ALASKA DEPARTMENT OF FISH AND GAME

JUNEAU, ALASKA

STATE OF ALASKA
Bill Sheffield, Governor

DEPARTMENT OF FISH AND GAME
Don W. Collinsworth, Commissioner

DIVISION OF GAME
W. Lewis Pamplin, Jr., Director
Robert A. Hinman, Deputy Director

ANNUAL REPORT OF SURVEY-INVENTORY ACTIVITIES

PART IV. MOOSE

Edited and Compiled by
Joann A. Barnett, Publications Technician

Volume XIV

Federal Aid in Wildlife Restoration

Project W-22-2, Job 1.0

Persons intending to cite this material should obtain prior permission from the author(s) and/or the Alaska Department of Fish and Game. Because most reports deal with preliminary results of continuing studies, conclusions are tentative and should be identified as such. Due credit would be appreciated.

(Printed May 1984)

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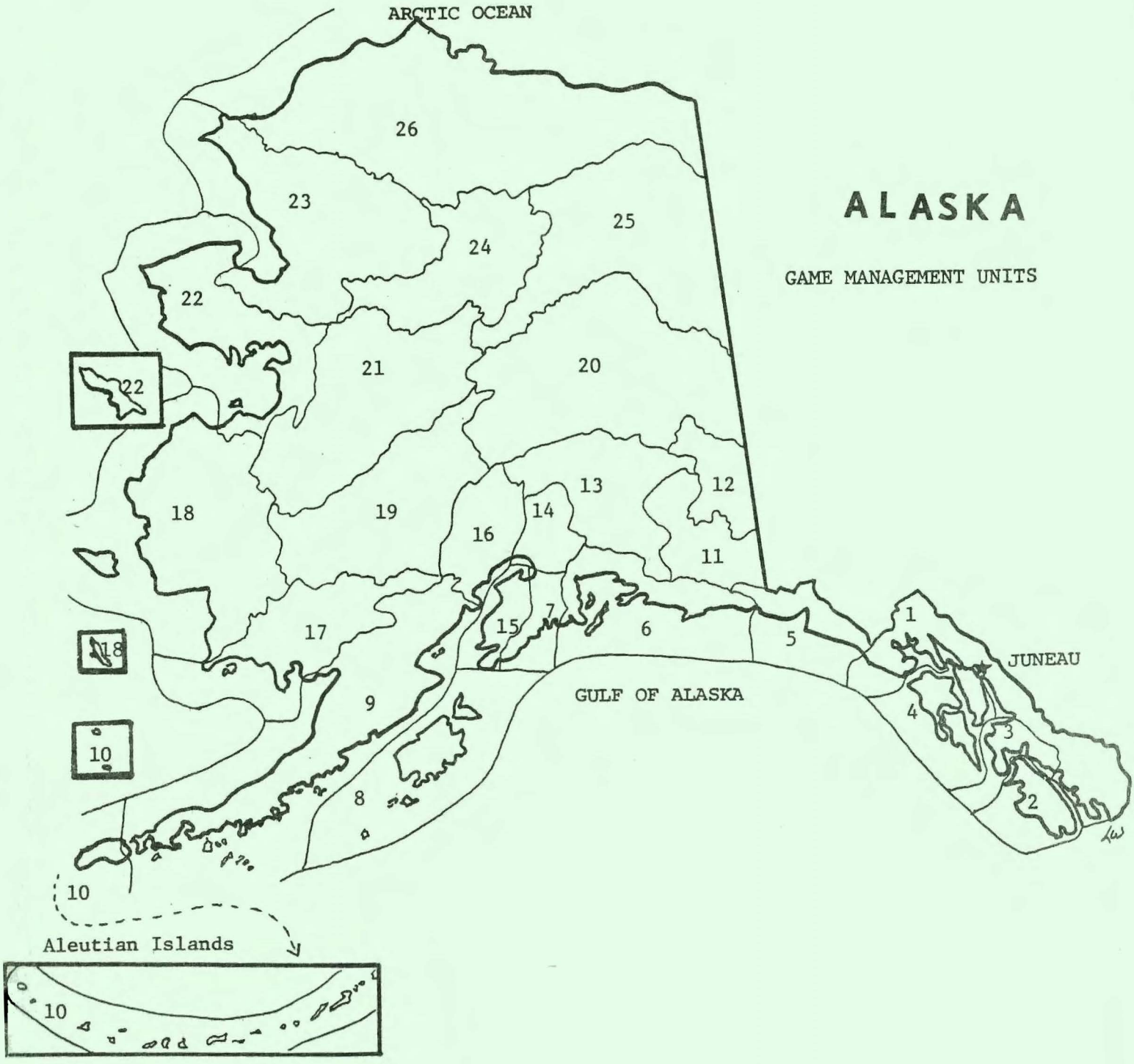
CONTENTS


ARCTIC OCEAN
ALASKA
GAME MANAGEMENT UNITS
26
23
25
24
22
21
20
22
18
19
16
14
13
12
11
17
15
7
6
5
1
18
JUNEAU
GULF OF ALASKA
9
4
3
10
8
2
10
Aleutian Islands
10

Statewide Harvest and Population Status

Moose

Status of moose populations is extremely variable, depending on local habitat conditions, weather, and mortality factors including hunting and predation. In spite of generally favorable winters recently, moose populations in much of the Interior are low and either stable or declining. The exceptions are those areas (Subunits 20A, 20B, and 20E, in particular) in which wolves have been reduced. Moose populations in the Cook Inlet area (GMU's 14A, 14B, and 16) are high, as is that on the Seward Peninsula (Unit 22).

The 1982-83 moose harvest, as determined from harvest tickets and permits, was 5,383 Statewide. However, this is a minimum figure, due to lack of compliance with reporting requirements. In some rural areas (e.g., GMU's 17, 20F, 21, 23, 24, and 25), biologists estimate that the unreported harvests may be 50-100% of the reported harvest.

The following is the reported harvest by Unit:

Unit/ Subunit	Reported harvest	Unit/ Subunit	Reported harvest
1B	36	17	49
1C	23	18	55
1D	25	19	335
5	75	20A	238
6A	58	20B	158
6C	21	20C	108
7	48	20D	120
9	130	20E	19
11	42	20F	17
12	86	21A	103
13	623	21B	71
14A	434	21C	16
14B	248	21D	195
14C	106	21E	69
15A	211	22	344
15B	72	23	128
15C	197	24	106
16A	206	25	118
16B	362	26	60
16(Kalgin)	71		

Robert A. Hinman
Deputy Director

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1A, 1B, and 3

GEOGRAPHICAL DESCRIPTION: Southeast Mainland from Cape Fanshaw to the Canadian Border and Adjacent Islands

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose have been expanding their range in GMU's 1B and 3 since 1960 and are present on several of the major islands (Fig. 1). They were unknown in Southeast Alaska until after 1875, but invaded the nearby Telegraph Creek area in British Columbia by 1870 (Peterson 1955). Moose are most common in areas that produce Salix browse, but are also found where Vaccinium is the primary winter forage. Vaccinium browse is relatively low in protein, which lowers reproductive capability; poor calf survival may occur during winters of heavy snow. Nutritive content of forage has been shown to be important to reproductive success in other parts of Alaska (Coady 1976).

A remnant herd is present on the Chickamin River in Subunit 1A as a result of a 1963-64 transplant of 14 moose from Cook Inlet and the Chickaloon Flats (Burris and McKnight 1973). Moose populations in Subunit 1A on the Unuk River are considered to be low and stable (R. Wood, pers. commun.). No sightings were reported in Unit 2.

The Thomas Bay moose herd in Subunit 1B supported a small harvest from 1970 through 1981 (Table 1). Based on limited aerial surveys (Table 2), calf survival declined in 1981 and 1982. The heavily hunted Stikine River herd in Subunit 1B was stable during the report period. Moose observations in GMU's 1B and 3 indicate invasion of new areas (Fig. 1).

The Farragut River was flown in June 1983, and no moose were observed. Tracks were occasionally noted on sandbars, and light browsing was observed on riparian vegetation. Moose sightings by fishermen and others using the Cape Fanshaw area are becoming more numerous. The Cape Fanshaw area is slated for logging and roading in the next few years, and moose population response to increased access by hunters and early successional stages of vegetation should be monitored. No moose harvest has been recorded in the last 10 years in the Cape Fanshaw area.

Population Composition

Productivity estimates on moose herds can be obtained from aerial surveys in at least 4 ways (VanBallenberghe 1979), including neonate:cow ratios obtained in early summer, calf:cow ratios obtained in late fall, short yearling:cow ratios obtained from surveys in the spring prior to parturition, and long yearling: cow ratios derived during late fall surveys. Dense overstory throughout most of the Subunit 1B moose range reduces the effectiveness of aerial surveys during fall; productivity estimates are based on short yearling:cow ratios obtained in the spring before snow melts, and calf:cow ratios derived in winter after leaves have fallen and snow is on the ground.

A helicopter survey was conducted in Thomas Bay on 5 December 1982 which resulted in a count of 22 moose (Table 2). The sex ratio was 5 bulls:100 cows, and no calves were seen. Early fall counts are not feasible in Thomas Bay since aerial observation is difficult in the forested areas and regrown clear-cuts. This helicopter count, conducted in the area north of LeConte Bay, was made when there was 4 inches (10 cm) of fresh snow on the ground. A subsequent flight by fixed-wing aircraft, funded by the U.S. Forest Service, yielded a count of 7 cows, no bulls, and no calves (J. Doerr, pers. commun.).

In the area south of LeConte glacier, a study of the potential effects on moose of proposed hydroelectric impoundments on the Stikine and Iskut Rivers was begun in 1981 (Boertje and Young 1982) and will be completed by July 1982. Sixteen cows and 4 bulls were captured and fitted with radio collars during March 1982, and an additional 4 cows were telemetered in January 1983. Detailed discussion of methods and results of the telemetry study will be presented in the final report (Craighead et al. In Press).

Aerial composition surveys were flown with a Hughes 500 helicopter utilizing 2 observers. The initial survey (4 Nov 1982) was conducted during very windy conditions and poor visibility, and a later count was believed to more accurately reflect herd composition (Table 2). The sex ratio was 5.1 bulls:100 cows, while there were 26.9% calves. Sighting moose on the Stikine River is difficult, even under optimum conditions.

During 472 radio locations where moose were known to be inside a 5 acre (2 ha) area, the telemetered moose were observed only 223 times (47.2%). Effectiveness of observation without telemetry equipment will be poorer than the 43-68% efficiency cited by LeResche and Rausch (1974) for the Kenai Peninsula.

Mortality

No moose were killed in Subunit 1A during the 1982 season, and little hunting occurred (R. Wood, pers. commun.). Five hunters returned moose harvest report cards.

The northern portion of Subunit 1B was closed to hunting by emergency order because of the lack of calves observed on post-season aerial surveys in 1981 (Table 2). Yearling bulls composed 88% of the Thomas Bay harvest in 1981; thus, the fall calf crop was essential to the harvest in the 1982 hunting season. Rausch and Bratlie (1965) reported similar conditions in the heavily hunted Matanuska valley. Subjective observations during the hunting season in 1981 indicated normal calf numbers, and snow accumulations of over 6 ft (2 m) are thought to have inflicted heavy mortality on Thomas Bay calves during the late winter of 1981-1982. Calves are more affected by deep snow than are adults. Snow depths exceeding 3 ft (1 m) are especially disastrous to calves because of their shorter stature and lower fat reserves (Coady 1976).

Continued low calf observations during winter 1982-83 (Table 2) cannot be attributed to severe winter weather. The initial survey was flown in early December when there was only 4 inches (10 cm) of accumulated snow. The extremely low sex ratio of 5 bulls:100 cows (Table 2) is not believed to be the current cause of low calf production. Rausch and Bratlie (1965) examined uteri in the Matanuska valley where the sex ratio was 5 bulls:100 cows and found over 80% conception. Ballard and Taylor (1980) concluded that low bull numbers in the upper Susitna River area were not responsible for low calf incidence in the fall. The number of calves observed in the winter, while based on limited survey data, shows a pattern of declining calf numbers in Thomas Bay since 1980 (Table 3). A single adult cow was found dead from natural causes during the report period.

The 1982 moose harvest on the Stikine River was 31 bulls, including 2 telemetered bulls. An additional telemetered bull was shot after the season closed, and the carcass was located by means of a mortality signaling device in the transmitter. Two dead calves were found during the winter; and neither appeared to have been killed by predators. There were unconfirmed reports of 2 additional moose dying during the winter. None of the telemetered cows died during the study period.

Biologists periodically visited hunters' camps on the Stikine to interview hunters concerning kills and to determine age of moose killed. A total of 20 bulls were examined: 10 (50%) were yearlings, 1 (5%) was a calf, and the remaining 9 (45%) were 2½-3½ years old. Of the 4 bulls collared in 1981, 3 (75%) were killed in 1982. One of the telemetered bulls was still alive in June 1983.

Although the northern portion of Subunit 1B was closed by emergency order, the expected increase in hunting pressure in lower Subunit 1B did not occur. Approximately 130 hunters hunted moose on the Stikine River in 1982, and 31 (23.9%) were successful. Four additional bulls were taken in lower Subunit 1B in the vicinity of Blake Channel.

During the 1982 season, 2 bulls (6.5%) were taken on opening day; 18 (58.1%) were taken during the 1st half of the season. Chronology of the harvest shows a fairly even distribution (Table 4).

Mandatory moose harvest report cards were used to supplement harvest data and to determine hunter effort, transportation means, and antler measurements. For Subunit 1B, 63 hunters returned harvest report cards which indicated that 14 moose were taken (40% of the known kill). Successful hunters averaged 12.5 days in the field, while the average for all hunters was 9.1 days. Mean antler length reported by hunters was 24.9 inches (632 mm), with a standard deviation of 5.5 inches (139 mm). Boats were reported as transportation by 48 (76%) Subunit 1B hunters. The remainder of the hunters failed to specify transportation means.

Management Summary and Recommendations

Survey by helicopter is the most productive census technique, but the expense renders it impractical for replicate counts. Use of a pellet group count method should be tested in Subunit 1B to determine its effectiveness in determining population trends. Aircraft may still be required to obtain sex ratios because there are known differences in the pellet group deposition rate of males and females (Franzmann et al. 1976).

Heavy hunting pressure on the bull segment in Subunit 1B results in distorted bull:cow ratios and creates a dependency on the yearling age class to provide hunting. Permit drawing systems have been poorly accepted in Subunit 1B. Antlerless hunting under permits in 1972 and 1973 removed 18 and 22 cows, respectively, but proved unpopular with local residents, who lobbied to have cow hunting abolished. It is doubtful that either-sex hunting would be accepted at this time. A portion of the male segment could be protected from harvest through imposing an antler restriction. For example, permitting the harvest of only bulls with at least 1 palmate antler would protect a portion of the yearling bulls. In the Nelchina Basin, VanBallenberghe (1979) found that less than half of the yearling bulls had spikes or small forked antlers. Data can be collected on antler formation of Subunit 1B bulls killed during the 1983 season to determine the practicality of an antler restriction.

Yearling bulls are capable of breeding, and protection of some yearlings would increase the chance of cows being bred. While the observed bull:cow ratio of 5:100 is thought to be adequate for breeding purposes (Rausch and Bratlie 1965), there is some point at which the number of bulls could be reduced below the number needed to service a sufficient numbers of cows to maintain the herd. Under the current system, few bulls develop large antlers, and the "trophy" concept is alien to the Subunit 1B moose hunter.

Continued logging and road development in Southeast Alaska pose problems in moose management. Logging has been shown to be responsible for moose population explosions in Scandinavia (Lavsund 1981, Wilhelmson and Sylven 1979) where early successional stages are sought by moose. Peak moose numbers in British Columbia in the mid-1950's and mid-1960's were attributed to logging and land clearing for agriculture (Macgregor and Child 1981). Conversely, large clear-cuts in Ontario helped increase predation by wolves, causing a population decline (Bergerud 1981). Clear-cutting and logging roads in combination in Ontario have led to excessive hunting of moose, declining populations, and closure of hunting seasons in recently logged areas (Eason et al. 1981).

Recent calf declines in heavily logged Thomas Bay were not matched by similar losses in the unlogged Stikine-LeConte wilderness. Predation in Thomas Bay may have increased by wolves utilizing the road system and preying on moose concentrations in unlogged areas as described in Ontario (Bergerud 1981). It is also possible that poor nutrition in the Thomas Bay area (Doerr et al. 1980) contributed to calf loss. It may be hypothesized that while moose numbers in GMU's 1B and 3 can increase after logging in response to seral vegetation, the population may not be stable. Study of moose-timber harvest relationships in Southeast Alaska is warranted.

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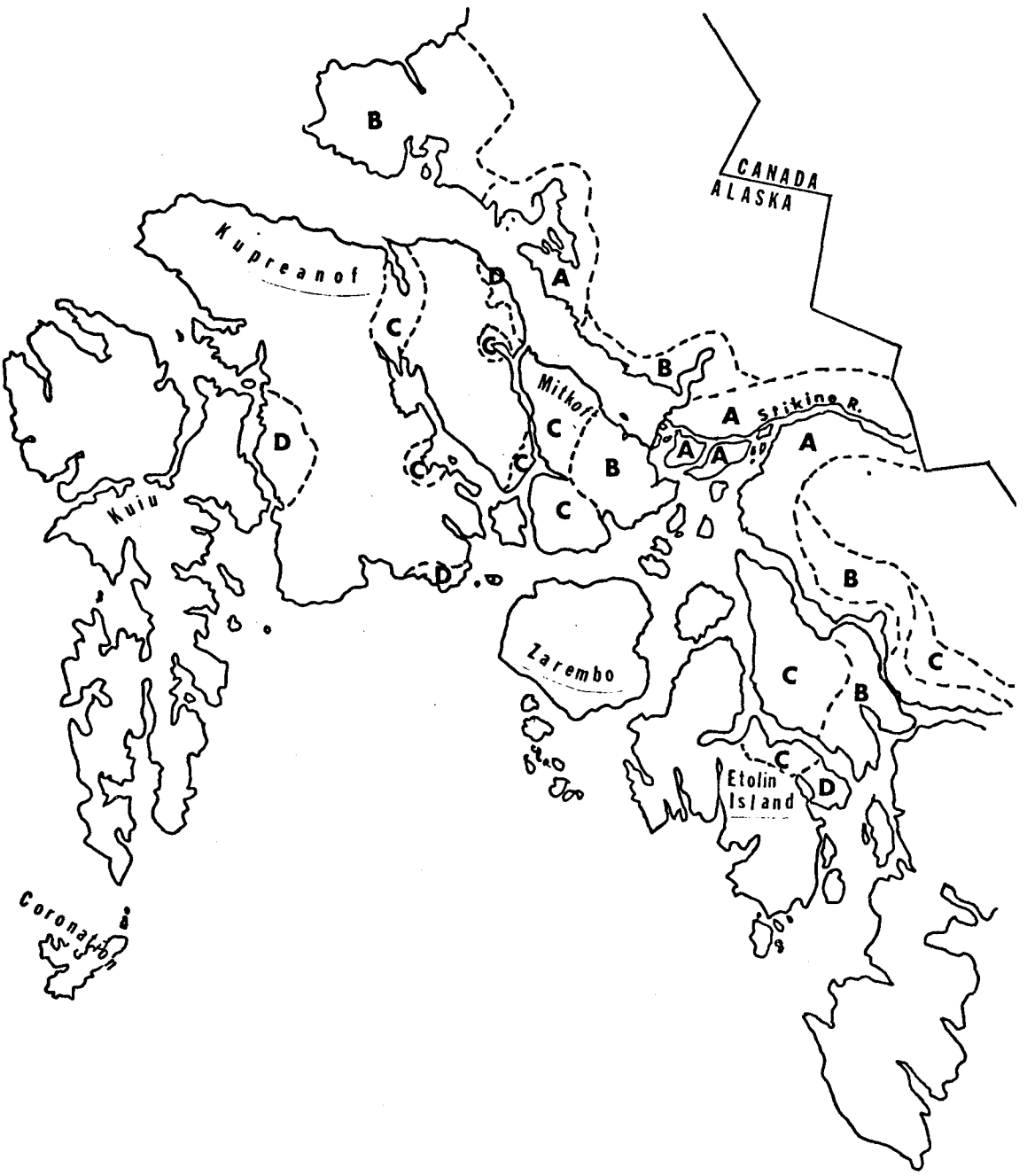

Fig. 1. Moose distribution map, 1982. A = popular moose hunting area; B = common (5 or more sightings annually); C = uncommon (less than 5 annual sightings); and D = rare (known from tracks and droppings).

Table 1. Subunit 1B moose harvest locations, 1970-1982.

Year	Thomas Bay		Stikine River		Other areas		Total	
	Bulls	Cows	Bulls	Cows	Bulls	Cows	Bulls	Cows
1970	12		28				40	
1971	10		25				35	
1972	5		8	18[a]			13	18
1973	3		25	22[a]	1		29	22
1974	4		25	1			29	1
1975	8		16		1		25	0
1976	16		21				37	
1977	13	1	19				32	1
1978	9		29				38	
1979	21		26				47	
1980	17		33	1			50	1
1981	10	2	33	1	4		47	3
1982	0		32[b]		4		36	
Average bull harvest	9.9		24.6				35.3	

[a] Cow permits were issued only in 1972-73. All other cows were taken illegally.

[b] One bull was killed after the season closed.

Table 2. Subunit 1B population composition data, winter 1982-83.

Area	Date	Bulls	Cows	Calves	Undet.[a]	Total	Bull/ 100 cows	Calf/ 100 adults	Count time(hr)
Thomas Bay[b]	12/5/82	1	20	0	1	22	5.0	0	3.1
Thomas Bay[c]	1/10/83	0	0	0	7	7	?	0	1.0
Stikine River[d]	11/4/82	1	30	7	1	39	3.3	21.9	3.8
Stikine River[b]	12/4/82	2	39	24	48	113	5.1	26.9	2.8

[a] All adults of unknown sex.
[b] Surveyed from Hughes 500 helicopter; snow accumulations and flight conditions optimum.
[c] Surveyed from Cessna 180; count shortened because of snowstorm.
[d] Surveyed from Hughes 500 helicopter; flight conditions poor (high winds).

Table 3. Subunit 1B postseason calf and bull observations, 1982-83.

Area	Ratio	Year 1980-81	1981-82	1982-83[a]
Thomas Bay	Calves/100 cows	47.0	20.0	0.0
Stikine River	Calves/100 cows	69.0	38.0	61.0
Thomas Bay	Bulls/100 cows	0.0	9.0	5.0
Stikine River	Bulls/100 cows	7.7	5.0	5.1

[a] Utilizing maximum count under best survey conditions with only positively identified animals being included.

Table 4. Stikine River moose harvest chronology, 1982.

Date				Total	Season
15-23 Sep	24-30 Sep	1-7 Oct	8-15 Oct	kill	length
11(35.5%)	7(22.6%)	5(16.1%)	8(25.8%)	31(100%)	31 days

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1C

GEOGRAPHICAL DESCRIPTION: Southeast Mainland from Cape Fanshaw to the Latitude of Eldred Rock

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Because survey data were not collected for the lower Chilkat Range or Taku River areas, the status of these moose populations is not fully known. However, comments by hunters indicated that population levels were similar to previous years. In Berners Bay, the moose population is near or above the carrying capacity of the winter range riparian habitat. Bulls-only hunting and poor calf recruitment, since at least 1980, have resulted in an unbalanced sex ratio (4.9 bulls:100 cows in December 1982). Based on an estimated 10.9 sq mi of riparian moose winter range habitat and 3 December 1982 survey results, the 1982-83 wintering moose density was 9.7 moose/sq mi.

Population Composition

A sex and age composition count was conducted by helicopter under excellent counting conditions in the drainages of Berners, Lace, Antler, and Gilkey Rivers on 3 December 1982. A total of 105 moose were observed, including 4 males, 82 females, and 19 calves. Sex and age ratios were as follows: 4.9 bulls:100 females, 23.2 calves:100 females, and 18% calves in the herd.

Mortality

Based on harvest ticket returns, the harvest for the Taku River area in 1982 was 14 bulls; 77 hunters hunted and the success rate was 18%. While all hunters averaged 5.7 days hunting, successful hunters spent an average of 6.4 days hunting. Chronology of the Taku harvest showed 8 bulls were taken in September and 6 in October. Five animals were killed during the 1st 7 days of the season compared with 10 the previous year.

In the lower Chilkat Range, 4 moose were taken in 1982 (Endicott River, 3 and St. James Bay, 1). Twelve hunters reported hunting in the area for a success rate of 34%. Successful hunters spent an average of 7.2 days hunting, while unsuccessful hunters spent 4.4 days. One bull was taken in September and 3 in October.

In the Berners Bay moose drawing permit hunt, 21 of the 25 permittees hunted (84%); 5 of the hunters were successful, a success rate of 24%. Successful hunters hunted an average of 5.2 days, while unsuccessful hunters spent 5.9 days. Two bulls were taken in September and 3 in October.

Antler widths of bulls (N = 4) killed in Berners Bay in 1982 ranged from 32 inches to 39 inches, averaging 35 inches. In 1981, antler width (N = 9) averaged 37 inches. The mean cementum ages of bulls killed in 1980, 1981, and 1982 were 5.5 years (N = 4), 2.4 years (N = 9), and 1.8 years (N = 5), respectively.

Management Summary and Recommendations

Hunter pressure and harvest levels in the Chilkat Range and Taku areas were similar to previous years with no known changes in moose population status. Hunter pressure will probably increase with the recent State land disposal in the Taku area. No season or bag limit changes are recommended at this time.

Since 1978, the Berners Bay moose population has been near or greater than the estimated carrying capacity. In 1978, 1980, and 1982, the number of moose observed during aerial surveys was 120, 81, and 105, respectively. Based on an estimated 10.9 sq mi of winter range riparian habitat, the density of moose on this range was 11.0, 7.3, and 9.7 moose/sq mi, respectively for these years. Studies of other North American moose populations have shown that sustained densities of 4-6 moose/sq mi of winter range preceded significant population declines. Population reductions have been recommended since 1979, including a limited cow harvest. The local Fish and Game Advisory Committee in Juneau supported the taking of 15 antlerless moose based on current recruitment information, and the elimination of the bull season to improve the unbalanced sex ratio (4.9 bulls:100 cows, 3 December 1982 survey results). The Board of Game subsequently adopted these proposed changes during their spring 1983 meeting. Fieldwork was completed in September 1982 on a Department study (initiated in 1981) to determine the extent, quality, and carrying capacity of riparian moose winter range in Berners Bay. Dry weights of vegetation samples were determined. The data are being reviewed.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1D

GEOGRAPHICAL DESCRIPTION: Haines-Skagway

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The area from Murphy Flats to Turtle Rock on the Chilkat River and the lower 15 mi of the Klehini River were surveyed by helicopter on 30 November and 1 December 1982. Two hundred moose were recorded in 4.8 hours of survey time, or 41.6 moose/hour (Table 1). Based on this survey, the moose population was estimated to consist of 44.3 calves/100 cows, 29.6 bulls/100 cows, and 34.2 calves/100 adults. The Chilkat River portion of the area was surveyed again on 20 March 1983, and 88 moose were counted in 5.6 hours (15.7 moose/hour). During this survey, 22% of the moose observed were calves (27.5 calves:100 adults), compared with 26% in the fall survey. The total number of moose observed and moose per hour have declined since 1981, when 211 moose (63.4 moose/hour) were observed; in 1982, 183 moose (42.2 moose/hour) were observed. Yet the number of calves per 100 adults increased from 18.5 in February 1982 to 27.5 in March 1983, indicating a substantial increase in production and good overwinter calf survival.

Mortality

Twenty-five moose (24 bulls, 1 cow) were harvested during the 1982 season. This harvest level was below the 1975-1981 average of 40 moose/year. Similarly, the percentage of hunters who were successful in 1982 (9.4) was below the 7-year mean (13.9).

No natural mortality was documented during the reporting period.

Management Summary and Recommendations

The success ratio of moose hunters, the total harvest, and the number of hunters in Subunit 1D decreased from prior years (Table 2). If the population estimate reported in 1981-82 (300-350 moose) were accurate, the 1982 harvest fell within the allowable harvest. Survey results indicated that overwinter calf survival was good (Table 1). Poor survey conditions were probably responsible for the low counts in March, and the 66% reduction in the total number of moose seen in early December was probably not caused by high mortality.

Action by the Board of Game in March 1983 changed the moose season from 15-30 September to 22 September-6 October. This change resulted from the public perception that more bulls would be available for hunting due to movements from higher elevation summering areas. In addition, moose would be more visible during leaf fall. Hunter participation should not increase greatly with this new season, but an increased harvest is possible. If the 1983 harvest rises significantly above the 8-year average (38), a more conservative season or a permit hunt with an established quota may be necessary in subsequent years.

No changes in seasons or bag limits were recommended.

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Table 1. Game Management Unit 1D moose surveys, 1982-1983.

Date	Total bulls	Total cows	Total adults	Total calves	% calves	Count time (hr)
11/30-12/1/82	34	115	149	51	25.5	4.8
3/20/83[a]	--	--	69	19	21.6	5.6

[a] Survey conditions ranged fair to poor. Chilkat River islands and hills above the Haines Highway not surveyed due to poor conditions.

Table 2. Game Management Unit 1D moose harvest, 1975-1982.

Year	Male	Female	Unk.	Total	No. hunters	Success ratio (%)
1975	25	0	1	26	300	8.7
1976	36	18[a]	1	55	430	12.8
1977	30	0	1	31	202	15.3
1978	44	1	0	45	293	15.4
1979	38	0	1	39	192	20.3
1980	48	0	0	48	342	14.0
1981	34	1	0	35	315	11.1
1982	24	1	0	25	267	9.4

[a] A 2-day either-sex hunt was conducted during the regular season.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 5

GEOGRAPHICAL DESCRIPTION: Yakutat and Malaspina Forelands, Gulf of Alaska

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulation No. 23.

Population Status and Trend

No data were available.

Mortality

In the Yakutat Forelands, the 1982 moose season ran a full month with 199 hunters taking a total of 48 bulls. Twenty-seven other permittees did not hunt. The 48 successful hunters spent a total of 137 days hunting ($\bar{x}$ = 2.9), while the 151 unsuccessful hunters were afield for 697 days ($\bar{x}$ = 4.6). Twenty-four percent of all permittees hunting were successful. Forty-one (85%) of the moose harvested were taken during the 1st week of the season. Seventeen moose (35%) came from drainages east of the Dangerous River, while the remaining 31 (65%) came from west of, and including, the Dangerous River watershed. A total of 3 permittees failed to submit hunt reports.

In the Nunatak Bench area, 9 of the 10 moose quota were taken during the 3 month, either-sex season (Fig. 1). Three bulls and 6 cows were taken by 14 hunters who entered the field (5 other permittees did not hunt). Ninety-five days were spent by the 9 successful hunters ($\bar{x}$ = 10.6), while the 5 unsuccessful hunters devoted 13 days ($\bar{x}$ = 2.6) to hunting the benchlands. Over 64% of those hunting were successful. Eight of 9 animals taken were harvested in the latter half of the season.

The earliest moose season in Unit 5 (1 Sep-31 Oct) attracted 78 permittees, 25 (32%) of which did not hunt. Of the 53 permittees hunting in the Malaspina Forelands area, 18 (34%) successfully harvested bull moose. Successful and unsuccessful hunters spent 54 ($\bar{x}$ = 3.0) and 161 ($\bar{x}$ = 4.6) days hunting, respectively. Most of the harvest (16, or 89%) occurred from 14 September through 9 October (Fig. 1). Eleven of 18 moose taken (61%) came from Point Manby and east in the Subunit.

No natural mortality was documented during the reporting period.

Management Summary and Recommendations

The 1982 permit registration hunt in the Yakutat Forelands area was an apparent success. High participation (226 applicants, 199 of which hunted), a harvest approaching the desired level (48 of 50-bull quota), and a fairly well-spaced harvest (over approximately 3 weeks) point to this success. A low nonresponse rate (3 of 226, or 1%) on permit reporting also indicates a workable system. The fact that 13 of 48 (27%) animals harvested were taken on opening day and 41 (85%) were taken in the 1st week indicates emergency closure authority is a desirable tool to have at the manager's disposal. No changes in seasons or bag limits are recommended.

For the 1st time in 3 years, the harvest goal was approached in the Nunatak Bench hunt. Furthermore, a high hunter success rate was documented. With no survey data available, no changes in bag limits are recommended. However, a change in the season opening date can be considered. It has been well documented that moose stay high on the benchlands until winter is well underway. During the 1982-83 hunting season, only 1 of 9 animals harvested was taken prior to 30 December. Adjusting the opening date to later in the year could reduce the chance for confusion in season dates on the benchlands and forelands among hunters as well as provide for more effective enforcement of regulations.

The 1982 harvest of 18 moose in the Malaspina Forelands was higher than the average take of 16 moose for the previous 13 years. The 1st 2 weeks and last 3 weeks of the season accounted for only 2 of 18 animals harvested. However, hunting pressure was lighter than in 1981 (53 compared to 85 hunters), when the desired harvest of 25 bulls was exceeded by 2 animals.

Land status remained the same in GMU 5B as described in 1981. The reduced 1982 harvest may be due in part to access restrictions by National Park Service regulations. Land selected by the Chugach Native Corporation remained under Bureau of Land Management administration and thus was available to hunters.

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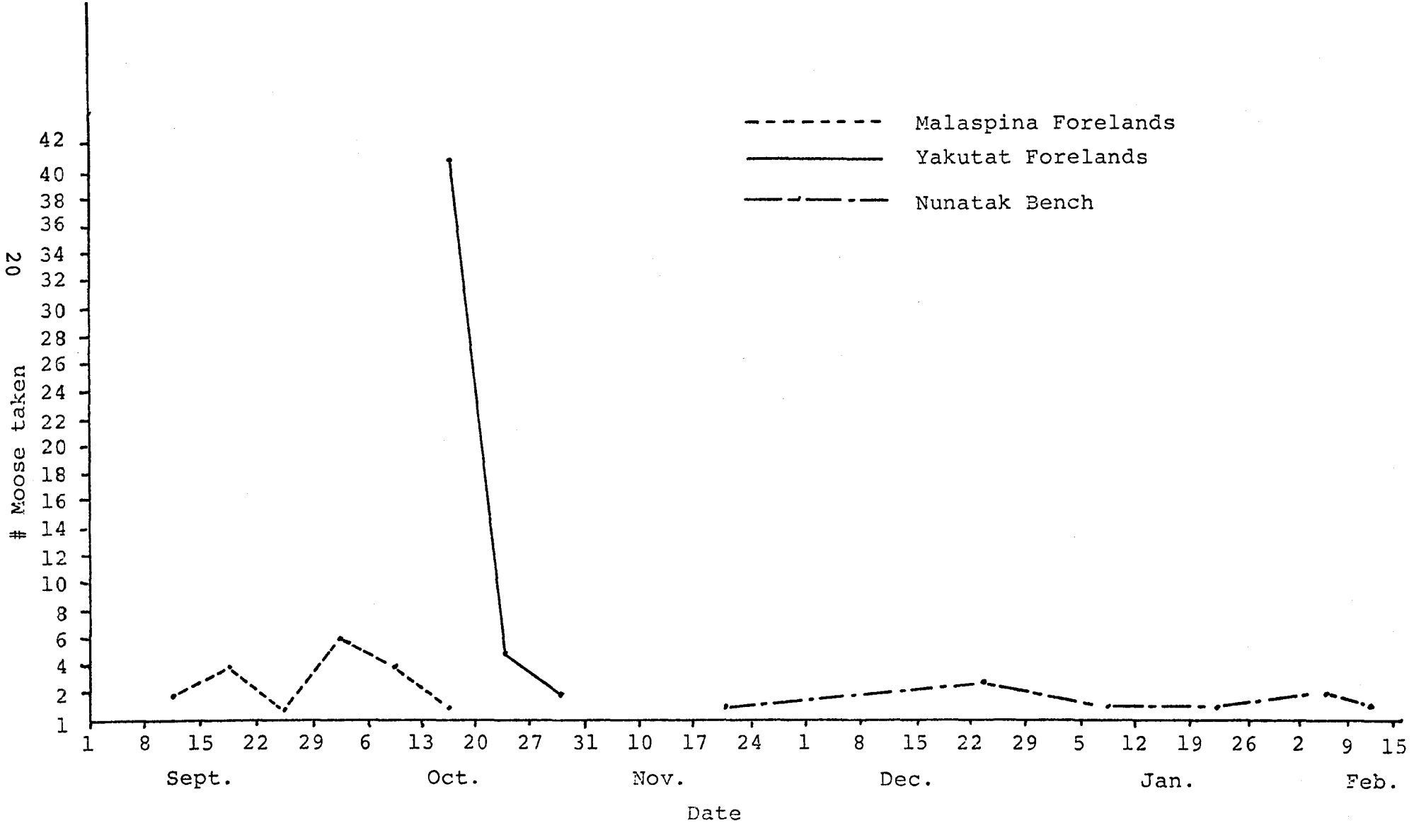
Figure 1. Chronology of moose harvest in Game Management Unit 5, 1982-83.



MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6A

GEOGRAPHICAL DESCRIPTION: Katalla to Icy Bay

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Sufficient data were not available to determine current status or trend of moose in Subunit 6A.

Population Composition

No data were available.

Mortality

The 1982 moose harvest was 58 animals: 43 bulls and 15 cows. Forty-five moose were taken from the Bering River-Controller Bay herd and 13 from the Tsiu River herd. The season was closed by emergency order on 8 October 1982, after 5½ weeks of hunting. The harvest of 13 moose from the Tsiu River herd was the 1st significant harvest to occur east of the Suckling Hills. Only 3 moose were taken from the Tsiu herd in 1981 and none in 1980. Two hundred and seventeen permits were issued, but moose hunting effort was unknown. Methods of transportation used by successful hunters were airboat (29), airplane (26), and riverboat (3).

Management Summary and Recommendation

This was the 1st time in 3 years that the desired quota of 50 moose was taken. The kill was nearly 50% greater than the previous year's harvest. The reason for the increased kill is unknown.

The winter of 1982-83 was extremely mild. Overwinter survival should be excellent; however, due to the lack of snow, nc moose surveys were flown during the fall or winter. Good composition counts are needed to manage these herds. Judging by the high percent (74%) of males in the harvest during this either-sex hunt, the 2 herds are not being overharvested.

Separate harvest quotas for the Bering River-Icy Bay and Tsiu River herds should be established for the 1983 season to prevent overharvesting the Bering River-Controller Bay herd and to encourage use of the Tsiu River herd. The Suckling Hills is a natural boundary which separates these 2 herds.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6C

GEOGRAPHICAL DESCRIPTION: West Copper River Delta

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

During the past 3 years, the West Copper River Delta moose herd has increased and is at or approaching the desired herd size of 175-200 moose.

Population Composition

A 2.7-hour moose survey was flown 21 January 1983. Survey conditions were fair; 162 moose were counted. The bull:cow ratio could not be determined, but the percentage of calves in the herd was 20.4. Other data obtained from this survey included moose of unidentified sex (104); females with 1 calf (18); females with 2 calves (7); lone calves (1); twins/100 females with calves (28%); total calves (33); and total adults (129).

Mortality

Twenty-one bulls were taken in Subunit 6C during the 1982 season. The season was closed 8 September after 2 half-days and 1 full day of hunting. Actual hunting effort was unknown, but 359 permits were issued.

Management Summary and Recommendation

The West Copper Delta moose herd has been below the desired population level since spring 1979 when 75-100 moose migrated across the Copper River. Small harvests of approximately 20 bull moose have been taken annually during past 3 years to allow maximum herd growth without eliminating all hunting. The 1982 harvest of 21 bulls conforms with management strategy to rebuild this herd.

Good survey conditions were not available to determine the status of the West Copper Delta moose herd. A survey flown 21 January revealed 162 moose under "fair" counting conditions. In my opinion, good-to-excellent count conditions would have revealed a moose population close to 200 animals.

The winter of 1982-83 was extremely mild, and overwinter survival should be excellent.

Without good survey data, it would be unwise to recommend any change in harvest quotas for the fall 1983 season.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 7

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula (except the Placer and Portage River Drainages)

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose occur throughout Unit 7 in intermountain valleys. Aerial surveys indicated that the moose population stabilized in 1980 and remained at relatively low densities.

Population Composition

A total of 210 moose were counted and classified in 1982. The combined counts included 41 bulls, 126 cows, and 43 calves. Nineteen moose were observed per hour of survey time.

The ratio of bulls:100 cows has risen steadily since 1977. In 1982, 33 bulls:100 cows were observed. Calf recruitment into the fall population was higher in the past 2 years than in previous years. This year 34 calves:100 cows were observed, and there were 17 sets of twins:100 cows with calves.

Mortality

Harvest reports indicated 36 bull moose were killed by 244 hunters; hunter success was 15%. This harvest compares with 48 bulls taken by 256 hunters the previous year.

Management Summary and Recommendations

In spite of a series of mild winters and relatively high natality, the moose population has experienced little growth. There were 44 and 34 calves:100 cows recruited into the fall moose population in 1981 and 1982, respectively. The count of moose per hour has remained essentially constant since 1980; however, the number of count areas sampled in 1982 was less than in 1980 and 1981. Adequate sampling of count areas is a priority objective for 1983. Unless unusually high mortality is occurring, the combined effect of 2 consecutive years of high calf recruitment should be noticeable during the 1983 surveys.

Public interest in moose on the Kenai Peninsula for hunting and viewing is higher than ever before and will probably continue to increase through the turn of the century. In recognition of this fact, U.S. Forest Service personnel are currently engaged in a prescribed burning program for the purpose of enhancing moose winter range. The Alaska Department of Fish and Game has contributed to this effort by providing information and expertise concerning the distribution and relative importance of wintering areas. Forest Service personnel report that 3,040 acres of winter range have been burned since 1981. They project that an additional 6,000 acres will be treated through the burning program during the next 5 years.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 9

GEOGRAPHICAL DESCRIPTION: Alaska Peninsula

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The moose population in Subunit 9B appears stable, while in 9C moose are stable or slowly declining. The Subunit 9E moose population continues to decline as a result of poor calf recruitment. A census in the central portion of 9E (1,300 mi^2 between Ugashik River and Cinder River) in February 1983 produced a population estimate of 1,148 ± 16% at the 90% confidence level. Moose densities for high, medium and low strata were 2.43, 0.85, and 0.24 moose/mi^2, respectively.

Population Composition

Poor snow conditions on much of the Alaska Peninsula hampered fall composition surveys; however, surveys were completed in 5 trend areas in Subunit 9B (Chekok, Kijik-Miller Creek, Koksetna-Chulitna, Big Mountain, and Nakeen); 3 areas in 9C (Branch, King Salmon Creek, and Park border); the Katmai area; and 3 areas in 9E (Dog Salmon, Mother Goose, and Cinder River). Results of these composition counts are presented in Table 1.

The addition of several new trend areas in Subunit 9B resulted in a more realistic picture of moose composition than was reflected in 1981 surveys. The bull:cow and calf:cow ratios were higher in 9B than elsewhere on the Alaska Peninsula. The area west of Lake Clark had particularly good calf production. Fall and winter surveys in that area showed that calves composed between 24 and 27% of the herd. The composition ratios for moose in 9C, except the Katmai trend area, were adequate and comparable to 1981. Moose in the Katmai trend area and in trend areas in Subunit 9E suffered very poor recruitment with only 9 calves:100 cows and 6% calves in the herd. This level of recruitment was particularly significant for 9E where the herd continued to decline. The bull:cow ratio in 9E has increased from about 19:100 in 1979 to 32:100 this year, primarily as the result of a shorter fall hunting season. A contributing factor may have been increased natural mortality of old-aged cows.

Mortality

The total reported hunter harvest for Unit 9 was 130 moose: 98 bulls, 28 cows, and 4 of unknown sex. Hunter success (39%) was comparable to the previous year. The bull harvest decreased in all Subunits, with the most dramatic decline in 9E where only 35 bulls were killed. The 9E harvest represents a 30% decrease from 1981. This decline was influenced by a 20% decrease in the number of hunters. Twelve of the 28 cows killed were taken during the December antlerless registration hunt for the Naknek drainage in 9C. This hunt remained open the entire month with 88 permits issued, of which 72 went to local residents.

Predation on neonatal moose calves is suspected to be the primary factor responsible for the continued poor calf recruitment on the Alaska Peninsula and for the failure of the moose herd in GMU 9E to stabilize. Calf:cow ratios in the central part of 9E declined from 40:100 on 1 June to 22:100 on 9 June to 9:100 in December 1982.

Range Analysis

Two range inventory and trend assessment stands were established near Painter Creek in Subunit 9E. The number of stems, browsed twigs, unbrowsed twigs, and stem height classes were recorded from randomly located 2 x 5 m quadrats, 20 quadrats in a 2-ha stand on an upland site, and 15 quadrats in a 1.5-ha stand on a lowland site. One hundred twigs of each willow species were clipped at mean browsing diameter, air dried, and weighed. One hundred current annual growth twigs of each species were similarly prepared and weighed, and preliminary results are presented in Tables 2 and 3.

Much of the upland area in the Painter Creek drainage is covered by dense stands of balsam poplar (*Populus balsamifera*). Understory species include highbush cranberry (*Viburnum edule*), grayleaf willow (*Salix glauca*), Barclay willow (*Salix barclayi*), and diamondleaf willow (*Salix pulchra*). Grayleaf and Barclay were the only 2 willow species encountered in the upland sample quadrats.

Preferred browse species such as feltleaf willow (*Salix alaxensis*), littletree willow (*Salix arbusculoides*), and diamondleaf willow were observed in the riparian zone; of those, only diamondleaf willow occurred in the lowland sample stands. The shrublands on the Painter Creek floodplain appeared to be dominated by Barclay willow. Machida (1979) reported Barclay willow was the least preferred willow by moose in his Kenai Peninsula study area, and Milke (1969) gave both grayleaf and Barclay willow low preference ratings in his Interior Alaska study.

Estimated percentage dry weight utilization of willow by moose at Painter Creek was 8.9% and 0% in lowland and upland stands, respectively. Some browsing had occurred in the upland stands; however, browsing intensities were very low, and none of the sample quadrats had been browsed.

Based on willow production and utilization values alone, moose numbers in the Painter Creek drainage appear to be well below the carrying capacity of the range. However, additional sampling is needed in other shrub communities within the drainage that may contain a greater proportion of preferred browse species.

During April 1981, a browse inventory was conducted near Pumice Creek in Subunit 9E (Sellers and McNay 1983). In conjunction with that inventory, twig samples were collected for nutritional analysis. Twigs were clipped from approximately 20 plants of each of 3 willow species (diamondleaf, feltleaf, and grayleaf) and alder (Alnus spp). Current annual growth twigs from willows were separated into old-aged plant samples and young-aged plant samples.

All clippings were air-dried for at least 7 days before being sent to the Palmer Plant and Soil Analysis Laboratory, Palmer, Alaska for analysis. Each sample was subjected to the Van Soest analysis; each was analyzed for the following elements: nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sodium (Na), cobalt (Co), zinc (Zn), manganese (Mn), and iron (Fe) (Table 4).

Crude protein and digestibility values from the Pumice Creek willow sample compare favorably with those reported from other Alaskan moose ranges (Table 5). The literature lacks information on the specific needs of moose for most of the macro and micronutrients; however, some attention has been given to the levels and seasonal variation in dietary sodium (Belvosky and Jordan 1981) and copper (Flynn et al. 1977). Sodium levels in the Pumice Creek sample appeared adequate; however, the 5.6 ppm value for copper may be marginal. On the Kenai Peninsula, a mean of 5.72 ppm copper in browse plants was considered marginally sufficient and was linked to faulty hoof keratinization and decreased reproductive rates (Flynn et al. 1977). Additional sampling is needed to assess the potential existence of copper deficiency in moose browse on the Alaska Peninsula.

Management Summary and Recommendations

The moose population in Subunit 9B appears relatively stable and more productive than in Subunits to the south. Winter surveys flown in cooperation with the National Park Service in the Lake Clark National Preserve showed that calves composed 27% of the population. Calf recruitment was lower around Lake Iliamna, but not enough data were available to determine if this problem is chronic or to identify predation as the cause.

Subunit 9C continues to show relatively poor calf production and recruitment into the yearling age class. Bull:cow ratios remained high, but because 9C contains the area's major human population/transportation center, close monitoring of moose densities and composition is necessary. The December antlerless registration hunt for the Naknek drainages, under close supervision, should continue to provide local residents additional opportunity to hunt moose.

The moose population in GMU 9E is still declining because of poor recruitment and an increasing old-age structure in the cow segment. Calf production in 1982, as measured during fall composition counts and a winter population census, was alarmingly poor. After discussions with residents of local villages, both the advisory committees and the Game Division withdrew support for the December antlerless moose season. In general, local residents would prefer to see the 50 inch or 3 brow tine regulation dropped in favor of bulls of any antler size during the December season. If the bull harvest during September remains low and the bull:cow ratio remains above 30:100, this relaxation of the regulation would be acceptable.

Preliminary analysis of range indicated that the moose herd in the central portion of GMU 9E was below carrying capacity, and further decline in this population is not desirable. Although no moose-bear predation studies have been conducted, I suspect that brown bears are depressing calf recruitment enough to prevent population growth. The elimination of the December antlerless moose season will probably not in itself cause the population to stabilize.

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Table 1. Fall sex-age ratios of moose in Unit 9, 1982.

Area	Total males/100 females	Small males/100 females	Calves/ 100 females	% calves in herd	Sample size
9B	54	11	33	17	384
9C	39	6	19	12	463
Katmai	45	9	9	6	214
9E	32	10	9	6	226

Table 2. Stem density, browse production, and browse utilization estimates from 2 x 5 m quadrats on an upland site near Painter Creek (N = 20), 1982.

Plant species	Stem density, stems/ha (SE)	Browse product. (kg/ha)	Browse utiliz. (kg/ha)
Salix barclayi	2,050 (1,104)	12.7	0
Salix glauca	2,150 (805)	11.3	0
Viburnum edule	19,650 (3,369)	--	--
Populus balsamifera (saplings)	8,600 (939)	--	--
Populus balsamifera (trees)[a]	2,014 (172)	--	--

[a] Tree density determined by point centered quarter method (N = 20).

Table 3. Stem density, browse production, and browse utilization estimates from 2 x 5 m quadrats on lowland site near Painter Creek (N = 15), 1982.

Plant species	Stem density, stems/ha (SE)	Browse product. (kg/ha)	Browse utiliz. (kg/ha)	% twigs browsed (SE)	% stems browsed (SE)
Salix barclayi	35,500 (6,820)	203.5	18.2	2.9 (0.9)	16.7 (4.5)
Salix pulchra	4,400 (2,270)	9.6	2.7	1.1 (0.9)	7.4 (7.0)

Table 4. Results of macro and micronutrient analysis from Pumice Creek browse samples, April 1981.

Plant sample	Nutrients								
	P(%)	K(%)	Ca(%)	Mg(%)	Na(%)	Cu(ppm)	Zn(ppm)	Mn(ppm)	Fe(ppm)
Salix alaxensis									
old growth	0.18	0.44	0.69	0.13	0.02	4	150.0	47.5	107
young growth	0.15	0.39	0.56	0.10	0.10	4	119.8	30.0	71
leaves	0.12	0.16	1.18	0.23	0.12	6	100.2	101.0	244
Salix pulchra									
old growth	0.17	0.39	0.41	0.14	0.10	5	214.5	252.4	57
young growth	0.15	0.36	0.40	0.13	0.10	6	180.8	185.0	43
leaves	0.09	0.11	0.49	0.17	0.06	3	160.8	452.1	86
Salix glauca									
old growth	0.14	0.44	0.40	0.16	0.03	9	152.7	131.5	64
young growth	0.15	0.38	0.33	0.12	0.10	7	176.3	79.4	56
Alnus spp.	0.15	0.31	0.41	0.09	0.10	4	32.0	94.3	51

Table 5. Nutritional values of Pumice Creek browse samples compared with those reported from other areas and in different seasons.

Data source/ season	% crude protein	% NDF[a]	% ADF[b]	% lignin	% cellulose	Digestibility in vivo	Digestibility in vitro
Kenai,[c] July	6.9	44.9	40.9	18.2	--	--	42.6
Kenai,[d] April	7.5	--	--	--	--	--	39.0
Interior,[e] June	12.0	51.7	40.2	11.7	28.5	--	--
Interior,[e] October	6.0	68.9	58.9	18.5	40.4	--	--
MRC Special	11.8	47.2	26.5	--	--	64.3	
Pumice Creek	8.8	51.9	36.3	12.6	22.4	--	38.8

[a] Neutral detergent fiber.
[b] Acid detergent fiber.
[c] Franzmann and Schwartz 1982.
[d] Schwartz et al. 1981.
[e] Gasaway and Coady 1974 (rumen samples).

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 11

GEOGRAPHICAL DESCRIPTION: Chitina Valley and the Eastern Half of the Copper River Basin

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose numbers are currently low, but apparently increasing from the extreme lows observed in the late 1970's. From the late 1950's through the 1960's, a mean of 86 moose per hour were observed in the Mt. Sanford-Mt. Drum count area. By the mid to late 1970's, this figure had declined to 14 moose per hour. In a November 1982 survey, 23 moose per hour were observed compared to 30 moose counted per hour the previous year.

Population Composition

During the fall 1982 count, with 85 moose sampled, 121 bulls:100 cows and 36 calves:100 cows were observed.

Mortality

Harvest report data indicated that 176 hunters killed 42 bull moose during the 1982 season. Hunter success was 24%, as compared with 36% last year. Nonresident hunters killed 4 moose, representing 10% of the total 1982 harvest. The most popular method of transport among successful hunters were ATV's (44%), followed by highway vehicles (24%) and aircraft (22%).

Management Summary and Recommendations

The increasing trend in hunting pressure and harvest seen over the past few years in Wrangell-St. Elias Park did not continue in 1982. Instead, the number of hunters reporting decreased 16%. This decline may be largely a response to poor weather conditions during the hunting season since similar declines were seen in adjacent areas.

With continued low harvest and high bull:cow ratios, there is no evidence to indicate that hunting is impeding population recovery; thus, no changes in season or bag limits were recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 12

GEOGRAPHICAL DESCRIPTION: Upper Tanana and White Rivers

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose densities in Unit 12, as determined by fall sex and age composition surveys, range from approximately 0.1 moose/mi^2 in the Tetlin-Northway flats area, to 1.0-1.5 moose/mi^2 in the Tok River drainage. The virtual absence of a local resident moose population in suitable lowland habitat in the Tetlin-Northway flats area is believed to be the result of chronic poaching and high rates of predation by bears and wolves.

Populations in most areas are believed to be nearly stable with no trends discernible using present survey techniques. However, moose inhabiting the north slope of the Alaska Range and the portion of Unit 12 north of the Tanana River and west of the Taylor Highway appear to be increasing in abundance as a result of recent reductions in wolf numbers in adjacent Subunit 20D and in Unit 12 north of the Tanana River.

Population Composition

During the period 7 October-22 November, 810 moose were classified during 18.4 hours of aerial surveys (Table 1). Tetlin National Wildlife Refuge (NWR) personnel provided data for the Cheslina and Kalukna River drainages.

Bull:cow ratios in the Dry Tok Creek and Little Tok River survey areas remain low. Recent moose movement investigations indicate that a substantial portion of the winter populations in these drainages summer in nearby Units 11 and 13 and are being harvested during the fall in those heavily hunted areas.

Calf survival to 5 months of age remained low in most areas. Moderately high densities of black bears, grizzly bears, and wolves exist throughout most of Unit 12 and are believed to be responsible for high neonate mortality.

Habitat Conditions

No standardized browse use surveys were conducted by the Department during this reporting period. Casual observations, however, indicate light to moderate levels of browse utilization in the Tanana Valley and a high level of use in the Tok River drainage. Tetlin NWR personnel reported high levels of browse use in the Cheslina drainage, which supports a relatively high moose density during the rutting periods. Snow accumulations were normal during winter 1982-83 and many moose remained in subalpine rutting areas throughout the winter, unlike winter 1981-82 when heavy snow forced nearly all moose into lowland ranges by December.

A 30-acre browse crushing trial project received heavy use by moose in the Tok River drainage. The area, characterized by feltleaf willow (Salix alaxensis) 10-20 ft in height, was crushed during March 1982. By August, the shoots were 3.0-5.5 ft tall with an estimated doubling or tripling of available biomass. Use during winter 1982-83 was nearly 100%, much heavier than adjacent untreated areas.

Mortality

Predation by black bears, grizzly bears, and wolves is the primary mortality factor affecting most moose populations in Unit 12. Chronic poaching in areas close to villages in the Unit is believed to be responsible for the virtual absence of resident moose in such areas during fall.

Approximately 5 moose were killed by automobiles during the reporting period, and an estimated 20-30 moose were taken illegally.

Moose hunting pressure in Unit 12 during 1982 increased 13% to 408 hunters, compared to 354 hunters in 1981 and 285 hunters in 1980.

Eighty-six bull moose were reported taken, for a hunter success rate of 21%. Ninety-one bull moose were harvested in 1981. The Nabesna Road area was opened for moose hunting during the fall 1982 season; 7 bulls (8% of the total harvest) came from this area. Harvest distribution is presented in Table 2.

A total of 172 residents of Unit 12 reported hunting in Unit 12. Unit residents reported killing 24 moose (28% of the total reported harvest), a 14% success rate. In addition, 191 other residents of Alaska hunted in Unit 12 and took 36 bull moose. Thirty-four nonresident hunters took 23 moose for a success rate of 68%, which was much higher than the 17% success rate attained by residents of Alaska. Undoubtedly, guides accounted for the higher rate of hunting success among out-of-State hunters.

Management Summary and Recommendations

Most moose populations in Unit 12 exist at low densities and appear to be stable. Moose densities are moderate in the Tok, Little Tok, upper Tetlin, and Cheslina drainages. Wolf reductions in northern Unit 12 and adjacent Subunit 20D are expected to result in increased densities of moose in the northern and western portions of the Unit.

The Tok River Operational Moose Management Plan should be fully implemented to improve habitat conditions and moose productivity. Moose habitat improvement efforts in the Tok River drainage should continue.

The Fire Management Plan for the Fortymile Planning Area should be implemented during 1983 to return a near-natural fire regime to much of the Unit.

I recommend that public aerial shooting permits be made available to initiate a measured reduction of wolf numbers in the eastern portion of Unit 12. Wolf reductions will be necessary to restore moose abundance in the Tetlin-Northway flats area.

A 50-inch antler spread (or 4 brow tines on 1 antler) restriction will be implemented in the southeastern portion of Unit 12 in 1983. No further regulation changes were proposed.

PREPARED BY:

David G. Kelleyhouse
Game Biologist III

SUBMITTED BY:

Jerry D. McGowan
Survey-Inventory Coordinator

Table 1. Unit 12 moose sex and age ratios observed during aerial surveys, 7 October-22 November 1982.

Area	Total bulls/ 100 cows	Small bulls/ 100 cows	% small bulls	Calves/ 100 cows	% calves	Moose/ hour	Total moose
North Alaska Range	55	14	7	31	17	24	54
Tok River	33	14	9	30	19	41	150
Dry Tok Creek	20	4	3	27	18	65	72
Little Tok River	19	4	3	12	9	78	202
Nabesna Road	38	11	7	19	12	26	58
Tetlin River-Tuck Creek	55	8	5	18	11	33	104
Tetlin Flats	73	23	13	9	5	NA	40
Cheslina River	52	24	14	28	15	21	52
Kalukna River	73	16	9	5	3	98	78

Table 2. Number and percentage of bull moose harvested in major drainages of Unit 12, 1982.

Drainage	Number of bulls taken	% total harvest
Tok	10	12
Little Tok	20	23
Tanana	14	16
Nabesna	20	23
Chisana-White	13	15
Tetlin	8	9
Unknown	1	1
Total harvested bulls	86	100

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 13

GEOGRAPHICAL DESCRIPTION: Nelchina and Upper Susitna Rivers

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The Unit 13 moose population increased during 1982. During the past 3 years, the number of moose observed during fall composition counts has increased. A series of mild winters resulting in low mortality was an important factor contributing to the increase in population size.

Population Composition

Moose sex and age composition counts were completed in 9 count areas during October and November (Table 1). More yearling bulls were observed during that count than in previous years.

Mortality

Six hundred and twenty-three moose were killed by 2,919 hunters during the 1982 season. Hunter success was 21.3%. Nonresident hunters killed 53 moose, or 8.5% of the harvest. The most popular method of transportation among successful hunters were ATV's (40%), followed by aircraft (28%) and highway vehicles (18%).

Management Summary and Recommendations

Aided by a series of mild winters, the Unit 13 moose population has been increasing. Fall composition counts indicate higher bull:cow ratios, largely due to greater yearling bull survival under restrictive hunting regulations. These regulations protect yearlings and 2-year-old bulls by requiring hunters to select for older, mature bulls. The mean age and number of mature bulls in the population have therefore declined.

Both moose hunting pressure and the moose harvest declined in 1982. Adverse weather conditions the last 10 days of the season may have contributed to this decline.

No changes in seasons and bag limits were recommended.

PREPARED BY:

Robert W. Tobey
Game Biologist III

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

Table 1. Moose sex and age composition in Game Management Unit 13, 1981-82.

Year	Lrg. bulls	Yrlg. bulls	Bulls/100 cows	Calves	Calves/100 cows	Total	Moose/ hr
1981	455	294	21.4	1,054	30.0	5,311	56.4
1982	427	475	23.9	970	25.7	5,645	65.3

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14A

GEOGRAPHICAL DESCRIPTION: Matanuska Valley

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The increasing numbers of moose observed during composition surveys suggest the moose population in the Matanuska Valley has increased.

Population Composition

Composition surveys were flown under good snow and weather conditions in all 8 historical trend count areas. An additional trend count area was also established and flown in the vicinity of the Point McKenzie Agriculture Project. Survey results are shown in Table 1.

Mortality

Harvest ticket reports indicated 311 bull moose were killed by 2,219 hunters. The number of hunters increased by 214 from the 1981 season. Moose hunting success rate was 14%, which was below the 9-year mean of 21%. An additional 123 antlerless moose were killed by 400 permit holders. An analysis of successful moose hunters show 96% were residents, 2% were nonresidents, and 2% were of unknown residency. Successful hunters spent an average of 4.4 days hunting.

A review of Department of Public Safety records indicated that 182 moose were killed by highway vehicles during winter 1982-83. This compares to 72 killed by highway vehicles during the previous winter.

There were 5 known cases of natural winter mortality. Three of the moose showed extreme tooth wear indicating old age. Two had improperly healed broken legs, which restricted their mobility.

Management Summary and Recommendations

A heavy snowfall in early October forced moose out of alpine areas to lower elevations. The number of moose wintering in the

human populated portion of Subunit 14A was substantially higher than during the previous 3 winters. This situation contributed significantly to the 2.5 fold increase in vehicle-caused moose mortalities.

At the time composition surveys were completed, most of the moose were in timbered areas where observation and classification are difficult. For this reason, the observed calf:cow ratio may be greater than 40:100.

The mean antler size of harvested bulls was 30.9 inches. The harvest of predominantly small antlered males is believed to indicate that hunting pressure is allowing few bulls to mature to the older age classes. If hunting pressure continues to increase, it may be necessary to consider restrictions to limit the harvest of bull moose.

The moose population is believed near the maximum level desired. Efforts are being made to improve moose habitat in the Moose Creek Moose Management Area. Gains realized in that area will be offset by losses to expanding agricultural areas such as Point McKenzie and Fish Creek. Residential developments continue to reduce moose range, with 3,500 new homes being built during 1983.

No changes in seasons or bag limits were recommended.

PREPARED BY:

Jack C. Didrickson
Game Biologist III

Nicholas C. Steen
Game Biologist II

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

Table 1. Moose sex and age ratios in Subunit 14A, 1982.

Count area	Males/ 100 females	Calves/ 100 females	Twins/ 100 females w/calves	Moose/ hour	Sample size	Count time (hr)
1	31.2	40.9	5.7	30.8	160	5.2
2	12.9	35.5	22.2	14.8	46	3.1
3	22.9	43.3	8.2	74.6	261	3.5
4	16.9	35.5	5.0	82.2	189	2.3
5[a]	21.9	51.0	5.6	85.1	332	3.9
6	16.9	49.4	6.4	91.3	411	4.4
7[a]	27.1	37.9	12.1	58.6	287	4.9
8[a]	12.2	26.7	0.0	58.1	250	4.3
Point McKenzie	14.1	25.9	0.0	59.5	119	2.1
Means	19.9	40.3	6.4	58.9		
Totals					2,055	33.7

[a] Incomplete survey.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14B

GEOGRAPHICAL DESCRIPTION: Willow to Talkeetna

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The moose population appears to be increasing as indicated by high calf production, survival, and moose density.

Population Composition

Composition surveys, totaling 23.6 hours, were flown throughout the Subunit in early December; 1,124 moose were counted at the rate of 47.6 moose/hour. Weather and snow conditions varied from poor to excellent depending on the area surveyed. Results of those surveys were as follows: 43.0 males/100 cows; 29.1 calves/100 cows; and 6.4 twins/100 cows with calves.

Mortality

A total of 248 moose, 151 bulls and 97 cows, were killed by hunters in Subunit 14B. In September, 203 moose (131 bulls and 72 cows) were killed by 997 hunters for 20% success. Ten of the 72 cows were taken by hunters possessing antlerless permits. During the winter season (28 Jan-10 Feb), hunters having antlerless permits killed an additional 45 moose (19 bulls, 24 cows, and 2 calves). Of the 50 permit holders, 45 hunted and all were successful.

The average age of moose harvested during the winter permit hunt was 4.9 years of age for males and 7.0 years of age for females, excluding calves. These ages compare to 6.0 and 7.7 years of age for males and females, respectively, harvested during the previous winter hunt. During the 1983 winter hunt, 20 adult females (including 3 long yearlings) were checked for pregnancy rate; 15 were found to be pregnant with an *in utero* ratio of 1.47 calves: cow.

Records obtained from the Department of Public Safety indicated that 22 moose were killed by highway vehicles during this reporting period. Observations along the Alaska Railroad tracks indicated 34 moose were killed by trains during the winter. This figure compares to 9, 6, and 9 moose killed annually by trains during the previous 3 winters.

Management Summary and Recommendations

The winter of 1982-83 began with a heavy snowfall in October, forcing moose out of alpine areas to lower elevations. The number of moose wintering in the human populated portion of Subunit 14B was higher than during the previous 3 years. This resulted in a higher rate of train and vehicle-caused moose mortalities.

Aerial composition surveys were conducted throughout Subunit 14B. Most of the moose were located at lower elevations. Locating moose in dense timber was difficult and time consuming. Observation of lone animals and calves was particularly difficult; thus, the observed ratios are questionable. Calf survival may therefore be greater than 29 calves:100 cows.

The majority of the cow harvest (62 animals) resulted from a 10-day, nonpermit hunt for that part of Subunit 14B located 3 mi east of the Parks and Talkeetna Spur Highways. That hunt generated extensive interest from the hunting public; however, due to the very limited access, few animals were killed. With relatively high calf reproduction and low mortality, we believed the population has increased and recommend the entire Subunit be opened to either-sex hunting, without permit, for the month of September.

PREPARED BY:

Jack C. Didrickson
Game Biologist III

Nicholas C. Steen
Game Biologist II

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14C and 7 within the Portage and Placer River drainages

GEOGRAPHICAL DESCRIPTION: Anchorage Area

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Calf production and winter survival have been at near maximum levels during the past 4 years, mainly as a result of 4 consecutive mild winters. During this time, the population increased slightly despite deteriorating browse conditions. This trend will likely continue barring the inevitable return of more severe winters.

Population Composition

Moose (1,100) were counted during aerial surveys conducted during October and November. These surveys were the most extensive ever flown within the Subunit, covering virtually every area where significant concentrations of moose are found. A ratio of 49 bulls:100 cows was obtained, the highest since Subunit-wide surveys were initiated (1966). Forty-six calves:100 cows were also observed, comparable to the 1979-81 mean of 48 calves:100 cows.

The mean age of 38 road-killed and 34 hunter-killed cow moose was 3.8 years, clearly representing a young, growing population. The mean age of 10 hunter-killed bull moose was 2.5 years.

Mortality

Thirty-five antlerless and 71 antlered moose were killed by sport hunters within the Subunit. The antlerless moose were taken under the drawing permit system from the Fort Richardson and Portage hunt areas. Thirty-six bulls were also taken from the same areas under permit, and the remainder (35) were taken during a general open season within other portions of the Subunit. Excluding those taken on Fort Richardson, the bull harvest was 69% above the 1977-81 mean of 42 bulls. Excluding the Fort Richardson hunt, 280 persons reported hunting moose for a success rate of 25%. In the Fort Richardson hunt, each of the 35 permittees took a moose.

An additional 159 moose, approximately 62 of which were calves, were killed by vehicles on Subunit 14C roadways between 1 June 1982-31 May 1983. This compares to a mean of 77 killed on local highways during previous reporting periods from 1977-1981. The 75% increase in vehicle-related deaths was attributable to the abundance of moose within the Subunit, the rapidly increasing number of motor vehicles on Anchorage area roadways, and heavy snow accumulation in early winter. A significant portion of this mortality (53%) occurred during the months of November through February when darkness and slippery roads created hazardous conditions for both motorists and moose. An additional 26 moose were reported killed by other means, such as poaching, accidents, and train kills. The total reported mortality for the Subunit was 291 moose.

Management Summary and Recommendation

As a consequence of 4 consecutive mild winters, the population continues to increase slowly to a high level last seen in the early 1970's. This fact, coupled with the annual loss of winter browse due to human expansion and high winter mortality due to a variety of causes, indicates the need for increased hunter harvest. I recommend this be accomplished by lengthening the existing season by 10 days to 30 September, providing for permit only antlerless hunts in several local drainages, and by allowing archery-only hunts in several areas presently closed to all moose hunting.

PREPARED BY:

David B. Harkness
Game Biologist III

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15A

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Results of moose surveys conducted in a portion of Subunit 15A indicated an increasing moose population. The portion surveyed, however, consisted primarily of the 1969 burn and Mystery Creek crushed areas. Both of these areas contain excellent moose browse, but make up a small portion of the Subunit. Most of the unsurveyed portion was within the 1947 burn, which no longer contains good moose browse. A slight increase in the overall moose population probably resulted from a series of mild winters since 1979.

Population Composition

Surveys were conducted in 8 of 13 count areas; 692 moose were classified. The U.S. Fish and Wildlife Service conducted 6 of 8 surveys. These surveys revealed 13 bulls:100 cows, 40 calves:100 cows, and 9 sets of twin calves:100 cows with calves. The percentage of calves in the sample was 26%, suggesting moderately high early-winter calf survival.

Mortality

Harvest information derived from hunter reports indicated 1,049 hunters killed 210 bulls and 1 cow. These figures represent a 24% decrease in the number of moose killed and a 7% decrease in the number of hunters reporting when compared to 1981 data. Hunter success was 15%. Alaskan residents accounted for 96% of the successful and 98% of the unsuccessful hunters.

Reported kill locations plotted on a map (not shown) have indicated that the majority of harvest came from the areas burned in 1969.

Management Summary and Recommendations

Increased public awareness of high moose density in the 85,000 acre 1969 burn area has tended to concentrate hunters. Habitat improvement is necessary in other portions of Subunit 15A to stimulate population growth and to distribute hunting pressure. The preferred method to improve habitat for moose, and consequently shift hunting pressure, is prescribed burning where feasible and crushing where burning is not possible.

A proposal to issue 30 permits for the taking of antlerless moose in the western portion of Subunit 15A (1969 burn) was approved by the Board of Game during their spring 1982 meeting. If moose survey data continue to show an increasing trend in moose density, it is recommended that this hunt be continued and the number of permits readjusted annually according to survey and harvest information.

PREPARED BY:

Ted H. Spraker
Game Biologist III

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15B

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Survey information, available in 3 of 4 count areas within Subunit 15B West, indicated the moose population was healthy and increasing. Surveys were not conducted in Subunit 15B East.

Population Composition

A total of 459 moose was counted in 15B West during an aerial survey conducted in November. Composition of observed moose were 14 bulls:100 cows, 5 yearling bulls:100 cows, and 39 calves:100 cows. Noteworthy was the fact that 353 of these animals (77%) were found in an area where the habitat had been mechanically manipulated to increase its potential carrying capacity.

Mortality

Hunters harvested a total of 49 bulls in 15B West during a 20-day season. Resident hunters took 96% ($N = 47$) of the harvest. Hunter success was 17%. Antler spreads of harvested bulls were as follows: $\leq$29 inches = 53% ($N = 21$); 30.0-49.9 inches = 35% ($N = 14$); and $\geq$50 inches = 13% ($N = 5$). The antler spreads averaged 31 inches. Successful hunters averaged 3.8 days in the field, and unsuccessful hunters averaged 6.0 days.

Seventy-three of 100 permittees hunted moose in Subunit 15B East. A total of 23 bulls were harvested, yielding a success rate of 32%. Mean antler spread was 56 inches ($N = 21$, range 46 to 65), and the largest antler spread was 65.8 inches.

Management Summary and Recommendations

Moose calf survival in 15B West was substantially improved in 1981 and 1982. Winter survival of the calves was high, and the addition of the yearling cohort resulted in moderate population growth. This increase in calf survival was influenced by a series of exceptionally mild winters that began in 1979.

The trophy bull moose hunt in 15B East continues to provide excellent hunting opportunities and is popular among Alaskan and nonresident sportsmen. The doubling of permits and splitting the season into 2, 20-day periods increased the average annual harvest from 15 to 25 bulls in 1982. This is an acceptable level of harvest; therefore, no regulatory changes were recommended.

PREPARED BY:

Ted H. Spraker
Game Biologist III

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15C

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose are near the ecological carrying capacity of the maturing forest habitats of this Subunit. Comparison of 1977-78 and 1981-82 count data clearly indicates the population in this region has made only modest gains during the past 5 years despite a recent series of mild winters.

Population Composition

Complete aerial surveys were conducted in 4 count areas that comprise approximately 70% of the land area between Tustemena Lake and Kachemak Bay. Survey conditions were nearly ideal for all areas. A total of 1,019 moose (125 bulls, 670 cows, and 224 calves) were classified. An average of 19 bulls:100 cows were observed. The ratio of calves:100 cows ranged from 17 to 67 and averaged 33.

Mortality

The reported harvest was 197 moose, which included 193 bulls and 4 moose of unspecified sex. This harvest was slightly smaller than that reported in 1981 (225 moose). Eight hundred eighty-six hunters pursued moose, and hunter success was 22%.

Management Summary and Recommendations

The mature state of forest habitats appears to be the major factor limiting moose population growth in Subunit 15C. Forests typically consist of rather dense, 50 to 100-year-old stands of spruce and, less commonly, spruce mixed with birch. Very small amounts of browse exist under these conditions. The highest browse production per unit area occurs in the open riparian and low alpine habitats.

The area's capacity to support moose could be greatly improved by reversing the present course of forest succession. Major wild fires occur too infrequently on the southern Kenai Peninsula to maintain optimal browse production. Furthermore, the potential

to extensively enhance habitat conditions appears quite limited due to the restrictive land management policies on the Kenai National Wildlife Refuge and complex land ownership patterns within the balance of the Subunit. Nonetheless, every effort should be put forth to identify tracts of public land where habitat manipulation may be used.

The region's carrying capacity for moose has been further reduced over the past 3 decades by various human-related disturbances on critical winter ranges. Most noteworthy of these losses are the following: range competition with domestic livestock in the lower Fox River Valley, and residential housing development on the Homer "benchlands." The Department should work closely with the Division of Lands to suggest ways to reduce foraging competition on ranges in Fox River Valley. Realistically, however, conditions for moose in the "benchlands" will continue to deteriorate in the future.

Preliminary evaluation of moose habitat and land ownership of the South Fork of the Anchor River shows that this area should be maintained in public ownership and primarily managed for moose. This goal can be accomplished if immediate steps are taken to designate the area as a State game range or refuge.

No changes in seasons and bag limits were recommended.

PREPARED BY:

David A. Holdermann
Game Biologist II

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16

GEOGRAPHICAL DESCRIPTION: West Side of Cook Inlet

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The moose population in Subunit 16A appears to be healthy and stable. The moose population in Subunit 16B has recovered from extensive winter kills experienced in the late 1960's and early 1970's.

Population Composition

Composition surveys were flown in early December in the Peters-Dutch Hills and Kroto Creek areas of Subunit 16A, and in the Alexander Creek, Susitna-Beluga Mountain, Sunflower Basin, Lone Ridge, and McArthur River areas of Subunit 16B. Survey results are shown in Table 1.

Mortality

In Subunit 16A, 206 moose, 163 males, 41 females, and 2 of unknown sex were killed by 947 hunters. The 150 persons with permits for antlerless moose reported taking 41 moose (4 males and 37 females), and the remainder of the harvest came from the general open season. Hunters were primarily State residents (187 successful, 697 unsuccessful); nonresidents (12 successful, 10 unsuccessful) and persons of unknown residency (7 successful, 34 unsuccessful) were less than 7% of total hunters.

There were 362 moose (296 males, 56 females, and 10 of unknown sex) killed by 1,135 hunters in Subunit 16B. State residents (297 successful, 684 unsuccessful) remained in the majority, with nonresidents (31 successful, 51 unsuccessful) comprising a slightly higher percent (14%) than in Subunit 16A.

An additional 78 hunters, hunting an unknown portion of Unit 16, killed 5 bull moose.

Management Summary and Recommendations

Composition data obtained in both Subunits were generally comparable to data from those same areas in recent years. The variations in data reflect bias introduced as a result of moose

movement and survey conditions rather than actual changes in the population status. A lack of adequate snow cover prevented surveys of some areas, and a significant movement of animals out of established boundaries caused problems. For count area L in the Long Ridge trend area, the sample size decreased from 142 animals observed in 1981 to only 18 because of such movements.

The Unit 16 moose populations appeared to be benefiting from the recent series of mild winters and experienced good reproduction and recruitment. Calf:cow ratios varied from a low of 26.6 calves:100 cows in the Sunflower Basin area to 47.7 calves:100 cows in the Kroto Creek area.

The harvest for Subunit 16A decreased from 248 moose in 1981 to 206, although the numbers of antlerless moose taken by drawing permit increased from 30 to 41. Hunter success (19.9%) remained the same for both years, and the decreased harvest was a product of reduced effort as a result of inclement weather during the season. In Subunit 16B, the same trend was evident with the reported harvest declining from 439 moose in 1981 to 362 and hunter numbers decreasing from 1,345 to 1,135.

Subunit 16B supports a large number of moose. Due to poor hunter access throughout most of the Subunit, only a moderate harvest was achieved. In an attempt to take more moose, we recommend increasing the length of the antlerless moose season by 10 days.

PREPARED BY:

James B. Faro
Game Biologist III

William P. Taylor
Game Biologist II

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

Table 1. Moose sex and age ratios in Game Management Unit 16, 1982.

Count area	Males/ 100 females	Calves/ 100 females	Twins/100 females w/calves	Moose/ hour	Sample size	Count time (hr)
Subunit 16A						
Peters-Dutch Hills	20.9	35.8	10.8	34.2	315	9.2
Kroto Creek	51.2	47.7	20.6	43.8	171	3.9
Totals					486	13.1
Means	30.0	39.4	14.1	37.1		
Subunit 16B						
Alexander Creek	39.8	43.2	12.1	67.1	161	2.4
Susitna-Beluga Mtn.	39.8	36.1	16.7	48.7	146	3.0
Sunflower Basin	52.2	26.6	11.8	112.7	524	4.7
Lone Ridge	a	a	a	a	18	3.0
McArthur River	43.5	33.9	10.5	40.3	110	2.7
Totals					959	28.9
Means	48.1	31.5	12.4	60.7		
Unit 16						
Totals					1,445	28.9
Means	41.8	34.2	13.1	50.0		

[a] Small sample size.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16B

GEOGRAPHICAL DESCRIPTION: Kalgin Island

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The moose population on Kalgin Island has been significantly reduced by hunting; however, the estimated population of 45-50 moose still exceeds a density of 2 moose/mi^2.

Population Composition

Forty-three moose were observed during a trend survey (2.3 hours) flown on 30 October 1982; 18.4 moose/hour were seen. The composition of that sample was 4 bulls, 21 cows, and 18 calves. Sex and age ratios were as follows: males/100 females (19.0); calves/100 females (85.7); and twins/100 females w/calves (20.0).

Mortality

Seventy-one moose (34 cows and 37 bulls) were taken from Kalgin Island before the season was closed by emergency order on 17 September. The age structure of the harvest was predominantly young animals; 82% were 3 years of age or younger. Only 8 of 141 moose killed in the past 2 seasons were 6 years of age or older. Examination of tooth wear suggested few moose lived beyond 6 years of age. Tooth wear was so extreme that it would be difficult for them to obtain adequate feed even during mild winters.

Management Summary and Recommendations

In December 1981, 141 moose were observed on Kalgin Island for a density in excess of 7 moose/mi^2 of available habitat. Observations of the island's vegetation indicated that extreme overbrowse had occurred, and significant winter mortality could be expected with even moderate snow depths. A special midwinter hunt was authorized and the known population reduced by 70 animals. In September 1982, an additional 71 moose were taken. With recruitment of calves born in spring 1982, a minimum of 43 moose are known to remain on the island.

Unlike moose on the mainland, Kalgin Island moose have no winter habitat they can move to in response to deep snow. The browse that supports them through the winter has already sustained use during the growing season. Therefore, browse is not available in the same quantity and quality that would be present were it not used during the growing season. Under the former stocking rate of 7 moose/mi^2, overbrowsing occurred; moose are now foraging on food items not normally utilized as a mainstay of their diet. The detrimental impacts of this nontypical feeding is reflected by rapid tooth wear.

The present density of 2 moose/mi^2 is still too high to allow vegetation to recover to the level where it could carry the population through a winter of moderate to heavy snow depths.

Reproduction next spring is expected to add a minimum of 20 moose to the population, as survival of calves is high on the predator-free island. It appears significant winter mortality has been avoided only because of recent mild winters.

We recommended that the population on Kalgin Island be maintained at a level of 1 moose/mi^2. The vegetation should be monitored to determine if it can recover from past overuse. The stocking rate of moose will be determined through annual surveys and adjustments made in response to carrying capacity. A registration hunt provides the best means of monitoring the harvest and to ensure the desired number of animals are removed from the island.

PREPARED BY:

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Game Biologist III

William P. Taylor
Game Biologist II

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 17

GEOGRAPHICAL DESCRIPTION: Bristol Bay

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Population status is highly variable between Subunits. A moose census was conducted in a 1,834/mi^2 portion of Subunit 17C using the population estimation method developed by Gasaway (1981). The census area was divided into 164 sample units which were stratified into 3 groups--high, medium, and low density.

Random sampling within each stratum yielded the following density estimates: high, 1.87 moose/mi^2; medium, 0.78 moose/mi^2; low, 0.35 moose/mi^2. The density estimate for the entire census area was 0.66 moose/mi^2. Using these estimates as a basis for prediction, the density in Subunit 17A is probably <0.1 moose/mi^2. In the Nushagak drainage portion of Subunit 17B, moose density probably falls between 0.6-0.9 moose/mi^2. Moose densities are higher in the Mulchatna River drainage, probably approaching 1.0-1.3 moose/mi^2.

Moose populations increased in most portions of Subunits 17B and 17C during this reporting period. Increases were due primarily to the mild winter and to the availability of the Mulchatna Caribou Herd to people of Nushagak River villages. Fewer cow moose were taken illegally during the winter months because caribou were easily accessible from December through March. The moose population in Subunit 17A, however, has been nearly extirpated by poachers, presumably from Togiak and Twin Hills.

Population Composition

Lack of snow prevented most surveys from being accomplished this fall. Surveys were conducted in the Sunshine Valley and Kemuk Mountain count areas (Table 1). As has been true in previous years, sex ratios in both areas exceeded 100 bulls:100 cows. Calves composed 20% of the herd in the Kemuk Mountain area and 10% in Sunshine Valley. Survival of yearlings appeared high in both areas.

Mortality

Harvest ticket reports indicate 149 hunters killed 49 moose, a 55% decline from 76 moose reported taken the previous year. Harvest data do not accurately reflect the true harvest level, as the majority of harvest taken during the legal season by residents of the Unit remains unreported. Additionally, a significant number of moose of both sexes are taken out of season.

Of the successful hunters who reported their kills, 39 were residents, 5 were nonresidents, and 5 did not specify residency. Of the 39 successful residents, 21 (34%) resided in Unit 17. Because residents of the Unit are responsible for nearly all the illegal kills and a large percentage of the unreported legal harvest, the actual percentage of moose taken by residents of the Unit is substantially higher. Harvest reports indicated that 29 moose were taken during the September season, 11 moose were taken during the December season, and 9 moose were taken out of season.

Boats (39%) and aircraft (21%) are the most common methods of transportation used for hunting moose. Access to Subunit 17B is primarily by aircraft while boats are used almost exclusively in Subunit 17C. While nearly all residents of the Unit utilize snowmachines for access during the winter season, only 5 hunters reported using them as their principal transportation means.

Winter snow conditions were mild during 1982-83, and no winter mortality was documented. Sealing certificates indicate the wolf population had increased substantially since 1981, and several wolf-killed moose were reported. The incidence of poaching appeared to be considerably lower than in past years. However, area residents allegedly took a minimum of 10 moose from the Togiak drainage, even though the moose season is Subunit 17A was closed.

Management Summary and Recommendations

Most residents of Subunit 17A were aware that the moose season was closed. It may take several years before villagers have sufficient respect for hunting regulations to make season closure effective.

Stratification criteria used during the Subunit 17C census should be extrapolated over other portions of the Unit to provide a better estimate of the moose population. Survey data are sparse in Subunit 17B. Survey efforts should be intensified there to provide baseline information necessary for intelligent consideration of regulation proposals.

During this reporting period, the Board of Game adopted a registration permit hunt for Subunits 17B and 17C, excluding the Mulchatna drainage above the confluence of the Chilchitna River with a 20 August-4 September season. This hunt was requested by the local advisory committee to provide an earlier season for local hunters. By increasing the season length in this manner,

it is hoped there will be less illegal killing cows. The Board of Game requested that the Department conduct adequate surveys during fall 1983 to document what effect this season will have on the moose population.

Literature Cited

Gasaway, W. C. 1981. Moose survey procedures development. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Final Rep. Proj. W-17-9, W-17-10, W-17-11, W-21-1, and W-21-2. Job 1.17R, 1.18R, and 1.19R. Juneau. 13pp.

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SUBMITTED BY:

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Table 1. Fall and winter sex and age ratios from Sunshine Valley and Kemuk Mountain count areas in Unit 17, Northern Bristol Bay, 1972-1982.

Count area	Date	Total bulls/ 100 cows	% yrlg. bulls in herd	Calves/ 100 cows	% twins/ 100 cows w/calves	% calves in herd	Moose/ hour	Total sample
Sunshine Valley	3/11/72	--	--	--	33.3	33.3	69	48
	3/28/80	--	--	--	40.0	15.6	--	45
	11/26/80	118.2	9.1	27.3	0.0	11.1	15	27
	1/5/82	--	--	--	33.3	19.6	58	46
	12/6/82	153.4	41.1	29.4	25.0	10.2	49	49
	2/24/83	--	--	--	20.0	17.6	26	68
Kemuk Mtn.	12/2/80	135.3	12.5	23.5	0.0	9.1	42	88
	12/8/82	161.1	9.3	65.2	25.0	20.0	38	75

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 18

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose populations remain depressed throughout Unit 18, particularly in the Kuskokwim River drainage. In the lower Yukon River drainage above Marshall, populations appear to have increased slightly but are still well below carrying capacity. In the lower Yukon River drainage below Pilot Station and St. Mary's, moose densities remain extremely low. Although much suitable habitat is available in both drainages, heavy hunting pressure and a high illegal harvest have prevented the establishment of viable populations in most of the Unit.

Population Composition

In November and December 1982, aerial composition counts were conducted along the Yukon River between Devils Elbow and Paimiut, and along the Kisaralik River-Ophir Creek drainage (Table 1). In both surveys, the observed percentage of calves was low, probably reflecting high mortality the previous spring due to record flooding. The bull:cow ratio was high in both samples, probably because of heavy hunting pressure on both cows and bulls rather than low mortality of bulls alone. In the Yukon River survey, bulls were classified as yearlings, young adults (antler spread $\leq$ 50 inches or less) or adults (> 50 inches). Virtually all adult bulls observed were classified as young adults, suggesting that hunting mortality is substantial among bulls.

The fall 1982 count of the Yukon River between Devils Elbow and Paimiut was compared with the fall 1981 count of the same area using contingency analysis (Table 2). Survey dates and conditions were similar in both years, and both surveys were conducted by the same observer and pilot. Overall composition counts differed significantly ($P < 0.001$); the proportion of cows with twins was significantly lower in 1982 than in 1981 ($P < 0.001$), and the proportion of lone cows was significantly higher ($P < 0.025$). These results suggest that calves suffered high mortality during spring 1982. Water levels along the lower Yukon River and associated drainages reached record heights and did not

subside until mid-to-late June. Many residents along the lower Yukon River observed dead, newborn calves in the river and believed that mortality during spring calving was greater than normal.

Late winter and spring composition counts were conducted on the Yukon River between Ohogamiut and Paimiut, and on the Nageethluk, Reindeer, and Andreafsky Rivers (Table 3). No moose were observed during the Andreafsky River survey, and the other samples were too small to provide reliable composition comparisons. The density of moose observed in all count areas was extremely low, averaging less than 5 moose/hour. The percentage of calves observed in the Yukon River survey was higher than that observed the previous fall. Because the survey was conducted in March and the spring snowpack was relatively shallow, I believe the discrepancy may be the result of movement of some adults away from the main river earlier than normal. In any case, overwinter calf mortality was probably quite low because of the mild winter.

Densities (moose/hour) and calf percentages observed during the 1983 late winter survey of the Yukon River (Russian Mission to Paimiut) were similar to results of surveys conducted in the same count area over the past 3 years (Table 4). The percentage of calves in the sample declined slightly from the previous year, but the difference is not statistically significant ($\underline{X}^2 = 3.22$, $\underline{P} > 0.05$). Although the 1982 calf crop was smaller than normal, recruitment of short yearlings appeared to be similar to past years.

Mortality

Hunting is the most important source of moose mortality in Unit 18. Hunters reported a legal harvest of 55 moose during the fall 1982 season. An additional 3 moose were reported taken during the closed season. Of the legal harvest, 32 moose were taken from the Yukon River drainage, 20 from the Kuskokwim, and 3 from unknown areas. Most of the reported harvest from the Yukon River drainage was taken above Marshall. In the Kuskokwim River drainage, most of the harvest was taken above Tuluksak and in the upper reaches of associated drainages. Because illegal hunting of moose during winter and early spring is a common practice, I believe the actual harvest is at least 100-150.

The 1982 reported harvest (58 moose) is substantially lower than that of 1981 (82 moose). A spot-check of hunters in the field during September indicated that most hunters were aware of the harvest ticket requirement and had tickets in their possession. Therefore, the lower harvest reported in 1982 probably reflects an actual reduction from 1981. Most hunters contacted in September commented that hunting conditions were poor due to high water, and hunting success appeared to be poorer than in past years.

In 1982, 220 hunters reported hunting, compared with 221 in 1981 and 145 in 1980. Most of the reported harvest was taken by residents of Unit 18 (83%), a pattern observed in past years as well (Table 5). Although competition from nonlocal hunters is significant in some rural Game Management Units, it appears to be minimal in Unit 18. Low moose densities, heavy hunting pressure from local residents, and special restrictions on the use of aircraft discourage nonlocal hunters.

As reported in previous years, most hunters used boats as the primary method of transportation (79%). The percentage of hunters using aircraft remains low (8%), reflecting the low number of nonlocal hunters using the area. The percentage of hunters using snowmachines as the primary method of transportation is also low (11%). Because most hunters in Unit 18 were afield in September (82%), the disproportionate use of boats compared with snowmachines is not surprising.

Although little is known about predation in Unit 18, I do not believe that it is a significant source of moose mortality. Wolves are rare or nonexistent throughout most of the Unit, and recurrent sightings of packs are made only in the Yukon River drainage above Russian Mission. Although grizzly bears are common in the Andreafsky and Kilbuck Mountains, there is little evidence that bears are major predators of moose in Unit 18.

Management Summary and Recommendations

Illegal moose hunting in winter and early spring by hunters using snowmachines remains a serious management problem in Unit 18. Moose are the only large ungulate available to most residents of Unit 18 and are usually considered too valuable to pass up when sighted by a hunter. A relatively high human population, in conjunction with extremely low moose densities, further aggravates the problem. Department personnel should continue to inform the public of the need for active moose management and the necessity of abiding by the seasons. Increased enforcement during winter and spring is also needed.

Most hunters are aware of seasons and harvest ticket requirements. Efforts should continue to establish license vendors in all villages and to inform the public of the need for the harvest ticket requirements.

Due to heavy hunting pressure throughout the year, occupation of many areas by moose appears to be quite transitory, and seasonal movement patterns may be very different from those observed in other areas of the State. I recommend using radio telemetry to better understand the nature of these movement patterns.

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Table 1. Unit 18 moose composition counts, fall 1982.

Area	Adult bulls/ 100 cows	Yearling bulls/ 100 cows	Total bulls/ 100 cows	Calves/ 100 cows	% calves	Sample size
Yukon R., Devils Elbow to Paimiut	34[a]	18	51	35	19	138
Kisaralik R./ Ophir Ck.	--	--	40	40	22	36

[a] All adult bulls classified had antler spreads of approximately $\leq$ 50 inches.

Table 2. Yukon River fall moose composition counts, Devils Elbow to Paimiut, 1981 and 1982.

Sex/age	1981		1982		X^2	P
	No.	%	No.	%		
Adult bulls	19	29	25	22	1.05	NS
Yearling bulls	4	6	13	12	1.41	NS
Cows/1 calf	12	19	20	18	0.01	NS
Cows/2 calves	12	19	3	3	13.21	<0.001
Lone cows	18	28	51	46	5.51	<0.025
Overall	65	100	112	100	26.50	<0.001

Table 3. Unit 18 moose composition counts, winter-spring 1983.

Area	Adults	Calves	% calves	Totals
Yukon R., Russian Mission to Paimiut	35	10	29	45
Yukon R., Ohogamiut to Russian Mission	6	1	17	7
Nageethluk R.	3	2	40	5
Reindeer R.	1	0	--	1

Table 4. Moose winter composition counts from the Yukon River, Russian Mission to Paimiut, 1980-1983.

Date	Adults	Calves	% calves	Totals	Moose/ hour
February 1980	38	11	22	49	15
February 1981	27	12	31	39	18
March 1982	22	15	35	37	19
March 1983	35	10	29	45	18

Table 5. Unit 18 moose harvest by residency status, 1979-82.

Residency status	1979		1980		1981		1982	
	No.	%	No.	%	No.	%	No.	%
Unit 18 resident	8	67	39	81	67	86	45	83
State resident (nonlocal)	0	0	4	8	3	4	3	6
Nonresident	3	25	4	8	8	10	1	2
Unknown	1	8	1	2	0	0	5	9
Totals	12	100	48	100	78	100	54	100

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 19

GEOGRAPHICAL DESCRIPTION: Middle and Upper Kuskokwim Drainages

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Data on moose densities in Unit 19 are unavailable. Because of poor survival of calves born in 1982, populations throughout the Unit are expected to remain stable or decline.

Population Composition

Survival of the 1982 moose calves was poor throughout most of Unit 19. Twin calves were rarely sighted during November surveys. Cold spring weather and rain during much of the summer probably contributed to poor survival.

Weather prevented completion of composition surveys in Subunit 19A, but cursory surveys indicate that calf survival was poor in 19A. Bull:cow ratios were relatively high especially in the foothills of 19B and 19C.

Movements

In February 1983, 10 bull moose were radio-collared on the Bear Creek Burn and 9 were radio-collared on the flats of the North Fork of the Kuskokwim River to the north and west of the burned area. Information will be obtained on the movement patterns of moose occurring on the flats of the Upper Kuskokwim Controlled Use Area (Subunit 19D) and in the adjacent foothills (Subunit 19C). The use by moose of the large Bear Creek Burn will also be evaluated. By May 1983, at least 5 of the 10 moose captured in the Bear Creek Burn near Farewell had moved down onto the flats; all 9 captured on the flats had remained there. Their movements will be monitored monthly for the next 2 years with the assistance of the Bureau of Land Management.

Mortality

The total moose harvest for Unit 19 in 1982 was estimated to be between 600 and 700 moose. The economic value of this harvest to residents of Unit 18 and 19 is estimated at $250,000 to $2.3 million in meat alone (Table 1). The reported harvest in 1982

was 335 moose, which was down from the 369 moose reported taken in 1980 and 1981. The number of hunters (687) was also down from 1981 (753); however, hunter success was identical (49%).

The number of hunters (208) who reported hunting in Subunit 19A increased slightly from 1981 (199), but the reported harvest was nearly identical (77 in 1982 and 78 in 1981). Boats remained the principal mode of transportation used by moose hunters in Subunit 19A (49%). Most hunters were Alaska residents (88%), and nearly one-fourth of the hunters were from Southcentral Alaska. An equal number of Unit 18 and Subunit 19A residents hunted Subunit 19A.

Subunit 19B continues to be the hunting domain of Southcentral residents (49%) and nonresidents (39%). There were fewer hunters in 1982 (142) than in prior years (189 in 1980 and 170 in 1981), and they took fewer moose (71 in 1982, 78 in 1981, 103 in 1980). The number of aliens hunting continued to decline sharply. Legislation enacted prior to the hunting season required all alien hunters to be accompanied by a guide. Aircraft continues to be the principal means of transportation (80%) to get to the hunting area.

Subunit 19C is also popular with Southcentral residents (59%) and nonresidents (39%). As in Subunit 19B, aircraft is the principal means of transportation used by hunters in Subunit 19C (88%). There were slightly fewer hunters in 1982 (129) than in 1980 or 1981 (148 and 147, respectively), and they reported taking 80 moose in 1982 compared to 78 in 1980 and 86 in 1981.

Moose hunting in Subunit 19D more closely follows the hunting pattern in Subunit 19A where boats are the principal mode of transportation (78%) rather than aircraft as in the foothills of Subunits 19B and 19C. The number of hunters who reported was down slightly (175) compared to 1981 (185). The reported take (104 moose) was identical both years. However, last year 40 hunters from Nikolai reported taking 25 moose in Subunit 19D, but this year Nikolai residents returned only 14 harvest reports that indicated a total of 7 moose killed. Apparently, last year's effort by the Subsistence Division to get a better return of harvest tickets in Nikolai did not carry over to this year. Based on hunter reports, 60% of those hunting in Subunit 19D lived in Subunit 19D, 12% were from Southcentral Alaska, and 11% were nonresidents.

Studies in Nikolai, Sleetmute, and Chuathbaluk by the Subsistence Division during the last 2 years provides some measure of the unreported harvest by Unit 19 residents (Table 2). The reported harvest ranged from 14% to 44% of the actual harvest as determined by village interviews. Similar comparisons suggested that only 23-30% of those hunting complied with the reporting requirement. Since residents of Subunits 19A and 19D compose at least 40-60% of the hunters in those Subunits, the actual harvests for Subunits 19A and 19D probably vary from 190 to 260

and 225 to 250, respectively. In Subunits 19B and 19C, the reported harvest is probably about 75% of the actual harvest; thus, the harvests in these Subunits were probably around 90 and 100 moose, respectively.

Management Summary and Recommendations

It is not clear what has caused the low initial survival of moose calves in Unit 19. Some areas like the Holitna and Innoko Rivers experienced spring floods and high water through most of June. Water levels on the upper Kuskokwim River stayed near normal except for a period of flooding in late summer and fall.

Surveys were not completed in Subunit 19A in November due to the lack of snow. So little snow accumulated during the winter that moose did not congregate along rivers, and consequently late winter counts were not attempted.

Harvest reports suggested that the reduction in numbers of alien hunters probably accounted for the slight decrease in hunting pressure and harvest in 1982. The weather during most of September was cool and rainy, and bulls did not seem to start moving until the last week of September. The fall harvest usually accounts for over 90% of the total harvest. Winter weather was more favorable for hunting than last year. The kill was probably higher, but few (10) reports were returned for that time period.

The recently initiated moose movement study in Subunits 19C and 19D will be continued for the next 2 years. Observations thus far indicate that moose living within the burned upland area during late winter move to the flats along the Kuskokwim River by summer.

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Table 1. Calculations used to estimate the economic value of the Unit 19 moose harvest to residents of Units 18 and 19.

Cost of least expensive beef purchased in local stores: $3.50-$8.50/lb.
Cost of beef purchased in Anchorage: $1.50/lb.
Shipping from Anchorage to village in Unit 19: $24-$85/100 lbs.
Cost of Anchorage beef flown into village: $1.75-$2.35/lb.
Estimated weight of moose cut and wrapped: 500-700 lbs.
Value of a moose as a substitute for beef purchased at a) Local store: $1,750-$5,950 b) Anchorage: $ 875-$1,650
Subtract $200-$300/moose for the estimated cost of gasoline used in hunting (gasoline @ $2.35-$2.75/gal.)
Estimated number of moose harvested by Unit 18 and 19 residents: 300 to 400.
Estimated value of Unit 19 moose harvest to residents of Units 18 and 19: $250,000 to $2.3 million.

Table 2. Compliance with the moose harvest ticket reporting requirement in selected Unit 19 villages, 1981 through 1982.

Village	Approx. no. hunters	Harvest tickets issued	Harvest tickets returned		Subsistence Division harvest data
			Success.	Unsucc.	
Nikolai	50	41	7	8	50
Sleetmute	35	10	5	3	19
Chuathbaluk	45	?	7	5	16

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20A

GEOGRAPHICAL DESCRIPTION: Tanana Flats, Central Alaska Range

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

A population estimate survey was conducted on the Tanana Flats portion of Subunits 20A and 20C during November 1982 to refine the population estimate obtained from a similar survey in 1978. Estimates were of the resident moose population, since the migratory segment had already moved to upland areas in the Alaska Range to the south and in the Tanana Hills to the north.

About 73% of the estimated 3,200 moose composing the Tanana Flats winter population occupy the area between the Little Delta and Wood Rivers. Density averages 1.6 moose/mi^2. Another 17% (560) occur west of the Wood River. Density was 0.75 moose/mi^2. The area east of the Little Delta River contained the fewest moose with density averaging less than 0.5 moose/mi^2.

The resident moose population on the Tanana Flats now appears to have been growing by about 25% annually, instead of 15% as previously believed. The rate of increase in the foothills population is thought to be about half that of the moose population on the Tanana Flats. Less effective wolf control and a moderately large grizzly bear population in the foothills probably account for these differences.

Population Composition

Moose wintering in upland areas of Subunit 20A experience different survival rates than moose that are year-round residents of the Tanana Flats (Table 1). Early winter calf survival and yearling recruitment indices obtained for moose residing on the Tanana Flats continue to indicate a rapidly growing moose population. However, both calf survival and yearling recruitment have declined since the late 1970's as the wolf population increased. The bull:cow ratio remained high.

Composition data from the foothills of the Alaska Range indicate a substantial decline in initial calf survival and yearling recruitment (Table 1). Some of these moose are permanent residents of the foothills area, while others overwinter in the area after summering on the Tanana Flats. Predation by wolves

and grizzly bears is substantially greater than on the Tanana Flats. The bull:cow ratio was also high in the foothills area.

Moose using the calving grounds in the central Tanana Flats consisted of animals from the Chena and Salcha Rivers of Subunit 20B, the Alaska Range foothills of Subunit 20A, as well as year-round residents of the flats. Annual preparturition surveys conducted during mid-May to assess overwinter calf survival showed 31 yearlings/100 cows, an 8% decline from the 5-year mean. Yearlings composed 19% of the herd. Even though recruitment was down slightly from recent years, survival remained relatively high compared to most other portions of Unit 20.

Mortality

According to harvest ticket data, 238 bull moose were taken in Subunit 20A during 1982 (Table 2), a 19% increase over 1981. The harvest has increased nearly 5-fold since 1978. Seventy-nine percent of the harvest (189 animals) was from the Tanana Flats between the Wood and Little Delta Rivers. Sixty-one moose were taken during the November season, the first held since 1974. Public pressure resulted in the establishment of a harvest quota of 50 bulls about 10 days before the hunt was due to begin. The season was closed 5 days early when the quota was attained.

Assuming yearling moose possess antler spreads of $\leq$30 inches, 17% of the harvest consisted of yearlings. Mean antler spread for all animals was 40.8 inches.

Hunts averaged 5.6 days in length, with no significant difference in hunt length between successful and unsuccessful hunters.

Hunters using aircraft or boats harvested the most moose, but the hunters experiencing the greatest success used horses and snow-machines (Table 3).

Habitat

Because of plant succession and the paucity of wildfires on the Tanana Flats, carrying capacity is generally declining. In many locations, preferred browse species are overmature or are being replaced by spruce or other nonbrowse species. Habitat may become limiting in the future if the moose population continues to grow at the present rate.

Management Summary and Recommendations

Moose numbers in Subunit 20A are continuing the rapid increase experienced since local wolf control commenced in 1976. Harvest levels are also increasing. Habitat limitations will not allow a sustained increase of moose numbers, and management plans must address a population goal commensurate with management objectives

and habitat limitations. Wolf populations should be monitored and control exerted when and where warranted. Range rehabilitation, either through prescribed burning or reduced wildfire suppression, should be addressed.

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Table 1. Subunit 20A moose composition data, November 1982.

Area	Bulls/ 100 cows	Calves/ 100 cows >2 years	Yearlings/ 100 cows >2 years	% calves	% yearlings
Flats	59	43	52	18	21
Foothills	47	32	24	16	13
Both areas combined	57	41	47	16	18

Table 2. Residency and success of moose hunters in Subunit 20A, 1982.

Status	Resident	Nonresident	Residency unknown	Total
Successful	206	22	10	238
Unsuccessful	515	46	14	575
Totals	721	68	24	813

Table 3. Transportation modes used by hunters in Subunit 20A, 1982.

Transportation	Successful	Unsuccessful	Total
Aircraft	89	126	215
Horse	12	2	14
Boat	82	186	268
Snowmachine	33	34	67
Off-road vehicle	17	28	45
Highway vehicle	2	25	27
Unknown	3	171	174
Totals	238	572	810

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20B

GEOGRAPHICAL DESCRIPTION: Fairbanks and Central Tanana Valley

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose density in most of Subunit 20B appears to be increasing; all the trend areas except Munson Creek and Goldstream showed a substantial increase. A pack of 8 wolves was removed from the Munson Creek area during winter 1982-83, which should reverse the declining trend of moose in this area. The Goldstream trend area is small; thus, differences noted during the 2 years that surveys have been completed may reflect differences in moose distribution due to early winter snows rather than a decline in moose numbers. The present density is still 4 times the 1975 density. After an effective wolf control program in the Minto Flats, Chena, and Chatanika drainages (which should produce a 1:47 fall 1983 wolf:moose ratio), moose populations should continue increasing in these drainages. Moose density in the area between the Tatalina drainage and Manley Hot Springs may have stabilized at a low level.

Population Composition

Fall sex and age composition surveys were flown on Minto Flats and in the Goldstream, Chena, and Salcha drainages (Table 1). The bull:cow ratio remains very high in Subunit 20B. Calf survival to early winter was good but lower than last year. This may be due to the increasing wolf population on the Tanana Flats calving area. Overwinter survival of calves was also down from last year, but it should be noted that this reflects conditions existing during the 1981-82 winter prior to the removal of significant numbers of wolves from the area.

Mortality

According to 1982 harvest ticket returns, 158 bulls were harvested by 1,420 reporting hunters (Table 2). Hunter success was 11%; most hunters were residents. The number of hunters increased by a substantial 74%, while the harvest remained about the same as 1981. The moose harvest increased on the Chatanika and Salcha River drainages, decreased on the Tatalina and Tolovana River drainages, and remained stable throughout the remainder of Subunit 20B (Table 2).

Nine moose were harvested by bow and arrow. Eight of those were taken near Fairbanks in the area restricted to bowhunting. Seven bulls were harvested by 29 reporting permittees who hunted in the Minto Management Area.

Yearling bulls composed 39% of the reported harvest based on antler spreads of $\leq$30 inches. Successful hunters spent an average of 4.2 days afield.

Moose mortality due to poaching and road kills declined in 1982-83 according to Fish and Wildlife Protection records. A minimum of 22 moose was estimated to have been taken illegally by poachers. Accidental road-killed moose accounted for another 35 moose in Subunit 20B. Mortality due to bears and approximately 25 wolf packs is unknown but thought to be substantial.

Management Summary and Recommendations

Moose densities are increasing throughout Subunit 20B except the western end which has a very low moose density. The habitat is underutilized, and the moose density is below carrying capacity. Because of large and increasing numbers of hunters in the Subunit, the moose population increase should be accelerated by maintaining a ratio of 1 wolf:50 moose in the central area where wolf control was conducted during winter 1982-83. Wolf control should be extended to the western end of Subunit 20B to help revive the moose population in that area.

The bull hunting seasons should be lengthened in the central portion of the Unit where the population is increasing and a high bull:cow ratio is evident.

Trend count areas should be established in the Chatanika and Tolovana River drainages and in the Manley Hot Springs area.

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Table 1. Moose survey data for Subunit 20B, fall 1982.

Area	Total bulls/ 100 cows	Small bulls/ 100 cows	% small bulls	Calves/ 100 cows	Calves/ 100 cows ≥2 years	% calves	Sample size
Minto	50	0	0	29	29	16	25
Goldstream	91	55	22	55	120	14	27
Chena	58	20	10	39	49	20	310
Salcha	49	14	7	42	49	22	190

Table 2. Distribution of Subunit 20B moose harvest, 1982.

Area	No. moose harvested
Chatanika River	33
Chena River	63
Goldstream Valley	6
Minto Flats	7
Salcha River	28
Tanana River	15
Tatalina River	2
Tolovana River	4
Unknown	0
Total	158

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20C

GEOGRAPHICAL DESCRIPTION: Kantishna, Cosna, and Nenana River Drainages

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose density along the Nenana and Totatlanika River drainages increased following wolf reduction efforts in the late 1970's, but may have now stabilized. The moose population in Denali National Park probably will continue to decline. No trend data were collected from the Lake Minchumina area, or the Cosna and Kantishna River drainages, but the low harvest suggests that moose numbers remain low.

Population Composition

Moose surveys were conducted in Moody Creek and Denali National Park (Table 1). Early winter calf survival was low in both areas. Ongoing research in Denali National Park indicates that grizzly bear predation accounts for most initial calf mortality. Chronically poor yearling recruitment and naturally high mortality among bulls has produced a low bull:cow ratio in the unhunted Denali Park population.

Mortality

Hunter success remained the same (22%) in 1982 as in 1981. Both the number of reporting hunters (531) and the harvest (108) declined. Significant harvest increases were recorded for Lake Minchumina and the Kantishna drainage, while sizable decreases were noted for both the Yanert Fork and the Cosna River areas (Table 2). Successful hunters averaged 5.4 days afield, which is 1 day longer than last year. Assuming that yearlings have antler spreads of <30 inches, this age group composed 33% of the harvest. Resident hunters constituted 92% and 97% of the successful and unsuccessful hunters, respectively. Poaching and predation are thought to be substantial mortality factors in Subunit 20C, but specific data are unavailable.

Management Summary and Recommendations

The moose population in the Totatlanika and Nenana River drainages in eastern Subunit 20C has responded favorably to reduction in wolf density. Grizzly bears appear to be responsible for the majority of summer moose calf mortality. The grizzly bear population should be reduced in this area by liberalizing hunting season lengths and returning to a 1 bear per year bag limit.

Short, bulls-only seasons must be maintained in the central and western portions of Subunit 20C until the status and trend of the moose population are determined. A predator control program may prove necessary. The establishment of moose trend count areas and the completion of a wolf survey are needed to determine management needs.

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Table 1. Moose survey data for Subunit 20C, November 1982.

Location	Bulls/ 100 cows	Small bulls/ 100 cows	% small bulls	Calves/ 100 cows	Calves/ 100 cows ≥2 yrs	% calves	Sample size
Moody Creek	26	5	8	12	13	9	101
Denali National Park[a]	30	7	5	10	10	7	145

[a] Data provided by National Park Service.

Table 2. Distribution of the known harvest of bull moose in Subunit 20C during fall 1981 and 1982.

Location	Moose harvest	
	1981	1982
Lake Minchumina	9	11
Cosna River	10	2
Kantishna River	19	16
Ferry area	11	11
Healy area	38	20
Totatlanika River	15	11
Nenana River	29	25
Teklanika River	6	6
Yanert Fork	22	6
Totals	159	108

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20D

GEOGRAPHICAL DESCRIPTION: Central Tanana Valley

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Reevaluation of the 1981 population estimate survey suggested 1,460 to 2,336 moose occurred south of the Tanana River in Subunit 20D in 1981. Surveys conducted in 1982 indicated that the population may have grown about 5% during the past year. The segment of the population west of the Johnson River appeared to be growing most rapidly.

Little information is available for the portion of Subunit 20D north of the Tanana River. Surveys were conducted in the Goodpaster River and Billy Creek drainages. Comparison of data obtained from the Billy Creek area in 1981 and 1982 suggests that the population is stable. The population in Subunit 20D north of the Tanana River is believed to number about 800 moose.

Population Composition

Most of the composition data for the area south of the Tanana River was obtained from established trend areas using a standardized minimum search intensity of 4 min/mi^2. North of the Tanana River, lower intensity searches of favored habitat were employed to superficially evaluate the overall situation. The latter surveys are more biased. Survey data are summarized in Table 1.

Analysis of data from the southwest portion of Subunit 20D revealed differences in moose density between the lowland and mountainous areas. Twelve yearling bulls per 100 cows were observed in the lowland count areas, and 8 yearling bulls/100 cows in the mountainous area. A lower bull:cow ratio was also apparent in the mountains (24 versus 38 bulls:100 cows). Calf survival in the 2 areas was nearly identical.

Mortality

The legal moose harvest in Subunit 20D was 120 bulls. Forty-five bulls were taken in the area south of the Tanana and west of the Johnson Rivers, 17 were taken in the area south of the Tanana and

east of the Johnson Rivers, and 58 were taken north of the Tanana River.

Boats were the primary method of access for hunters north of the Tanana River. Most harvest occurred along the Goodpaster River. Aircraft access into the larger lakes east of the Goodpaster drainage has increased in recent years.

Highway vehicles were the predominant mode of access for successful hunters (71%) in the southwest portion of Subunit 20D. Off-road vehicles and motorbikes were used by 23% and 6% of the successful hunters in this area, respectively. In the southeast portion of Subunit 20D, more than half of the successful hunters (53%) used highway vehicles or walked. No preferences were apparent among other modes of transportation. Transportation options are restricted within the Macomb Plateau Controlled Use Area.

The ages of moose harvested in most of Subunit 20D were inferred from antler measurements furnished by hunters. More accurate age determinations were possible for moose killed in the Delta permit hunt area due to the requirement that lower jaws be turned in.

As in 1981, most (72%) of the harvest in the southwest portion of Subunit 20D consisted of 1- to 3-year-old moose. Yearlings composed one-third of the total harvest. In contrast, the harvest from the southeast portion of the Subunit appeared to be weighted more toward older animals. Eighteen percent of the harvested moose probably were yearlings, 53% probably were between 2 and 6 years of age, and 24% were likely older than 6 years. North of the Tanana River, 45% of the harvested moose appeared to be yearlings, and 40% were in the 2- to 6-year-old class.

Table 2 summarizes the number of moose known to have been killed by causes other than legal hunting. The 37 moose reported that died from causes other than hunting is more than double the number reported last year. During this reporting period, road kills doubled and the known illegal kill increased from 1 to 16.

Habitat

Habitat does not appear to be limiting the moose population at this time. Browse use is not excessive even in the Donnelly Dome area where moose density is the highest in the Subunit.

Management Summary and Recommendations

After about a decade at low levels, the moose population south of the Tanana River seems to be increasing. Predation is slowing the rate of increase and limiting the number of moose available for human use. Data suggest that wolf predation is keeping yearling recruitment low. Bear predation remains unquantified,

but both black and grizzly bears almost certainly affect the moose calf survival rate. Wolf control should be continued in Subunit 20D, with particular emphasis on public participation.

The bag limit for grizzly bears should be changed back to 1 bear every year.

Collection of composition and trend data has been improved by the establishment of trend count areas in most of Subunit 20D south of the Tanana River. Data collection in the area north of the Tanana River must be similarily improved. Stratification flights should be scheduled for 1983 or 1984 to aid in the establishment of trend areas.

Because the 1981 population estimate survey in Subunit 20D south of the Tanana River did not provide a population figure with sufficient precision, another survey should be scheduled for 1983 or 1984. Should the proposed goal of 1,600-2,400 moose prove acceptable to the public, an accurate population estimate will be important as the population approaches this level.

Additional moose browse information is needed. Browse use should be evaluated annually, with high-use areas receiving priority.

The high losses of moose to poaching and road kills must also be reduced. An expanded public relations effort probably will be most productive to this end. These mortality factors will become more important as the moose population expands.

Moose movements need to be better understood. It is not known how moose distribution during the November survey period compares to distribution during the hunting season. Moose calving areas have not been located. If calving areas were known, hunting and trapping pressure could be directed to large predators in these areas.

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Table 1. Sex and age composition of the Subunit 20D moose population, 1982.

Area[a]	Bulls/ 100 cows	% yearling bulls	Calves/ 100 cows	Calves/ 100 cows >2 years	Twins/ 100 cows w/calf	% calves	Total sample
20D southwest	33	15	26	29	0	16	380
20D southeast	56	5	17	17	0	10	178
20D northwest	21	10	14	17	0	10	40
20D northeast	40	8	10	11	0	7	60
All areas combined	39	7	21	23	0	13	658

[a] Subunit 20D may be divided into north and south halves at the Tanana River; into southwest and southeast portions at the Johnson River; and into northeast and northwest portions at the Goodpaster drainage.

Table 2. Known nonhunting moose mortality in Subunit 20D, 1 July 1982-30 June 1983.

Cause of death	Cow			Bull			Unknown		Total
	Calf	Ylg	Ad	Calf	Ylg	Ad	Calf	Unknown	
Road kill	3	2	6	2	0	2	0	0	15
Illegal kill	1	0	3	0	1	5	2	4	16
Defense of property	0	0	1	0	0	0	0	0	1
Other	1	0	3	0	0	0	0	1	5
Totals	5	2	13	2	1	7	2	5	37

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20E

GEOGRAPHICAL DESCRIPTION: Fortymile, Charley, and Ladue River Drainages

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Moose densities are low and likely declining slowly in Subunit 20E, except in a 3,000 mi^2 area in the southwestern portion. It is believed that substantial wolf reductions in that area during winters 1981-82 and 1982-83 have arrested the moose population decline by reducing overwinter mortality. Moose mortality attributable to wolf predation was reduced by 91% following inception of the wolf control program in 1981 (22 kills in 1981-82 compared to 2 kills observed in 1982-83).

A moose population estimate survey was conducted in 1981. A density of 0.2 moose/mi^2 was calculated for southwestern Subunit 20E. By extrapolation of quadrat sampling data, a population estimate of 1,400 to 2,000 moose was obtained for the entire Subunit.

Population Composition

A total of 366 moose was classified during aerial surveys conducted between 8 October-10 November 1982 (Table 1). One area was surveyed too early and had to be repeated.

Composition of the moose population in Subunit 20E is best represented by pooling data from all survey areas because of the small sample sizes obtained for individual areas. Composition data obtained during 1982 are believed comparable to those obtained during the population estimate survey in 1981.

Bull ratios are quite high throughout the Subunit due to the hunting closure that existed from 1977 to 1981. Neonate survival and yearling recruitment have also increased since 1978. Although still quite low (14 small bulls/100 cows), recruitment has nearly tripled from the 3 small bulls/100 cow average for the years 1974-76.

Mortality

Most moose mortality occurring in Subunit 20E is believed to be the result of predation by black bears, grizzly bears, and wolves. Poaching may also be a significant mortality factor in the vicinity of Chicken, the Taylor Highway, and various mining areas along the Fortymile River.

Wolf control in the southwestern portion of Subunit 20E has reduced wolf densities from approximately 1 wolf/35 mi^2 to less than 1 wolf/100 mi^2 since 1981. A ratio of 35 moose:1 wolf should be achieved during winter 1983-84, and wolf predation on moose should decline to low levels.

A legal moose hunting season was reinstituted during this reporting period because of the high bull:cow ratio, an expected low harvest of moose, and an expected high harvest of grizzly bears by moose hunters.

The 113 hunters who reported hunting in Subunit 20E harvested 19 bulls for an overall success rate of 17%. Only 10 residents of Subunit 20E reported hunting moose, and none were successful. Only 1 moose was taken by the 3 nonresident hunters reporting. Alaskans residing outside Subunit 20E took 18 moose. The harvest was concentrated near Taylor Mountain, Mosquito Flats, Mt. Fairplay, and Chicken.

Habitat Conditions

Even though an unflexible fire control policy has reduced carrying capacity for moose in many portions of Subunit 20E, the present moose population is far below carrying capacity. Implementation of the Fire Management Plan for the Fortymile Planning Area will help restore a near-natural fire regime to much of the Subunit. This, in turn, should help maintain productive moose habitat.

Management Summary and Recommendations

Moose exist at low densities throughout most of Subunit 20E; populations are believed to be slowly declining, except within the wolf control area. Predation by bears and wolves is believed to be the primary factor causing population declines. Low wolf and bear densities should be maintained in the southern part of Subunit 20E for approximately 5-10 years to allow affected moose populations to achieve moderate densities (1 moose/mi^2).

A further 10-day extension of the moose season is recommended for the upper portion of the Mosquito Fork drainage where moose density is high relative to other portions of the Subunit and neonate mortality due to bear predation is a severe problem. A

longer moose season may attract hunters to this important lowland moose calving area where grizzly bears are abundant. An increased harvest of bears by moose hunters would aid Department efforts to rehabilitate this moose population.

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Table 1. Subunit 20E moose sex and age ratios observed during aerial surveys, 8 October-10 November 1982.

Area	Total bulls/ 100 cows	Small bulls/ 100 cows	% small bulls	Calves/ 100 cows	% calves	Moose/ hour	Total moose
Kechumstuk-Mt. Veta 10/8/82	69	15	9	2	1	36	104
Kechumstuk-Mt. Veta 11/8/82	109	12	5	12	5	38	75
Upper Mosquito Fork	69	15	9	0	0	22	22
Mosquito Flats, East	62	15	9	8	5	28	22
Mosquito Flats, North	50	4	2	19	11	55	44
Mt. Fairplay	78	0	0	33	16	15	19
Sixtymile Butte	89	42	20	26	12	24	41
Ladue River	52	9	5	17	10	9	39
20E total (excluding 10/8/82 Kechumstuk-Mt.Veta survey)	75	14	7	16	8	22	262

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20F

GEOGRAPHICAL DESCRIPTION: Central Yukon, Hess Creek, and Tozitna River Drainages

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Little population data are available, but informal observations and other indices suggest a low, essentially static, population. Although habitat is generally poor throughout Subunit 20F, it is probably not limiting population size at present. Other factors, possibly including predation, may be restricting the population to its current low level.

Mortality

According to harvest ticket data, 17 moose were harvested by 76 hunters, a 37% decline from the 1981 harvest. Hunting effort declined by 30%. The largest harvests occurred in the Hess Creek drainage and in the Manley-Tofty area, with the remaining harvest coming from other scattered locations. Assuming that yearling moose have antler spreads $\leq$30 inches, 12% of the harvest was comprised of yearlings. The mean antler spread was 42.5 inches, which is about the average for Unit 20.

The majority of the individuals (42) who hunted in Subunit 20F reported their residency as Fairbanks; the remaining hunters were mostly local residents. All hunters were residents of the State.

Out-of-season hunting and consequent unreported harvest is believed to be substantial in Subunit 20F.

Management Summary and Recommendations

The moose population in Subunit 20F is low and probably stable. Virtually all hunting is by State residents, but the 22% hunter success is only average compared to the rest of Unit 20. Habitat is not believed responsible for present low moose numbers; predation by wolves and grizzly bears may be limiting calf survival and subsequent recruitment.

If recruitment substantially improves, habitat will then become a major limiting factor. Range rehabilitation, either through burning or decreased wildfire suppression, should be encouraged and accomplished.

Predation effects should be examined and minimized, if necessary. Increased efforts should be made to systematically gather baseline data on moose population size, composition, recruitment, and trend.

The Subsistence Division should obtain data regarding the magnitude of unreported harvest.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21A

GEOGRAPHICAL DESCRIPTION: Upper Nowitna, Iditarod, and Upper Innoko Drainages

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

No composition surveys were completed in Subunit 21A during this report period, but past data suggest that the moose population is stable.

Mortality

Reported hunter take in the upper Nowitna was 32 moose during the September hunt and 1 moose during the November hunt. In the Innoko drainage, 70 moose were harvested. Nine were taken during the November hunt, which is an increase from the 2 reported in 1981-82. Aircraft were used as the primary means of transportation by 39 successful hunters in the Innoko drainage.

Wolf predation continues to be the largest source of moose mortality in the Subunit. The Nowitna River portion still supports 60-70 wolves in 5-8 packs. The wolf:moose ratio is between 1:26 and 1:33, which may result in a stable moose population if other mortality is not excessive.

Management Summary and Recommendations

Moose populations in Subunit 21A appear stable; however, trend surveys were not conducted. Trend surveys should be conducted every other year in selected areas, and at least 1 composition survey should be conducted along the Innoko drainage yearly. The increase in the November harvest in the Innoko drainage was matched by a decline in the September harvest, resulting in an unchanged total harvest from 1981-82.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21B

GEOGRAPHICAL DESCRIPTION: Lower Nowitna River, Yukon River between Melozitna and Tozitna Rivers

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

A November 1980 population estimate survey conducted in the Nowitna River drainage produced an estimate of 2,386 (±10%) moose. Two trend areas were established using sample unit boundaries from this survey. The 75-mi^2 Deer Creek trend area borders the Yukon River on the Nowitna Flats. A density of 1.3 moose/mi^2 was indicated by the November 1982 survey, while 1.4 moose/mi^2 were evident in 1980. The population is probably stable.

The 66-mi^2 trend area at the confluence of the Nowitna and Sulatna Rivers is within an area that receives heavy hunting pressure. Density during the November 1982 survey was 1.7 moose/mi^2, compared to 2.2 moose/mi^2 in 1980. The population has probably declined, but differences in moose density could be due to changes in the survey area. The trend area is twice as large as the area surveyed for the 1980 population estimate survey.

Population Composition

The outlook for recruitment is poor along the lower portion of the Nowitna River (Table 1). The calf:cow ratio in the Nowitna/Sulatna trend area is very low, and recuitment is expected to decline. If moose numbers are actually declining, as suggested by the apparent decline in moose density, then the rate of decline can be expected to increase.

The bull:cow ratio in the Nowitna/Sulatna trend area has declined since 1980 (Table 1) and reflects the continued high harvest of bulls from the riverine area. The Nowitna River provides most hunter access before snowfall; thus, the harvest is concentrated along the riparian strip. Because most of the season occurs before moose movements associated with the rut, the majority of moose taken along the Nowitna are residents of the Nowitna valley. The situation may soon prove undesirable to people

hunting along the river, but should have little effect on the total population. The 1980 population estimate survey established that a high bull:cow ratio (96:100) existed away from the heavily hunted river front; that a corresponding overall ratio of 50 bulls:100 cows existed in areas likely to receive some hunting pressure; and that the ratio was lowest (37:100) at the Nowitna/Sulatna confluence where hunting was heaviest. Overall, a bull:cow ratio of 71:100 existed in 1980; thus, even if the bull:cow ratio in the trend area becomes drastically skewed, normal movements of bulls to the riverine area during rut will ensure that breeding of resident cows remains adequate.

In the Deer Creek area, calf survival and yearling recruitment increased markedly since 1980 (Table 1). A high bull:cow ratio is also evident. The area is approximately 20 mi from the Nowitna/Sulatna trend area discussed above.

Mortality

For the 1st time since 1978, a check station was not operated on the Nowitna during moose season. However, counts indicated that during the period 19-26 September, 90 hunters used boats on the Nowitna.

The reported harvest from Subunit 21B was 69 bulls and 2 cows, similar to the 1981-82 season. Most hunting occurs from boats or float-equipped aircraft. Because harvests are concentrated near water courses, most of the Subunit is unhunted. Thirty-six bulls were taken in the Nowitna drainage, a decline of 18 moose from the 1981 harvest. The decline in harvest was partially the result of warm, rainy weather that delayed the rut, made hunting conditions unpleasant, and kept some bulls in the uplands. Twenty-four moose were taken along the Yukon River; 9 bulls and 2 cows were taken along the Ruby Road, the boundary between Subunits 21B and 21D. Successful hunters in this area did not specify on which side of the road moose were taken. Hence, all moose killed along the road have been included in the harvest figures for Subunit 21B. Analysis of moose teeth provided by hunters indicated that few yearlings were taken (Table 2), as has been the case since 1980. Although hunters tend to be selective, these data are believed to reflect the paucity of young bulls entering the population.

Bull moose in the Nowitna drainage produce significantly smaller antlers than elsewhere in Unit 21 or the Interior. According to harvest tickets, where measurements are made by the hunter, only 27% of the moose killed in Subunit 21B have antlers >50 inches, compared to Subunits 21A and 21D where antlers >50 inches composed 37% and 40%, respectively, of bulls taken. These data are substantiated by data from the Nowitna check station where Department personnel measured antlers and collected incisor teeth for aging from 141 moose between 1974 to 1982.

Management Summary and Recommendations

The moose population of the Nowitna drainage, where hunting is heavy, appears to be declining; recruitment will probably decrease in the coming year. The population probably cannot sustain the combined losses due to natural mortality and hunting. The reduced harvest in 1982 might temporarily help the declining bull:cow ratio, but high predation by wolves and black bears is responsible for poor calf survival and is preventing herd growth. If recuitment observed in November 1983 is poor, as predicted, and density declines further, consideration should be given to reinstatement of wolf control along the lower Nowitna. In the interim, hunting seasons should be altered to reduce hunting pressure on the resident segment of the moose population. A later opening and closing date would shift more of the harvest to bull moose normally residing away from the river.

It is recommended that trend areas be surveyed every other year, except along the heavier hunted portions of the Nowitna where the trend areas should be surveyed annually. Trend areas need be established in the Long Creek and Mason Slough areas. The Nowitna River check station has provided useful information and should be continued. Most hunters interviewed in 1982 missed the check station and thought it helped contribute to an orderly hunt.

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Table 1. Subunit 21B moose composition counts, November 1982.

Trend area	Yearling bulls/ 100 cows	Yearling bulls/ 100 cows	% bulls	Calves/ 100 cows >2 years	% twins	% calves	N
Nowitna/ Sulatna	28	15	11	21	0	12	114
Deer Creek	95	29	13	48	0	15	99

Table 2. Age classes of 30 male moose harvested in Unit 21B, September 1982.[a]

Age (years)	Harvest N	Harvest %
1	0	0
2	3	10
3	6	20
4	8	27
5	3	10
6	3	10
7	5	17
8	0	0
9	1	3
10	0	0
11	0	0
12	1	3
13	0	0

[a] Includes moose harvested in the 21A portion of Nowitna River.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21C

GEOGRAPHICAL DESCRIPTION: Upper Dulbi River and Melozitna River Drainage above Grayling Creek

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The Subunit 21C moose population appears stable, but more intensive surveys are needed to adequately assess population status and trend. Previous survey attempts have provided information on distribution that will aid in the establishment of trend areas. No composition data were obtained.

Mortality

No data are available on natural mortality, but the drainage has substantial wolf and grizzly bear populations.

Hunters reported taking 16 moose in Subunit 21C, all from the Melozitna River drainage. All hunters used aircraft for transportation into the area. Since the Subunit boundary along the Dulbi River is unclear, all moose harvested by hunters using boats on the Dulbi River were considered taken in Subunit 21D.

The number of moose harvested in the Subunit was less than the annual average of 25 for the previous 3 years. Fish and Wildlife Protection conducted extensive patrols in the area and cited 1 same-day-airborne violation. Forced adherence to this regulation probably affected hunter success.

Management Summary and Recommendations

Permanent population trend areas are needed and should be surveyed yearly until trends in the Subunit are established. The Subunit boundary in the Dulbi River area should be moved upstream from its present location to Cottonwood Creek, the farthest navigable point for boats during September.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21D

GEOGRAPHICAL DESCRIPTION: Middle Yukon, Eagle Island to Ruby, Koyukuk River below Dulbi Slough

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The riverine areas of Subunit 21D have supported high moose densities for many years, and the moose population is stable or expanding along the Yukon and lower Koyukuk Rivers. During November 1982, surveys in the Three Day Slough, Dulbi River, and Squirrel Creek trend areas showed greater moose densities than indicated by 1981 data, but the differences probably reflected changes in survey technique (increased search intensity) rather than an increase in population.

Population Composition

Surveys in November 1982 (Table 1) in the Koyukuk River portion of Subunit 21D continued to show high densities, moderate bull: cow ratios, moderate calf survival, and low-to-moderate yearling recruitment. Along the Yukon River, moose density ranged from moderate to high; surveys indicated high bull:cow ratios, good calf survival, and good yearling recruitment.

Mortality

The 1982-83 hunting season was split into 2 periods, both allowing antlerless harvest. The harvest reported for September included 132 bulls, 24 cows, and 1 moose of unknown sex. The percentage of cows taken in September (15%) was double the percentage taken during the 1981-82 harvest. Poor hunting conditions early in the 1982 season when only bulls could be taken resulted in most of the harvest occurring during the portion of the season when cow moose were also legal; thus, cows composed a larger than normal percentage of the harvest.

Public relation efforts of the Game and Fish and Wildlife Protection Divisions resulted in increased compliance with the reporting requirement during the September season. Previous estimates of the actual harvest have entailed doubling the reported harvest; probably less than 10% of the 1982-83 harvest went unreported.

During the month of September, a moose hunter check station was operated at Mary Vernetti's cabin, 18 mi up the Koyukuk River. The objectives of the check station were to establish a Department presence along the river during the moose season, to determine the residency of hunters, to collect antler measurements, to collect incisor teeth for aging, and to provide public assistance. The station was an unqualified success and public acceptance was excellent. The 186 hunters recorded through the station killed 74 moose. Twenty-six hunters were not residents of Subunit 20D.

During a 2nd moose season (15 Jan-15 Feb), a total of 38 moose were harvested. Fifteen were bulls and 23 were cows. The actual harvest was probably 10-20% higher than the reported harvest.

Bull moose in the Koyukuk drainage of Subunit 21D have larger antler spreads and attain large spreads at an earlier age than moose in Subunit 21B and Interior Units 20 and 12. According to harvest ticket data, where measurements are made by hunters, 37% of the moose killed in Subunit 21D had antler spreads of $\geq$50 inches, compared to only 27% in Subunit 21B. These findings are substantiated by information collected by Department personnel at the Koyukuk check station. Age and antler spread data from 72 moose killed in the Koyukuk drainage indicate that Koyukuk moose attain the 50-inch average at 4.5 years, 1.25 years earlier than moose in the Nowitna drainage and 1.5 years earlier than moose harvested from Units 12 and 20. The 60-inch average is attained at 9 years of age along the Koyukuk. The Koyukuk moose are similar to Seward Peninsula (Unit 22) moose with respect to their large antler spread and early attainment of the 50-inch average size. This similarity is expected since moose are thought to have emigrated from the Koyukuk area to the Seward Peninsula during the last 30 years.

The natural mortality of moose within the Subunit is thought to be high. In the uplands, good populations of grizzly bear are present, black bears are abundant in the lowland areas, and numerous wolf packs range throughout. Twelve black bear were found within the Three Day Slough moose trend area during a May 1983 survey for bear, but only one was a sow, indicating that most of the sows were overlooked. A density of 1 bear/2.4-3.5 mi^2 is estimated if it is assumed that one-half to two-thirds of the bears were missed during the survey. Black bears are probably a major predator on moose calves in the Three Day Slough area.

Management Summary and Recommendations

Moose populations along the river floodplains in Subunit 21D are high, appear stable, and sufficient to support current seasons. The high mortality among adult moose and the low recruitment of yearlings, due to predation by bears and wolves, is justification for retaining the Koyukuk Controlled Use Area in the Koyukuk lowlands. Trend areas should be monitored yearly, and new areas established elsewhere in the Unit. The Koyukuk check station

should be continued, and more effort should be expended at monitoring the winter harvest. The current level of enforcement by the Division of Fish and Wildlife Protection should be maintained.

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Survey-Inventory Coordinator

Table 1. Subunit 21D moose survey data, November 1982.

Trend area	Size (mi^2)	Observed density[a] moose/mi^2	Bulls/ 100 cows	Yrlg. bulls/ 100 cows	% yrlg. bulls	Calves/ 100 cows >2 years	Twins/ 100 cows w/calves	% calves	N
Three Day Slough	95.2	5.1	47	13	8	30	3	15	491
Dulbi River	42.1	3.9	36	7	4	31	12	18	164
Squirrel Creek	24.4	3.5	57	18	9	50	0	21	87
Kaiyuh Slough	39.2	1.3	76	20	9	45	28	17	53

[a] Search intensity $\geq$4 min/$mi.^2$

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21E

GEOGRAPHICAL DESCRIPTION: Yukon River Drainage Upstream from Paimiut-Kalskag Portage, Including the Lower Innoko River Downstream from the Iditarod River, to the Mouth of Blackburn Creek

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Past data have indicated a healthy, probably increasing moose population.

Population Composition

November surveys indicated that calf mortality had been high (Table 1) probably result of floods along the middle and lower Innoko and Yukon drainages in Subunit 21E. The Innoko River was at near flood stage from mid-May until late June, then again in September. The November cow:calf ratio on the Innoko from Holikachuk to Railroad City was 8 calves:100 cows. Along the Yukon from Blackburn Island to Holy Cross, the ratio was 14 calves:100 cows.

Mortality

Sixty-nine harvest tickets were submitted by successful Subunit 21E moose hunters. Checks of hunters in the field indicated that many local residents hunted without having obtained harvest tickets. Unreported harvest is estimated to be 4-5 times greater than the reported take. Reported harvest for residents of various villages was as follows: Grayling, 14; Shageluk, 5; Holy Cross, 8; and Anvik, 3. During September, hunters reported taking 62 moose; however, in November, only 7 moose were reported taken.

Fifty hunters used boats as their primary transportation means, and 12 used aircraft during the September hunt.

Management Summary and Recommendations

The moose population is apparently healthy and capable of supporting the current level of reported and unreported harvest.

Trend areas or composition surveys should be established and flown annually.

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Table 1. Results of Subunit 21E moose surveys, November 1982.

Area	Total bulls/ 100 cows	Yrlg. bulls/ 100 cows	Calves/ 100 cows	Twins/ 100 cows w/calves	% calves	Moose/ hour	Total moose
Innoko Hills, Holikachuk to Railroad City	92	10	8	0	4	43	102
Yukon River, Holy Cross to Blackburn Island	45	10	14	11	9	129	557

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 22

GEOGRAPHICAL DESCRIPTION: Seward Peninsula

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Historical records indicate that moose did not occur in Unit 22 prior to 1900. During the mid-1930's, a few moose immigrated westward onto the Seward Peninsula from Yukon River drainages. Moose numbers gradually increased, most noticeably during the late 1960's. By 1970, moose had expanded into most of the suitable habitat, and subpopulations increased dramatically in a number of drainages. The central Seward Peninsula subpopulation exhibited the greatest increase and appeared to be near or above winter range carrying capacity. Densities were much lower in the western and southern portion of Unit 22, and moose appeared to be stable or increasing only slightly, even though range was not a limiting factor.

Changes in population status since the last reporting period were minor.

Population Composition

During the past decade, the greatest moose density and the highest moose harvests have occurred in Subunit 22D. For these reasons, this area has the highest management priority, as well as the most complete aerial survey history. Subunit 22D contains 2 major drainages: the Kuzitrin River, an area with relatively good access and high annual harvests; and the American/Agiapuk River, an area without road access and with low-to-moderate harvests. During all but 4 years from 1971 to 1982, fall population composition and productivity data have been obtained in these 2 drainages (Tables 1, 2). During this 12-year period, bull:cow ratios in the Kuzitrin exhibited a slow decline from 50:100 to about 30:100. With increased hunting pressure and higher harvests, this decline was not unexpected. Bull:cow ratios in the American/Agiapuk drainage also declined slightly during the same period, but still remain quite high at approximately 60:100. Movements of radio-collared animals have shown that moose regularly travel between the Kuzitrin and American River drainages during the fall and early winter (Grauvogel

1983). Because of population intermixing and because no count area exhibited ratios below 30:100, I believe that a sufficient number of bulls have always been available for breeding. Nevertheless, a decline in calf production and/or survival has apparently occurred recently. From 1973 to 1981, fall calf:cow ratios ranged from 55:100 to 70:100. In 1982, fall ratios fell to 35:100 in the Kuzitrin and 48:100 in the American River. These values represent declines of 49% and 33%, respectively, from the mean (Tables 1, 2). The cause of the lower productivity is not known, but in part may be attributed to cows being in poorer physical condition. This hypothesis is supported by changes in serological values (Grauvogel 1983). Although cow:calf ratios are not now alarmingly low, a long-term downward trend in productivity may be occurring. Changes in population composition should be carefully monitored in the future.

Mortality

Hunting was undoubtedly the major source of moose mortality in Unit 22 during the reporting period. Hunting seasons were the longest in the State, ranging from 5 to 8 months. The reported harvest according to the computer printout was 401 moose. However, this number was erroneous due to duplicate reporting from the moose harvest report and the Unit 22 antlerless moose report. When the error was corrected by hand tabulation, the minimum reported harvest was 344 moose, still the highest harvest on record. The composition of the 1982-83 harvest was 244 bulls (71%) and 100 cows (29%).

During the previous 8 years, the annual harvest ranged from 138 to 298 moose, with a mean of 242. From the early 1970's, interest in taking moose in Unit 22 has been steadily increasing, especially among local residents. Whereas moose hunting was once only a minor hunting activity, it has now become one of the most important activities during September and October. Local residents now spend literally hundreds of man-hours in search of a legal moose. Increasing hunting pressure has resulted in ever-increasing annual harvests. In portions of Subunits 22B and 22D, the annual harvest is near the annual recruitment. The number of hunters who obtained antlerless moose permits is a good indicator of the tremendous interest in moose hunting. During the open season, 904 antlerless permits were issued for Subunits 22B, 22D, and 22E. Most permits were obtained by local residents during September and October. Hunters with antlerless permits harvested 162 moose, (100 cows and 62 bulls) (Table 3).

Every year a number of hunters fail to report taking their moose, even though it is a legal requirement. Reminder letters to hunters who held antlerless moose permits have provided some data on the magnitude of the nonreporting problem. During the last 2 years, at least 5% of all hunters who failed to report on their antlerless moose permit were successful.

Hunters who obtained antlerless permits usually had direct contact with Department staff and were probably more cognizant of regulations than were other moose hunters. Thus, a success ratio of 5% is probably minimal for all classes of moose hunters who failed to report. In addition, hunters from rural villages accounted for another source of moose mortality. A comparison of village population figures with the number of moose tickets issued by vendors in the rural areas suggests that some hunters entered the field without a moose harvest ticket in their possession. I estimate that 25-50 moose were killed by hunters who failed to obtain a moose harvest ticket and/or failed to report. Therefore, the actual Unit 22 harvest probably fell in the interval 344-400.

Management Summary and Recommendations

During the past decade, aerial surveys have shown a substantial increase in moose numbers. Subunits 22B and 22D populations experienced the most dramatic growth during the 1970's, but growth has tapered off within the last few years. Winter browse is restricted to a narrow belt along the major rivers; in some locations, moose density may be exceeding the long-term carrying capacity of the winter range. Long either-sex seasons have slowed and/or curtailed "excessive" population growth throughout most of the Unit. However, more information is needed to determine the desired density of moose on the winter range.

Moose composition surveys have revealed a gradual decline in bull:cow ratios in heavily hunted areas, but relatively stable and high bull:cow ratios in unhunted populations. Recent aerial surveys showed a marked decline in calf survival compared to previous years. This condition may only be temporary, or it may be a long-term trend. Bull:cow ratios and annual recruitment should be carefully monitored over the next few years, especially in Subunit 22D where hunting pressure and harvest are highest. In portions of Subunits 22B and 22D, the harvest is approaching annual recruitment. The status of the moose population and the effects of hunting should be carefully monitored during the next few years. If the survival of calves continues to decline, a research and/or intensive management study should be initiated to determine the cause and identify a possible remedy.

For the immediate future, liberal hunting seasons should be retained. However, as the harvest continues to escalate and as environmental conditions change, precise harvest information will become increasingly more important. The Department must continue to work with the public to stress the importance of complying with game regulations. Hunters who acquire moose tickets and antlerless moose permits should be sent reminder letters to determine the percentage of successful hunters who fail to report voluntarily. The quality of harvest data should be improved in all villages, especially at locations where many hunters fail to acquire a hunting license or harvest ticket.

The antlerless permit should be retained because it provides a level of positive control not available through harvest tickets. The Seward Peninsula is extremely vulnerable to overhunting due to its open terrain and accessibility by aircraft and snowmachines. Seasons and bag limits should be critically reviewed in all Subunits on an annual basis.

Literature Cited

Grauvogel, C. A. 1983. Seward Peninsula moose population identity study. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-22-1, Job 1.29R. Juneau. 25pp.

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Table 1. Bull and calf ratios from the Kuzitrin River drainage during fall surveys, 1971, 1973-76, and 1979-82.

Year	Bulls/ 100 cows	Yrlg. bulls/ 100 cows	Calves/ 100 cows	% calves in herd	Total sample
1971	38	19	107	39	83
1973	50	17	54	23	82
1974	52	22	75	28	427
1975	35	12	73	32	34
1976	56	24	63	24	230
1979	31	9	62	30	418
1980	30	7	48	26	243
1981	71	16	71	26	226
1982	33	11	35	19	437
Means (1971-81)	45	16	69	2	--
% decline in 1982[a]	27	31	49	32	--

[a] Value computed by dividing the difference of the 1971-82 mean and the 1982 value by the 1971-82 mean.

Table 2. Bull and calf ratios from Agiapuk/American River drainages during fall surveys, 1973-76 and 1979-82.

Year	Bulls/ 100 cows	Yrlg. bulls/ 100 cows	Calves/ 100 cows	% calves in herd	Total sample
1973	91	22	60	20	76
1974	178	57	125	17	30
1975	86	14	67	24	17
1976	62	27	64	22	205
1979	65	21	58	22	320
1980	61	23	58	22	101
1981	59	18	69	26	142
1982	66	17	48	19	196
Means (1973-81)	86	26	72	22	--
% decline in 1982[a]	23	27	33	14	--

[a] Value computed by dividing the difference of the 1971-82 mean and the 1982 value by the 1971-82 mean.

Table 3. Unit 22 antlerless permit harvest by Subunit, 1982-83.

Subunit	Hunt No.	Harvest		
		Cows	Bulls	Totals
22B	954	28	19	47
22D	955	50	41	91
22E	956	22	2	24
Totals	--	100	62	162

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 23

GEOGRAPHICAL DESCRIPTION: Kotzebue Sound

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The Unit 23 moose population appeared to be stable during this reporting period; indices of absolute numbers did not vary beyond normally accepted limits. The reported harvest (128 moose) was down from that of 1981-82 (176 moose) but was similar to previous years. No major shifts in population composition were apparent, except for the late winter calf percentage that declined from 27% in 1982 to 14% in 1983.

Population Composition

Aerial surveys of the lower Noatak, Buckland, and part of the Squirrel River count areas were conducted in November 1982 (Table 1). The lower Kobuk count area was also surveyed in November, but poor weather hampered data collection. Surveys of the Wulik, Kivalina, lower Noatak, middle Kobuk, upper Kobuk, and Ambler River count areas were conducted from January through March 1983 (Table 2). Snow was relatively shallow over much of Unit 23 by late winter; hence, some age/sex classes had probably moved out of the count areas, which would bias composition data. Surveys conducted in the Wulik-Kivalina, Noatak, and Kobuk River subregions were representative of moose populations in northern Unit 23. The Selawik subregion of southern Unit 23 was not surveyed. The Buckland survey produced acceptable data but may not be representative of the remaining northern Seward Peninsula subregion.

A decline in calf percentage from late winter 1982 to late winter 1983 was a consistent feature of the 1983 counts. Declines ranged from 35% to 58% and were statistically significant in all count areas except the Wulik-Kivalina Rivers (Table 3). Fall surveys in the Noatak and Buckland count areas indicated a decline in calves compared with fall 1979 levels (23% for the Noatak and 43% for the Buckland area), but the differences were not statistically significant ($P > 0.05$). Declines in calf percentage of at least 50% have periodically occurred in parts of

Unit 23 (Department files, Kotzebue), only to be followed by increases of similar magnitude the following year. This variability may reflect changes in productivity/suvivorship or may result from sampling bias due to between-year variation in moose distribution patterns (Quimby 1983). Nevertheless, the widespread decline in calf percentages warrants close scrutiny, especially if there are similar indications in the future.

Composition data suggest that productivity and recruitment were mediocre; however, there is no indication that current levels of mortality exceed recruitment. Moose numbers observed per hour of survey time have fluctuated widely in past years, but at present this index does not indicate any substantial change in population size.

Mortality

The reported Unit 23 harvest consisted of 128 moose, including 119 males, 8 females, and 1 of unreported sex (Table 4). The actual harvest was higher; there were 2 known cases of moose taken out of season, and 5 other cases were suspect. Additional unreported harvest undoubtedly occurred, but the total kill was probably within the sustained yield of the population.

Of 267 hunters who returned harvest reports, 128 (48%) were successful. Of 117 successful hunters for whom residency status was determined, 96 (82%) were Alaska residents, and 48 (50%) of these resided within Unit 23. Methods of transportation for 128 successful hunters were as follows: airplane, 51%; boat, 38%; and snowmachine, other, and unknown, 11%.

Use of the moose harvest ticket system varied widely between communities (Table 5). For instance, 21 harvest tickets were issued in Deering (population 100), while the same number was issued in Noatak (population 260). Few people who obtained harvest tickets returned harvest reports (range, 5% in Noatak to 41% in Selawik). More effort should be made to explain and encourage compliance with the moose harvest reporting system.

Management Summary and Recommendations

Composition surveys indicated that the spring calf complement declined from 1982 to 1983 throughout the Unit. Reported harvest also declined from 1982 to 1983. However, there are no direct indications that the population is declining.

Next year's management activities should include close scrutiny of calf production and recruitment to determine whether the low 1983 calf percentage was a short-term occurrence or the beginning of a long-term trend. Action should be taken to encourage greater local compliance with the moose harvest reporting system.

Sufficient data have accumulated in Unit 23 files to warrant a thorough review, compilation, and statistical analysis to determine whether there are any indications of population changes. This process would include an evaluation of the comparability of data from different years. Recommendations should then be made to improve data collection and data analysis.

Literature Cited

Quimby, R. L. 1983. Unit 23 moose survey-inventory progress report. Pages 135-138 in J. A. Barnett, ed. Annual Report of Survey-Inventory Activities. Part II. Moose. Vol. XIII. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-22-1, Job 1.0. Juneau.

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Table 1. Sex and age composition of Unit 23 moose population by count area, November 1982.

Count area	Males/ 100 females	% yrlg. males	Calves/100 females ≥2 years old	Twins/100 females w/calves	% calves	Moose/ hour	Total sample
Lower Noatak	62	8	49	13	20	54	226
Squirrel	39	6	43	0	22	19	47
Buckland	63	7	17	0	8	17	71

Table 2. Age composition of Unit 23 moose population by count area, January-March 1983.

Count area	Total moose	Calves	% calves	Moose/hour
Wulik-Kivalina	139	15	11	27
Lower Kobuk	81	16	20	35
Middle Kobuk	176	26	15	32
Upper Kobuk	133	18	14	29
Ambler	69	10	14	14
Middle Noatak	327	34	10	73
Lower Noatak	380	64	17	72

Table 3. Comparative late winter calf percentage of Unit 23 moose population by count area, 1982 and 1983.

Count area	1982		1983		% decline in calves	X^2	P
	Adults	Calves	Adults	Calves			
Wulik-Kivalina	38	10	124	15	48	3.11	<.1
Lower Kobuk	32	22	65	16	51	7.06	<.01
Middle Kobuk	106	51	150	26	53	14.64	<.001
Upper Kobuk	56	20	115	18	46	5.31	<.025
Middle Noatak	294	92	293	34	58	21.97	<.001
Lower Noatak	139	50	316	64	35	7.28	<.01
All count areas combined	665	245	1,063	173	48	55.84	.001

Table 4. Reported Unit 23 moose harvest after reminder letters, 1982-83.

Subregion	Males	Females	Unspecified	Totals
Wulik-Kivalina	3	0	0	3
Noatak	56	6	1	63
Kobuk	26	1	0	27
Selawik	16	0	0	16
Buckland-Northern Seward Peninsula	6	1	0	7
Unknown	12	0	0	12
Totals	119	8	1	128

Table 5. Unit 23 moose harvest report issuance and return by community, 1982-83.

Community	Harvest reports issued	Harvest reports returned	Successful	Unsuccessful
Kotzebue	504	78	25	53
Noorvik	49	14	4	10
Kiana	47	12	3	9
Selawik	34	14	5	9
Shungnak	31	9	4	5
Ambler	23	5	0	5
Deering	21	4	3	1
Noatak	21	1	1	0
Buckland	5	1	0	1
Kobuk	0	3	3	0
Kivalina	0	0	0	0
Point Hope	0	0	0	0
Totals	735	141	48	93

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 24

GEOGRAPHICAL DESCRIPTION: Koyukuk River Drainage North of and Including Dulbi Slough

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

The moose population in the southern half of Unit 24 is high and appears stable. In the central portion of the Unit, between Hughes and Bettles including the Kanuti River drainage, the population is low and the trend is unknown. In the northern portion of the Unit (from the Alatna Hills north), moose populations are moderate, with some local abundances. The northern population appears to be increasing or stable. Trend areas were established in 1982; thus, the stated trends are subjective evaluations at this time.

Population Composition

Seven composition surveys were conducted during November 1982. In the northern portion of the Unit, 4 surveys were flown: on the flats between Bettles and the Koyukuk River, in the Alatna Hills on the West Fork of Henshaw Creek area, on the Malamute Fork of the John River, and around Ipnek Mountain west of the North Fork of the Koyukuk River. The Ipnek Mountain survey was conducted inside the Gates of the Arctic National Park. Almost all the moose were located away from the riverbottoms and were found mainly at treeline. Results of these surveys (Table 1) indicate the moose populations are doing well, and calf survival and yearling recruitment are good. The bull ratio and harvest data indicate that hunting pressure is light in the area. The Henshaw Creek area was established as a trend area, and the moose density was 1.5 moose/mi^2. The Bettles West area was also flown for density; 1.0 moose/mi^2 was found.

Three areas in the southern portion of Unit 24 were surveyed: the Huslia River Flats, the South Fork of the Huslia River, and the Dulbi Slough area. Koyukuk National Wildlife Refuge personnel flew the Dulbi Slough survey in a Cessna 180 aircraft. The South Fork of the Huslia River area receives no hunting pressure. Results of the surveys (Table 2) indicate that moose densities are high in the southern portion of Unit 24, but calf survival and yearling recruitment are currently poor.

Mortality

During a split season, 106 moose were reported taken from Unit 24. Hunters reported taking 103 moose during the September hunt and 3 during the March hunt. However, illegal hunting actually occurred throughout the winter in the villages of Huslia and Hughes. The illegal winter take is estimated at 35 moose.

The number of moose taken along the Dalton Highway has been increasing each year. The current year's harvest was 13. The number of hunters using aircraft as their transportation decreased to 22 and the number using boats was 64. The overall reported harvest was 30 moose less than during 1981-82. Part of the reason for the decrease in reported harvest was the creation of the Gates of the Arctic National Park which prohibited sport hunting, and part was due to a decrease in Department efforts to contact hunters after the March hunt.

Management Summary and Recommendations

The establishment of trend areas should aid in determining population status in part of Unit 24. Trend areas need to be established in the central portion of the Unit and along the Dalton Highway. Preliminary results from the trend areas in the southern part of Unit 24 indicate that while density is high, recruitment is poor. It is recommended that the Koyukuk Controlled Use Area be maintained to keep mortality at its present level. Recruitment of yearling moose was good in the northern part of Unit 24, although present density is low. No changes in the current hunting season were recommended.

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Table 1. Unit 24 moose composition counts, November 1982.

Area	Bulls 100 cows	Yrlg. bulls/ 100 cows	% yrlg. bulls	Calves/100 cows >2 years old	% calves	N	Density (moose/mi^2)
Bettles West	266	66	14	300	21	14	1.0
Henshaw Creek	106	17	7	29	10	67	1.5
John River	60	10	4	77	30	23	--
Ipnek Mountain	109	24	9	56	17	53	--
Areas combined							
Means	107	21	8	52	16	--	--
Total	--	--	--	--	--	157	--

Table 2. Unit 24 moose composition count trend area type surveys, November 1982.

Area	Mi^2	Bulls/ 100 cows	Yrlg. bulls/ 100 cows	% yrlg. bulls	Calves/ 100 cows >2 years old	% calves	N	Density (2 moose/mi^2)	Intensity (2 min/mi^2)
Huslia River Flats	40.6	39	10	6	27	15	134	3.3	5.0
Dulbi Slough	34.6	46	5	4	7	4	110	3.1	5.8
Huslia River South Fork	22.1	50	12	7	24	12	41	1.8	5.2
Areas combined									
Means		43	8	5	18	10	--	--	--
Total		--	--	--	--	--	285	--	--

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 25

GEOGRAPHICAL DESCRIPTION: Yukon Flats; Chandalar, Porcupine, and Black River Drainages; Birch and Beaver Creeks

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Surveys to estimate moose population status and trend were conducted during November 1982 in all Subunits of Unit 25 except 25A. These areas varied in size from 15-60 mi^2 and were surveyed with a search intensity of approximately 4 min/mi^2.

Four areas were surveyed in Subunit 25B. The Salmon Village and Gulch Creek trend areas on the Black River had been previously surveyed in fall 1980. Additional trend areas were established at Fish Creek on the Porcupine River and Snowy Peak on the Kandik River. Mean density for all trend areas was 0.65 $moose/mi^2$. Moose density was 0.30 $moose/mi^2$ less than observed during fall 1980, implying a downward population trend. However, this conclusion is tentative because comparative data between years are available for only 2 of the 4 trend areas.

The Porcupine River drainage upstream from the mouth of the Coleen River appears to have the lowest moose densities in Subunit 25B. Density is probably less than 0.30 $moose/mi^2$ in this area. Only 15 moose were observed during 2 days of searching favorable habitat.

Two trend areas were surveyed in Subunit 25C. Density in the Trail-Ophir Creeks trend area was 0.61 $moose/mi^2$, suggesting a decline of 0.71 $moose/mi^2$ since 1981. A new trend area was established in high-quality upland habitat within the Albert Creek burn near Central. Seasonal concentration of moose in this small area of good habitat produced a density of 5.2 $moose/mi^2$. These habitat conditions are no longer common due to years of effective fire suppression. However, the count area demonstrates the potential this area has for supporting a larger moose population.

Nine trend areas were surveyed in Subunit 25D. The average moose density west of a line extending from Circle to Venetie was 0.30

moose/mi^2; east of that line, density averaged 0.55 moose/mi^2. These densities were similar to those observed in 1980 and 1981; thus, moose numbers are probably stable.

Population Composition

Composition of the moose population was determined by pooling trend area data (Table 1). However, sample sizes were small due to the low moose densities encountered in most areas. Consequently, these data must be interpreted cautiously.

Composition data for Subunit 25B indicated moderate calf survival and poor yearling recruitment. Moose numbers are probably decreasing as indicated by population trend data. However, the high bull:cow ratio suggests that the population is still capable of sustaining the limited bull harvest which occurs in this Subunit.

In Subunit 25C, calf survival and yearling recruitment continue to be good, suggesting that numbers may not be decreasing as indicated by population trend data. Bull:cow ratios were the highest in Subunit 25C, but the survey design or the small sample size may have biased the data.

Composition data for Subunit 25D indicated that initial calf survival was excellent, but yearling recruitment varied throughout the Subunit. Recruitment ranged from poor in the western half of the Subunit to excellent in the eastern half. However, composition data from the eastern half of the Subunit come primarily from 1 count area and may not be representative of conditions throughout the eastern half.

Mortality

Reliable mortality information is unavailable for most of Unit 25. At least half the total harvest is illegal and, therefore, is not reported through the harvest ticket system. Other sources of mortality are also largely unquantified.

Harvest ticket returns for Unit 25 indicated 118 (37%) of the 319 reporting hunters killed a moose (Table 2). The reported harvest and hunter success were unchanged from 1981. Subunit 25B had the largest reported harvest, and the highest success rate (62%). The success rate among reporting hunters in the other Subunits varied from 19% to 46%. Local hunters, other Alaskan residents, and non-Alaskans accounted for 30, 49, and 12% of the reported harvest, respectively.

Airplanes and boats provided transportation for 31 and 42% of the successful moose hunters in Unit 25, respectively (Table 3). Road access is not available except in Subunit 25C.

Progress was made toward quantifying sources of mortality in Subunit 25D. Hunter surveys were conducted, illegal kills were investigated, and a wolf survey was completed.

An aerial survey of Subunit 25D west of Birch Creek and the Hadweenzic River was conducted on opening day (10 Sep) and midway through the season (15 Sep) to locate hunters using aircraft for hunting access. Representatives from the 3 villages within the survey area participated as observers. The survey revealed that few moose were harvested by hunters using aircraft. One hunting party with 3 aircraft was located. Their harvest of 6 moose compared favorably with the harvest ticket total of 11 moose reported by all aircraft hunters in the survey area.

A survey of local hunters who used boats while hunting was conducted by randomly patrolling the Yukon, Porcupine, and Black Rivers by boat. Successful hunters were questioned and asked to show licenses and harvest tickets. Survey results suggest that most local residents who hunted during the season comply with license and harvest ticket requirements. Seven hunters were checked, and no major violations of regulations were found. These people were 54% of the total successful local hunters who reported.

Only 5 of the 30 illegal kills reported in Subunits 25B and 25D could be verified. However, I feel that most reports were reliable, that reported illegal kills composed less than half the number occurring, and that illegal kills were a significant portion of the total mortality incurred by the moose population. Eight cows, 2 calves, and 1 bull were among the 11 illegally killed moose for which sex and age information was available.

The wolf survey in the western portion of Subunit 25D indicated that wolves may be the most important source of mortality in that area. Approximately 50 wolves in 8 packs were believed present, but due to marginal survey conditions, underestimation was likely. Once better estimates of wolf and moose numbers are attained, a low ratio (<30 moose:wolf) should be evident. The moose kill by wolves could equal or exceed the average yearly recruitment.

Habitat Conditions

Preliminary evaluation of browse availability and use indicated that the current population was well below carrying capacity. Browse use on the winter range probably did not exceed 20% of the available supply. Food, therefore, is not a significant factor influencing mortality.

Management Summary and Recommendations

Moose density is low in most of Unit 25, and population trends vary from stable to declining. Moose numbers are probably decreasing in Subunits 25B and 25C and are stable in Subunit 25D. The magnitude and characteristics of the legal harvest show very little change from last year. The illegal kill of moose probably is greater than the legal harvest.

Low moose density along the Porcupine River upstream from the mouth of the Coleen River makes this area a special problem within Subunit 25B. The recently approved season reduction for this area should help address the problem. Additional moose surveys are planned.

The western portion of Subunit 25D continues to be a major problem area. Moose density is critically low and will remain so unless significant management actions are taken. Those actions should be specified along with population and user objectives in a formal management plan. Formulation of that plan will require continuation of current data gathering activities. Those activities include the following: surveys of moose, wolves, hunters, and browse; public meetings to discuss moose problems; and investigation of moose movements and habitat preference using radio telemetry.

The management actions that will be required to rehabilitate the moose population in the western portion of Subunit 25D include the following: regulatory changes designed to limit harvest, to improve reporting, and to encourage legal rather than illegal harvest; wolf control; and increased enforcement. Implementation of these management actions has already begun. The Board of Game approved a 1st attempt at the required regulatory changes by instituting a registration permit hunt for fall 1983. Approval for a wolf management program designed to reduce the population by 50% should be obtained as soon as possible. Increased law enforcement efforts should be sought by requesting Department of Public Safety Personnel to devote more law enforcement effort to the area. A full-time officer will be required during limited periods when illegal kills frequently occur.

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Table 1. Moose sex and age ratios for Unit 25, November 1982.

Subunit	Area	Bulls/ 100 cows	Calves/ 100 cows	Twins/ 100 cows w/calves	% calves	% yearlings	Sample size
25B	Black, Nation, and Kandik Rivers	117	35	20	14	4	43
25C	Trail-Ophir Creeks	127	45	0	17	13	30
	Albert Creek	82	41	13	18	16	49
25D[a]	Western half	54	69	21	31	10	58
25D[a]	Eastern half	86	50	10	21	24	52

[a] Data supplied in part by the U.S. Fish and Wildlife Service.

Table 2. Residency of successful moose hunters in Unit 25, fall 1982.

Subunit	Local resident	Nonlocal Alaska resident	Nonresident	Unspec.	Total harvest
25A	1	10	10	0	21
25B	13	14	0	9	36
25C	2	23	2	0	27
25D	13	10	1	2	26
Unspecified	6	1	1	0	8
Totals	35	58	14	11	118

Table 3. Transportation methods used by successful moose hunters in Unit 25, fall 1982.

Subunit	Airplane	Horse	Boat	Snow-machine	Off-road vehicle	Highway vehicle	Unspec.
25A	10	4	5	0	0	0	2
25B	10	0	22	0	1	1	2
25C	5	1	2	0	8	11	0
25D	11	0	14	1	0	0	0
Unspecified	1	0	6	0	1	0	0
Totals	37	5	49	1	10	12	4

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 26

GEOGRAPHICAL DESCRIPTION: Arctic Slope

PERIOD COVERED: 1 July 1982-30 June 1983

Season and Bag Limit

See Hunting Regulations No. 23.

Population Status and Trend

Over the last 3 decades, moose have become well established in most of the favorable habitat on Alaska's Arctic Slope. Occasional animals range as far north as the arctic coast in summer, but wintering moose are confined primarily to the inland riparian systems. The greatest wintering densities occur on the central Colville River and its tributaries.

Unitwide aerial surveys were conducted in 1970 and 1977. Moose distributions were similar in both years, and about 1,500 moose were observed during each survey. Annual spring surveys of the Colville River and its tributaries between the Anaktuvuk and Killik Rivers were conducted from 1974 to 1981. During this period, the adult segment of the population appears to have increased from 400 to 600 animals. However, recruitment to short yearlings declined from a high of 37% in 1975 to 20% in 1980 and then dropped precipitously to 7% in 1981. No spring survey was conducted in 1982, although observations by Game Division biologists in Subunits 26A and 26B indicated that recruitment was substantially higher than in 1981.

A composition survey of the Colville River system was flown in 1983 under poor observation conditions. Of 315 moose observed, 15% were short yearlings. The Chandler River, a standard count area, was omitted from the survey due to deteriorating snow cover. Because this drainage appeared to hold a large proportion of adults without calves, 15% short yearlings may overestimate recruitment for the entire Colville River system.

The 1981 and 1983 spring surveys suggest a decline in recruitment to short yearlings compared to earlier years. A rigorous assessment of the Colville River moose population is necessary but must now await the 1984 spring counts; it should not be further postponed.

Population Composition

No information was obtained during the reporting period. For results of previous surveys, see Coady (1982).

Mortality

The 1982 reported harvest for Unit 26 was 60 moose (Table 1); this is the lowest reported harvest since 1978 and represents a 35% decline from the mean harvest for 1979, 1980, and 1981. Although this decline is not completely understood, poor September flying weather south of the Brooks Range limited access to the Colville River system from Fairbanks. Hunter success (59%) was also the lowest since 1979 (Table 1). Although hunters could legally shoot a moose of either sex, 52 of the moose reported in 1982 (87%) were bulls (Table 2).

Table 3 compares 1981 and 1982 harvests by Subunit. Data for 1981 were obtained from Anderson (1983). Most of the reported harvest came from Subunit 26A (56% in 1981 and 63% in 1982). The proportion of the Unitwide harvest taken from Subunit 26B declined from 37% (37 moose) in 1981 to 20% (12 moose) in 1982. This decline is statistically significant ($P < 0.05$), and partially reflects the 1982 closure of the Dalton Highway to bow hunting for moose. However, other unknown factors (including reporting error) may also be involved.

Nearly 50% of the 1982 reported harvest was taken by hunters living in the Fairbanks area, and nonresidents accounted for 38% of the harvest (Table 4). Only 8% of the 1982 Unit 26 moose kill can be attributed to residents of the North Slope. Some local residents undoubtedly are not reporting, but the extent of this bias and the reasons for it are not presently understood.

No information on natural mortality was available for the 1982-83 reporting period.

Management Summary and Recommendations

Information collected during the reporting period suggests low recruitment compared with previous years and a decline in hunting pressure since 1981. These conclusions are tentative, however, because the spring survey was done under deteriorating snow conditions, and because harvest tickets are sometimes not available and often are not used by North Slope residents. My lack of experience in the Unit also makes interpretation of existing data more difficult.

At its spring 1983 meeting, the Board of Game opened the Colville River below the mouth of the Anaktuvuk River beginning 1 August. Use of aircraft for this lower river hunt is prohibited. The traditional season for all of Unit 26 begins on 1 September. The early opening was requested by hunters in Nuiqsut to provide an opportunity to legally hunt before the river becomes too low for boat travel. The impact of the new regulation on the Unit 26 moose population will be monitored; however, the take by Nuiqsut residents is small and the mayor of Nuiqsut believes that no more than 6 moose were killed there last fall.

We must accurately assess both the status of the moose populaton and moose hunting in Unit 26 in order to establish a rational management strategy. We should begin by estimating moose population parameters including recruitment, sex and age composition, and population size. To this end, the Barrow area biologist should place the highest priority on obtaining reliable recruitment data on the Colville River in spring 1984; conduct sex and age composition counts in Subunits 26A and 26B in October 1983; and assess the feasibility of a Unitwide aerial census in 1984 and compare the results with those of 1970 and 1977.

These activities will be completed by the end of the 1983-84 reporting period.

We must also refine our harvest estimate. This effort will begin with a field assessment of hunting pressure and distribution during the 1983 seasons on the Colville River and its tributaries. We will also intensify harvest ticket distribution and follow-up efforts on harvest reporting.

The moose ranges of Unit 26 are remote, isolated, and unique. An assertive moose management program should recognize and attempt to perpetuate the characteristics of moose hunting that are identified with the Unit. Both subsistence and recreational hunting styles should be considered, and management should proceed on the basis of the following assumptions:

1. Certain aspects of moose hunting in Unit 26 are unique and worth maintaining;

2. Economic and social pressures are changing North Slope habitats and the way people hunt moose;

3. Not all moose management philosophies are equally desirable or compatible for the Unit;

4. Moose habitat in Unit 26 is geographically discrete from other habitats and can be managed as a unit or a collection of units;

5. Cooperative management agreements can be developed with agencies and landowners having authority over Unit 26 habitat;

6. It is possible to measure and report how hunters, landowners, and other individuals perceive the importance and special characteristics of moose hunting in the Unit.

On this basis, we must characterize moose hunting in Unit 26 so that we can actively manage for particular moose hunting experiences. Three questions should be addressed: who hunts moose in the Unit, what motivates these individuals to hunt there, and

what characteristics of moose hunting in the Unit do these hunters want to see preserved. A strategy for obtaining this information will be developed during the 1983 moose hunting season.

No harvest reduction or other changes in existing regulations are recommended at this time. Management options should be considered by the end of the next reporting period.

Literature Cited

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Table 1. Unit 26 moose hunter success, 1977-1982.

Season	Harvest	Hunters	Success rate (%)
1977	36	48	75
1978	46	81	57
1979	90	108	83
1980	89	132	67
1981	99	145	68
1982	60	102	59

Table 2. Unit 26 moose harvest by Subunit, 1982.

Subunit	Sex		Total
	M	F	
26A	31	7	38
26B	11	1	12
26C	0	0	0
Unknown area	10	0	10

Table 3. Unit 26 moose harvest by Subunit, 1981 and 1982.

Subunit	1981 (%)	1982 (%)	P[a]
26A	56	63	NS
26B	37	20	<0.05
26C	1	0	NS
Unknown area	6	17	<0.05
Totals	100	100	

[a] Significance level based on t-test for difference in proportions.

Table 4. Residency of reporting successful Unit 26 hunters, 1982.

Residency	Hunters	
	No.	%
North Slope	5	8
Fairbanks area	25	42
Elswhere in Alaska	7	12
Outside Alaska	23	38
Totals	60	100