Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Survey-Inventory Management Report
1 July 1993- 30 June 1995

BISON

Mary V Hicks, Editor

Grants W-24-2 & W-24-3
Study 9.0
November 1996

STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
Frank Rue, Commissioner

DIVISION OF WILDLIFE CONSERVATION
Wayne L. Regelin, Director

Free copies of this report and other Division of Wildlife Conservation publications are available to the public. Please direct requests to our publications specialist.

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

TABLE OF CONTENTS

LOCATION

UNIT: 11 (12,782 MI^2)

HERD: COPPER RIVER

GEOGRAPHICAL DESCRIPTION: from the Dadina River to the Kotsina River

BACKGROUND

The Copper River bison herd originated from animals relocated from the National Bison Range in Boise, Montana to Delta Junction, Alaska in 1928. In 1950, 17 bison were moved from the Delta herd to the Nabesna Road in northern Game Management Unit 11. These bison moved away from the release site and, by 1961, they had moved into the Dadina and Chetaslina River area where they remained. The herd has, at times, numbered as many as 120 bison. Until recently herd growth was limited primarily by human harvest.

The department held the first hunt, by registration permit, for Copper River bison in 1964. Registration hunts were held annually, with only 6 hunts canceled between 1964 and 1988. Because of a decline in herd numbers, however, there has not been a hunt since 1988. Hunters have harvested a total of 217 bison from this herd.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain the herd at a minimum of 60 overwintering adults by controlling the number of bison taken by hunters.

METHODS

Biologists conducted aerial surveys to determine composition of the herd in the spring following the calving period. Between 1984 and 1992 radio collars were used to facilitate finding the herd during spring surveys. Currently there are no radio collars on bison in this herd. Bison surveys are now conducted by flying transects through bison habitat between the Dadina and Chesnina rivers. When bison numbers were high enough to allow a hunting season, total kill and hunting pressure were controlled by registration permit. During open season, we monitored the harvest by issuing registration permits from the Alaska Department of Fish and Game (ADF&G) office in Glennallen and by requiring permittees to report to the Glennallen office at the end of their hunt.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The Copper River bison herd was relatively stable during the late 1960s and 1970s, following a period of growth in the 1950s. Survey data indicated a slight decline in herd size during the early 1980s, but bison numbers had increased by 1986 and remained high until 1988. There was a substantial decline in

the herd following the severe winter of 1988-89 with the bison count declining 27%. Herd size increased slightly in 1991 and 1992 but started to decline in 1993 and has been declining every year.

Population Composition

Survey results include 54 adults and 10 calves observed during aerial surveys of the Copper River herd during 1995 (Table 1). Observed calf production was lower than in the prior two years when 15 calves were observed in both 1993 and 1994. Calf production/survival has fluctuated considerably between years. The highest number of calves observed was 23 in 1979, and the lowest calf count was in 1989 with only 3. During the past 5 years, the herd size has averaged 60 adult bison. In 1987 we counted 83 adults; this remains the highest adult count in recent years.

Distribution and Movements

The Copper River bison herd inhabited a home range bounded by the Dadina River on the north, the Copper River on the west, the Kotsina River to the south, and the Wrangell Mountains to the east. We seldom observed bison or bison sign north of the Dadina River or south of the Kotsina River. Seasonal distribution included intensive use of the Copper River floodplain and bluffs during winter and spring. This was followed by a movement to higher elevations along the Dadina and Chetaslina Rivers during the summer to feed on plants as they green up later in the season. During the late 1970s and the 1980s, there were only occasional reports of bison observed along the western bank of the Copper River in Unit 13. We surmised this was because of human disturbance from the Kenny Lake area and hunting pressure prevented range expansion to the west. During the past 5 years, however, some bison have been reported grazing in hay and crop fields in the Kenny Lake area. If a large number of bison should cross the Copper River and feed extensively on the Kenny Lake farms, a serious conflict with farmers would arise.

MORTALITY

Harvest

Season and Bag Limit. The established season for resident and nonresident hunters in Unit 11, for the area east of the Copper River, south of the Nadina River and Nadina and Sanford Glaciers, west of a line from Mount Sanford to Mount Wrangell to Long Glacier, and west of the Kotsina River is 5 October to 10 November. The bag limit is 1 bison every 5 regulatory years by registration permit.

Board of Game Actions and Emergency Orders. During its spring 1989 meeting, the Board of Game changed the scheduled opening date for Copper River bison hunts from 21 September to 5 October. The opening date was delayed 2 weeks to reduce opening day hunting pressure. By opening the season 2 weeks after the close of moose season, a mixed-bag moose and bison hunt was not possible.

The Copper River bison hunt was closed by emergency order on 1 July 1989, and it has not been reopened. The initial closure was caused by poor recruitment and a low count of adults. The closed season has been maintained because of low adult counts or low calf counts in subsequent years.

Human-induced Mortality. There were no hunts held for Copper River bison during the current reporting season. The last hunt was held during 1988, when hunters harvested 7 bison.

Permit Hunts. When held, the Copper River bison hunt is administered as a registration hunt where an unlimited number of registration permits are issued on a first-come, first-served basis. Permits are available only in Glennallen, and all hunters must report hunt results there also. Registration permits are not available until one day before the scheduled opening date (5 October). The hunt may be closed by emergency order if the desired harvest is reached before the season closes on 10 November. The most recent harvest quota is 8 bison. Hunters must carry a portable radio and listen to daily news announcements on the local radio station for emergency closure notification.

Hunter Residency and Success. There were no hunts held for Copper River bison during the current reporting period. Historically, the Copper River bison hunt has always been popular with local rural residents. During the last hunt in 1988, 40% of the permittees were local residents.

Harvest Chronology. There was no harvest of Copper River bison during this reporting period. The last 3 hunts held on this herd lasted only 2 or 3 days before the desired harvest was reached and the seasons were closed by E.O.

Transport Methods. River boats were the most popular method of transportation.

Other Mortality

We monitored winter severity and potential for winter starvation, recording snow depths at the Dadina Lake snow station. This station is near the bluffs along the Copper River where the herd winters. Between 1985 and 1988, winter severity indices at Dadina Lake varied from "Mild" to "Moderate." Snow depths observed during the winter of 1989 were 80% above normal and resulted in a winter snow severity index rate of "Severe." Yearly snowfall has been high since then and the winters of 1990 through 1995 were also classified as "Severe."

Observations of the Copper River herd indicate accidental death may be an important source of natural mortality to bison. Sources of accidental mortality included falling off the steep bluffs that border the Copper River and drowning in the river. During winter bison use the bluffs extensively for feeding. These slopes have predominantly clay soils, which hold moisture and freeze. The frozen clay creates a steep slide with little, if any, secure footing for the bison. During the 1988 hunting season, hunters reported finding 3 dead bison at the base of the bluff. It appeared the bison fell from the cliff. This was the second documented case of this type of mortality. In the spring of 1993, 6 bison were found dead along the Copper River with at least 3 of the animals thought to have drowned. This river-related mortality coincides with recent increased movements to the west side of the Copper River.

Wolves, black bears and brown bears are relatively abundant in the Copper River bison range. These predators are certainly capable of killing bison, but research into predation rates on Copper River bison has not been conducted.

HABITAT

Assessment: Studies to evaluate habitat condition have not been conducted on the Copper River bison range. Most of the Copper River bison range is black spruce forest. Bison frequent swamps, sedge meadows, grass bluffs, and river bars of the Copper, Dadina and Chetaslina rivers. Field observations

of preferred feeding locations such as the Copper River bluffs show evidence of heavy use; such feeding patterns will probably cause reduced forage production.

CONCLUSIONS AND RECOMMENDATIONS

The Copper River bison herd has declined in size. Survey results covering a 5-year period indicate good calf production in at least 3 of these years. Recruitment of calves into the adult class has been low or adult mortality has equaled or exceeded calf recruitment.

Reasons for the decline in bison numbers are unknown as there are no research projects directed at determining natural factors controlling the population. Snow survey results from a snow course at Dadina Lake, centrally located in the Copper River bison herd range, indicate the last 6 winters have had deep snow pack and the winters were classified as severe. Deep snow conditions could result in increased overwinter mortality and reduced recruitment.

Field observations indicate accidental death has been an important source of natural mortality. Increased observations during winter have focused attention on sources of accidental loss, rather than a change in the accidental mortality rate.

Predation rates on the Copper River bison herd are unknown. Wolves, black bears and brown bears are numerous on the home range of the Copper River bison herd. A brown bear was observed feeding on a bison carcass near the Copper River in 1993, but the bear may have been only scavenging a winter kill or drowned animal. The influence of deep snow on predation rates during the last 6 winters is unknown. Possibly bison become more vulnerable to predators during periods of deep snow.

Historically, human harvests have been an important factor in determining herd size. In years of poor recruitment or reduced numbers of adults, human harvest was lowered or eliminated. From 1964 through 1981 the yearly harvest quota was 15 bison. Between 1982 and 1988 bison numbers recovered more slowly following human harvest. In response to reduced calf recruitment, the yearly harvest quota was reduced to 8 animals. In addition, it was necessary to close the Copper River bison hunt in 1982 and 1985 to allow herd recovery. A hunt has not been held since 1988.

Historically, the Copper River bison hunt has been very popular. In fact, its popularity created problems after the yearly quota was cut from 15 to 8 bison. During the past few hunts, the season was closed by emergency order after only 2 days. The Copper River bison hunt was always considered a quality hunting experience, but during the last 3 hunts, crowding of hunters, lower harvest quotas, and early season closures have threatened this status.

I recommend the hunting season for the Copper River bison herd remain closed until the herd increases to 80 overwintering bison older than calves. More adult cows are needed to increase the annual calf production. In order to maintain more cows in the herd it is necessary to have a larger herd because cows cannot be protected from harvest in this herd. Most of the hunting takes place in the timber where sex identification is impossible. In a larger herd, minor overharvest of cows would have fewer biological effects on the herd, making periodic seasonal closures less necessary to rebuild numbers.

The Copper River bison range has supported more than 90 animals in the past. Body and blood condition parameters obtained from captured cows during winters with normal snowfall indicated

adequate forage. However, habitat conditions may have deteriorated since these condition parameters were obtained and now preclude an increase in the bison population.

PREPARED BY:

Robert W. Tobey
Wildlife Biologist

SUBMITTED BY:

Karl Schneider
Management Coordinator

Table 1. Copper River bison spring aerial composition counts and estimated population size, 1991-95.

Regulatory year	Adults[a]	Calves (%)	Total bison observed	Estimated population size[b]
1991/92	60	13 (18)	73	73
1992/93	72	9 (11)	81	81
1993/94	60	15 (20)	75	75
1994/95	54	15 (22)	69	69
1995/96	54	10 (16)	64	64

[a]Fixed-wing aircraft survey - no composition other than adults and calves.
[b]Extrapolated estimates not calculated from total counts.

Table 2. Copper River bison harvest and accidental death, 1988-93.

Regulatory year	Hunter harvest							Accidental death	Grand total
	Reported				Estimated				
	M(%)	F (%)	Unk.	Total	Unreported	Illegal	Total		
1988/89	6(86)	1(14)	0	7	--	--	--	5[a]	12
1989/90[b]	--	--	--	--	--	--	--	0	0
1990/91[b]	--	--	--	--	--	--	--	0	0
1991/92[b]	--	--	--	--	--	--	--	0	0
1992/93[b]	--	--	--	--	--	--	--	7[c]	7

[a]3 falling from bluffs of Copper River; 1 winter kill; 1 radiocollaring mortality.
[b]Hunting season closed
[c]Includes all observed natural mortalities.

Table 3. Copper River bison harvest data by permit hunt, 1988-95.

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
450	1988/89	38	32	73	27	6(86)	1(14)	0	7
475	1989/90[a]	--	--	--	--	--	--	--	--
[b]	1990/91[a]	--	--	--	--	--	--	--	--
[b]	1991/92[a]	--	--	--	--	--	--	--	--
[b]	1992/93[a]	--	--	--	--	--	--	--	--
b	1993/94[a]	--	--	--	--	--	--	--	--
b	1994/95[a]	--	--	--	--	--	--	--	--

[a]Hunting season closed
[b]No hunt scheduled, therefore number not assigned.

Table 4. Copper River bison hunter residency and success, 1988-95.

	Successful				Unsuccessful			
Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Resident[b]	Nonresident	Total (%)	Total hunters
1988/89	1	6	0	7(27)	19	0	19(73)	26
1989/90[c]	--	--	--	--	--	--	--	0
1990/91[c]	--	--	--	--	--	--	--	0
1991/92[c]	--	--	--	--	--	--	--	0
1992/93[c]	--	--	--	--	--	--	--	0
1993/94[c]	--	--	--	--	--	--	--	0
1994/95[c]	--	--	--	--	--	--	--	0

[a]Local means resident of Unit 11 or 13.
[b]Local residency data for unsuccussful hunters not available.
[c]Hunting season closed

Table 5. Copper River bison harvest chronology percent by time period, 1988-95.

Regulatory year	Harvest period 9/21-27	*n*
1988/89	2 days - Closed by EO 9/23	7
1989/90	No hunt	-
1990/91	No hunt	-
1991/92	No hunt	-
1992/93	No hunt	-
1993/94	No hunt	-
1994/95	No hunt	-

Table 6. Copper River bison harvest percent by transport method, 1988-95.

	Percent of harvest								
Regulatory year	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1988/89	14%	--	86%	--	--	--	--	--	7
1989/90[a]	--	--	--	--	--	--	--	--	0
1990/91[a]	--	--	--	--	--	--	--	--	0
1991/92[a]	--	--	--	--	--	--	--	--	0
1992/93[a]	--	--	--	--	--	--	--	--	0
1993/94[a]	--	--	--	--	--	--	--	--	0
1994/95[a]	--	--	--	--	--	--	--	--	0

[a]Hunting season closed

LOCATION

UNIT: 11 (13,300 mi^2)

HERD: Chitina River

GEOGRAPHICAL DESCRIPTION: The Chitina River from the confluence of the Tana River to the Chitina Glacier

BACKGROUND

The Chitina bison herd originated from animals relocated from the National Bison Range in Moise, Montana to Delta Junction, Alaska in 1928. In 1962, 29 cows and 6 bulls were moved from Delta Junction to May Creek. The herd increased to 56 bison in 1981 but has subsequently declined to 34.

The first Chitina bison hunt was held by drawing permit in September 1976. Permit hunts were held for 13 years between 1976 and 1988. During these permit hunts, sport hunters took 57 bison from the Chitina herd, with an average yearly kill of 4 animals. There has not been a Chitina bison hunt since 1988.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain the herd at a minimum of 50 overwintering adults by increasing or decreasing human harvests when bison numbers exceed or fail to reach this herd goal.

METHODS

Biologists conducted aerial surveys to determine composition of the herd in the spring after the calving period. Survey techniques included flying transects through all the bison habitat in the lower Chitina valley to obtain a direct count. Hunting was eliminated during this reporting period because minimum management objectives were not met.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The Chitina Bison Herd was stable for the 10-year period between 1976 and 1985. Between 1985 and 1989, the number of bison observed in the Chitina herd declined from 56 to 30 animals (46%). Since 1989 the Chitina herd has been stable at a reduced level.

Population Size

We counted 34 bison during an aerial survey of the Chitina River in June 1995 (Table1).

Population Composition

Biologists observed 33 adults and 1 calf during aerial surveys of the Chitina herd during 1995 (Table 1). This is the lowest calf production/survival ever observed from a complete herd survey. Calf production and/or survival has fluctuated considerably over the last few years. Timing of the surveys probably is not a factor in variable calf counts because the surveys were usually conducted in June or early July every year.

Distribution and Movements

The Chitina Bison Herd ranges within the riparian and upland habitats below the 2000 feet elevation, along a 40-mile portion of the upper Chitina Valley. Although movements vary considerably, the herd can usually be located between the Tana River and Barnard Glacier. During the past few years, biologists have observed especially heavy use of the riparian zone between Bryson Bar and Bear Island; survey efforts have focused on this area. Old bulls in this herd are loners and exhibit solitary behavior, often bedding in forested areas, making survey conditions difficult.

MORTALITY

Harvest

Season and Bag Limit. The established hunting season for residents and nonresident hunters in Unit 11 is 6 September to 30 November. The bag limit is 1 bison every 5 regulatory years by drawing permit only. Up to 12 drawing permits may be issued. The hunt area is that portion of the Chitina River east of the Lakina River and south and east of the Nizina River in Unit 11.

Board of Game Actions and Emergency Orders. In 1985 the Board of Game changed the Chitina bison hunt from a sport hunt to a subsistence hunt. Only local rural residents were eligible for the permits. The board reclassified the Chitina bison hunt as a sport hunt in 1986 and residents and nonresidents were eligible to hunt. The department canceled the Chitina bison hunt in 1989 by emergency order because the number of bison counted in the spring of 1989 was well below the population objective. A hunt has not been held since.

Human-induced Mortality. No hunt was held during the current reporting period. Hunters killed 4 bulls during the 1988 season, which was the last year a hunt was held.

Permit Hunts. When held, the Chitina bison hunt is administered as a drawing permit hunt with up to 12 permits authorized. During the last hunt in 1988, 423 hunters applied for 6 permits available.

Hunter Residency and Success. The Chitina bison hunt has been popular with local residents. In fact, nonresidents did not draw a tag during the last 6 Chitina hunts.

Transportation Methods. Historically, virtually all of the successful Chitina bison hunters used aircraft.

Other Mortality

Natural mortality rates have not been determined for the Chitina bison herd. Although instances of wolf predation on bison have been reported by trappers and local residents, there have not been any investigations into causes of natural mortality in this herd.

HABITAT ASSESSMENT

In 1984 the National Park Service studied the range in the upper Chitina Valley (Miquele 1985). This range study indicated grazing by ungulates on the Chitina bison range had not resulted in any recent deterioration in plant condition. The range was recovering from earlier overuse when horses were abundant on the grazing leases. Miquele (1985) also concluded that a bison herd of 50 animals had not adversely affected the habitat, and the management objective of 30 overwintering bison could be increased. He also concluded the range could not support a very large bison herd.

During the past 5 years, appreciable vegetation loss has occurred on the Chitina bison range. This is a result of rechannelization of the Chitina River toward the north bank. The first area affected was the floodplain northeast of Bear Island. This was a heavily used riparian area before 1991 when flooding first occurred. It was estimated over 50% of the vegetation has been washed away. Over the past 4 years, flooding has occurred east of Bear Island, near Bryson Bar, and extended toward Hubert's landing. It is impossible to predict effects of this flooding on the herd. At the very least, the herd must change short-term feeding patterns.

CONCLUSIONS AND RECOMMENDATIONS

Between 1985 and 1989 the Chitina bison herd declined by almost 50% but remained relatively stable throughout this reporting period. Small fluctuations in count data between years probably reflect survey technique rather than actual changes in bison numbers. Solitary bulls are especially difficult to find on aerial surveys. Legal harvests by sport hunting were stopped in 1989 after the herd declined. The reasons for the failure of the herd to increase without legal sport harvests is unknown. In prior years the herd continued to grow even with an annual sport harvest.

Calf production and/or survival this year was the lowest ever observed in the Chitina herd. Sources of neonatal bison loss are unknown. Predators, including wolves and both brown and black bears, are abundant and could be a factor in calf predation. Another explanation for poor recruitment could be due to a reduction in available forage due to flooding. Numerous river bars covered with vegetation eroded away because of flooding and rechannelization of the Chitina River through important feeding areas during the past 5 years. The short-term effects of flooding and resulting vegetation loss may have temporarily reduced carrying capacity.

LITERATURE CITED

MIQUELE, DALE. 1985. Food habits and range conditions of bison and sympatric ungulates on the Upper Chitina River, Wrangell-St. Elias National Park and Preserve. US Dept. of Interior. Nat. Park Service. AK. Region Research/Resources Management Report AR-8. Anchorage. 112pp.

PREPARED BY:

Robert W. Tobey
Wildlife Biologist

SUBMITTED BY:

Karl Schneider
Management Coordinator

Table 1. Chitina bison spring aerial composition counts and estimated population size, 1991-95.

Regulatory year	Adults[a]	Calves (%)	Total bison observed	Estimated population size[b]
1991/92	28	3 (10)	31	31
1992/93	24	7 (22)	31	31
1993/94	27	5 (16)	32	32
1994/95	27	3 (10)	30	30
1995/96	33	1 (3)	34	34

[a]Fixed-wing aircraft survey - no composition other than adults and calves.
[b]Extrapolated estimates not calculated from aerial counts.

Table 2. Chitina bison harvest and accidental death, 1988-92.

	Hunter harvest									
Regulatory	Reported					Estimated				Grand
year	M	(%)	F (%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	total
1988/89	4	(100)	0	0	4	0	0	0	4[a]	8
1989/90[b]	--		--	--	--	--	--	--	0	0
1990/91[b]	--		--	--	--	--	--	--	0	0
1991/92[b]	--		--	--	--	--	--	--	0	0
1992/93[b]	--		--	--	--	--	--	--	0	0

[a]Radiocollaring mortalities
[b]Hunting season closed

Table 3. Chitina bison harvest data by permit hunt, 1988-92.

Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
1988/89	6	33	0	100	4 (100)	0 --	0	4
1989/90[a]	0	--	--	--	--	--	--	0
1990/91[a]	0	--	--	--	--	--	--	0
1991/92[a]	0	--	--	--	--	--	--	0
1992/93[a]	0	--	--	--	--	--	--	0

[a]Hunting season closed

Table 4. Chitina bison hunter residency and success, 1988-92.

	Successful				Unsuccessful			
Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonresident	Total (%)	Total hunters
1988/89	2	2	0	4	0	0	0 (0)	4
1989/90[b]	--	--	--	--	--	--	--	0
1990/91[b]	--	--	--	--	--	--	--	0
1991/92[b]	--	--	--	--	--	--	--	0
1992/93[b]	--	--	--	--	--	--	--	0

[a]Local means Unit 11 or 13 resident.
[b]Hunting season closed

Table 5. Chitina bison harvest percent by transport method, 1988-92.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1988/89	100	--	--	--	--	--	--	--	4
1989/90[a]	--	--	--	--	--	--	--	--	0
1990/91[a]	--	--	--	--	--	--	--	--	0
1991/92[a]	--	--	--	--	--	--	--	--	0
1992/93[a]	--	--	--	--	--	--	--	--	0

[a]Hunting season closed

LOCATION

UNIT: Unit 19

HERD: Farewell

GEOGRAPHICAL DESCRIPTION: All of the drainages into the Kuskokwim River upstream from Lower Kalskag

BACKGROUND

A transplant of 18 animals from the Delta Bison Herd established the Farewell Bison Herd in 1965. An additional 20 bison were transplanted to the area from Delta in 1968 to supplement the existing herd. The first legal harvest from this herd occurred in 1972 after aerial surveys revealed it could sustain nominal harvests. Since 1972, 24 hunts have been held and over 300 bison have been legally harvested.

The Farewell bison hunt has been administered as a drawing permit hunt, except in 1979 and 1984 when it was administered as a registration and "Tier II" subsistence hunt, respectively. From 1980 through 1983, 20 permits were allocated each year. From 1985 to 1988 the number of permits was increased to 40 each year. During the 1989 and 1990 regulatory years, 70 drawing permits were awarded each year, 40 for fall hunts and an additional 30 permits for spring (March) hunts. In the 1991 regulatory year 80 permits were awarded, 40 for fall and 40 for spring hunting periods. During the period 1992-1994, 50 permits were awarded each year, while in regulatory year 1995, we issued 20 permits each for the spring and fall periods.

MANAGEMENT DIRECTION

The Farewell Bison Herd is managed for optimal sustained yield of animals while providing uncrowded and aesthetic hunting conditions. The herd generally ranges on the 1977 Bear Creek burn or on river bars of the South Fork of the Kuskokwim River, where availability of forage seems adequate. Because range conditions seem to be capable of sustaining a larger population of bison, the number of drawing permits should remain at the current level in an attempt to allow the herd to increase.

MANAGEMENT GOALS AND OBJECTIVES

Maintain a minimum of 200 bison and determine the optimum sustainable level of harvest.

- Conduct periodic aerial surveys of the range, size, and composition of the bison herd.
- Instrument and radiomonitor up to 6 bison to more efficiently locate bison for the purpose of conducting surveys.
- Conduct late winter aerial surveys to determine extent of predation and/or starvation mortality.

Work in cooperation with the Alaska Department of Natural Resources (DNR) and other landowners to complete a prescribed fire in the Farewell area in an attempt to increase the abundance and availability of seasonal forage for bison.

Administer and monitor the permit drawing hunts for the Farewell Bison Herd.

METHODS

Aerial surveys are conducted annually to determine herd size and composition. Because of difficulties encountered in locating bison for the purpose of conducting surveys, radiocollars were attached to 3 adult cows during summer 1991, using helicopter-supported darting techniques. Three additional radiocollars were deployed in summer 1992. Six more will be deployed in spring 1996. Early spring flights are conducted within the traditional range of the herd to monitor extent of winter and predation mortality.

Plans for enhancing habitat are currently underway. A control burn prescription is being developed in cooperation with the US Bureau of Land Management (BLM) and DNR. The prescription should be in place by spring 1996 and, if weather parameters are met, a portion of the 1977 Bear Creek burn area will be subjected to a controlled burn.

The McGrath area office assigns drawing permit winners to one of several 10- or 15-day hunt periods in September or March. No more than 15 hunters are allowed afield at the same time in order to reduce crowding and provide a high-quality hunting opportunity. Hunters are required to check in at McGrath either by telephone or in person before and after their hunts. Hunters are also required to complete and return a mail-out questionnaire following their hunt. Questionnaire results and personal interviews form the database for evaluating various aspects of the hunt.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Between 1968 (when aerial surveys were initiated) and 1988, the Farewell Bison Herd experienced an average annual growth rate of about 10%. Although there are no reliable estimates of population size since 1988, it seems that human harvest and other mortality factors affected the herd's growth (Table 1).

Population Size

Recruitment, hunting mortality, and other survey data indicate a population of 280 to 300 bison (Table 1). Sporadic and unpredictable movements of the bison during each of the past 5 years negated attempts to determine herd size. I suspect the July 1995 composition survey, during which we tallied 260 bison, was about 80% to 90% of the total population.

Population Composition

During this reporting period, 20 surveys were conducted. Percent calves in the herd ranged from a low of 12.8 (5/92, precalving) to a high of 27.1 (7/93). During 4 surveys conducted in June or July 1992-1995 when the majority of the herd was surveyed, calf percentages ranged from 16.8%

to 24.0%, averaging 20.8%. The July 1995 survey was conducted with a helicopter (Robinson R-22) and allowed more detailed enumeration of the various sex and age categories than is possible using fixed-wing aircraft. A total of 260 bison was observed (adult female = 119, adult male = 51, yearling = 40, calf = 50).

Distribution and Movements

During winters the Farewell Bison Herd is typically scattered in small groups (10 to 40 animals) on the Bear Creek burn and surrounding ranges, taking advantage of windswept grass and sedge forage. During summer these groups begin moving onto the South Fork Kuskokwim River floodplain, generally moving erratically in a southern direction toward the headwaters of that drainage. In recent years bison were seen as far upriver as Sled Pass (Hartman River/Stony River headwaters) and Ptarmigan Valley (South Fork Kuskokwim/Happy River headwaters). In past years bison were also observed as far west as the Windy Fork of the Kuskokwim River and north to within 20 km of Nikolai on the South Fork Kuskokwim River. Several small groups of bison are pioneering a 1990 lightning-caused burn area on the east side of the South Fork Kuskokwim River. This is a potential area for herd expansion.

MORTALITY

Harvest

Hunter harvest of bison from the Farewell Bison Herd during this reporting period is indicated in Tables 2 and 3. Success rates for Hunt No. 351 (formerly Hunt No. 451) declined and were the lowest ever recorded during the 1992 season (17% success rate). Rather than reflecting a paucity of bison, I believe this is a result of increasing numbers of moose hunters in the traditional bison hunting areas, leading to increased disturbance of bison. Bison moved to more inaccessible areas, reducing the harvest. Hunter success rates during Hunt No. 352 (formerly Hunt No. 452), occurring in March, remained between 45% and 65%. All hunters who went afield during the March 1995 season were successful.

Season and Bag Limit.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 19, 1 bison every 5 regulatory years by drawing permit only.	1 Sep-30 Sep 1 Mar-30 Mar	1 Sep-30 Sep 1 Mar-30 Mar

In March 1989, the Alaska Board of Game approved the department's proposal to issue 100 drawing permits and extend the open season from 10 August through 31 March. Although that allowed a greatly increased harvest, the department returned to reduced harvests to allow the herd to grow.

Hunter Residency and Success. The majority of applicants and permittees for the Farewell Bison Hunt are Alaska residents (Table 4). Nonresidents obtained only 6 permits in the past 5 years,

making up only 2% of the permittees. Local residents (permittees residing in Unit 19) received only 17 permits (less than 6% of permits).

Hunter success averages about 40%. However, this figure includes all permit holders, both those who go afield and those who do not. During the past 5 regulatory years an average of 28% of the permit holders did not hunt (Table 2). Thus, more than half the hunters who go afield are successful.

Success rates vary by assigned hunt period (Table 5). Chronology of the harvest is probably affected more by weather conditions (directly affecting access) rather than bison vulnerability. However, hunter success rates are generally much higher in March than in September.

Transport Methods. During the fall hunt (Hunt No. 351/451) initial access to the Farewell area is typically by aircraft (Table 6). During the past 5 years, no hunters reported using a boat for initial access. About half the fall hunters use all-terrain vehicles as a secondary access method. During the spring hunt (No. 351/451), primary access is also by airplane. However, access by snowmachines is becoming more frequent among permittees. Generally, hunters using aircraft to reach the hunting area in March use skis or snowshoes to stalk and retrieve bison.

Other Mortality

Until 1988 there seemed to be little natural mortality. However, since that time, 6 dead bison were incidentally located. This information was presented in the FY92 bison management report. No systematic surveys were conducted to document the extent of natural mortality.

HABITAT

Very little is known about the range conditions for the Farewell Bison Herd. The herd spends winters on and adjacent to the Bear Creek burn where forage seems to be adequate. Summer range is generally limited to a smaller area of the Bear Creek burn, as well as the various river floodplains within the Alaska Range. Although no estimate of bison carrying capacity of the range is available, a cursory examination of selected areas during summer 1995 by University of Alaska graduate student Maria Berger indicated adequate forage availability.

In cooperation with DNR and BLM, a spring burn is being planned. This work will be conducted on a portion of the 1977 Bear Creek burn where grass and sedge growth is declining, replaced by a successional reversion to black spruce. Plans are not yet firm on the time and extent of the burn, but the intent will be to provide increased forage for bison and stimulate browse production for moose.

CONCLUSIONS AND RECOMMENDATIONS

It is now evident that hunter harvest is but one of many inimical factors affecting the Farewell Bison Herd. Total herd size must be monitored closely and permit numbers adjusted annually to manage the herd. Based on a cursory examination of the range during summer 1995, the number of permits was reduced in an attempt to allow the bison population to slowly grow. Monitoring herd growth is important and will entail deploying additional radiocollars and periodically

monitoring those transmitters for accurate estimates of herd size. The McGrath area office should continue to administer the hunt to provide assistance to hunters and ensure timely and accurate hunt reports. A priority in management of the Farewell Bison Herd is to establish a program of prescribed burning in the Farewell bison range.

PREPARED BY:

Jackson S Whitman
Wildlife Biologist III

SUBMITTED BY:

David D James
Management Coordinator

REVIEWED BY:

David D James
Management Coordinator

Table 1 Farewell bison annual aerial composition counts and estimated population size, 1990-1995

Regulatory year	Adults	Calves (%)	Total bison observed	Estimated population size
1990-1991	107	20 (16)	127	280
1991-1992	163	33 (17)	196	280
1992-1993	171	51 (23)	222	300
1993-1994	172	44 (20)	216	300
1994-1995	210	50 (19)	260	300

Table 2 Farewell bison harvest data by permit hunt, 1991-1995[a]

Hunt no.	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
451	1990-1991	40	28	40	32	8 (62)	5 (38)	0	13
	1991-1992	40	23	40	37	8 (53)	7 (47)	0	15
	1992-1993	30	30	53	17	4 (80)	1 (20)	0	5
	1993-1994	30	37	37	27	7 (88)	1 (12)	0	8
	1994-1995	30	30	37	33	7 (70)	3 (30)	0	10
	1995-1996	20	30	45	25	2 (40)	3 (60)	0	5
452	1990-1991	30	17	23	60	8 (44)	10 (56)	0	18
	1991-1992	40	20	27	53	11 (52)	10 (48)	0	21
	1992-1993	20	25	30	45	6 (67)	3 (33)	0	9
	1993-1994	20	30	10	60	2 (22)	7 (78)	3	12
	1994-1995	20	35	0	65	5 (38)	8 (62)	0	13
	1995-1996	20							
Totals	1990-1991	70	23	33	44	16 (52)	15 (48)	0	31
	1991-1992	80	21	34	45	19 (53)	17 (47)	0	36
	1992-1993	50	28	44	28	10 (71)	4 (29)	0	14
	1993-1994	50	34	26	40	9 (53)	8 (47)	3	20
	1994-1995	50	32	22	46	12 (52)	11 (48)	0	23
	1995-1996	40							

[a] Figures only represent legally harvested animals.

Table 3 Farewell bison harvest, 1991-1995

Regulatory year	Hunter harvest							
	Reported				Estimated			
	M (%)	F (%)	Unk	Total	Unreported	Illegal	Total	Total
1990-1991	16 (52)	15 (48)	0	31	0	0	0	31
1991-1992	19 (53)	17 (47)	0	36	0	0	0	36
1992-1993	10 (71)	4 (29)	0	14	0	0	0	14
1993-1994	9 (53)	8 (47)	3	20	0	1	0	21
1994-1995	12 (52)	11 (48)	0	23	0	0	0	23
Total	66 (55)	55 (45)	3	124	0	1	0	125

Table 4 Farewell bison hunter residency and success, 1990-1996[a]

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[b] resident	Nonlocal resident	Nonres	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonres	Unk	Total (%)	
1990-1991	5	26	0	0	31 (44)	0	39	0	0	39 (56)	70
1991-1992	2	33	1	0	36 (45)	2	39	3	0	44 (55)	80
1992-1993	1	13	0	0	14 (28)	1	35	0	0	36 (72)	50
1993-1994	1	17	2	0	20 (40)	2	28	0	0	30 (60)	50
1994-1995	3	20	0	0	23 (46)	0	27	0	0	27 (54)	50

[a] Figures are for all hunters, whether they hunted or not.
[b] "Local Resident" refers to hunters living in Unit 19.

Table 5 Farewell bison harvest chronology by time period, 1990-1995

Regulatory year	Harvest period								
	8/22-31	9/1-10	9/11-20	9/21-30	3/1-10	3/11-20	3/21-30	Unk	*n*
1990-1991	3	3	3	4	7	5	6	0	31
1991-1992	1	2	4	8	7	6	8	0	36
1992-1993	0	1	4	0	4	3	2	0	14
1993-1994	0	2	3	3	3	1	1	7	20
1994-1995	0	3	4	3	4	0	3	6	23
Percent	4	11	16	16	23	14	18		102

Table 6 Farewell bison harvest percent by transport method, 1990-1995

Regulatory year	Method of transportation				
	Airplane	Boat	Snowmachine	Unk	*n*
1990-1991	84	0	16	0	31
1991-1992	81	0	19	0	36
1992-1993	71	0	29	0	14
1993-1994	70	0	20	10	20
1994-1995	74	0	17	9	23

LOCATION

UNIT: 20D (5720 mi^2)

HERD: Delta

GEOGRAPHICAL DESCRIPTION: Central Tanana Valley near Delta Junction

BACKGROUND

The ancestors of modern bison first colonized North America after migrating from Asia to Alaska over the Bering Land Bridge (Reynolds et al. 1982). Subsequently, 2 subspecies developed: wood bison (*Bison bison athabascae*) in Alaska and parts of Canada and plains bison (*B. b. bison*) in Canada and the contiguous United States. Bison were once the most abundant large mammal in Alaska but became extinct about 500 years ago probably due to changing climate. Bison were found along the Delta River near Delta Junction before their extinction in Alaska (D Guthrie, pers commun).

In 1928, 23 plains bison were transplanted from the National Bison Range in Montana to the Delta River. By 1947 the herd increased to 400 animals. Hunting, used to manage herd size, began in 1950; the bison hunt is one of the most popular permit drawing hunts in the state. Delta bison have been transplanted to other parts of Alaska to establish additional herds.

As agriculture developed on their established range, the Delta Bison Herd began to include hay and cereal grains in their fall and winter diets. In 1976 the state of Alaska made agricultural development a priority within the established range of the Delta Bison Herd, and in 1978 large-scale agricultural land disposals began. Eventually bison began to negatively affect agricultural harvests by feeding on crops in the fall.

In 1979 the Alaska Legislature established the 90,000-acre Delta Junction Bison Range (DJBR), south of the Alaska Highway and adjacent to the Delta Agricultural Project (DAP). The purpose of the DJBR was to perpetuate free-ranging bison by providing adequate winter range and altering seasonal movements of bison to reduce damage to agriculture. In 1984 the legislature appropriated $1.54 million for DJBR development and increased the Delta bison permit hunt application fee from $5 to $10, with the intent that $5 from each application be used for DJBR management. Since 1984 the appropriated funds have been used to develop 2800 acres of bison forage on the DJBR in 2 field complexes named the Panoramic and Gerstle fields, purchase equipment for forage management, and hire personnel to accomplish these tasks.

Bison damage to farms in the DAP was significantly reduced in 1985 when the first substantial forage production occurred on the DJBR. DJBR forage development and management continued through this reporting period, reducing conflicts between bison and agriculture.

MANAGEMENT DIRECTION

MANAGEMENT GOALS AND OBJECTIVES

- Maintain a healthy, free-ranging bison herd in the Delta Junction area.
    - Prevent the transmission of diseases from livestock to the Delta Bison Herd.
    - If diseases are transmitted from livestock to the Delta Bison Herd, prevent the spread of diseases from bison to other wildlife species.
- Reduce conflicts between bison and the public, including but not limited to agriculture interests in the Delta Junction area.
    - Manage bison and summer range habitat so that at least 75% of the Delta Bison Herd remains west of the Richardson Highway (between Black Rapids Glacier and the Tanana River) until 20 August annually.
    - Keep the Delta Bison Herd out of the Delta Agricultural Project until 1 October annually.
    - The department will provide assistance to the public experiencing bison conflicts.
- Manage the Delta Bison Herd to provide the greatest opportunity to hunt and view bison.
    - Calculate an accurate annual budget for accomplishing recommended goals and objectives.
    - Attempt to acquire additional funding sufficient to accomplish all goals and objectives of managing the Delta Bison Herd on public lands.
    - Manage the Delta Bison Herd for maximum productivity with a sex ratio of no less than 30 bulls:100 cows.
    - The department will organize volunteer efforts to help accomplish goals and objectives.
    - Manage the Delta Bison Herd at 360 bison precalving from 1 July 1993 to 1 November 1995. The Delta bison management program will be evaluated in November 1995 to determine compliance with goals and objectives, funding and staffing levels, and biological capacity of public lands. Thereafter, herd size will be adjusted to include increasing or decreasing as required and to match resources with goals and objectives.
    - Administer the Delta bison hunt to reduce landowner/hunter conflicts and to maintain hunter access to private land in the DAP to the extent possible.

- Investigate methods and funding sources to improve bison viewing opportunities for the public.

METHODS

DJBR MANAGEMENT 1994

Approximately 800 acres of the perennial grasses, nugget bluegrass and arctared fescue, were fertilized in the Panoramic and Gerstle fields. Fertilizer was applied from 28 May to 12 June 1994 and consisted of 200 pounds/acre of N60-P20-K0-S10. Fertilizer was applied with an 8-ton capacity broadcast spin spreader pulled by a John Deere 4250 tractor. Fertilizing cost was approximately $19,500 (Karczmarczyk 1994).

Approximately 110 acres of the Panoramic Fields were planted with oats from 12-23 June in acreage that had been disked and left fallow for the control of *Calamagrostis canadensis*. Before planting, fields were fertilized with about 200 pounds/acre of N60-P20-K0-S10 by broadcasting fertilizer onto the fallow soil with a broadcast spreader. Approximately 100 pounds/acre of oat seed were spread using the broadcast spreader, and the field was disked with a field disk to incorporate the fertilizer and seed into the soil (Karczmarczyk 1994).

Round berm piles were buried on approximately 400 acres in the Panoramic Fields in June. A dozer was used to dig a hole beside the berm pile. The hole was large enough to accommodate the piles; topsoil was piled beside the hole. The berm material was then pushed into the hole and the topsoil spread over the filled hole so the area could be planted (Karczmarczyk 1994).

Additional bison attractants on the DJBR were 2 660-gallon stock tanks with drinking water and numerous 50-pound trace element salt blocks placed at various locations.

DJBR MANAGEMENT 1995

Approximately 640 acres of the perennial grasses, nugget bluegrass and arctared fescue, were fertilized with N60-P20-K0-S10 at the rate of 200 pounds/acre. Fertilizer was applied to perennial grasses in the Gerstle Fields from 17-21 May and in the Panoramic Fields from 23-29 May 1995. Fertilizer was applied with an 8-ton capacity broadcast spreader pulled by a John Deere 4250 tractor. In addition to the spring fertilizer application, about 40 acres in the Panoramic Fields were fertilized on 29 August with approximately 100 pounds/acre of urea to test the effectiveness of a fall application of nitrogen (Riesgaard 1995). Fertilizer purchases totaled $15,444.

We planted 145 acres in the Panoramic Fields with oats, using methods described for 1994 field operations above. Oats were planted at 3 different times to determine the best planting date for optimum bison forage production. Oats were planted on approximately 1, 10, and 29 June (Riesgaard 1995). Acreage planted to oats were heavily infested with *Calamagrostis* in previous years. The ground was broken with a field disk each year since 1993 in an attempt to kill *Calamagrostis*.

Additional bison attractants on the DJBR were 2 660-gallon stock tanks with drinking water and numerous 50-pound trace element salt blocks placed at various locations.

Mechanical control of *Calamagrostis* was tested on approximately 150 acres in the Panoramic Fields by mowing test plots 2 and 3 times during the summer. Fifty acres received 2 cuttings and were mowed on 12-14 June and 8-9 August. One hundred acres received 3 cuttings and were mowed on 12-14 June, 5-6 July, and 8-9 August. The goal was to cut *Calamagrostis* at least by the time the plants growth reached the 6- to 8-leaf stage, stressing the plant and forcing it to use root reserves to produce new vegetative growth. *Calamagrostis* was mowed using a New Holland disk mower, and grass was mowed to a height of approximately 6 inches above the ground.

Approximately 60 acres in the Panoramic Fields heavily infested with *Calamagrostis* were disked and left fallow (Riesgaard 1995). Fallowing the ground was intended to reduce or eliminate *Calamagrostis* by exposing the root systems to winter desiccation.

A private contractor was hired to cut willow (*Salix* sp.) and aspen (*Populus tremuloides*) that were invading the Gerstle Fields. The mowing occurred from 26 June to 4 July 1995. Approximately 563 acres were mowed at a cost of $15.83/acre.

Forage quality was measured in the Panoramic and Gerstle Fields by collecting grass samples from randomly scattered sites and mixing the subsamples to form a composite sample for each field. Samples were then submitted to the University of Alaska Cooperative Extension Service for forage analysis. Forage samples were analyzed for: crude protein (%), phosphorus (%), potassium (%), calcium (%), acid-detergent fiber (%), in vitro dry matter disappearance (%), total digestible nutrients (%), metabolizable energy (Mcal/lb), and net energy (Mcal/lb).

HERD MANAGEMENT

Population Status and Trend

Aerial censuses are used to determine herd size. A Piper Supercub PA-18 was used to conduct visual searches and to locate aggregations that contained a radiocollared bison. Aggregations were counted visually if possible. Aggregations difficult to count visually were photographed with a 35-mm camera on ASA 400 print film and counted from the photographs. The prehunt population size is considered the maximum number of bison counted during the photocensuses.

A precalving population estimate was calculated by subtracting hunting mortality, estimates of wounding loss, and other known and estimated sources of mortality from the prehunt population estimated for the previous fall.

Population Composition

Sex and age composition surveys were conducted on the ground by locating groups containing radiocollared bison. Sex and age were determined by observing bison with 8 x 40 binoculars or a 15 to 60 power spotting scope. Bulls were differentiated from cows by body size, pelage, horn shape, and presence of a penis sheath. Yearling bulls were differentiated from adult bulls by horn size and shape.

Distribution and Movements

We monitored fall bison movements by locating radiocollared bison and from reports of people observing bison. Locations of radiocollared bison were obtained from the ground by using a single antenna and listening for peak signal strength to determine the general location of the bison. Precise aerial locations were obtained by mounting a pair of antennas on an aircraft and locating the radiocollared bison.

Bison are captured on the ground for the purpose of attaching a radiocollar. When bison first migrate from the Delta River area to the DJBR they are relatively tame and can be approached with a vehicle. A truck is used to slowly approach within 50 to 75 feet. In 1994, 2 drug combinations were used to anesthetize bison: 1100 mg of tiletamine hydrochloride and zolazepam hydrochloride (Telazol®, Fort Dodge Laboratories, Fort Dodge, Ia 50501) with 60 mg xylazine hydrochloride (Anased®, Lloyd Laboratories, Shenandoah, Ia) and 4.5-5.0 mg carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colo) with 50 mg xylazine hydrochloride. Once immobilized, bison were fitted with radiocollars. After collaring, bison were injected with 100 to 150 mg naltrexone hydrochloride (Trexonil®, Wildlife Pharmaceuticals) to reverse immobilization.

Disease Management

Bison hunters were asked to collect approximately 30 ml of blood from the bison they killed. These samples were centrifuged and serum was removed by aspiration. Sera were frozen until tested for the following diseases: epizootic hemorrhagic disease, bluetongue, infectious bovine rhinotracheitis, bovine viral diarrhea, respiratory syncytial virus, parainfluenza 3, *Brucella suis* IV, and Q fever.

Harvest Management

Bison hunters attended a mandatory prehunt orientation. The primary purpose of the orientation is to teach hunters to differentiate between bull and cow bison, discuss land status in the hunt area, and give hunters supplies and instructions for collecting biological samples from their bison.

Bison hunters were required to check out after their hunt. Hunters completed a questionnaire concerning: date and location of kill, days afield, number of shots required, caliber of weapon, and weight of bullet. After hours, hunters put this questionnaire, blood samples, and the distal end of the lower jaw in a drop box at the Delta Junction ADF&G office. If hunters checked out during working hours, department staff examined the carcass to record tooth eruption and extract an I1 tooth from bison that had all permanent teeth. Teeth were sent to Matson Laboratories (PO Box 308, Milltown, Mont 59851) for aging. Horns were measured according to the Boone and Crockett Club scoring system.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population size and trend is regulated through annual harvest by hunters. Estimates of precalving population size during 1994 was 340, below the management objective of 360. The prehunt

population estimate was 446 bison, which included 15 feral bison that escaped from the Steve Holcomb farm and joined the wild herd (Table 1).

The 1995 precalving population estimate was 397 bison and met the management objective, due in part to the feral bison and their offspring that were added to the herd. Prehunt population size increased to 485 bison (Table 1).

Population Size

1994-1995. Bison census flights were flown on 28 July, 22 and 29 September, and 10 October 1994. The largest number of bison counted was 446, observed 29 September 1994. The animals were observed in 6 large aggregations, and it was difficult to accurately differentiate between adults and calves, so the percent calves in the herd was not estimated (Table 1).

1995-1996. Bison census flights were flown on 17 and 18 July, and 17 and 21 August 1995. The largest number of bison counted was 485, observed 21 August (Table 1). During the 21 August survey, 60% of the 485 bison counted were located within the area burned by the Hajdukovich Creek wildfire in June and July 1994. The ground in the burned area was black with ash, and bison were very difficult to see from the air. Although I believe the count was accurate, there may have been bison missed.

Population Composition

1994-1995. Sex and age composition of 172 bison was determined on 19 and 20 September 1994. Calf survival to fall was good with 53 calves:100 cows. Calves were 24% of the sample. Survival to 18 months of age was good with 21 yearling bulls:100 cows, and yearling bulls were 7% of the population (Table 2).

The bull:cow ratio was 70 bulls:100 cows (Table 2) and adult bulls composed 24% of the observed population (Table 2). Adult cows (including yearling cows) composed 45% of the herd (Table 2).

1995-1996. Sex and age composition data were collected from 231 bison on 26, 27, and 28 September 1995. Calf survival to fall remained high with 52 calves:100 cows, and calves composed 22% of the population. Survival to 18 months of age increased to 22 yearling bulls:100 cows, yearling bulls composing 9% of the population (Table 2).

The bull:cow ratio was 87 bulls:100 cows (Table 2), and bulls composed 27% of the observed population (Table 2). Cows (including yearling cows) composed 42% of the observed population (Table 2).

Distribution and Movements

1994-1995. Bison moved from the Delta River to the DJBR earlier than specified in the management objective. No bison were seen on the DJBR during observations on 20 July 1994, indicating migration to the DJBR had not yet begun. Subsequently, bison were observed on the DJBR on 25 July 1994 (Karczmarczyk 1994). However, most of the herd (345) was observed on the Delta River on 28 July 1994. A local pilot reported 40 to 50 bison in the Panoramic Fields

4 August 1994 (H Weiler, pers commun). These movements were consistent with previous observations. Typically, when the Delta Bison Herd migrates from the Delta River to the DJBR, individual groups of bison move during a period of several weeks.

The management objective to keep bison out of the DAP until 1 October was not accomplished in 1994. Bison began moving from the DJBR into the DAP between 27 and 30 August. The date when most of the herd moved into the DAP is unknown. Farmers in the DAP began harvesting their crops from 8 to 17 August 1994. Most crops were harvested by 31 August 1994, although a few crops were not harvested until 14 September 1994 (D Ferdinand, pers commun). Although bison began moving into the DAP earlier than specified in the management objective, they did not begin moving into the DAP until near the completion of harvest, and no major crop damage occurred.

Typically, the Delta Bison Herd begins migrating from their winter range in the DAP/DJBR area during late February or early March, although some bison usually remain on the winter range until April. The date movement began from the DAP/DJBR is unknown for spring 1995. However, in spring 1995 an unusually large number of bison seemed to remain in the DAP much later than usual, and farmers were concerned that bison might start calving in the DAP. Bison were reported in the DAP on 11 and 18 April 1995. On 19 April bison were reported on both winter and summer range with approximately 50 bison reported in the DAP (M Schultz, pers commun) and 12 bison reported on Texas Range, Fort Greely Military Reservation, which is bison summer range (K Spiers, pers commun). On 21 April approximately 75 bison were seen on Texas Range and on 22 April 105 bison were seen on the DJBR and in the DAP (D Bunselmeier, pers commun). The last report of large numbers of bison in the DAP was an observation of 100 to 150 bison in the DAP on 4 to 6 May (F Burris, pers commun). No bison were reported on winter range later than 6 May 1995, and no newborn calves were ever reported on the winter range. It is not known why a large number of bison remained on the winter range until at least the first week of May 1995.

Three bison were darted with Telazol® on 24 August 1994, but none were successfully immobilized. In contrast, Telazol® has been used successfully on domestic bison. Elevated excitation levels during darting may diminish Telazol's® effectiveness on wild bison.

Two bulls and 2 cows were radiocollared on 25 August 1994. Two bulls and 1 cow were immobilized with carfentanil/xylazine hydrochloride. One bull was immobilized 3 minutes after injection, the other was immobilized approximately 2 minutes after injection. The antagonist naltrexone reversed the immobilization in 4 minutes for 1 bull and 7 minutes for the other. One adult cow received a partial injection high on 1 hind quarter and failed to become immobilized. The cow was redarted in the hind quarter 1 hour later and immobilized within approximately 5 minutes. When given the antagonist, the bison recovered in 3 minutes. The second cow was darted with carfentanil citrate/xylazine hydrochloride but received a partial injection and failed to become immobilized. Approximately 25 minutes later, the cow was darted with Telazol®/xylazine hyrdrochloride and immobilized 7 minutes after the injection. The bison recovered 4 minutes after given naltrexone hydrochloride.

1995-1996. During a bison census flight on 18 July 1995, bison were located along the Delta River, the most southerly group west of Ruby Creek and the most northerly group west of Bolio Lake. Bison were also located on uplands along the Delta River in the Texas Range and Big Lake areas on Fort Greely.

After calving along the Delta River and the uplands of Texas Range, bison began migrating back to the DJBR in late July 1995, and most of the herd did not remain west of the Richardson Highway until 20 August as specified in the management objective. Forty-four bison were seen in the Panoramic Fields of the DJBR on 27 July 1995. The first observation of bison in the Gerstle Fields of the DJBR occurred on 2 August 1995, when 30 bison were seen. Large numbers of bison began moving from the Panoramic Fields to the Gerstle Fields on about 16 August, and large numbers of bison used the Gerstle Fields through 27 August. Bison also used the area burned during the 1994 Hajdukovich Creek wildfire. The wildfire burned about 22,400 acres, most of which was on the DJBR south of and including a portion of the Gerstle Fields and west on the DJBR to about Sawmill Creek. During an 21 August census flight, 291 bison were observed in the burn south and west of the Gerstle Fields. Bison moved back and forth between the Panoramic and Gerstle fields during this entire time; however, movement between the fields seemed to increase during September.

Bison began moving into the DAP on approximately 25 August 1995, earlier than the 1 October date specified in the management objective. Tracks of 30 to 40 bison were seen in Tract M of the DAP, located north of the Gerstle Fields (D Bunselmeier, pers commun). These bison apparently moved into Tract M and then returned to the Gerstle Fields. A cow and calf bison were reported in the DAP on 29 August (H Weiler, pers commun). A large group of about 200 bison were seen in Tract M on the evening of 31 August (D Bunselmeier, pers commun).

Weather conditions were poor for harvesting crops in the DAP in late fall 1995, with prolonged periods of rain and poor drying conditions for crops. Farmers in the DAP did not start harvesting significant acreage until about 4 September, and harvest was not completed until about 23 September (D Ferdinand, pers commun).

Although many bison moved into the DAP on approximately 31 August 1995, the entire herd did not move into the DAP at that time. Large numbers of bison remained in the DJBR or moved between the DAP and the DJBR. For example, approximately 200 bison were seen in the Gerstle Fields on 22 September 1995. Therefore, even though large numbers of bison moved into the DAP before completion of late harvest, the DJBR significantly reduced the number of bison that could have moved into the DAP during harvest.

Four cows were radiocollared during 1995 with carfentanil citrate/xylazine hydrochloride. Two cows were immobilized on 31 July, 1 cow was immobilized on 3 August, and 1 cow was immobilized on 24 August.

One cow was immobilized within 9 minutes of injection in the hind quarter and recovered within about 3.5 minutes after given the antagonist. A second cow received a partial injection from the first dart, was shot with a second dart in the hind quarter about 40 minutes later, and was immobilized within about 8 minutes of the second injection. This cow recovered within about 30

seconds of receiving the antagonist. A third cow was hit in the ribs forward of the hind leg and was immobilized within 14 minutes. This cow recovered 3.5 minutes after receiving the antagonist. A fourth cow was darted in the hind quarter, immobilized within about 12 minutes, and recovered about 5 minutes after receiving the antagonist.

MORTALITY

Harvest

Season and Bag Limit. The resident and nonresident bison hunting season was open from 7 October to 31 March during the 1993-1994, 1994-1995, and 1995-1996 hunting seasons. Participation in the hunt was by drawing permit for Hunt DI403 (either-sex bison 1993-1994; bull only 1994-1995 and 1995-1996) or for hunt DI404 (cow only). The following conditions applied to each permit:

1 Permittees were required to attend an orientation course before hunting.

2 Permittees were assigned specified time periods to begin hunting determined by the order permits were drawn.

3 Permittees were required to use a rifle capable of shooting a 200-grain bullet with 2000 ft-lbs of retained energy at 100 yards. Bows had to comply with 5 AAC 92.075(4) to be legal means of harvest. Crossbows are prohibited. Certain muzzleloading firearms qualified.

1993-1994 — During the 1993-1994 hunting season, 90 permits were issued for the either-sex bison hunt (Hunt DI403) and 30 permits were issued for the cow only hunt (Hunt DI404) (Table 3). The bag limit was 1 bison every 5 years.

1994-1995 — During the 1994-1995 season, we issued 40 permits, with 20 issued for the bull only hunt (Hunt DI403) and 20 for the cow hunt (Hunt DI404) (Table 3). The bag limit was 1 bison every 5 years.

1995-1996 — During the 1995-1996 season, we issued 120 permits, with 70 permits for the bull only hunt (DI403) and 50 permits for the cow only hunt (DI404). The bag limit was 1 bison every 5 years. Harvest statistics were not available for the 1995-1996 season at this writing and are not included in this report.

Game Board Actions and Emergency Orders. There were no actions by the Alaska Board of Game that affected the Delta Bison Herd during this reporting period.

Human-induced Mortality.

1993-1994 — Human-induced mortality during 1993-1994 was estimated to be 117 bison. Hunters killed 109 bison which included 51 bulls and 58 cows. Additional mortality was estimated to be 7% wounding loss equal to 8 bison (Table 4).

Hunters with either-sex permits (Hunt DI403) killed a higher proportion of cows than anticipated, with 40% of the either-sex harvest being cows. Consequently, total harvest for Hunts DI403 and DI404 resulted in a higher harvest of cows (53%) than anticipated (Table 4).

Successful hunters with either-sex permits (Hunt DI403) hunted a mean of 4.3 days and unsuccessful hunters hunted a mean of 7.2 days. Successful hunters with cow permits (Hunt DI404) hunted a mean of 3.5 days; unsuccessful hunters hunted a mean of 5.0 days.

The most commonly used weapon during 1993-1994 continued to be a .338 caliber rifle, used by 29% of the hunters. Other commonly used weapons included the 30-06 and .375 H&H caliber rifles used by 18% of hunters each, and the .300 Winchester Magnum rifle used by 14% of hunters (Table 5).

1994-1995 — Human-induced mortality during 1994-1995 was estimated to be 45 bison. Hunters killed 38 bison which included 20 bulls and 18 cows. Additional mortality was estimated to be 7% wounding loss equal to 3 bison, and an additional 4 bison were known to die of other causes (Table 4). Hunters with bull only permits (Hunt DI403) killed 19 bulls and hunters with cow only permits (Hunt DI404) killed 18 cows and 1 bull (Table 3).

Successful hunters with bull only permits (Hunt DI403) hunted a mean of 3.0 days and no DI403 hunters were unsuccessful. Successful hunters with cow only permits (Hunt DI404) hunted a mean of 3.0 days; unsuccessful hunters hunted a mean of 2.0 days.

The most commonly used weapon during 1994-1995 continued to be a .338 caliber rifle, used by 47% of the hunters. Other commonly used weapons included the 30-06 caliber rifle used by 24% of hunters, and .375 H&H caliber rifles used by 9% of hunters (Table 5).

Permit Hunts. The number of applications for Delta bison permits continued to increase with 13,977 applications in 1994 and 15,257 applications in 1995 (Table 6). The increased number of permits provides much needed DJBR operating funds because $5 from each application is intended for DJBR management.

Hunter Residency and Success.

1993-1994 — Most (95%) Delta bison hunters continued to be nonlocal Alaska residents. Permittees that actually hunted had a 92% success rate (Table 7).

1994-1995 — Most (100%) Delta bison hunters continued to be nonlocal Alaska residents. Permittees that actually hunted had a 97% success rate (Table 7).

Harvest Chronology.

1993-1994 — Because of the large number of permits issued during the 1993-1994 hunting season, harvest occurred during nearly the entire season from 7 October 1993 to 31 March 1994. However, most bison were harvested in 2 distinct periods during the hunting season. During the fall portion of the hunt, 70% of the harvest occurred during the first 9 weeks of the hunt (7 October-8 December 1993). Only 7% of bison were killed during weeks 10 to 17 (9 December

1993-2 February 1994). The second distinct period of harvest occurred during weeks 18 to 25+ (3 February-31 March 1994) when 25% of the harvest occurred (Table 8).

1994-1995 — During the 1994-1995 hunting season, harvest again occurred in 2 distinct periods. The first period of high harvest was during weeks 1 to 7 (7 October-24 November 1994) when 68% of the harvest occurred. Only 16% of the harvest occurred during the next 14 weeks, weeks 8 to 21 (25 November 1994-2 March 1995). The second distinct period of harvest occurred during weeks 22 to 24 (3-23 March 1995) when hunters harvested 16% of bison (Table 8).

Most harvest occurs during fall. However, a significant number of permittees hunt late in the season for a variety of reasons, including failure to kill a bison earlier, inability to hunt earlier, or selectivity toward trophy animals. Weather also influences harvest chronology. Most bison are killed early in the season when temperature and day length are conducive to hunting. By early December, short days and cold temperatures make it difficult to hunt. Hunting activity generally increases again mid-February with longer, warmer days.

Transport Methods.

1993-1994 — Highway vehicles and snowmachines continued to be the 2 most commonly used modes of transportation by successful bison hunters. Highway vehicles were used by 66% of successful hunters and snowmachines by 24% (Table 9).

1994-1995 — Highway vehicles and snowmachines continued to be the 2 most commonly used modes of transportation by successful bison hunters. Highway vehicles were used by 56% of successful hunters and snowmachines by 39% (Table 9).

Harvest Locations.

1993-1994 — Most bison continued to be harvested on private property in the DAP. During the 1993-1994 hunting season, 75% of the bison were killed in the DAP and 24% were killed on the DJBR (Table 10).

1994-1995 — Most bison continued to be harvested on private property in the DAP. During the 1994-1995 hunting season, 86% of the bison were killed in the DAP and 14% were killed on the DJBR (Table 10).

Most bison are killed in the DAP because the herd spends most of the hunting season there, and the DAP is also much more accessible than the DJBR during the hunting season. However, the percent of harvest in the DAP has declined since 1990-1991 because more farmers charged access fees for bison hunters and there was also an increase in the number of farmers closing their property to bison hunters in recent years.

Other Mortality

Natural mortality has not been quantified for the Delta Bison Herd but it is probably low. There are no records of predation on Delta bison even though coyotes, wolves, grizzly bears, and black bears are found in the area. Most nonhunting mortality is caused by humans through road kills.

Disease Management

The greatest potential for nonhunting mortality to Delta bison are diseases that could be transmitted from domestic livestock in the Delta Junction area. For example, cattle in the Delta Junction area are known to have had infectious bovine rhinotracheitis, bovine viral diarrhea, bovine respiratory syncytial virus, infectious bovine kerato conjunctivitis, and parainfluenza 3 (PI3) (D Quarberg, pers commun).

Bison continue to be free from most of the infectious diseases for which serum antibody tests are conducted. The exception is PI3 (Table 11). However, by itself, PI3 does not seem to pose a health problem to the herd at this time. The slight decrease in prevalence of PI3 in 1991 samples is probably due to different testing procedures and adjustment of titer thresholds with a new testing laboratory, rather than an actual decreased incidence of the disease (R Zarnke, pers commun).

During this reporting period, the department changed serum testing laboratories for samples dated 1991 and later. Most serum collected during 1991 and 1992 was not tested for Q fever rickettsium or *Leptospira interrogans* bacterium because the new laboratory was not capable of testing for these titers.

HABITAT

DJBR Habitat Management During 1994

Conditions were dry during the 1994 field season. Application of fertilizer to perennial grasses from 28 May to 12 June 1994 resulted in fair to good forage production, but production could have been better with more precipitation (Karczmarczyk 1994). DJBR soils are particularly susceptible to droughty conditions because of shallow topsoil.

Field activities on the DJBR were interrupted when the department received a report from the US Army Corps of Engineers that unexploded artillery shells, possibly containing nerve gas, may be present on the DJBR. This discovery disrupted field activities and resulted in the cancellation of a contract to disk about 150 acres in the Panoramic Fields severely infested with *Calamagrostis*.

DJBR Habitat Management During 1995

Forage was fertilized earlier in May 1995 than in May 1994 and, combined with less droughty conditions, resulted in good production of perennial grasses on the DJBR.

Oats planted on 1 June 1995 had matured to the heading stage and grown to a height of 24 inches when bison began arriving on the DJBR late July. Oats planted on 10 June had grown to 14 inches, and oats planted 29 June had grown to about 3 to 6 inches when the bison began arriving on the DJBR.

When bison began migrating to the Panoramic Fields on the DJBR on 27 July, they foraged on the youngest oat crops, planted 29 June. These oats were the highest quality forage on the DJBR at that time.

After consuming most of the youngest oats, bison preferred perennial bluegrass and oats planted earlier (1 and 10 June) in the Panoramic Fields. When most bluegrass in the Panoramic Fields had been heavily grazed, many bison moved to the Gerstle Fields on 16 August, leaving most of the oats planted on 1 and 10 June in the Panoramic Fields ungrazed. No oats were planted in the Gerstle Fields. Bison foraged on bluegrass and spent considerable time in the area burned during the Hajdukovich Creek fire.

Bluegrass forage samples collected in the Gerstle Fields on 27 July, when bison began migrating to the DJBR, had moisture-free crude protein of 10.75%. Bluegrass samples collected in the Panoramic Fields consisted of mown and unmown samples. The resulting Panoramic Fields composite sample had crude protein of 14.78%. Protein was probably higher in the Panoramic samples than the Gerstle samples because a portion of the Panoramic sample had been mowed, thus retarding plant maturation and resulting in higher crude protein levels. Samples of *Calamagrostis* collected in the Panoramic Fields that had been mowed 2 times had crude protein of 16.50%. The *Calamagrostis* samples also had higher protein levels because they had been mowed. Bluegrass samples collected in the Gerstle Fields on 17 August, when many of the bison moved to the Gerstle Fields, had crude protein of 8.23%.

Forage analysis indicate that during 1995 uncut bluegrass fertilized 17-21 May had crude protein of 10.75% when bison began arriving on the DJBR in late July. This bluegrass, plus oat crops, had sufficient quality (as measured by crude protein levels and other factors) to keep bison on the DJBR and out of the DAP at that time. Bluegrass that had declined in quality to 8.23% crude protein by mid-August was still sufficient to keep bison on the DJBR at that time.

These forage samples also reveal that mowing retarded plant maturation and increased forage quality as measured by crude protein (%). However, retarding *Calamagrostis* growth and increasing crude protein to 16.50% did not improve *Calamagrostis* palatability sufficiently to cause bison to graze it extensively.

Acreage in the Panoramic Field that had been disked and left fallow as a method of *Calamagrostis* control showed significant reduction in *Calamagrostis* in 1995. This area, approximately 110 acres in the northeast corner of the Panoramic Fields, was first disked in summer 1993. The soil was disked, and then a cover crop of oats was planted for bison forage. Bison grazed the oats during fall, and the soil remained fallow in winter so the *Calamagrostis* root system would be exposed and dried out during winter. This process was repeated in 1994 and 1995. Subjective evaluation during 1995 indicated that *Calamagrostis* had been reduced in the acreage by about 75%. The area was disked and planted to oats again in 1995.

Mowing seemed to significantly retard *Calamagrostis* vegetative growth and seed production during 1995. *Calamagrostis* in the Panoramic Fields was approximately 18 to 24 inches high, had 1 tiller, and was in the 4- to 5-leaf stage by the first mowing on 12-14 June. One hundred fifty acres were cut to a height of 6 inches. By 5-6 July *Calamagrostis* regrew to a height of 17 to 18 inches, was in the 5-leaf stage, and had produced 2 tillers. *Calamagrostis* was again cut to a height of 6 inches on 100 acres, and 50 acres were not mowed on 5-6 July. By 8-9 August *Calamagrostis* on the 100 acres that had been cut twice had regrown to a height of 6 to 11 inches, was in the 3- to 6-leaf stage, and had produced 3 tillers. Regrowth on the 50 acres that

had only been mowed 12-14 June was not measured on 8-9 August. All 150 acres were again mowed to a height of 6 inches on 8-9 August.

Mowing *Calamagrostis* did not seem to reduce the number of *Calamagrostis* clumps (*Calamagrostis* is a bunch grass that grows in clumps). However, compared to unmowed acreage, mowed *Calamagrostis* clumps were smaller in diameter, had more leaves with shorter height, and produced no seed heads. Senescence was also significantly delayed in mown versus unmown *Calamagrostis*. Hopefully, repeated mowing causes the plant to use root reserves throughout summer to continuously replace vegetative growth without being able to adequately replace root reserves. The result may reduce overwinter survival of *Calamagrostis*.

Assessment and Enhancement

A graduate student from the University of Alaska Fairbanks continued data analysis and writing a Masters of Science thesis evaluating forage quality and quantity on the Delta River summer range of the Delta Bison Herd.

CONCLUSIONS AND RECOMMENDATIONS

The Delta Bison Herd continues to do well. Herd productivity and survival of calves continue to be good. Herd size met the precalving size objective in 1994 but exceeded the objective in 1995. Additional hunting permits will be issued to bring herd size in compliance with the management objective and reduce the bull:cow ratio for a more productive herd.

Either-sex permits will not be issued for the next hunting season, so the department will have greater control over harvest. However, either-sex permits should not be eliminated as a management tool in the future, primarily because they simplify bison hunting for permittees.

Although 100% of the herd was exposed to PI3, the herd apparently was not exposed to any other serious livestock diseases. We will continue to monitor Delta Bison Herd serology. The serologic health of the Delta Bison Herd continues to be jeopardized by domestic bison escaping captivity and joining the wild herd. Interagency efforts should continue to encourage regulatory changes to provide greater oversight of domestic bison to assure they are disease free and do not escape captivity.

Permit application fees continue to fund management of the DJBR. The DJBR met the legislative intent to reduce conflicts between bison and agriculture, and continues to benefit farmers by delaying bison movements into the DAP. Specific objectives to keep 75% of bison west of the Richardson Highway until 20 August and bison out of the DAP until 1 October were not met. However, in 1994 bison were kept out of the DAP until harvest was nearly completed and bison/agriculture conflicts were few. In 1995 late fall weather delayed crop harvest and some bison moved into the DAP before completion of harvest, which resulted in more crop damage.

The greatest challenges to DJBR management at this time are 1) controlling the native grass, bluejoint (*Calamagrostis canadensis*) or developing techniques to make it more palatable for bison; 2) develop more cost-effective forage management techniques; and 3) holding bison on the

DJBR until the conclusion of harvest in the DAP. Work will continue toward improving these aspects of DJBR management.

One objective of the 1993-1998 Delta Bison Management Plan was to evaluate the Delta bison management program in November 1995. The November 1995 program evaluation has not occurred due in part to higher priority commitments, mostly related to the Unit 20D predator-prey intensive management program. Also, final results of research to evaluate the Delta River forage quantity and quality were not available and have delayed bison plan review. An attempt will be made to review the Delta bison management program with the Delta Bison Working Group during 1996.

LITERATURE CITED

KARCZMARCZYK PF. 1994. DJBR annual report, form 1994-EZ. Alaska Dep Fish and Game. Fairbanks. 3pp.

REYNOLDS HW, RD GLAHOLT, AND AWL HAWLEY. 1982. Bison. Pages 972-1007 *in* JA Chapman and GA Feldhammer, eds. Wild Mammals of North America: Biology, Management, and Economics. The Johns Hopkins Univ Press, Baltimore. 1147pp.

RIESGAARD RE. 1995. DJBR Annual Report. Alaska Dep Fish and Game. Fairbanks. 2pp.

PREPARED BY:

Stephen D DuBois
Wildlife Biologist III

SUBMITTED BY:

David D James
Management Coordinator

REVIEWED BY:

David D James
Management Coordinator

Table 1 Precalving and postcalving population estimates for the Delta Bison Herd from 1983-1995

Year	Precalving[a] population estimate	Prehunt population estimate
1983	355	360
1984	300	356
1985	285	378
1986	300	361
1987	275	396
1988	337	426
1989	366	432
1990		440
1991	378	484[b]
1992	384	482
1993	392	465
1994	340	446[c]
1995	397	485

[a] Calculated by subtracting known mortality from previous postcalving population count.
[b] Includes 17 domestic bison that escaped and were incorporated into the herd.
[c] Includes 15 feral bison that joined the herd in May 1994.

Table 2 Delta bison fall ground composition ratio counts and estimated population size, 1986-1987 through 1995-1996

Regulatory year	Bulls/100 Cows	Yrlg bulls/ 100 Cows	Calves/100 Cows	Adults		Percent yrlg bulls	Percent calves	Total sample size	Estimated prehunt population size
				% Bulls	% Cows[a]				
1986-1987	44	10	47	38	62	5	25	119	361
1987-1988[a]									
1988-1989	72	17	45	42	58	8	21	141	426
1989-1990	106	25	50	51	49	10	20	225	432
1990-1991	114	19	47	53	47	7	18	110	440
1991-1992	74	10	29	42	58	5	14	201	484[b]
1992-1993	87	14	46	31	43	6	20	381	482
1993-1994	67	21	62	20	44	9	27	308	465
1994-1995	70	21	53	24	45	7	24	172	446[c]
1995-1996	87	22	52	27	42	9	22	231	485

[a] No surveys.
[b] Includes 17 domestic bison that escaped and were incorporated into the herd.
[c] Includes 15 domestic bison that escaped and were incorporated into the herd.

Table 3 Delta bison harvest data by permit hunt, 1986-1987 through 1994-1995

Hunt no./Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk (%)	Total harvest
403[a]	1986-1987	10	0	0	100	9 (100)	0 (0)	0 (0)	9
	1987-1988	35	0	0	100	33 (100)	0 (0)	0 (0)	33
	1988-1989	20	10	0	100	18 (100)	0 (0)	0 (0)	18
	1989-1990	30	3	4	96	21 (81)	5 (19)	0 (0)	26
	1990-1991	70	0	3	97	59 (87)	9 (13)	0 (0)	68[b]
	1991-1992	70	0	6	94	50 (74)	18 (26)	0 (0)	68[c]
	1992-1993	80	4	1	95	62 (82)	13 (17)	1 (1)	76
	1993-1994	90	1	7	92	50 (60)	33 (40)	0 (0)	83
	1994-1995	20	5	0	95	19 (100)	0 (0)	0 (0)	19
404	1986-1987	55	0	0	100	6 (11)	47 (89)	0 (0)	53
	1987-1988	15	0	0	100	2 (15)	11 (85)	0 (0)	13
	1988-1989	30	0	10	90	3 (11)	24 (89)	0 (0)	27
	1989-1990	35	0	0	100	1 (3)	33 (97)	0 (0)	34
	1990-1991	20	5	5	95	0 (0)	18 (100)	0 (0)	18
	1991-1992	30	0	17	83	0 (0)	25 (100)	0 (0)	25
	1992-1993	20	0	0	100	0 (0)	20 (100)	0 (0)	20
	1993-1994	30	3	10	87	1 (4)	25 (96)	0 (0)	26
	1994-1995	20	0	5	95	1 (5)	18 (95)	0 (0)	19
Totals for all permit hunts	1986-1987	65	0	0	100	15 (24)	47 (75)	0 (0)	6
	1987-1988	50	0	0	100	35 (76)	11 (24)	0 (0)	46
	1988-1989	50	2	7	96	21 (47)	24 (53)	0 (0)	45
	1989-1990	65	2	2	98	22 (37)	38 (63)	0 (0)	60
	1990-1991	90	2	3	97	59 (67)	27 (31)	0 (0)	86
	1991-1992	100	0	9	91	50 (54)	43 (46)	0 (0)	93[c]
	1992-1993	100	3	1	99	62 (65)	33 (34)	1 (1)	96
	1993-1994	120	2	8	91	51 (47)	58 (53)	0 (0)	109
	1994-1995	40	3	3	95	20 (53)	18 (47)		38

[a] Hunt 403 was a bulls-only hunt for 1986-1987 through 1988-1989 and was an either-sex hunt from 1989 through 1990-1991.
[b] One bull was harvested for the Alaska Wildlife Safeguard raffle.
[c] Two hunters killed 2 bison each.

Table 4 Delta bison harvest and accidental death, 1986-1987 through 1994-1995

Regulatory year	Hunter harvest							Other mortality	Total
	Reported				Estimated				
	M(%)	F(%)	Unk (%)	Total	Unreported[a]	Illegal	Total		
1986-1987	15 (24)	47 (75)	0 (0)	62	5	0	5	0	67
1987-1988	35 (76)	11 (24)	0 (0)	46	4	0	4	0	50
1988-1989	21 (47)	24 (53)	0 (0)	45	4	0	4	0	49
1989-1990	22 (37)	38 (63)	0 (0)	60	5	0	5	0	65
1990-1991	59 (67)[b]	27 (31)	0 (0)	86	6	0	6	2	94
1991-1992	50 (54)	43 (46)	0 (0)	93	7	0	7	0	100
1992-1993	62 (65)	33 (34)	1 (1)	96	7	0	7	3	106
1993-1994	51 (47)	58 (53)	0 (0)	109	8	0	8	0	117
1994-1995	20 (53)	18 (47)	0 (0)	38	3	0	3	4	45

[a] Estimated wounding loss equal to 7% of the permits issued.

[b] One bull was harvested via the Alaska Wildlife Safeguard Raffle.

Table 5 Percent of successful Delta bison hunters using different weapons during Hunts 403 and 404, 1989-1990 through 1994-1995

	% Successful hunters					
Weapon	1989-1990	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995
338	29	28	31	25	29	47
30-06	25	15	24	23	18	24
300 Win Mag	11	27	15	20	14	3
375 H&H	14	10	11	17	18	9
300 Weatherby	7	4	5	2	4	0
8 mm Mag	4	3	2	3	2	0
458	3	3	1	1	1	0
350 Rem Mag	1	3	1	1	0	0
348 Win	0	1	0	1	0	0
300 H&H						6
Unk 300 Cal					7	
Blackpowder	1	1	2	1	2	3
Bow & Arrow	0	1	2	1	0	0
Other	3	1	3	4	5	6
n	76	67	91	90	104	34

Table 6 Number of applications received for Delta bison Hunts 403 and 404 from 1977 through 1995

Year	No. applications	No. permits issued
1977	2121	20
1978	3555	15
1979	3970	25
1980	4561	35
1981	5237	55
1982	8105	75
1983	7889	75
1984	11,276	55
1985	666[a]	55
1986	6585	65
1987	6434	50
1988	9705	50
1989	10,151	65
1990	11,822	90
1991	11,057	100
1992	12,387	100
1993	13,654	120
1994	13,977	40
1995	15,257	120

[a] Eight thousand nine hundred thirty-one applications were received before Tier II regulations were implemented and applications were returned.

Table 7 Delta bison hunter residency and success for hunters reporting for drawing Permit Hunts DI403 and DI404, 1986-1987 through 1994-1995

	Successful					Unsuccessful					
Regulatory year	Local[a] resident	Nonlocal resident	Nonres	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonres	Unk	Total (%)	Total hunters
1986-1987	4	57	0	1	62 (100)	0	0	0	0	0 (0)	62
1987-1988	1	44	0	1	46 (100)	0	0	0	0	0 (0)	46
1988-1989	2	40	1	2	45 (94)	0	3	0	0	3 (6)	48
1989-1990	3	57	0	0	60 (98)	0	1	0	0	1 (2)	61
1990-1991	4	31	0	0	85 (97)	0	3	0	0	3 (3)	88
1991-1992	3	86	2	0	91 (91)	2	7	0	0	9 (9)	100
1992-1993	6	87	1	2	96 (99)	0	1	0	0	1 (1)	97
1993-1994	5	103	1	0	109 (92)	0	9	0	0	9 (8)	118
1994-1995	0	38	0	0	38 (97)	0	1	0	0	1 (3)	39

[a] Local residents reside in Unit 20D.

Table 8 Percent harvest of Delta bison by time period, 1986-1987 through 1992-1993. Each harvest period represents 7 days, beginning 7 October and ending 31 March.

Regulatory	Harvest periods																										
year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	*n*
1986-1987	7	13	9	16	20	0	7	9	9	0	0	2	7	0	0	0	0	0	0	0	0	0	0	0	0	0	45
1987-1988	9	9	9	9	11	17	9	2	4	0	0	0	0	0	0	0	0	0	4	4	4	4	2	0	2	0	46
1988-1989	4	4	13	2	11	13	11	0	2	2	0	0	2	4	0	0	0	0	4	4	7	9	2	2	0	0	45
1989-1990	6	14	16	6	14	6	14	8	4	0	0	0	2	0	0	0	0	2	2	0	2	0	2	0	0	4	50
1990-1991	2	6	13	14	13	7	13	9	2	2	1	1	1	0	1	1	0	0	0	1	2	1	2	5	0	1	86
1991-1992	11	5	6	11	15	8	14	2	0	0	1	1	1	0	2	2	1	1	3	2	2	5	3	2	0	0	93
1992-1993	14	12	13	10	10	12	9	5	1	0	0	0	0	0	2	0	1	0	2	5	2	1	1	0	1	0	94
1993-1994	14	3	11	11	8	8	10	3	2	0	0	1	2	0	3	1	0	2	2	2	0	2	4	6	6	1	109
1994-1995	26	8	18	8	3	0	5	0	0	11	0	0	0	0	0	0	0	5	0	0	0	8	3	5	0	0	38

Table 9 Delta bison harvest percent by transport method for Hunts DI403 and DI404, 1991-1992 through 1994-1995

Regulatory year	Method of transportation								
	Airplane	Horse/ Dog team	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1991-1992	1	0	0	1	14	3	67	14	93
1992-1993	0	0	0	4	49	1	41	5	96
1993-1994	0	2	0	5	24	4	66	0	109
1994-1995	0	0	0	0	39	3	56	0	39

Table 10 Percent of Delta bison harvested by location during permit hunts DI403 and DI404 from 1989-1990 through 1994-1995

	Location of kill		
Year	Delta Ag Project	Delta Jct Bison Range	Other
1989-1990	95	5	0
1990-1991	91	9	0
1991-1992	77	23	0
1992-1993	78	17	5
1993-1994	75	24	1
1994-1995	86	14	0

Table 11 Serum antibody prevalence of 9 infectious disease agents in the Delta Bison Herd, 1984-1992

Agent	1984	1985	1986	1987	1988	1989	1990	1991	1992
Infectious bovine rhinotracheitis virus SN[a] (8)[b]	0/48[c]	0/29	0/52	0/42	0/43	0/38	0/43	0/59	0/74
Bovine viral diarrhea SN (8)	0/48	0/29	3/52	0/43	0/43	0/38	0/43	0/58	0/75
Parainfluenza 3 virus HI[a] (8)	41/41	28/29	52/52	38/38	42/43	38/38	42/42	54/59	74/74
Respiratory syncytial virus IFA[a] (20)			0/52	0/43	0/43	0/38	4/43	1/53	0/70
Epizootic hemorrhagic disease virus ID[a] (+)	0/48	0/229	0/52	0/43	0/10	0/33	0/43	0/59	0/75
Bluetongue virus ID (+)	0/48	0/29	0/52	0/43	0/10	0/33	0/42	0/59	0/75
Brucella suis IV bacterium BAPA (+); STT[a] (50)	0/48	0/1	0/52	0/43	0/43	0/41	0/41	0/59	0/75
Q fever rickettsium CF[a] (20)	1/48	0/29	0/50	0/39	0/6	0/33	0/8		
Leptospira interrogans bacterium MAT[c] (100)			5/52	4/42	0/10		1/43	0/13	

[a] Test method: SN = serum neutralization test, HI = hemagglutination inhibition test, IFA = indirect fluorescent antibody test, ID = immunodiffusion test, BAPA = buffered acidified plate antigen test, STT = standard tube test, CF = complement fixation test, and MAT = microscopic agglutination test.

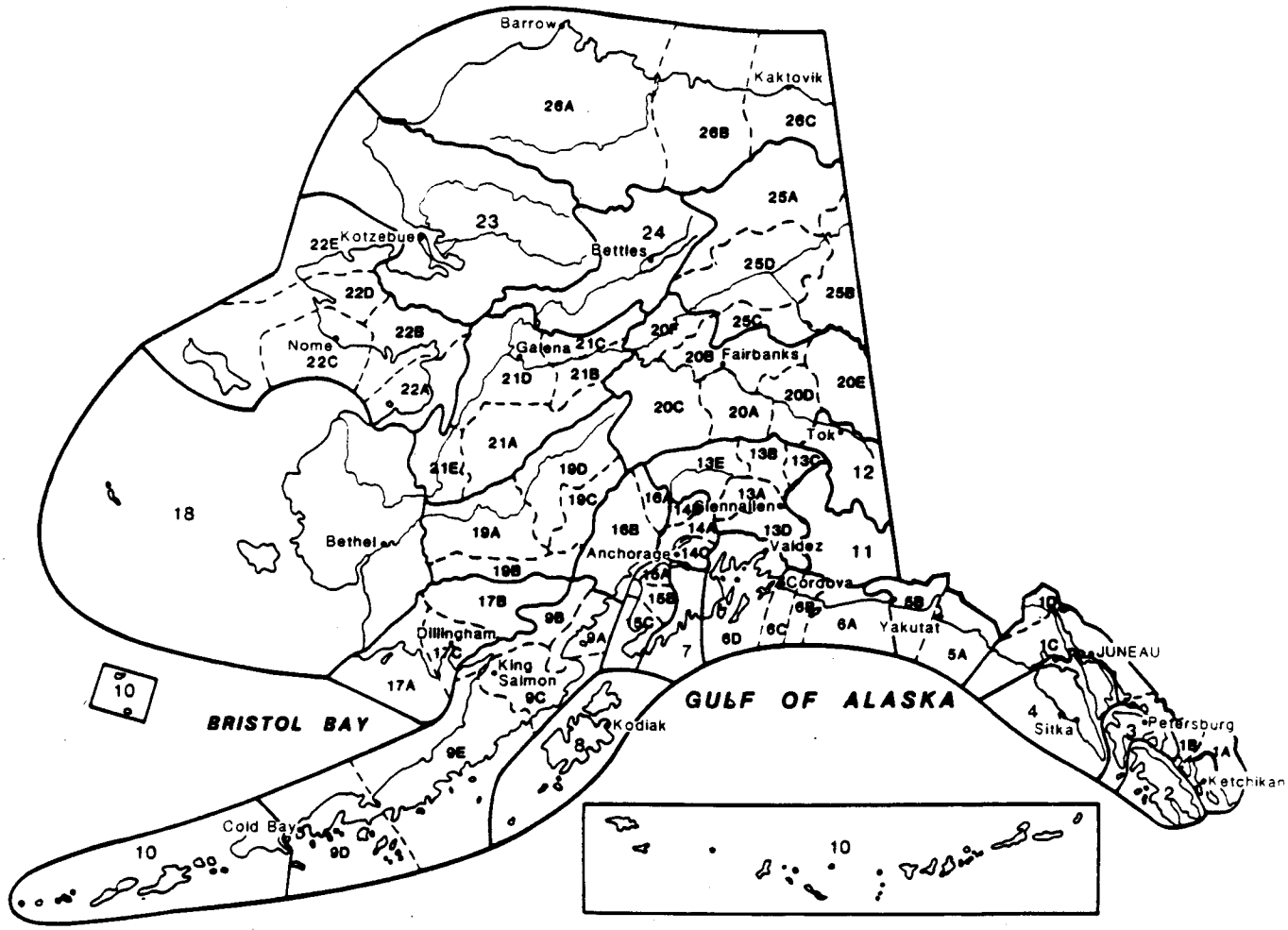
[b] Number in parentheses indicates minimum titer necessary to be considered evidence of exposure to agent in question. (+) indicates that test is interpreted as simply either "positive" or "negative."

[c] Number positive/number tested.

NOTES

NOTES

Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.

LEONARD LEE RUE III