Progress Towards Meeting Project Objectives: The stratified census which resulted in a population estimate of $5,885 \pm 706$ moose indicated that the population was near the upper end of population objectives. Bull:cow ratios, however, fell below objectives because of affects of previous winter conditions, higher than normal hunting pressure, and reduced cow harvest. Winter 1991-92 produced above average snow accumulations. Calf survival suffered for the third year in a row as a result.

We estimated harvestable surplus at 550-700 moose, including 400-500 cows. Antlered moose seasons could not be changed this period. A 20-day permitted season for antlerless moose was recommended for the fall 1992, and was adopted by the Board of Game. Up to 400 antlerless permits may be issued, with 200 for hunts west and east, respectively, of a line formed by the Knik-Goose Bay/Wasilla-Fishhook roads. Past harvest data indicate that harvest of cows will be less than half of potential surplus, while harvest of

bulls will exceed desired levels by 200-250. Resulting post-hunt sex ratios should be 10-12 bulls:100 cows in 1992.

New 5-year population and human use objectives for moose in Subunit 14A were drafted. The population objective is to maintain a population of about 5,000-5,500 moose with a minimum sex ratio of 20 bulls:100 cows. The human use objective is to achieve and maintain an average annual human harvest of 600-700 moose by 1995. These objectives would be in effect during the next report period.

Project Location: Subunit 14B

Project Objectives: Increase the moose population to an estimated 2,500 by 1995 with a posthunting sex ratio of no less than 30 bulls:100 cows.

Work Accomplished During the Project Segment Period: No aerial surveys were conducted in Subunit 14B this period. As of 30 June, 350 individuals reported hunting and 49 (14%) were successful during the 1-10 September season. During 1 July 1991-30 April 1992 46 moose were killed by trains on the Alaska Railroad. During 1 October 1991-30 April 1992 17 moose were killed by automobiles in Subunit 14B. No more than 5 moose were thought to have been killed illegally, while no moose were reported killed in defense of life or property.

Progress Towards Meeting Project Objectives: The Subunit 14B moose population was last estimated at $1,795 \pm 247$ in November 1991. The lack of survey data for 1992 prevent accurate modification of that estimate. However, we assume that reduced hunting harvest and less than severe snow depths in the last two winters has prompted some increase in the population. We believe the fall 1992 population will be 1,800-2,200, well below the population objectives.

Based on a population of 2,000 moose, a composition similar to fall 1991, and a minimum allowable post-hunt sex ratio of 20 bulls:100 cows, we estimate a harvestable surplus of 50-100 bulls for fall 1992 east of the closed transportation corridor.

We developed new population and human use objectives for the next 5-year period. The low capability of Subunit 14B habitat to sustain moose during winter 1989-90 prompted ADF&G to reduce population objectives. The new population objective is to achieve, by 1995, and maintain a population of 2,500-2,800 moose with a minimum sex ratio of 20 bulls:100 cows. The human use objective is to achieve and maintain an average annual harvest of 200-300 moose by 1997.

Project Location: Subunit 14C

Project Objectives: Maintain the existing moose population with a posthunting sex ratio of no less than 25 bulls:100 cows.

Work Accomplished During the Project Segment Period: We determined herd population size and composition for Subunit 14C by aerial surveys flown during November and December. We observed 1,139 moose. Several drainages were not counted. The ratios of bulls and calves per 100 cows were 31 and 34 respectively. We estimate the subunit population at 2,000 moose.

We required hunters to report their success on either a harvest or a permit report depending on whether they participated in the general season or a special permit hunt. Reports required information on harvest location, days hunted, sex of the animal, transportation method, hired services, date of harvest, and antler spread when appropriate.

Over the past decade Subunit 14C has supported a large harvest of cow moose. During the past report period cows comprised 48% of the total harvest, or 116 animals. This is the largest take of cows over the past 25 years. Despite this harvest the population remains high because of excellent calf survival over many years, possibly related to reduced number of major predators throughout much of the wintering range. All cows were killed during special permit hunts. Hunters also took 124 bulls, of which 44 came from the general season and 80 during special permit hunts. Hunters average 5.5 days afield and were 31% successful. Over 38% of all moose were taken on either Fort Richardson or Elmendorf Air Force Base with an additional 33% taken from the Portage area hunts. Bowhunters took nearly 42% of the total harvest. Seasons ran continuously in one portion or another of the subunit from August 20 through January 15, excluding only from November 16-December 14. An additional 129 moose were killed by vehicles in the subunit between June 1, 1991 and May 31, 1992.

Progress Towards Meeting Project Objectives: Aerial surveys conducted during late 1991 found an overall ratio of 31 bulls:100 cows, above the project objective of 25 bulls:100 cows. Current harvest levels can be maintained for the foreseeable future given the overall population estimate and above average calf production and survival.

Project Location: Subunit 15A

Project Objectives: Maintain the existing moose population with a posthunting sex ratio of no less than 15 bulls:100 cows.

Work Accomplished During the Project Segment Period: Eight of 13 count areas in Subunit 15A were flown during fall sex and age composition surveys. The following totals and ratios resulted: 1,690 moose classified; 34 calves:100 cows; 22 bulls:100 cows and calves comprised 22% of all moose observed. The bull and calf to cow ratios

decreased by 1/100 when compared to 1991. Calf percentage of total animals observed remained unchanged.

An estimated 250 archery hunters participated during the August 25-29 pre-season archery only hunt in Subunit 15A resulting in a reported harvest of 8 bulls. The highest harvest, 18 bulls, was reported by approximately 400 archers in 1989. The reduced effort and harvest was attributed to a mandatory bow hunter education course initiated in 1990 that many archers had not completed before the season. Archers were required to follow the same antler restrictions imposed on hunters during the general season, allowing only those bulls with either spike/fork or 50-inch antlers to be hunted. Archers did not report harvesting any bulls in the 50-inch or larger category and averaged 2.1 days hunting with a range of 1 to 4 days for successful hunters.

Preliminary data showed 984 hunters reported hunting Subunit 15A during the general 1-20 September 1991 season resulting in a harvest of 184 bulls and 1 moose of unspecified sex. Successful hunters averaged 5.3 days compared to 6.4 days for all hunters. The harvest was comprised of 109 (59%) spike/fork antlered bulls and 47 (25%) bulls with an antler spread of 50 inches or greater or having at least three brow tines on one antler and 29 (16%) of unreported spread (N=185). State residents harvested 99% of the moose reported during 1991 for Subunit 15A.

We received 1,219 applications for 20 permits issued to hunt antlerless moose in Skilak Loop Management Area (SLMA). The season was 21-30 September. All permittees hunted and 11 were successful. All moose harvested were females and ranged in age from 1 to 14 years.

Progress Towards Meeting Project Objectives: The Selective Harvest Program enacted in 1987 has allowed the moose population in Subunit 15A to exceed the ADF&G objective of 15 bulls:100 cows. Results from 1991 surveys indicated a bull:cow ratio of 22:100, an increase of 10:100 since the program began. ADF&G would like to maintain the population at its present size. Loss of habitat through human development or deterioration from natural plant community succession is the primary factor controlling moose density in Subunit 15A. Attempts to enhance areas through prescribed burning by the U.S. Fish and Wildlife Service (USFWS) and ADF&G have been largely unsuccessful because of restrictions necessary to safely burn on the Kenai Peninsula.

The winter of 1991-92 was a moderately severe winter with snow depths up to 3 feet over most of the western one-third of Subunit 15A. Because most moose in Subunit 15A use this area as winter range, the winter conditions caused higher than normal moose mortality, especially among calves.

No changes in season length are recommended for 1992. The selective harvest program gained additional public support during the 1991 season and should be continued.

Project Location: Subunit 15B

Project Objectives: Maintain the existing moose population with a posthunting sex ratio of no less than 15 bulls:100 cows.

Maintain the existing moose population with a posthunting sex ratio of no less than 40 bulls:100 cows in Subunit 15B East.

Work Accomplished During the Project Segment Period: Two hundred forty-eight hunters reported hunting in Subunit 15B West during the 1-20 September season harvesting 39 bulls. Successful hunters averaged 4.4 days afield compared to 5.3 days for all hunters. Twenty-three (59%) of the 39 successful hunters reporting their means of transportation used a highway vehicle. Horses were the second most common transport means used (15%). Hunter success rate was 16%.

The bag limit for Subunit 15B West is one bull with a spike/fork or 50 inch antlers. The 1991 harvest was comprised of 22 (56%) spike/fork antlered bulls, 11 (36%) bulls with an antler spread of 50 inches or greater or possessing at least three brow tines on one antler, and 3 (8%) with unreported antler spread (N=39).

Moose hunting in Subunit 15B East is allowed by permit only with a bag limit of one bull with 50 inch or larger antler spread. One hundred permits were issued resulting in the harvest of 34 bulls that averaged 7 years of age with a range of 3 to 11. The average antler spread was 54 inches and ranged from 38.3 to 68.8 inches (N=34).

Progress Towards Meeting Project Objectives: The Selective Harvest Program initiated in 1987 was designed to reduce the harvest of males and allow the bull:cow ratio to increase. Because no areas were surveyed during 1991 an assessment of the population's status and trend could not be determined. The bull:cow ratio is suspected to be in excess of 15:100 considering previous years' survey data when more representative areas are surveyed. Although Subunit 15B East was not surveyed in 1991, we believed it to have well over the management objective of 40 bulls:100 cows from staff observations and comments from permittees hunting the area.

Moose habitat in Subunit 15B is deteriorating primarily through natural plant community succession and to a lesser extent by human encroachment.

Because recent censuses have not been conducted, an accurate assessment of population trend is not available. However, the 1989/90 and 1991/92 winters were severe, resulting in higher than normal winter mortality especially in the calf age class.

We recommend no changes in season or bag limits for Subunit 15B for the 1992 season. The Selective Harvest Program was designed to protect the male segment of the population from over harvest following a severe winter.

Project Location: Subunit 15C

Project Objectives: Maintain the existing moose population with a posthunting sex ratio of no less than 15 bulls:100 cows.

Work Accomplished During the Project Segment Period: We surveyed two of eight count areas during the 1991 fall sex and age composition surveys. We classified 913 moose with ratios of 40 calves:100 cows and 36 bulls:100 cows. Calves represented 22.8% of the total moose counted.

We completed a complete Gasaway style census during late winter when snow conditions were optimum. We censused the lowland portion of Subunit 15C (1,190 mi²). We estimated a population of 2,079 moose from survey results. Confidence intervals around the estimated population ranged $\pm 19.81\%$ for 80 % CI (1,677 - 2,491) to $\pm 31.48\%$ for 95 % CI (1,425 - 2,734). Low sightability of moose was the largest factor for high CI. The true population for the census area probably occurs near the upper CI. An additional 200-300 moose was estimated to be in the mountainous portion of Subunit 15C (outside census area).

Progress Towards Meeting Project Objectives: In Subunit 15C the selective harvest program was designed in part to increase bull:cow ratios. Because we surveyed only two count areas during this period, an accurate assessment of the program success cannot be made. However, hunter reports and general field observations suggest that bulls are more abundant in Subunit 15C and the regulations are generally well supported by a variety of wildlife users. We recommend maintaining the current spike-fork or 50 inch restriction in the bag limit.

Project Location: Unit 16 (12,300 mi²)
West side of Cook Inlet

Project Objectives: Maintain a moose population of 10,000 with a posthunting sex ratio of no less than 20 bulls:100 cows.

Work Accomplished During the Project Segment Period: No aerial surveys of Subunit 16A moose were conducted this period.

As of 30 June, 866 persons reported hunting bulls in the 1-15 September general season; 135 (16%) were successful.

Studies of radio-marked moose from Subunit 16A show that some moose winter near the Parks Highway/Alaska Railroad corridor in Subunits 14A and 14B. Thus, some Subunit 16A moose are subject to non-hunting, human-induced mortality in these areas, but the

magnitude of this mortality is unknown because moose from up to three subunits winter in this area. Along the Parks Highway within northern Subunit 16A, 13 moose were known to have been killed by highway vehicles from October 1991 to April 1992. The number of moose thought to have been killed illegally was 10-15, while no moose were reported killed in defense of life and property.

We did not conduct a planned census of Subunit 16B south of the Beluga River because of inadequate snow cover. No other surveys were planned for the subunit during this report period. Winter weather was moderate throughout most of the subunit until late winter and mortality did not appear to be above average.

Hunters reported killing 193 bull moose during the 1991 general seasons including 2 on Kalgin Island. The seasons were 1-10 September for the Redoubt Bay area and September 1-20 for the remainder of the subunit. During the Tier II winter hunt, 51 additional bulls were taken during the 4-17 January 1992 season that was established by emergency order.

Progress Towards Meeting Project Objectives: Although there was no specific population objective for Subunit 16A, we assumed previously that the objective for this subunit was 2,500 moose. Lack of current survey data prevent accurate modification to 1990 population estimates. However, moderation of winter conditions, reduced hunter harvest, and reduced non-hunting mortality cause us to believe that the fall 1991 post-hunt Subunit 16A moose population was 2,800-3,400. Even after a 30-40% decline during 1989-90, the old objective was met.

The population information collected in fall 1990 caused us to reevaluate Subunit 16A population objectives. We developed draft 5-year population and human-use objectives. The proposed population objective is to achieve, by 1995, and maintain a fall population of 3,500-4,000 moose with a minimum of 20 bulls:100 cows. The human use objective is to achieve, by 1997, a minimum average annual harvest of 300 moose.

Using the draft population objectives and assuming average population productivity, average winter mortality, and a fall 1991 population of 3,100, the potential harvestable surplus should be 150-225 bulls. The current unchanged 1-15 September general bull season will probably produce 140-160 bulls in the harvest. The resulting post-hunt population should approach 3,200 moose and a bull:cow ratio of 24-26:100.

Seasons for the fall 1993 and 1994 seasons should be 1-20 September at least, with an any bull bag limit. Following the severe winter of 1989-90, the hunting season in Subunit 16A was reduced to 10 days (from 30 days). A 20-day season (for any bull) was recommended to the Board of Game in 1991. The Board adopted a 15-day season for any bull that would be in effect through fall 1992.

Although there was no specific population objective for Subunit 16B, we assumed that the objective for this subunit was 7,500 moose. Lack of current survey data prevent

accurate modification to 1990 population estimates. However, moderation of winter conditions, reduced hunter harvest, and reduced non-hunting mortality cause us to believe that the fall 1991 post-hunt Unit 16 moose population was 7,000.

We developed draft 5-year population and human-use objectives. The proposed population objective is to maintain a fall population of 6,500-7,500 moose with a minimum of 25 bulls:100 cows. The human use objective is to achieve, by 1994, an average annual harvest of 400-450 moose.

A 10 day extension for the fall 1991 season was adopted for Subunit 16B by the Board of Game because total numbers and composition were compatible with the objectives established for the subunit.

Project Location: Unit 17 (18,800 mi²)
Northern Bristol Bay

Project Objectives: Unit 17 project objectives are to: 1) establish a minimum population of 100 moose in Subunit 17A; 2) achieve and maintain a density of 1 moose/mi² on habitat considered to be good moose range in Subunit 17B; and 3) maintain a minimum density of 0.5 moose/mi² in areas considered to be moose habitat in Subunit 17C.

Work Accomplished During the Project Segment Period: Fall sex and age moose counts were conducted in 4 trend count areas within Subunit 17C. Counts averaged 67.2 moose per hour with a total of 382 moose observed. The overall ratios were 70 bulls:100 cows and 56 calves:100 cows (26.4% calves). In January, we saw 6 moose (5 adults & 1 calf) during a 3.5 hr survey of the Togiak and Kulukak rivers in Subunit 17A. We monitored fall harvest by personal interviews on the Nushagak and Mulchatna rivers and by analysis of harvest ticket returns.

Preliminary data from harvest tickets returned by February 1992 indicated that 256 hunters killed 197 bulls, no cows, and 2 moose of unspecified sex during the 1991-92 general season. No moose were harvested in Subunit 17A, 141 were in Subunit 17B, and 55 were harvested in Subunit 17C. Three moose were harvested in unspecified areas. Hunter success was 88% for local residents, 77% for other Alaska residents, and 82% for nonresidents. Aircraft was the most common mode of transportation (63%). Most of the harvest was distributed throughout the September season (83%). Seventeen bulls were harvested during the December season. Preliminary data as of June 1992 indicated 220 moose killed by 536 hunters (41% success rate).

Harvest data from Registration Hunt 983 indicated that 238 hunters harvested 49 bulls and 1 moose of unspecified sex during the 1991-92 season. No moose were harvested in Subunit 17A, 15 were harvested in Subunit 17B, and 28 in Subunit 17C. Six moose were harvested in unspecified areas. Hunter success was 22% for local residents (48/220) and

11% for other Alaska residents (2/18). Nonresidents were not eligible to participate in this hunt. Boats were the most common means of access (81%).

Progress Towards Meeting Project Objectives: Moose throughout Unit 17 experienced another mild winter in 1991-92 and survival appeared to be high. In Subunits 17B and 17C, trend data suggest the populations are stable to increasing in most areas. Hunter success remains high in spite of ever increasing harvest levels. In recent years moose have become common sites near Nushagak River villages throughout the winter. I believe this is evidence of an increasing moose population and an indication that local villagers are respecting seasons and bag limits.

Census data for Unit 17 have not been collected since 1987, so there are no recent measures of how the population compares to objective levels. We had planned to conduct a census of the upper Mulchatna River and its tributaries with staff from Lake Clark National Park during fall/winter 1991, but insufficient snow conditions prevented it. We should budget for a moose census in Subunit 17B or 17C as soon as possible.

Moose numbers in Subunit 17A continue to be severely depressed. Habitat conditions in that subunit appear excellent and healthy moose populations are available in adjacent areas. Illegal harvests are the suspected cause for the chronic low population levels in Subunit 17A. Evidence suggests that more than 20 moose were harvested from Subunit 17A this report period.

Segment Period Project Costs:

	<u>Personnel</u>	<u>Operating</u>	<u>Total</u>
Planned	197.6	54.6	652.2
Actual	197.6	60.575	258.175
Difference	0	-5.975	-5.975

Explanation: Actual operating costs were 5.975 more than planned because of additional counts conducted in Subunit 14A and higher than anticipated costs to conduct a moose census in Subunit 15C.

Submitted by:

John N. Trent
Management Coordinator

Project Title: Interior Moose Population and Habitat Management

Unit 12

Project Objectives and Activities:

1. Increase the moose population from an estimated 2,500-3,500 to 5,000-7,000 with an annual harvestable surplus of at least 3% by the year 2000.
2. Increase the overall moose hunter success rate to at least 35% without reducing participation from current levels (400 hunters/year) by the year 2000.
3. Maintain a posthunting sex ratio of at least 40 bulls:100 cows.

Tetlin and Tok river drainages:

1. Maintain the present population of moose (1,200-1,500).
2. Increase the harvestable surplus to at least 3% by the year 2000; increase the proportion of males in the population to 40 bulls:100 cows by the year 2000; increase the proportion of resident moose in the Unit 12 population to at least 50% by the year 2000; and increase the browse production on at least 100 acres/year for at least 10 years in known winter range in the Tetlin and Tok river drainages.

Northwestern Unit 12 (Robertson River, upper Tanana Valley):

1. Increase the (1) moose population from an estimated 400 to 800 moose by the year 2000, (2) proportion of males in the population to 40 bulls:100 cows along the north slope of the Alaska Range (adult bulls > 5 years should compose no less than 20% of all bulls > 17 months posthunting), and (3) browse production on at least 100 acres/year for at least 10 years in known winter range.

Eastern Unit 12 (Cheslina River to U.S.-Canada Border):

1. Increase the (1) moose population from an estimated 1,200-1,300 to 2,200-2,500 by the 2000 and (2) proportion of males in the upper Chisana River area to 40 bulls:100 cows and increase the proportion of adult bulls > 5 years in that population to at least 20% of all bulls > 17 months.

Work Accomplished During the Project Segment Period: ADF&G staff flew fall moose composition and trend count surveys during October and November 1991 in 10 traditional count areas and classified 1,472 moose in 33.2 hours of survey time. We observed 44 moose per hour of survey, approximating the 3-year mean of 42. Calf survival declined to 28 calves:100 cows > 2 years, the lowest level since 1987. The

yearling bull:cow ratio of 12:100 was comparable with the past 2 years. The overall bull:cow ratio was 49:100, exceeding the population objective of 40:100.

Preliminary harvest reports indicate that in 1991, 285 hunters (234 residents, 15 nonresidents, and 36 of unknown residency) took 107 bull moose in Unit 12, for an overall success rate of 37.5%. Success rate is probably inflated because not all reports have been received. Harvest and success rate were substantially higher in 1991 than the past 3 years. Unit residents (Northway, Tetlin, and Tok) harvested 41 bulls or 38.3% of the harvest and represented 37.9% of the hunting pressure with 108 hunters. The mean antler width was 42.2 inches for bulls harvested in Unit 12. Yearling bulls with antlers < 30 inches (\bar{n} = 12) composed 13% of the harvest, bulls with antlers 30-49.9 inches (\bar{n} = 51) composed 54%, and mature bulls with antlers \geq 50 inches (\bar{n} = 32) composed 33%. Mean antler width was smaller than the past 2-years mean of 45.9 inches.

Approximately 1,000 shrubs were evaluated along transects at 14 sites in the Tok and upper Tanana river portions of Unit 12. Use by moose was normal (low) for this area of low moose density.

Progress Toward Meeting Project Objectives: ADF&G refined project objectives during FY92 to reflect changes in management emphasis due to the Draft Area-Specific Wolf Management Plan, land ownership patterns, and projected funding levels. About 77% of the Unit 12 lands are included in the Wrangell-St. Elias National Park and Preserve, the Tetlin National Wildlife Refuge, or the Tetlin Indian Reservation. Therefore, most management options and actions are prescribed by either federal law or reservation policy. More active management is planned only in northwestern Unit 12, which is primarily state and private land. Definite funding for habitat enhancement is no longer available. The refined objectives are listed below:

1. Increase the moose population from an estimated 2,500-3,500 to 4,000-4,500 by the year 2010.
2. Maintain a minimum posthunting sex ratio of 40 bulls:100 cows.

Northwestern Unit 12 (Robertson River and upper Tanana Valley):

1. Increase the (1) moose population from an estimated 400 to 800 moose by the year 2000 and (2) maintain a minimum of 20 bulls:100 cows along the north slope of the Alaska Range.

Unit 19, and Subunits 21A and 21E

Project Objectives and Activities:

Unit 19:

1. Develop statistically sound moose population estimates for select portions of the unit by spring 1993.
2. Annually assess population status and trend in portions of the unit where harvest levels make significant impacts on moose populations.
3. Maintain a unitwide reported harvest of at least 500 moose.
4. Maintain a unitwide reported moose hunter success rate of at least 45%.
5. Maintain a reasonable harvest of cow moose in Subunits 19A and 19D.
6. Maintain an annual average moose antler spread measurement of at least 48 inches in Subunits 19B and 19C.
7. Assess accuracy of moose harvest reporting in select portions of the unit.

Subunits 21A and 21E:

1. Delineate moose survey areas in both subunits suitable for use in obtaining annual information on population status and trend.
2. Maintain a moose population in Subunit 21A capable of sustaining a reported harvest of at least 150 bull moose with an average antler spread measurement in excess of 48 inches.
3. Maintain a moose population in Subunit 21E capable of sustaining a reported harvest of at least 125 moose that includes some reasonable opportunity to take cow moose.
4. Maintain a reported moose hunter success rate of at least 50% in both subunits.
5. Encourage the USFWS, U.S. Bureau of Land Management, and Alaska Department of Natural Resources to reduce suppression efforts on wildfires that do not threaten human life, property, or valuable resources, in accordance with provisions of the Alaska Interagency Fire Plan, so that fire can fulfill its natural role of maintaining young, highly productive, and diverse habitats.
6. Increase compliance with the requirement to use harvest tickets and reports.

Work Accomplished During the Project Segment Period: ADF&G did not conduct moose population and status surveys in all traditional count areas during autumn 1991 because of insufficient snow coverage. In Unit 19, only two areas were subjected to trend/composition surveys, while Subunits 21A and 21E had no surveys. In the Farewell Burn in Subunit 19C, moose numbers and ratios changed little from the previous 3 years' counts. We computed moose per hour at 156. Calves increased slightly to 29:100 cows. Bull numbers remained stable at 44:100 cows. We surveyed the Candle Hills Count Area in Subunit 19D, again with little change over previous years' data. We observed 37 moose/hour, with 20 bulls:100 cows and 32 calves:100 cows.

We did not conduct late winter mortality surveys because moose did not concentrate on traditional wintering areas along the major drainages because of extremely mild winter conditions. We did conduct a moose census during early March 1992 in a 1,240-mi² area in the Lime Hills of Subunits 19A and 19D. Final estimates indicate a population of 0.73 moose/mi². At 90% CI, the moose population in the area was estimated at $905 \pm 16.6\%$.

Reported moose harvests in Subunit 19A have been relatively stable at 137 moose/year, although this is probably less than half of what is actually taken; reporting rates are very low (45% in 1988). Reporting rates are better in Subunits 19B and 19C, with averages of 140 moose for Subunit 19B and 113 for 19C reported annually during the period 1986-90. Reporting compliance in Subunit 19D has also been poor, with 122 moose reported annually during the same time period. In Unit 19, reported moose harvests began a steady decline during the 1989-90 season. This is probably because of (1) heavy mortality from wolf predation and winter starvation, (2) shortened season lengths, and (3) unseasonably warm weather during the 1991 fall season. In Subunit 21A, reported moose harvests have remained stable during the period 1986-90, with a mean reported annual harvest of 142 moose. In Subunit 21E, reported harvests increased during each of the past 5 years from 112 moose in 1986 to 184 in 1990.

We did not conduct browse surveys during summer 1991. Efforts continued to be expended on attempts to reburn portions of the 1977 Bear Creek (Farewell) Burn. Continued cooperation with the Department of Natural Resources resulted in nearly one million acres of new burns during both 1990 and 1991 summers in the McGrath area, with moose and other important species being benefited tremendously. We did not conduct telemetry studies in the area during this report period.

Progress Toward Meeting Project Objectives: Completion of objectives for these units was complicated by the lack of snow, leading to little fall survey work. However, the Lime Village moose population estimation survey was the first such survey completed in Unit 19 and contributed greatly to our understanding of moose populations in the area.

Subunit 20A

Project Objectives and Activities:

1. Maintain at least 8,000 adult moose (i.e., excluding calves) in the population and 10,000 total moose.
2. Maintain a bull:cow ratio of at least 30:100 overall. Maintain at least 20 bulls:100 cows in count areas in the northeastern Tanana Flats and in the western and central foothills.
3. Maintain an annual harvest of ≤ 300 adult bulls (i.e., excluding yearlings) and a total harvest of <400 bulls.
4. Allow the harvest of cow moose when the population is above the objective of 8,000 adult moose and is exhibiting a positive growth rate.

Work Accomplished During the Project Segment Period: We completed two population estimation surveys in Subunit 20A between 19 November and 4 December 1991. In the western foothills, we censused a 1,422-mi² area that corresponded exactly to an area censused in 1988. In the Tanana Flats, we censused a 1,610-mi² area that was

only a subset of an area censused in 1988. The foothills were stratified at 39 seconds/mi² so that we could use the data to further evaluate the superstratification technique. The Flats were stratified at 33 seconds/mi², which is consistent with normal census stratification.

From these two censuses, we estimated that the 1991 Subunit 20A moose population included 8,788 adult moose (excluding calves) and 11,072 total moose. Point estimates for the censused areas included $3,927 \pm 15.0\%$ (90% CI) (2.8 moose/mi²) in the western foothills and $3,906 \pm 15.2\%$ (90% CI) (2.4 moose/mi²) in the central flats.

Composition data from these 1991 censuses indicated the moose population in Subunit 20A was 28 bulls:100 cows overall (weighted by adult sample size). Bull:cow ratios were 21:100 in the central Tanana Flats and 32:100 in the western foothills.

According to 1991-92 moose harvest report cards, 1,149 hunters harvested 382 moose (33% success rate) from Subunit 20A. Of these 382 moose, 331 (87%) had antler spreads of 30 inches or larger, 38 (10%) had antler spreads less than 30 inches, and 13 had unknown antler spreads.

We gathered harvest information by operating a hunter check station on the Tanana River at the Chena Pump Campground (one of the primary boat launching areas) from 7 to 19 September 1991. Preliminary results indicate that 210 moose hunters were contacted, of whom 58 (28%) were successful and 152 were unsuccessful. Hunters using airboats apparently had higher success rates (36% of 59) than hunters in riverboats (18% of 90). We estimated the 1991 adult moose population to exceed 8,000 moose (8,788). During this report period, we reviewed data from the 1988 population estimation surveys and subsequently revised the resulting population estimate. Although the population appears to have increased from 1988 to 1991, we could only detect an increase (12%/year) in the southwest foothills. There was no measurable increase in the Tanana Flats population. Because of lack of funding, we did not conduct May moose surveys to estimate recruitment of the 1991 cohort or twinning rates among the 1992 cohort. We had previously done these in 1987-91.

Progress Toward Meeting Project Objectives: Based on November 1991 moose censuses, we are meeting our objective to maintain at least 8,000 adult moose (8,788) and at least 10,000 total moose (11,072).

We are just under our objective to maintain at least 30 bulls:100 cows overall (28:100). Although we did not examine census data to pull out subsets of data relating to count areas, it appears that we met our objective to maintain at least 20 bulls:100 cows in the central Tanana Flats (21:100) and in the western foothills (32:100).

Hunters exceeded our harvest objective of harvesting ≤ 300 adult bulls by killing 331 bulls with antler spreads ≥ 30 inches. We did meet our objective to keep total harvest to < 400 bulls (382).

We did not propose any cow harvests for Subunit 20A because we did not detect a positive growth rate in the Tanana Flats, although we met our population objective overall. We will consider liberalizing moose hunting regulations in the southwest foothills where growth rates were approximately 12% per year from 1988 to 1991.

The following specific information should be added to our list of objectives:

Subunit 20A:

- 3.a. Monitor moose harvest from the general season with harvest report cards and hunter check stations. Assume that adult bulls have antlers ≥ 30 inches.
- 4.a. Estimate moose population trend.

Subunit 20B

Project Objectives and Activities:

- 1. Increase the moose population to 10,000 moose by 1993, with 4,000 in western Subunit 20B and 6,000 in central/eastern Subunit 20B.
- 2. Maintain a minimum of 20 bulls:100 cows in each count area and an overall Subunit 20B ratio of at least 30 bulls:100 cows.
- 3. Sustain an annual harvest of at least 300 bulls.

Work Accomplished During the Project Segment Period: ADF&G did not conduct moose surveys in Subunit 20B during this report period. However, we did analyze data from previous censuses and stratification flights to derive a current estimate of moose in Subunit 20B. Based on this analysis, Subunit 20B contained approximately 9,800 moose in November 1990. This estimate included 3,400 in western Subunit 20B, 4,200 in central Subunit 20B, and 2,200 in eastern Subunit 20B. Although the moose population had not reached our objectives by fall 1990, it has been increasing and will probably reach our target by fall 1993.

Regional differences in growth rates within the subunit reflect the history of wolf reduction programs. The highest growth in the moose population occurred in Subunit 20B West (14-23%), where wolves were reduced from 1984 to 1986. There was a moderate growth rate in Subunit 20B Central (5-13%), where wolves were less intensively reduced from 1982 to 1984. The lowest growth rate was in Subunit 20B East (-4 to +7%), where wolves were not controlled.

In 1991-92, the general season harvest reports indicate that 429 moose were killed by 2,593 hunters (17% success rate). In addition, 28 bulls were killed (26 in September, 2 in November) during Registration Hunt 986 for bowhunters in the Fairbanks Management Area. Seventy-nine percent (22/28) of these bulls had antler spreads \leq 30 inches. The success rate was 11% (28/257). The total number of hunters registering for either the September or November hunt was 333.

Eighty-four hunters having Minto Moose Tier II permits harvested 36 bulls; 26 of these moose were taken in September and 8 were taken during the January-February season. This brings the total 1991-92 moose harvest in Subunit 20B to 493 bulls.

Progress Toward Meeting Project Objectives: We expect to reach population objectives 1 and 2 by fall 1993. We met our objective to sustain an annual harvest of at least 300 bulls (469 reported killed in general and permit hunts in 1991). We will consider extending the general hunting season in Subunit 20B by 5 days if population objectives are reached.

The following specific information should be added to our list of objectives:

- 3.a. Monitor harvest from the general season with harvest report cards and hunter check stations.
4. Provide additional moose hunting opportunity for hunting within the Fairbanks Management Area with a registration hunt for bowhunters.
 - 4.a. Administer Registration Hunt 986.
5. Limit the moose hunting opportunity in Minto Flats to Tier II hunters if necessary.
 - 5.a. Evaluate current needs for Tier II hunting of moose in the Minto Flats Management Area.

Subunits 20C and 20F

Project Objectives and Activities:

1. Estimate moose hunting mortality and document nonhunting mortality when possible.
2. Maintain an annual posthunting sex ratio of at least 30 bulls:100 cows.
3. Estimate moose densities by 1991.
4. Promote moose habitat enhancement by allowing natural fires to alter vegetation succession.
5. Establish definitive moose population objectives by 1992.

Work Accomplished During the Project Segment Period: In Subunit 20C, 376 hunters reported taking 142 moose during 1991-92, which is higher than that reported since at least 1984. From 1984 to 1990, reported harvests ranged from 70 to 116, and the number of hunters ranged from 280 to 308.

In Subunit 20F, 155 hunters reported taking 37 moose during 1991-92. Although this hunting pressure is higher than since 1984 (1984-90 range from 81 to 124 hunters), harvest remained consistently low (1984-90 range from 15 to 41).

Only one moose has been reported harvested for the Nuchalawoyya Potlatch during the last 2 years. The village of Tanana did not have the potlatch in 1991 and one cow moose was taken for the 1992 potlatch. The Tier II hunt in Subunit 20F was only in effect during the 1990-91 season and is no longer a regulation.

We gathered data on nonhunting mortality and will analyze it during the next report period. We did not conduct any activities for objectives 2 through 5.

Progress Toward Meeting Project Objectives: We have gathered little information on moose in Subunits 20C and 20F because of demands for information from more intensively used areas. Overall moose densities are low, but there are some areas with medium or high densities. Harvest and hunting pressure have remained relatively stable during the past 8 years and are not expected to influence moose populations undesirably. We will review management objectives during the next report period after the Wolf Management Plans are finalized by the Board of Game in November 1992.

Subunit 20D

Project Objectives and Activities:

1. Manage for a total posthunting season population of 7,000 moose in Subunit 20D with 3,000 in northern Subunit 20D, 2,500 in southwestern Subunit 20D, and 1,500 in southeastern Subunit 20D.
2. Manage for a posthunting season bull:cow ratio of 30:100.
3. Manage for a calf:cow ratio of no less than 30:100.
4. Increase the bull age structure in southwestern Subunit 20D so that by 1993 at least 20% of the bulls observed after the hunting season have an antler spread of ≥ 50 inches.

Work Accomplished During the Project Segment Period: We modified population objectives based on draft area-specific wolf management plans to manage for a posthunt population of 4,000-6,000 moose, with 1,200-2,200 in northern Subunit 20D, 2,000-2,500 in southwestern Subunit 20D, and 1,000-1,500 in southeastern Subunit 20D.

We flew population trend count surveys during fall 1991 in the Donnelly, Knob Ridge, and Agricultural Project Trend Count Areas (TCA) in southern Subunit 20D and in the Central Creek TCA in northern Subunit 20D.

Density of moose in the Donnelly TCA was 3.1 moose/mi². Calf survival was 32 calves:100 cows and yearling survival was poor with 4 yearling bulls:100 cows. Bull:cow ratios declined to 16:100. Fourteen percent of all bulls had antler spreads ≥ 50 inches. Density of moose in the Knob Ridge TCA was 1.9 moose/mi². Calf survival was 31:100 cows and yearling bull survival was 4:100 cows. The bull:cow ratio declined to 33:100. The Agricultural Project TCA was only partially completed. Density of moose declined in the Central Creek TCA to 1.9 moose/mi². Calf survival was poor with 15:100 cows and yearling bull survival was poor with only 6:100 cows. Bull:cow ratios were 69:100.

We flew composition surveys in the Robertson River drainage of southern Subunit 20D and the Billy Creek drainage of northern Subunit 20D. Moose seen per hour increased to 33. Calf survival improved to 35:100 cows but yearling bull survival was only 4:100 cows. The bull:cow ratio declined to 31:100. We observed 36 moose/hour during the Billy Creek composition survey; however, sample size was small with only 64 moose observed. Calf survival was good with 32:100 cows and yearling bull survival increased significantly to 14:100 cows. The bull:cow ratio was 96:100.

The number of hunters in Subunit 20D increased to 658 during the 1991 season; hunters harvested 144 moose for a 22% success rate. Fifteen residents were issued Tier II permits to hunt the 1 January-15 February 1992 subsistence season in southeastern Subunit 20D, but no moose were reported harvested. We did not conduct moose browse surveys because of higher priority commitments.

ADF&G staff cooperated with the U.S. Army to locate radio-collared moose in southwestern Subunit 20D. The data will be analyzed by staff at a later date.

Progress Toward Meeting Project Objectives: We conducted aerial surveys to determine trends in population and analyzed harvest from harvest ticket reports.

We cannot determine progress toward population size objectives because we did not conduct population estimation surveys in Subunit 20D. However, we believe that moose populations are probably stable in southwestern Subunit 20D although the bull:cow ratio is below the management objective and declining, stable in southeastern Subunit 20D, and declining in northern Subunit 20D, though calf and yearling survival have increased significantly in northeastern Subunit 20D.

In southwestern Subunit 20D, calf:cow ratios met the Subunit 20D objective though the ratios have continued to decline from a high of 47 calves:100 cows in 1988. Bull:cow ratios are below the objective and continued to decline. The bull:cow ratio may be declining because of high harvest of bulls and an increase in the number of cows in this

area. Bull age structure is below the objective. To meet the age structure objective, regulations should be revised to redefine the definition of a 50-inch bull from one having a 50-inch antler spread or at least three brow tines on one antler, to a bull having at least four brow tines on one antler.

In southeastern Subunit 20D, calf:cow ratios met the Subunit 20D objective in the Knob Ridge TCA and Robertson River survey. Bull:cow ratio objectives were met in both areas, although they are declining.

Calf:cow ratios were significantly below the Subunit 20D objective in the Central Creek TCA in northwestern Subunit 20D, but were met in the Billy Creek area of northeastern Subunit 20D. Bull:cow ratios met the objective in both areas. Poor calf survival is probably because of predation in northwestern Subunit 20D, and improved calf survival in northeastern Subunit 20D may be the result of liberalized grizzly bear seasons and bag limits in adjacent Subunit 20E.

Subunit 20E

Project Objectives and Activities:

1. Maintain a posthunting sex ratio of at least 40 bulls:100 cows in the Charley River drainage.
2. Increase the moose population from an estimated 2,000-3,000 to 8,000-10,000 with an annual harvestable surplus of at least 3% by the year 2000 in the remainder of Subunit 20E.
3. Increase the overall moose hunter success rate to at least 35%, while increasing hunter participation from 200 to 800 hunters by the year 2000 in the remainder of Subunit 20E.
4. Maintain a posthunting bull:cow ratio of at least 40:100 in all areas.

Work Accomplished During the Project Segment Period: We flew fall moose composition surveys during October and November 1991 and classified 834 moose during 19.8 hours of survey time. We observed 42 moose/hour of survey, exceeding the 5-year mean of 32 moose/hour.

The posthunt sex ratio was 65 bulls:100 cows, approximating last year's ratio of 64:100. There were 14 yearling bulls:100 cows, substantially higher than the 1986-90 average of 11:100. The overall bull:cow ratio meets the population objective.

The Subunit 20E calf:100 cow > 2 years ratio was 32:100. There was substantial difference across the subunit in calf survival to five months. The calf:cow ratio in the western portion was 25:100 compared with 37:100 in the eastern portion. Overall, calf survival to 5 months and yearling recruitment levels in the subunit will allow continued slow growth of this population.

Increased bear harvests in the subunit are believed to have contributed to the higher calf survival. Caribou mortality data collected during FY92 indicate that wolves selected for caribou instead of moose the past winter, benefiting moose calf survival.

During September 1991, 334 hunters (304 residents, 9 nonresidents, and 21 hunters of unknown residency) reported harvesting 92 bulls and 1 cow moose. This is the highest ever reported harvest in Subunit 20E. The season was extended by five days in 1991 to 15 September. The harvest during that period was 21 bull moose (23% of the total harvest) compared with 4 (9.5% of the total harvest) during 1990. Local resident hunters ($n = 83$) reported taking 36 bulls (39% of the harvest) for a 43% hunter success rate. Other Alaskan resident hunters ($n = 221$) took 56 bulls for a 25% success rate. Nonresidents could hunt for the first time since 1984 in Subunit 20E. Nine nonresidents participated in the hunt and harvested two bulls. Nineteen moose were taken in the Yukon River area and the remainder from southern Subunit 20E. The Mosquito Fork of the Fortymile River yielded the most moose ($n = 17$). Mean antler width was 44.2 inches compared with 49.8 in 1990 and 47.9 inches in 1989.

We did not conduct browse use surveys or radio-telemetry surveys in Subunit 20E during this report period.

Progress Toward Meeting Project Objectives: The moose population in Subunit 20E is increasing slowly (4-5% annually) but still remains at low density (0.4 moose/mi²). Wolf and bear predation are the main limiting factors. At the present predator levels, the moose population will not reach the population or human use objectives by the year 2000. Project objectives will need refining if active predator management is not initiated. The Board of Game will act upon the Draft Area-Specific Wolf Management Plan and the associated Draft Implementation Plan during the fall 1992 meeting. If the board adopts these plans, active wolf management will begin in Subunit 20E in 1992, and no change in the population objectives will be necessary.

Land ownership and management priorities have made it necessary to delete one of the project objectives. The Charley River is part of the Yukon-Charley Rivers National Preserve, and we have limited management options in this area. Therefore, we will delete the following objective: maintain a posthunting sex ratio of at least 40 bulls:100 cows in the Charley River drainage.

Subunits 21B, 21C, 21D, and Unit 24

Project Objectives and Activities:

Subunit 21B:

1. Increase the overall moose population in Subunit 21B to 4,000-4,500 moose by 1995.

The floodplain areas of the Yukon and Novi rivers:

1. Maintain or increase November moose densities to 2.5-4.0 moose/mi².
2. Maintain an average annual harvest of 40 moose from the desired population of 1,000-1,600 moose.
3. Determine the extent and sources of moose calf mortality from May 1988 through May 1990.

Remainder of the Novi drainage:

1. Maintain or increase November moose densities to 0.5 moose/mi².
2. Maintain an average annual harvest of 20 moose from the desired population of 1,100-1,300 moose.

Remainder of Subunit 21B:

1. Maintain or increase November moose densities to 0.5 moose/mi².
2. Maintain a minimum annual harvest of 30 moose from the desired population of 1,600-1,700 moose.

Subunit 21C:

1. Increase the moose population to 2,500-3,000 in the Melozitna River drainage to increase hunting opportunities.
2. Maintain the moose population of 550-750 in the Dulbi River drainage to sustain hunting opportunities.

Subunit 21D:

1. Maintain a population of at least 4,000 moose south and east of the Koyukuk River, including the Three-day Slough floodplain.
2. Maintain an early winter density of at least 4.0 moose/mi² within the Three-day Slough floodplain.
3. Maintain a posthunting ratio of 30 bulls:100 cows in the population being monitored within the Three-day Slough trend count area.
4. Develop guidelines for maximum winter browse use in the Three-day Slough area.
5. Maintain a moose population level of 900-1,000 in the Kateel River drainage and develop a population level for the Gisasa River by 1991.
6. Maintain an early winter density of at least 3.0 moose/mi² in floodplain areas along the Yukon River that are subject to both the September and February hunting seasons.
7. Develop a moose population level and density estimate by 1994 for the remainder of the subunit, including the Yukon and Nulato rivers.

Unit 24:

1. Manage a moose population at the current level of 3,000-4,000 in the area south of Hughes, including the Koyukuk Controlled Use Area.
2. Increase the moose population to 5,000-6,000 in the area from Hughes to Bettles, including the Kanuti Controlled Use Area and the South Fork drainage.

3. Increase the moose population north of Bettles, excluding the Gates of the Arctic National Park, to 3,000-3,500.
4. Maintain the moose population in the Gates of the Arctic National Park at 1,300-1,500.

Work Accomplished During the Project Segment Period: We conducted a population estimation survey in Unit 24 in October 1991 in cooperation with personnel from the USFWS Kanuti National Wildlife Refuge, U.S. National Park Service, and Bureau of Land Management in a 3,373-mi² area along the Dalton Highway corridor. The population was estimated at the 90% confidence level at $1,416 \pm 21.9\%$ moose. Productivity in the area indicated low recruitment. The bull:cow ratio was 50:100, calf:cow ratio was 21:100, and the yearling percentage in the herd was 8.6.

We flew fall moose composition surveys during November 1991 and classified 200 moose in Subunit 21B in 77 mi² along the Novi River, for a density of 2.6 moose/mi². The bull:cow ratio at 21:100 was lower than previous years suggesting a possible decline, the calf:cow ratio was 29:100, and the yearling percentage in the herd was 6. In Subunit 21D within the Three-day Slough trend count area the observed density of moose was 11 moose/mi². Productivity was good with excellent calf recruitment. The bull:cow ratio was 34:100, the calf:cow ratio was 31:100, and there were 6% yearlings in the herd.

We conducted a moose calf twinning survey in May 1992 to determine the percentage of cows producing twins. The observed twinning rate was 51%. Numbers lower than 20% usually indicate environmental stress either from hard winters or poor forage conditions.

In Subunit 21B, 108 hunters reported taking 58 bull moose. We operated a moose hunter check station at the mouth of the Nowitna River and contacted 155 hunters who harvested 45 moose within the drainage that includes part of Subunit 21A. Twenty-two hunters were unit residents, 115 were Alaska residents, and 18 were nonresidents. The number of hunters using the Nowitna River area remained stable.

In Subunit 21C, 37 hunters harvested 21 moose. Four hunters were nonresidents, residency was unknown for 5 hunters, and 28 hunters were Alaska residents.

In Subunit 21D, 357 hunters harvested 271 moose of which 248 were bulls and 23 were cows. Harvest has been slowly increasing within the subunit with the majority coming from the Koyukuk River. We operated a check station on the Koyukuk River and contacted 380 moose hunters. They took 210 moose with residency and harvest as follows: 136 unit residents took 49 moose, 189 Alaska residents took 121 moose, and 55 nonresidents took 38 moose. The number of nonunit hunters has increased 20%.

In Unit 24, 220 hunters harvested 128 moose. The number of hunters (142) using the Dalton Highway for access increased by 10% and they took 43 moose of the 128 total.

We conducted winter moose browse trend surveys in two areas within Subunit 21D. Use of the preferred species *Salix alaxensis* continues to be very high in one area. In the Three-day Slough area the overall browse rate for all species has not risen significantly in the past 8 years. For the preferred species *S. pulchra*, the mean percent twigs browsed has increased from 65 to 77. This was in the same period when moose density increased from 5.7 to 10.9 moose/mi².

Progress Toward Meeting Project Objectives: In Subunit 21B, moose populations within the Nowitna River drainage have reversed their decline but are still 23-42% below the population objectives.

The moose population is currently at or above the population management objective level in Subunits 21C and 21D. In southern and northern Unit 24, the moose population is currently at or above the objective level. In central Unit 24, the population is 66% of the population objective. Predation and excessive harvest are keeping the population low, and until the predator:prey ratios are altered it is unlikely the objective will be reached. The continuation of winter browse surveys will aid in the preparation of guidelines for maximum allowable levels within the Three-day Slough area.

Management objectives were modified during this report period as follows:

Subunit 21D:

5. Maintain a moose population level of 900-1,000 in the Kateel River drainage and develop a population level for the Gisasa River by 1993.

Subunits 25A, 25B, and 25D

Project Objectives and Activities:

Unit 25 overall:

1. Estimate subsistence needs and harvest levels by 1991 and reduce the harvest of cow moose by 5-10% annually beginning in 1990.

Subunit 25A:

1. Ensure that the annual mean antler spread of harvested bulls does not drop below 50 inches; maintain a posthunting sex ratio of at least 50 bulls:100 cows; and determine population size, composition, and distribution by 1991.

Subunit 25B:

1. Determine moose population size, composition, and distribution by 1991.

Subunit 25D West:

1. Increase the population to 1,300 moose by 1990; prevent the annual harvest from exceeding 50 bulls; and determine the effect of recent and older burns on moose distribution, movements, production, and survival by 1992.
2. Determine moose population size, composition, and distribution by 1990; maintain a stable population of approximately 2,300 moose; and determine productivity.

Work Accomplished During the Project Segment Period: The USFWS contracted with ADF&G to conduct a moose stratification in portions of Subunit 25A. On 12-13 November 1991, we stratified 175 sample units in the Coleen, Sheenjek, and Chandalar river drainages. We saw 61 moose total in only 23 (13%) of the sample units, including 31 cows, 17 bulls, 8 calves, and 5 of unknown sex and age. Moose were extremely scarce in the area, despite relatively good habitat.

USFWS personnel classified 314 moose during composition surveys in the Sheenjek and Coleen drainages in Subunit 25A. Composition was 91 bulls:100 cows, 13 yearling bulls:100 cows, and 31 calves:100 cows. Calves composed 14% of the sample and yearling bulls composed 4% of the sample.

We did not conduct composition surveys in Subunit 25B. We did conduct extensive surveys in Subunit 25D and classified 305 moose. In the western half of the area, composition (\bar{n} = 112) was 98 bulls:100 cows, 8 yearling bulls:100 cows, and 31 calves:100 cows, with 13% of the sample being composed of calves. In the eastern portion of Subunit 25D, composition (\bar{n} = 193) was 66 bulls:100 cows, 9 yearling bulls:100 cows, and 26 calves:100 cows with calves composing 13% of the sample. Population status in the areas surveyed appears similar to that observed in previous years.

During the 1991-92 seasons, 69 hunters reported hunting in Subunit 25A, 44 in Subunit 25B, and 51 in Subunit 25D. Among reporting hunters, moose harvest was 45 (65% success) in Subunit 25A, 32 (73% success) in Subunit 25B, and 33 (53% success) in Subunit 25D. An additional 47 hunters reported in connection with the Tier II moose hunt in Subunit 25D West. Twenty-three hunters reported they did not hunt. The remaining 24 hunters reported taking six moose. A sizable number of hunters are believed to have not complied with reporting requirements. Only in Subunit 25D, where there has been significant public education effort by the area biologist and refuge staff, was there sizable (66) reporting by unit residents. In contrast, only 6 unit residents reported hunting in Subunit 25A, and 18 reported hunting in Subunit 25B.

Most of the reported harvest came from the Sheenjek, Coleen, and Chandalar river drainages in Subunit 25A, the Kandik and Black rivers in Subunit 25B, and the Beaver, Yukon, and Porcupine rivers in Subunit 25D.

The preferred methods of access among reporting hunters were aircraft in Subunit 25A (75%) and boats in Subunits 25B (75%) and 25D (61%).

Progress Toward Meeting Project Objectives: We made little progress toward meeting the project objectives for Subunits 25A and 25B because of lack of funds. However, objectives for antler size and bull:cow ratios are being met in Subunit 25A, and a stratification survey provided some information on population size and composition. In Subunit 25D composition surveys provided information on population size, composition, and distribution. The management objective of harvesting no more than 50 bulls in Subunit 25D is being met.

Population management objectives were updated as follows:

Unit 25 overall:

1. Estimate subsistence needs and harvest levels by 1993 and reduce the harvest of cow moose by 5-10% annually.

Subunit 25A:

1. Ensure that the mean annual antler spread of harvested bulls does not drop below 50 inches; maintain a posthunting sex ratio of at least 50 bulls:100 cows; and determine population size, composition, and distribution by 1993.

Subunit 25B:

1. Determine moose population size, composition, and distribution by 1993.

Subunit 25D West:

1. Increase the population to 1,300 moose by 1994; prevent the annual harvest from exceeding 50 bulls; and determine the effect of recent and older burns on moose distribution, movements, production, and survival by 1993.
2. Determine moose population size, composition, and distribution by 1993; maintain a stable population of approximately 2,300 moose; and determine productivity.

Subunit 25C

Project Objectives and Activities:

1. Increase survey coverage of the moose population and derive a population estimate by 1990.
2. Provide annual harvests of 30-50 bull moose and an overall bull:cow ratio above 30:100.

Work Accomplished During the Project Segment Period: We did not conduct any moose surveys in Subunit 25C during this report period. In 1991-92, 164 hunters reported harvesting 46 moose in Subunit 25C. This hunting pressure and harvest are similar to those observed in recent years for this area.

We cooperated with BLM in radio-collaring nine adult moose (seven cows, two bulls) in April 1992. Although they were captured in American, McKinley, and Willow creeks, and the mouth of the North Fork of Preacher Creek, several moose traveled to the Fairbanks area to calve during summer. Several bulls also moved to the Yukon Flats for the summer. BLM will continue to monitor these collared moose to obtain data on seasonal distribution.

Progress Toward Meeting Project Objectives: Our survey plans for Subunit 25C during November 1991 were postponed because weather conditions in early November were not good enough to begin our higher priority censuses in Subunit 20A until the middle of the month. However, we plan to stratify or survey a portion of central Subunit 25C/northcentral Subunit 20B in November 1992 to collect density and composition data.

Harvest objectives are currently being met and we propose no changes in regulations at this time.

We recommend that objectives be revised as follows:

1. Estimate moose density and composition in Subunit 25C by 1993.
 - a. Cooperate with BLM to "superstratify" approximately 1,000 mi² in central Subunit 25C in November 1992.
2. Provide for a sustained annual harvest of 30-50 bull moose.
 - a. Monitor moose harvest with harvest report cards and hunter check stations.
3. Manage for a moose population with an overall ratio of 30 bulls:100 cows.
 - a. Collect moose composition data during the superstratification of central Subunit 25C during November 1992.

Subunits 26B and 26C

Project Objectives and Activities:

1. Determine population distribution, composition, density, and trends by 1991.
2. Determine movements and habitat use in heavily harvested drainages beginning in 1991.
3. Maintain an annual posthunting season sex ratio of at least 50 bulls:100 cows.
4. Maintain a mean annual antler spread of at least 50 inches among bull moose harvested during the general season.
5. Maintain an annual hunter success rate of at least 40%.
6. Determine subsistence needs and harvest levels by 1991.

Work Accomplished During the Project Segment Period: We continued aerial surveys in 10 established trend areas on the north slope of the Arctic National Wildlife Refuge

during late October and early November 1991 and classified 871 moose. Calves and yearlings were moderately abundant in all areas except for the Canning River where calf survival and total numbers declined in recent years. Bull:cow ratios ranged from 49:100 on the Canning River to 85:100 in the eastern areas. Calf:cow ratios were 25:100 in Subunit 26B, 34:100 in eastern Subunit 26C, and 5:100 on the Canning River. Yearling bull:100 cow ratios were 10 in 26B, 10 in eastern 26C, and 7 on the Canning River.

Moose populations seem to be doing generally well in Subunits 26B and 26C, except in the Canning River area. The combination of low numbers and chronically low recruitment in the Canning population are cause for concern. The actual number of bulls in this population declined from approximately 80 in the mid-1980s to about 30 in 1991. We are considering more conservative management of the Canning moose population.

Forty-one hunters reported harvesting 27 moose in Subunit 26B. Most hunting pressure occurred in the Sagavanirktok River drainage. In Subunit 26C, 9 hunters reported taking 5 moose, primarily along the Sadlerochit River. The preferred methods of access among reporting hunters were aircraft in Subunit 26B (71%) and Subunit 26C (67%). We did not conduct browse utilization or radio-telemetry studies in Subunits 26B and 26C.

Progress Towards Meeting Project Objectives: We accomplished minimal work toward the project objectives in fiscal year 1991 because of the transfer of the area biologist for these subunits. The USFWS did some survey work in Subunits 26B and 26C, and we reviewed and incorporated results into management reports.

Objectives were updated as follows:

1. Determine moose population distribution, composition, density, and trends by 1993.
2. Determine moose movements and habitat use in heavily harvested drainages beginning in 1993.
3. Maintain an annual posthunting season sex ratio of at least 50 bulls:100 cows.
4. Maintain a mean annual antler spread of at least 50 inches among bull moose harvested during the general season.
5. Maintain an annual moose hunter success rate of at least 40%.
6. Determine subsistence needs and harvest levels by 1993.

Segment Period Project Costs:

	<u>Personnel</u>	<u>Operating</u>	<u>Total</u>
Planned	131.4	94.0	225.4
Actual	131.4	77.5	208.9
Difference	0.0	+16.5	+16.5

Explanation: Poor snow conditions during late fall precluded sex and age composition counts in portions of Units 19, 21, and 24. Funds were shifted to late winter wolf surveys.

Submitted by:

Kenton P. Taylor
Management Coordinator

Project Title: Western Alaska Moose Survey and Inventory

Project Location: Unit 18 (42,000 mi²)
Yukon-Kuskokwim Delta

Project Objectives:

1. Increase the moose population in Unit 18 by 10% a year while maintaining a population goal for the Yukon River population of 3,000 moose. A population goal for the Kuskokwim River population has not been set. The bull:cow ratio for both populations will be maintained at a minimum of 30 bulls:100 cows.
 - a. Conduct fall sex and age composition surveys and winter recruitment surveys of the Yukon River population annually.
 - b. Conduct fall and/or mid-winter surveys of the major drainages of the Kuskokwim to assess the status and population size of the Kuskokwim River population.
2. Improve harvest reporting and compliance with hunting regulations.

Work Accomplished During the Project Segment Period: We completed a census of the moose population on the Yukon River during February and March 1992. We used four fixed-wing aircraft to complete the census. The size of the census area was 1550 mi².

The department, the USFWS, and several school districts from lower Yukon River and Kuskokwim River communities have continued a cooperative project to monitor moose movements in the Yukon and Kuskokwim river drainages. The radiotelemetry information is currently being incorporated into the school math and science curriculum. Ten radio-collared moose along the lower Yukon River were radiolocated periodically with students from the lower Yukon school district. An additional 11 collared moose were tracked periodically with students from the Yupiit and Kuskpuk school districts from the Kuskokwim area. Additional funding and support for the project was provided by the Association of Village Council Presidents and the Bureau of Land Management.

We used a hunter check station on the Yukon River during September 1991 to collect harvest and age information of moose taken in Unit 18 and Subunit 21E. A total of 287 hunters went through the check station. Of the 97 moose reported harvested, we sampled 73 for antler measurements and 59 for aging by extracting an incisor.

We gathered additional harvest statistics from harvest reports turned in by hunters. In Unit 18, 175 hunters returned harvest reports, and reported harvesting 66 male moose. Successful hunters needed an average of 6.6 days to harvest a moose. Sixty-three successful hunters used boats as transportation, and 3 used snowmachines. Forty-nine (74%) moose were harvested along the Yukon River drainage, one (2%) was harvested

on the Johnson River, and the remaining nine (24%) moose were harvested near the Kuskokwim River.

Progress Towards Meeting Project Objectives: During the past 6 years, estimated recruitment rates obtained from aerial survey data ranged from 12 to 25% for both the Yukon and Kuskokwim river populations. Steady increases in moose numbers have been observed in the Yukon River mid-winter trend count areas since 1985. However, fall sex and age composition surveys of the Yukon River population still need to be completed. During late February and early March 1992, we completed a census along the upper Yukon River in Unit 18. We did not complete surveys of the Yukon delta and the major Kuskokwim drainages this year because of poor weather conditions, lack of time, and budget constraints. We estimate the Kuskokwim River population at slightly greater than 300 moose based upon the November 1989 and 1990 surveys. The Yukon River population census resulted in a minimum population estimate of 1,000 moose. Improved harvest reporting and compliance with regulations is being achieved through hunter contacts at the check station, radio and newspaper announcements, law enforcement activities, and community meetings.

Project Location: Unit 22 (25,000 mi²)
Seward Peninsula and that portion of the Nulato Hills draining west into Norton Sound.

Project Objectives and Activities: The overall population management objective is to maintain a minimum population level of 5,000-7,000 moose throughout the unit. In Subunit 22A, the objective is to increase population size from the current estimate of 400-600 moose to at least 800-1,000 moose. In Subunits 22B and 22D, the objective is to maintain the population at 1,500-2,500 and 2,500-3,000 moose, respectively, with a minimum bull:cow ratio of 30:100. In Subunit 22C, the objective is to maintain the existing population of 350 with a minimum bull:cow ratio of 20:100. In Subunit 22E, the objective is to maintain the existing population of 250-350 moose.

These objectives will be attained through the following management activities:

1. Estimating abundance, sex and age composition, and recruitment to yearling age and determine trends in population size and composition.
 - a. Conducting aerial surveys throughout the unit during late fall and early spring to provide an index of population status and trends, sex and age composition, and yearling recruitment.
 - b. Conducting moose censuses in each of the 5 subunits to estimate abundance.
2. Monitoring human and natural mortality factors affecting the population.
 - a. Evaluating hunting mortality by analyzing all harvest data.

- b. Improving harvest reporting through public contacts and improved communication.
3. Developing a moose management plan, with special emphasis on areas adjacent to the road system.

Work Accomplished During the Project Segment Period: A total of 301 moose (206 males and 95 females) were reportedly harvested from Unit 22. A breakdown of the known locations of harvest by Subunit is as follows: Subunit 22A - 26; Subunit 22B - 67; Subunit 22C - 19; Subunit 22D - 177; and Subunit 22E - 12. The total number of hunters participating in this year's hunt was 651, and 93% were residents of Alaska. Hunter success rate for the season was 46%.

Jaws were collected from 137 harvested moose. We determined ages and sent letters indicating the age of the moose to hunters providing jaws. We collected cannon bones and teeth from hunter-killed moose and analyzed them in an effort to determine the cause of the unusually high incident of tooth breakage among Seward Peninsula moose.

We spent 90 flight hours during spring 1992 censusing moose in Subunit 22B. The calculated density estimate within the census area was 697 moose (+/- 18% at the 95% CI). We calculated short yearling recruitment at 14%.

A school program developed several years ago explaining the importance of wildlife management concepts, rules, and regulations was used throughout Unit 22 schools. We made several trips to villages to explain the need for regulations and harvest reporting as well as to assist local license vendors. We spent considerable time answering and making phone calls, writing articles, sending out mailings of regulation material, and assisting the unit's license vendors.

Progress Towards Meeting Project Objectives: A combination of inclement weather and poor snow conditions during both spring and fall prevented completion of adequate moose surveys in all subunits.

We suspect that the unreported harvest of moose in Unit 22 is substantial. Much of this harvest is thought to be attributable to hunters who do not purchase licenses or pick up harvest tickets rather than by those who hunt outside of current season dates. Efforts to inform the public of the importance of wildlife conservation and the need for regulations are thought to be having an effect in some communities as the number of individuals purchasing license and/or picking up harvest tickets has increased. However, additional contact with local residents, particularly with village residents, needs to occur if complete compliance with current moose regulations is to be forthcoming.

Discussions pertaining to moose management took place on several occasions throughout the year. However, the actual ground work for development of a moose management plan was not initiated.

Project Location: Unit 23 (43,000 mi²)
Kotzebue Sound and the Western Brooks Range

Project Objectives and Activities: The population management objective of Unit 23 is to maintain the moose population at existing levels, and the bull:cow ratio at a minimum of 40:100. These objectives will be attained through the following management activities:

1. Drafting a moose management plan for Unit 23 by June 1993, and finalize by December 1994.
2. Adopting a modified census technique using methods developed by Gasaway et. al (1986) to monitor moose population size and composition.
3. Conducting annual surveys in established trend count areas to monitor population composition and recruitment.

Work Accomplished During the Project Segment Period: We completed fall composition surveys in the middle Noatak, upper Nimiuktuk, and Wulik rivers trend count area during November 1991. Snow conditions in southern portions of Unit 23 were inadequate for conducting moose surveys during November. Surveys conducted in the northern portion of the unit provided further evidence that most of the trend count areas currently used to monitor Unit 23 moose populations are too small to accurately reflect population trends. It appears that snow-induced movements of moose mask changes in population size. Although estimates of sex and age composition may be affected by snow-induced movements as well, we believe these effects are not significant.

The middle Noatak River trend count area appears least affected by snow-induced movements of moose, probably because it is the largest trend count area in the unit. Moose density declined here from 1.87 moose/mi² in 1991 to 0.65 moose/mi² in 1992. This probably reflects the substantial overwinter mortality of moose that occurred during winter 1990-91. The bull:cow ratio in this trend count area increased from 31 in 1991 to 36 bulls:100 cows in 1992. This increase is probably an artifact of disproportionately heavy mortality among old cows which occurred during the severe winter of 1990-91. Many old bulls are harvested each year by sport hunters, whereas the few cows that are harvested are not selected by age. This allows old cows, which are more vulnerable to winter mortality, to comprise a relatively large proportion of the population.

A cooperative moose telemetry project with the National Park Service in the middle Noatak River drainage began during April 1992. Twenty-five bulls and 25 cows were radio-collared, and an additional 35 bulls were ear-tagged. The study should provide better insight into the dynamics of the Noatak River population, and will provide critical information needed to manage this heavily-hunted population.

Progress Toward Meeting Project Objectives: A moose telemetry project began in the middle Noatak River drainage to determine the minimum census area needed to accurately monitor moose population size and composition. The study should also allow us to more

adequately evaluate harvest and natural mortality rates, and assess productivity. We completed trend surveys in established trend count areas during fall 1991 and spring 1992. The goals of establishing census areas and completing a management plan are still in the planning stage, and will be reported more completely in the next progress report.

Literature Cited:

Gasaway, W. C., S. D. DuBois, D. J. Reed, and S. J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Biol. Papers of the Univ. of Alaska, Fairbanks. 108pp.

Project Location: Subunit 26A (53,000 mi²)
Western North Slope

Project Objectives:

1. Maintain the Subunit 26A moose population at the current level, and a minimum population of 1,500 moose in the Colville River drainage. A minimum bull:cow ratio of 30:100 will be maintained throughout Subunit 26A.
 - a. Conduct late winter trend counts annually to monitor population trends and short yearling recruitment. The population will be completely surveyed at 7-year intervals.
 - b. Conduct fall surveys to monitor sex and age composition trends.
2. Manage for a hunter success rate of not less than 50%.
3. Manage the harvest for spatial and temporal separation of recreational and subsistence hunters.
 - a. Monitor the harvest through field contacts and hunter harvest reports.

Work Accomplished During the Project Segment Period: Fall sex and age composition surveys were completed in the Colville River drainage during November 1991. During these surveys we observed 325 moose. Of these, 72 were bulls (40 bulls per 100 cows), 182 were cows, and 71 were calves (22% calves). The estimated antler size of the bulls was as follows:

Inches	<30	39-40	40-49	50-59	60+
Percent	16%	11%	19%	43%	12%

We conducted a survey to determine population trend and short yearling recruitment during April 1992 in trend count areas on the Colville, Anaktuvuk, and Chandler river drainages. We counted 828 moose (680 adults and 148 calves) yielding a short yearling recruitment rate of 18%.

We compiled harvest data from harvest reports submitted by hunters. Hunters reported killing 59 bulls and 8 cows during the 1991 hunting season. The average hunt lasted 5.0 days, and the hunter success rate was 66%. The chronology of the harvest was as follows: 5-11 August (2); 12-18 August (1); 25-31 August (3); 1-7 September (37); 8-14 September (14); 15-21 September (6); 11 November (2); and 12 December (1). The harvest was distributed throughout the Colville River drainage, and the largest numbers of animals were taken from the Chandler River (25%), the Colville River from the mouth of the Killik River to the Anaktuvuk River (22%), and the Anaktuvuk River (27%). Antler sizes and percentage of animals having those sizes were as follows:

< 25"	0%
25-29.99"	3.0%
30-34.99"	1.5%
35-39.99"	1.5%
40-44.99"	6.0%
45-49.99"	7.5%
50-54.99"	13.4%
55-59.99"	35.8%
60-64.99"	11.9%
> 65"	3.0%

Of the 102 people that reported hunting, 12 (12%) were residents of the North Slope, 64 (63%) were nonlocal Alaska residents, 37 (36%) were nonresidents, and 1 was of unknown residency. Of the 67 successful reporting hunters, 9 (13%) were from the North Slope, 37 (55%) were nonlocal Alaska residents, 29 (43%) were nonresidents, and 1 was of unknown residency.

Progress Toward Meeting Project Objectives: We counted 828 moose during the spring trend count indicating that population size has remained stable. The short yearling recruitment rate was 18% and the reported harvest was less than 4%, so the population size will probably not be reduced by hunting pressure. The hunter success rate was 66% which is well above the goal of 50%.

The goal of spatial and temporal separation of recreational and subsistence hunters was realized for the most part. Subunit 26A is a controlled use area where aircraft cannot be used to hunt during August, allowing local people using boats to complete much of their hunting activities before recreational hunters arrive. In addition, local hunters tended to concentrate their efforts on the lower part of the Colville River, while recreational hunters generally flew into the upper portions of the drainage.

We observed 40 bulls:100 cows during fall composition surveys. Before the 1991 survey, there had been a decreasing trend with the number of bulls per 100 cows dropping from 54 to 33 bulls:100 cows between 1983 and 1990. Fall surveys will be completed in the future to evaluate this situation.

Segment Period Project Costs:

	<u>Personnel</u>	<u>Operating</u>	<u>Total</u>
Planned	54.5	41.3	95.8
Actual	54.5	64.7	119.2
Difference	0	+23.4	+23.4

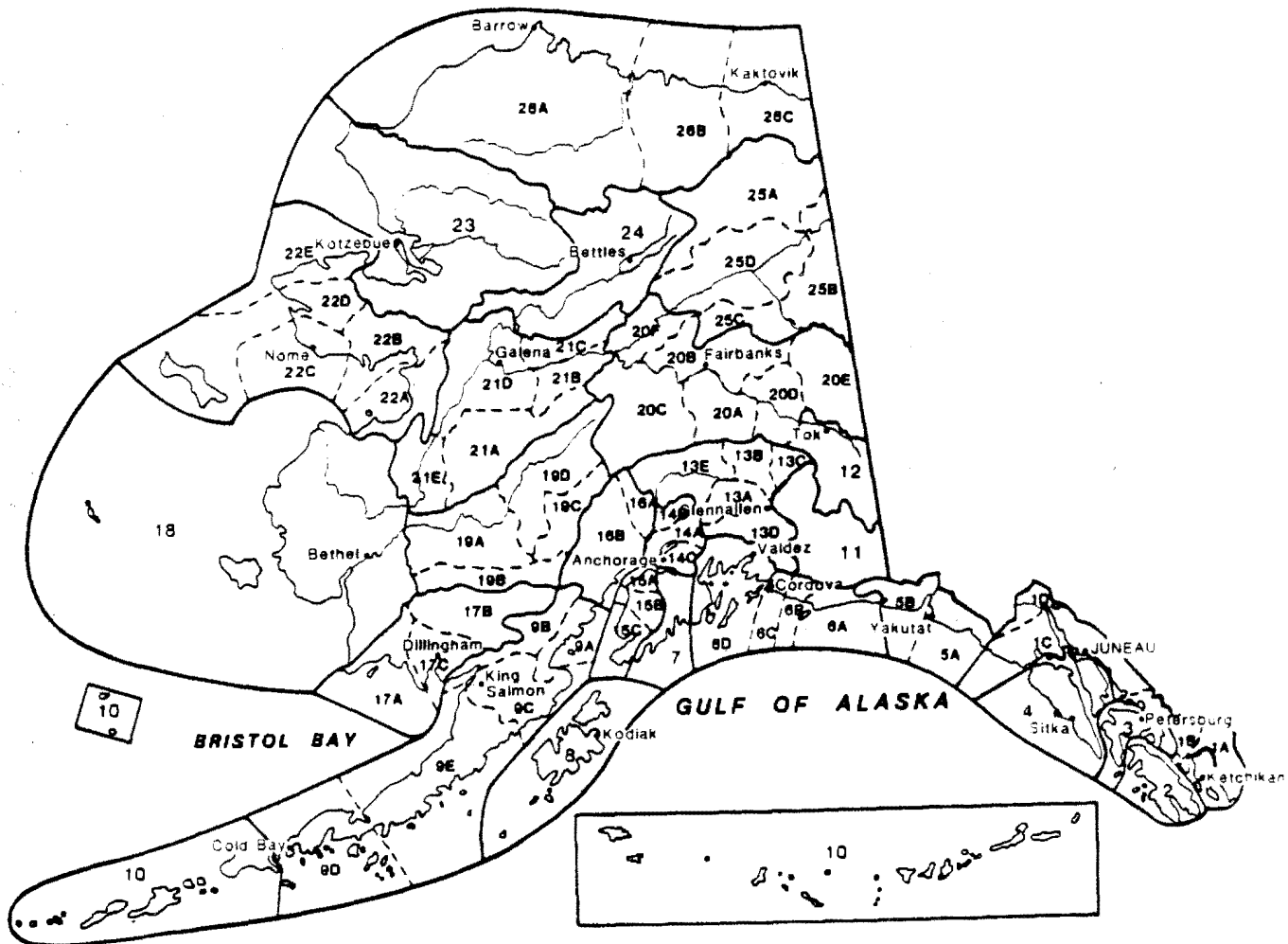
Explanation: Additional funds from a Legislative supplemental appropriation allowed the staff to initiate the Noatak telemetry study, and complete censuses in Unit 18 and Subunit 26A.

Submitted by:

Steve Machida
Survey-Inventory Coordinator

ARLIS

Alaska's Game Management Units



Federal Aid in Wildlife Restoration

The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program then allots the funds back to states through a for-

each state's area and of paid censehold-state. ceives 5% enues col-year, the lowed. The

ment of Fish and Game uses the funds to help restore, conserve, manage, and enhance wild birds and mammals for the public benefit. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes necessary to be reponsible hunters. Seventy-five percent of the funds for this project are from Federal Aid.

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U.S. Fish & Wildlife Service

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