Bison
Management Report
of survey-inventory activities
Federal Aid in Wildlife Restoration
1 July 1997–30 June 2000

Mary V. Hicks, Editor
Alaska Department of Fish and Game
Division of Wildlife Conservation
November 2000

Please note that population and harvest data in this report are estimates and may be refined at a later date.

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DEPARTMENT OF FISH AND GAME
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TABLE OF CONTENTS

LOCATION

GAME MANAGEMENT UNIT: 11 (12,782 mi^2)

HERD: Copper River

GEOGRAPHIC DESCRIPTION: Dadina River to the Kotsina River

BACKGROUND

The Copper River bison herd originated from animals relocated from the National Bison Range in Moise, 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. Factors controlling herd size are hunter harvest and annual snow depth.

The department held the first hunt, by registration permit, for Copper River bison in 1964. Between 1964 and 1988, hunters harvested a total of 217 bison from this herd. The Copper River bison hunt was closed between 1989 and 1999 because of a decline in herd size.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

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

METHODS

I conducted aerial surveys to determine composition of the herd in the spring following the calving period. Between 1984 and 1992 we used radio collars to locate the herd during spring surveys. Currently there are no radio collars on bison in this herd. We now conduct aerial surveys by flying transects through bison habitat between the Dadina and Cheshnina Rivers.

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 of 27% in the herd following the severe winter of 1988–89. Herd size increased slightly in 1991 and 1992, declined through 1996, increased in 1997, and has stabilized the last 2 years (Table 1).

Population Composition

Survey results included 68 adults and 19 calves observed during aerial surveys of the Copper River herd during 1999 (Table 1). Calf production/survival has been high the last 3 years, with last year's count of 19 the highest since 1978. The lowest calf count was in 1989 when only 3 calves were observed. The 70 adults observed represent a 32% increase (70 compared to 53) over the 1996 count. The number of adults counted the last 3 years has been stable between 67 and 70 animals. The highest adult count was 83 and occurred in 1987.

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. Bison or bison sign were seldom observed north of the Dadina River or south of the Kotsina River. Seasonal distribution included intensive use of the Copper River flood plain and bluffs along the Copper River during winter and spring. During summer the bison moved to higher elevations along the Dadina and Chetaslina Rivers 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 preventing range extension to the west. During the 1990s, however, bison have been reported grazing in hay and crop fields in the Kenny Lake area. If a large number of bison 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 Units 11 and 13D is 1 September to 31 March. The hunt area includes that portion of Unit 11 east of the Copper River, south of the Nadina River and Sanford Glaciers, west of a line from Mount Sanford to Mount Wrangell to Long Glacier, and west of the Kotsina River and that portion of Unit 13D east of the Edgerton Hwy. The bag limit is 1 bison every 5 regulatory years by drawing permit.

Board of Game Actions and Emergency Orders. During its spring 1999 meeting, the Board of Game opened the Copper River bison hunt for the first time in 10 years. The hunt was changed from a registration hunt to a drawing permit hunt, and the hunt area was enlarged to include a portion of Unit 13D.

Hunter Harvest. There were 7 bison (6 bulls, 1 cow) taken during the 1999 season (Table 2). The previous hunt was held during 1988, when 7 bison were also harvested.

Permit Hunts. The Copper River bison hunt is administered as a drawing permit hunt (DI 454) with up to 12 permits authorized. In 1999, 678 hunters applied for the 12 available permits. Prior to 1 September, permitees are required to indicate if they will hunt or an alternate will be chosen. Successful permitees are required to report to the Glennallen office within 1 day of leaving the field.

Hunter Residency and Success. All 7 successful hunters were nonlocal Alaskan residents (Table 3). Only 1 local rural resident was drawn for a permit, and no nonresidents were drawn. Historically, the Copper River bison hunt has always been popular with local rural residents, and during the last hunt in 1988, 40% of the registered hunters were local rural residents. However, changing this hunt from a registration to a drawing permit hunt reduced the ability of local residents to participate.

Harvest Chronology. Two bison were taken in September, 3 in October, and 2 in March (Table 4). The season was not closed by emergency order, giving hunters approximately 210 days of hunting opportunity. When this hunt was a registration hunt, the last 3 seasons lasted only 2 or 3 days before the desired harvest was reached and the season closed by emergency order.

Transport Methods. Historically, riverboats have been the most popular method of transportation. However, in 1999 highway vehicles were the most important method of transportation for successful hunters (Table 5).

Other Mortality

We monitored winter severity and the potential for winter starvation by recording snow depths at the Dadina Lake snow station. This station was near the bluffs along the Copper River where the herd winters. The severity rating for snowfall in 1996 was moderate, but all the winters since then have been rated mild. Snow depth is a critical factor in bison survival overwinter. In years with deep snow conditions, bison mortality increases and calf production/survival declines.

Observations of the Copper River herd indicate that accidental death from falls and drowning is an important source of natural mortality to bison (Table 6). Bison fall off steep bluffs bordering the Copper River and drown. During winter bison use the bluffs extensively for feeding. These slopes have predominantly clay soils that hold moisture and freeze. The frozen clay creates a steep slide with little, if any, secure footing for bison. In the spring of 1993, 6 bison were found dead along the Copper River; we believe at least 3 of the animals drowned after falling through ice. Drowning mortality is difficult to document because dead bison are swept down 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 we have not conducted research into predation rates on Copper River bison.

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 openings, grass bluffs, and river bars of the Copper, Dadina, and Chetaslina Rivers. Field observations of these preferred feeding locations, such as the Copper River bluffs, show evidence of heavy use and reduced forage production.

CONCLUSIONS AND RECOMMENDATIONS

The Copper River bison herd increased between 1995 and 1997, then stabilized at the current stocking level. Calf production/survival the last 3 years has been high, with 17 or more calves observed each year. This yearly recruitment is appreciably above the 12-calf average observed each year between 1990 and 1996. The total herd count was high enough last year to allow for a harvest of 8 bison and still meet the overwinter objective of 60 bison.

The Copper River bison hunt was opened in 1999 after being closed for 10 years. However, the hunt was changed from a registration to a drawing permit hunt. When this hunt was run as a registration hunt, hunt conditions were overcrowded because the hunt area is very small. Also, with heavy hunting pressure, the harvest quota was often reached in 1 to 3 days, and the possibility was great that the harvest quota would be exceeded before the season could be closed by emergency order. The board addressed overcrowding and overharvesting issues by changing the hunt to a drawing hunt where participation is limited. However, hunters receiving a permit were assured a long season with aesthetic hunting conditions.

Access to the Copper River herd was limited during the 1999 hunt to public lands along the Copper River and private farms along the Edgerton Highway. A large portion of the herd's range includes private property that was not open to trespass by bison hunters. As a result, successful hunters watched bison movements and conducted their hunt when bison were on lands open for access. To the best of my knowledge, there were no trespass instances by permitees in this hunt. Farmers in the Kenny Lake area responded very favorably to this hunt because it decreased the incidence of crop loss from bison. Trespass fees for accessing private property will probably become an issue for future hunts. Hunters will need to recognize that a substantial sum of money to trespass may be required to be successful in future hunts.

Limiting factors on the size of the Copper River herd include human harvests, habitat limitations, accidental deaths, snow depth, and predation. In years with good calf production/survival, human harvests kept the herd within the management objective. In years with deep snow conditions, bison survival and production declined and human harvests were stopped. We have observed accidents, such as bison falling from the river bluffs and drowning while crossing thin ice, frequently enough to consider these important sources of mortality. Wolves, black bears, and grizzly bears are all numerous on the home range of the Copper River herd, but the department has not researched the effects of these predators on the herd.

I recommend holding a bison hunt as long as calf production/survival is high enough to maintain 60 overwintering bison. Because this hunt takes place in the timber and visibility is often poor, limiting this hunt to bulls only is not practicable. Sex identification in the thick timber is difficult and could lead to mistakes and wasted cows should they be taken during a bulls-only season. The percent cows in the harvest needs to be monitored and yearly harvest quotas adjusted to maintain productivity in the herd. Hunters need to be educated so that bulls are selected when possible, leaving adult cows in the herd. No changes in season length or bag limit are recommended, but the number of permits issued next year should be set after spring counts are completed, verifying current recruitment and survival.

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Assistant Management Coordinator

Table 1 Copper River bison spring aerial composition counts and estimated population size, 1995–1999

Regulatory year	Adults[a]	Calves	(%)	Bison Observed	Estimated Population Size[b]
1995–96	54	10	(16)	64	64
1996–97	53	11	(17)	64	64
1997–98	70	17	(20)	87	87
1998–99	67	17	(20)	84	84
1999–00	68	19	(22)	87	87

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

Table 2 Copper River bison harvest data by permit hunt, 1988–2000 (DI 454)

Regulatory year	Permits Issued	Applications	Percent Did not Hunt	Percent Unsuccessful Hunters	Percent Successful Hunters	Bulls	(%)	Cows	(%)	Unknown	Total Harvest
1988–89	38	38	32	73	27	6	(86)	1	(14)	0	7
1999–00	12	678	17	30	70	6	(86)	1	(14)	0	7

Table 3 Copper River bison hunter residency and success, 1988–2000

Regulatory year	Successful					Unsuccessful				Total hunters
	Local[a] Resident	Nonlocal Resident	Nonresident	Total	(%)	Resident[b]	Non-resident	Total	(%)	
1988–89	1	6	0	7	(27)	19	0	19	(73)	26
1999–00	0	7	0	7	(70)	3	0	3	(30)	10

[a]Local means resident of Unit 11 or 13.

[b]Local residency data for unsuccessful hunters not available.

Table 4 Copper River bison harvest chronology percent, 1988–2000

Regulatory year	Harvest Period							
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	*n*
1988–89	2 days Closed by EO	0	0	0	0	0	0	7
1999–00	2	3	0	0	0	0	2	7

Table 5 Copper River bison harvest percent by transport method, 1988–2000

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-wheeler	Snow-machine	ORV	Highway Vehicle	Unknown	*N*
1988–89	14%	0	86%	0	0	0	0	0	7
1999–00	14%	0	14%	14%	14%	0	43%	0	7

Table 6 Copper River bison harvest and accidental death, 1988–97

Regulatory year	Hunter Harvest										
	Reported						Estimated				
	M	(%)	F	(%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	Total
1988–89	6	(86)	1	(14)	0	7	--	--	--	5 [a]	12
1989–92[b]	--	--	--	--	--	--	--	--	--	0	0
1992–93[b]	--	--	--	--	--	--	--	--	--	7 [c]	7
1994–97[b]	--	--	--	--	--	--	--	--	--	0	0

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

LOCATION

GAME MANAGEMENT UNIT: 11 (13,300 mi^2)

HERD: Chitina River

GEOGRAPHIC 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 as many as 56 bison in 1985, declined to a low of 30 bison in 1994, then increased until the winter of 1997–98.

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, hunters took 57 bison from the Chitina herd, with an average yearly kill of 4 animals. The Chitina bison hunt was closed between 1989 and 1999.

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

We conducted aerial surveys to determine composition of the herd in spring after the calving period. To obtain a direct count, we included transects throughout all bison habitat in the lower Chitina Valley.

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 46% from 56 to 30 animals. From 1989–94 the herd was relatively stable at 30 to 35 animals. The herd increased between 1995 and 1997, peaking at 46 bison in 1997. In 1998 the herd declined by 28% to 32 bison and remained stable at this lower level in 1999.

Population Size

I counted 33 bison during an aerial survey of the Chitina River in June 1999 (Table 1).

Population Composition

I observed 27 adults and 6 calves during aerial surveys of the Chitina Herd in 1999 (Table 1). During this survey the calf count was a 50% increase in calves over the previous count. Historically, calf production and survival is low after a severe winter as observed during 1997–98 in the lower Chitina Valley. Timing of the surveys probably is not a factor in variable calf counts because surveys usually have been 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 ft 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 1990s biologists 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 difficult to count because they exhibit solitary behavior, often bedding in forested areas.

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 bull every 5 regulatory years by drawing permit (DI 450) only. Up to 2 drawing permits may be issued. The hunt area is that portion of the Chitina River east of the Chakina River and south and east of the Nizina River in Unit 11.

Board of Game Actions and Emergency Orders. In 1999 the Board of Game opened the Chitina bison hunt after a 10-year closure that started in 1989.

Hunter Harvest. Hunters killed 2 bulls during the 1999 season (Table 2).

Permit Hunts. The Chitina bison hunt is administered as a drawing permit hunt (DI 450) with up to 2 permits authorized. In 1999, 373 hunters applied for the 2 available permits. Successful permitees are required to report within 1 day of leaving the field.

Hunter Residency and Success. The hunter success rate was 100% (Table 3). Both permitees were nonlocal Alaskan residents (Table 4).

Transportation Methods. Both successful hunters reported using aircraft (Table 5). Historically, successful Chitina bison hunters have used aircraft as the only practical means of accessing this remote hunt area.

Predation. Trappers and local residents have reported wolf predation on bison. Brown bears have also been observed feeding on bison carcasses, but it is not known if they killed the bison or were scavenging. Research on wolf or brown bear predation on bison has not been conducted because of high costs associated with study and because of remoteness of the herd.

Other Mortality

Deep snow pack over a prolonged period during the winter may be an important cause of mortality and reduced productivity in the Chitina bison herd. Deep snows were considered important factors in the herd decline in the late 1980s; during the early 1990s poor recruitment was a limiting factor. Unfortunately, snow records were not recorded until 1992–93 and were not available to ADF&G until May 1998 (Rick Kenyon, pers. commun. ADF&G files, Glennallen). Snow records for Chitina between 1992–95 indicate moderate winter severity, mild winter conditions between 1995–1998, and a very severe winter in 1998. Calf recruitment in the Chitina herd was low during moderate winters between 1992 and 1995 but increased after mild winters in 1996 and 1997. During the severe winter of 1997–98, 6 adult bison were found dead. All were judged to have starved because they were emaciated and had low bone marrow fat. This assumption as to the cause of death is supported by a report from a local trapper (M. McCann, pers. commun.) that snow depths were the deepest he had observed in 20 years. He also reported that a lack of wind kept important feeding areas along the Chitina River snow covered. In other years wind often cleared river bars of snow, making foraging easier for bison.

HABITAT ASSESSMENT

In 1984 the National Park Service studied the range in the upper Chitina Valley (Miquele 1985). This range study indicated that grazing by ungulates on the Chitina bison range had not caused recent plant deterioration. 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 that the range could not support a very large bison herd.

Appreciable vegetation loss occurred on the Chitina bison range during the early 1990s, the 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. Over 50% of the vegetation was washed away. Since 1991, flooding has occurred east of Bear Island, near Bryson Bar, and extended toward Hubert's landing. Recent bison mortality during a winter with deep snows indicates this loss of critical river bar habitat may have reduced the carrying capacity below the previous estimate during moderate or severe winters.

CONCLUSIONS AND RECOMMENDATIONS

The Chitina bison herd declined by almost 50% between 1985 and 1989, remained relatively stable through 1995, increased for 2 years, then experienced a severe die-off during the winter of 1997–98. The herd was stable in 1999. Small fluctuations in count data between years probably reflect survey technique rather than actual changes in bison numbers. Often bedding in forested areas, solitary bulls are especially difficult to find on aerial surveys. Legal harvests by sport hunting were stopped in 1989 after the herd declined. Because the herd continued to grow in prior years, even with a sport harvest, hunting was not considered a limiting factor on herd growth. Severe winters with deep snow and lack of sufficient wind to clear bars of snow are now considered important limiting factors on bison productivity and survival. Flooding of critical river bars and loss of vegetation cover have reduced carrying capacity, especially during periods of deep snow. Wolves

and brown and black bears are abundant and could also influence herd size, but lack of research precludes documenting predation rates.

The decline in productivity and survival during winters with moderate to severe snow conditions presents a management dilemma. The management objective of 50 overwintering bison was based on a range study conducted during the mid 1980s. Recent changes in the river have reduced food availability, lowering the carrying capacity during moderate to severe winters. I assume the impact of deep snow on survival is density-independent because increased mortality and a decline in productivity have been observed at various stocking levels. Examination of winter-killed bison indicates that very old bison are especially susceptible. I suspect calves of the year also have high mortality rates, but they are not found because they die earlier in the winter and are more easily scavenged. The magnitude of a die-off in a deep snow year depends on the calf production and number of aged bison in the population. The number of bison entering the aged category will depend on the frequency of severe winters and human harvests.

Future management should focus both on reaching the herd objective and reducing the impact of severe winters by lowering the number of susceptible old bison present in the herd. To accomplish this, a limited harvest of adult bulls was begun in 1999. Management efforts will be focused on harvesting a limited number of adults every year, depending on herd size, thus reducing the number of animals in the "aged" class that are susceptible to winter mortality. Since winter mortality appears to be relatively density-independent, limited bull harvests should be allowed if the herd exceeds 30 bison but is below the 50 animals objective. Cow harvests would be instituted when the herd approaches 50 animals or when calf recruitment exceeds 8 calves. Because we cannot assure that hunters will select the oldest bison, we can only presume that by providing a long season for a very limited number of hunters that they would attempt to take large trophies. While this limited harvest will not prevent overwinter mortality, it will provide for some human use of the Chitina bison herd when herd numbers fall below the 50 bison objective. Conducting a very small drawing permit hunt for bison is an equitable management strategy to ensure continued hunter participation in this popular hunt for wild bison.

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. U.S. Department of Interior. National Park Service. Alaska. Region Research/Resources Management Report AR-8. Anchorage. 112pp.

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Table 1 Chitina bison spring aerial composition counts and estimated population size, 1995–1999

Regulatory year	Adults[a]	Calves	(%)	Bison observed	Estimated population size[b]
1995–96	33	1	(3)	34	34
1996–97	32	7	(18)	39	39
1997–98	39	7	(15)	46	46
1998–99	29	3	(9)	32	32
1999–00	27	6	(18)	33	33

[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, 1988–99

Regulatory year	Hunter Harvest										Total
	Reported						Estimated				
	M	(%)	F	(%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	
1988–89	4	(100)	0	0	0	4	0	0	0	4 [a]	8
1999–00	2	(100)	0	0	0	2	0	0	0	0	2

[a]Radiocollaring mortalities

Table 3 Chitina bison harvest data by permit hunt, 1988–99 (DI 450)

Regulatory year	Permits issued	Applications	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	Harvest
1988–89	6	423	33	0	100	4	(100)	0	4
1999–00	2	373	0	0	100	2	(100)	0	2

Table 4 Chitina bison hunter residency and success, 1988–99

	Successful					Unsuccessful				
Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonresident	Total	(%)	Hunters
1988–89	2	2	0	4	(100)	0	0	0	(0)	4
1999–00	0	2	0	2	(100)	0	0	0	(0)	2

[a]Local means Unit 11 or 13 resident.

Table 5 Chitina bison harvest percent by transport method, 1988–99

	Percent of harvest								
Regulatory year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1988–89	100	--	--	--	--	--	--	--	4
1999–00	100	--	--	--	--	--	--	--	2

LOCATION

GAME MANAGEMENT UNIT: 19 (36,486 mi^2)

HERD: Farewell

GEOGRAPHIC DESCRIPTION: All of the drainages into the Kuskokwim River upstream from Lower Kalskag. Bison inhabit only the Farewell area of Units 19C and 19D.

BACKGROUND

In 1965 a translocation of 18 animals from the Delta bison herd established the Farewell bison herd. The Alaska Department of Fish and Game translocated an additional 20 bison to the area from Delta in 1968 to supplement the herd. Since 1968 the herd has flourished, growing to approximately 350 animals. Hunting began in 1972, and since then hunters have legally harvested over 490 bison. Hunting the Farewell bison herd has been by permit only. Almost 3000 drawing permit applications are received annually for the combined fall and spring hunts, indicating strong hunter interest in remote bison hunts. In 1998 a governor's permit was issued to a sportsman's group that auctioned the permits with 90% of the proceeds returned to the department.

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 over the 1977 Bear Creek burn area or on the South Fork Kuskokwim River bars where available forage is adequate. Because range appears adequate, we will continue issuing the current number of drawing permits to allow the herd to slowly increase.

MANAGEMENT OBJECTIVE

- Maintain a minimum of 300 bison and determine the optimal sustainable harvest.

Related Management Activities

- Conduct periodic aerial surveys of the range, size, and composition of the bison herd.
- Instrument and monitor up to 6 bison to more efficiently gather herd size, composition data, and habitat use patterns.
- Conduct late winter aerial surveys to determine the extent of predation and 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 to increase seasonal bison forage abundance and availability.

- Administer and monitor the permit drawing hunts for the Farewell bison herd.

METHODS

We conducted aerial surveys annually to document herd size and composition. Surveys were flown using fixed-wing aircraft and used both visual search techniques and radiotelemetry to locate groups of bison. We estimated herd size by attempting to locate 4 radiocollared bison in the herd and counting bison associated with them. In addition, we searched heavily used bison habitat in the Farewell burn and along the South Fork of the Kuskokwim. We then adjusted the total number upward by estimating how many bison we might have missed. During surveys we classified bison as adults and calves. To assist in locating groups of bison, we radiocollared 6 adult cows during fall 1998, using helicopter-supported darting techniques.

Early spring survey flights were conducted within the traditional range of the herd to monitor the extent of winter mortality. We flew known wintering areas, using fixed-wing aircraft to search for evidence of kill sites and to check for mortality among radiocollared animals.

Plans for enhancing habitat are underway. Cooperative work with the Alaska Department of Natural Resources (DNR) to formulate a prescribed burn prescription on state land was formalized by May 2000. A similar plan is being considered for lands managed by the U.S. Bureau of Land Management.

The drawing permit hunts for Farewell bison were administered from the McGrath area office. Hunt reports were collected from permittees that included harvest date, location, chronology, transportation, and effort. Harvest data were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY98 = 1 Jul 1998 through 30 Jun 1999).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Between 1968 (when aerial surveys were initiated) and 1988, the Farewell bison herd grew about 10% annually. Since 1988 no complete surveys were accomplished, but hunting and natural mortality factors likely have slowed the herd's growth (Table 1). In RY91, RY92, and RY95 the number of drawing hunt permits were reduced from 80 to 50 and then to 40. This was done to allow a slow increase in the bison herd (Table 2).

Population Size

Although no complete census has been conducted since 1988, recruitment, hunting mortality, and limited survey data indicate the population has recently increased to about 350 bison (Table 1). Repeated attempts to completely enumerate herd size during each of the past 5 years have not been successful because of unpredictable movements and only a small number of functioning radiocollared bison. As of June 2000, 4 radiocollared bison remained in the herd.

Population Composition

During the past 5 years, we conducted 8 surveys. Percent calves in the herd was 11.6–23.6 (Table 1). During 3 surveys in May, June, or July 1995–2000 when most of the herd was seen, calf percentages were 11.6–19.2%, averaging 15.6%. The July 1995 survey was conducted with the aid of a helicopter (Robinson R-22), which allowed more detailed enumeration of the various sex and age categories than previous counts from fixed-wing aircraft. A total of 260 bison were observed (adult female = 119, adult male = 51, yearling = 40, calf = 50). The number of bison counted during 1996 was the highest recorded, at 276 animals (Table 1).

Distribution and Movements

During winters the Farewell bison herd is typically scattered in small groups (10–40 animals) on the Bear Creek burn and surrounding ranges, taking advantage of windswept grass and sedge forage in these areas. During summer these groups begin moving onto the South Fork Kuskokwim River floodplain, generally moving erratically in a southerly direction toward the headwaters of that drainage. In recent years, bison have been seen as far upriver as Sled Pass (Hartman River/Stony River headwaters) and into Ptarmigan Valley (South Fork Kuskokwim/Happy River headwaters). In past years, bison have also been 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 have pioneered into a large lightning-caused 1991 burn on the east side of the South Fork Kuskokwim. This could be a potential area for permanent herd expansion. During early spring 1998, it was being used extensively by at least 150 bison. During the past few years, continued expansion of the herd's range to the south has also occurred. Groups of bison can regularly be found, throughout the year, south of Egypt Mountain and near Rohn Roadhouse, predominately on the east side of the South Fork of the Kuskokwim River. Previously, these areas were used only in summer.

MORTALITY

Season and Bag Limit.

Bag limit	Resident Seasons	Nonresident Seasons
Unit 19:	1 Sep–30 Sep (DI351)	1 Sep–30 Sep (DI351)
1 bison every 5 regulatory years by drawing permit only.	1 Mar–31 Mar (DI352)	1 Mar–31 Mar (DI352)

Board of Game and Emergency Orders. No Board of Game actions or emergency orders were taken or issued during this reporting period.

Hunt History. The first legal harvest from this herd occurred in RY72 after aerial surveys revealed that it could sustain nominal harvests. Since then, 37 hunts have been held (27 of 28 regulatory years – no hunt in RY73). The Farewell bison hunt has generally been administered as a drawing permit hunt, although in RY79 and RY84 it was administered as registration and Tier II subsistence hunts, respectively. During RY80–RY83, 20 permits were allocated each year. During RY85–RY88 the number of permits was increased to 40. The first spring bison hunt was held in March 1990. During RY89–RY90, 70 drawing permits were awarded annually, 40 for fall

hunts and 30 for spring (March) hunts. In RY91, 80 permits were awarded annually, (40 fall/40 spring). For RY92–RY94, 50 permits were awarded annually (30 fall/20 spring), while in RY95–RY99, 40 permits were issued annually (20 fall/20 spring). During RY99, hunting opportunities were extended. Hunt conditions that confined hunters to a 10- or 15-day period during the season were changed to allow permittees to hunt anytime during the fall or spring seasons.

Hunter Harvest. Annual harvest of bison has ranged was 16–29 from RY95–RY99 (Table 3). The proportion of bulls harvested during this period was 67–74%. Hunters prefer to take bulls because they are larger and have both more meat and trophy potential.

Illegal harvest was an uncommon occurrence; however, during the spring 1999 hunt a radiocollared cow was probably illegally shot and not salvaged.

Permit Hunts. Starting in RY98, a "Governor's Permit" was issued to a sportsman's group (Alaska Bowhunters Association) to auction for money. The group got 10% of the proceeds and the remainder was returned to the department. These permits have sold for $8100 and $7500 during the last 2 years. The first permittee (spring 1999) was not successful, but this year's permittee (spring 2000) harvested a large bull using archery equipment.

Harvest Chronology. Harvest chronology prior to RY99 was determined by the deliberate distribution of permittees over the season, rather than by hunter choice or success (Table 4). During RY99 when permittees were allowed to choose when to hunt, they distributed themselves throughout the season. This confirmed that hunters will distribute themselves throughout the season naturally, maintaining aesthetically pleasing hunt conditions.

Hunter Residency and Success. The vast majority of applicants and permittees for the Farewell bison hunt were Alaska residents (Table 5). Nonresidents obtained 10 permits in the past 5 years, making up only 5% of the permittees, while "local" residents (permittees residing in Unit 19) obtained 7 permits (less than 3.5% of total permits), and nonlocal Alaska residents obtained 184 (92%) of the 200 possible permits.

Success rates for the September hunt DI351 have been relatively low (mean RY92–RY98 = 42%). Success for the September 1999 hunting increased to 76%, probably as a result of the extension of season length per permittee. Hunter success rates in March hunt DI352 remained at 60–100% (87% for those who actually hunted during RY92–RY99). I assume these higher hunter success rates during March are due to increased access opportunities (snowmachines and airplanes), an absence of moose hunters, and use of guide services.

Transport Methods. During the September hunt (DI351), initial access to the Farewell area was typically by aircraft (Table 6). About half the September hunters used all-terrain vehicles as a secondary access method. During the March hunt (DI352), the primary access method was also by airplane. However, access by snowmachines is apparently becoming more popular among permittees. Generally, hunters using aircraft to reach the hunting area in March use skis or snowshoes to stalk and retrieve bison.

Natural Mortality

Wolves or grizzly bears kill few, if any, bison calves or adults; almost all calves are recruited to adulthood. Disease is also rare in the herd. We had planned to search for bison carcasses in April 2000 to estimate natural mortality, but no aircraft were available.

HABITAT

Little is known about the range conditions for the Farewell bison herd. The herd spends winters on and adjacent to the Bear Creek burn and on another burn east of the South Fork Kuskokwim where forage appears adequate. Summer range is generally limited to a smaller area of the Bear Creek burn and 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 and an additional aerial evaluation by Robert Stephenson (ADF&G) in spring 1998 indicated adequate forage availability, with unused range to the north, east, and west.

In cooperation with DNR, a spring burn is planned to provide increased forage for bison and stimulate browse production for moose. This work will be conducted on a portion of the 1977 Bear Creek burn where grass and sedge growth is declining and is being replaced by black spruce. The prescription was met during spring 2000; however, the burn was not accomplished because burning conditions for black spruce were not favorable. This burn will be attempted again during spring 2001.

CONCLUSIONS AND RECOMMENDATIONS

We probably met our objective to maintain a minimum of 300 bison in the Farewell area. We harvested the optimum number of bison (<40), while maintaining some growth. At least 30 bison were recruited into the population annually, with a yearly harvest of 29. We met our objective to complete periodic aerial surveys of the bison, but aircraft availability made these flights less frequent than desired. We met our radiocollaring objective to instrument and monitor up to 6 bison. At the end of this reporting period, we had 4 collared bison on the air. Four other collars were shed or the bison died. We are planning to retrieve these collars during RY01 and have them refurbished and redeployed by RY02. We did not accomplish our objective to conduct late winter surveys to assess predation and starvation mortality rates in the herd. This was primarily due to the lack of aircraft charters available to do the work. Hopefully during RY01, this situation will change. We did accomplish our objective to work with DNR and other landowners to conduct a prescribed burn. Although burning conditions were not favorable during spring 2000, we are considering plans for a burn during spring 2001. We met our objective to adequately administer permit hunts for the Farewell bison herd. The permit hunt continued to attract many prospective hunters to this truly unique hunting experience.

In an ongoing regional effort to list objectives with their corresponding management activities, the next reporting period objectives and activities will be restated as follows:

OBJECTIVE 1: Maintain a minimum population of 300 bison

Activity 1: Maintain a sample of radiocollared bison to monitor the herd distribution and movements.

Activity 2: Conduct aerial surveys of bison to assess the population status and herd composition.

Activity 3: Promote a diverse successional stage habitat mosaic within the range of bison herd to benefit bison and other species by cooperating with other land and resource management agencies.

OBJECTIVE 2: Maintain a harvest of up to 40 bison

Activity: Issue 40 drawing permits, 20 for the fall season and 20 for the spring season.

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Table 1 Farewell bison aerial composition surveys and estimated population size, 1992–2000

Survey date	Adults	Calves (%)	Bison observed	Estimated population size
5/18/92	123	18 (12.8)	141	
5/20/92	134	36 (21.2)	170	
5/22/92	141	34 (19.4)	175	
6/02/92	158	32 (16.8)	190	
6/30/92	117	31 (21.0)	148	
7/21/92	163	33 (16.8)	196	280
8/03/92	90	16 (15.1)	106	
11/11/92	110	18 (14.1)	128	
11/19/92	157	26 (14.2)	183	
6/22/93	171	51 (23.0)	222	
7/21/93	82	22 (21.2)	104	300
10/26/93	70	26 (27.1)	96	
5/07/94			175	
5/16/94	172	44 (20.4)	216	
5/26/94	155	42 (21.3)	197	
7/27/94	76	24 (24.0)	100	300
4/30/95	89	21 (19.9)	110	
7/05/95	210	50 (19.2)	260	300
7/18/95	153	30 (16.4)	183	
7/18/96	229	47 (17.0)	276	320
7/01/97	181	31 (14.6)	212	
7/28/97	140	24 (14.6)	164	320
8/25/99	42	13 (23.6)	55	350
5/30/00	234	31 (11.6)	265	350

Table 2 Farewell bison harvest data by permit hunt, regulatory years 1992–1993 through 1999–2000[a]

Hunt no.	Regulatory year	Permits issued	Permitees not hunting (%)	Unsuccessful hunters[b] (%)	Successful hunters[b] (%)	Bulls (%)	Cows (%)	Unk	Total harvest
DI351	1992–1993	30	9 (30)	16 (76)	5 (24)	4 (80)	1 (20)	0	5
(Fall)	1993–1994	30	11 (37)	11 (58)	8 (42)	7 (88)	1 (12)	0	8
	1994–1995	30	9 (30)	11 (52)	10 (48)	7 (70)	3 (30)	0	10
	1995–1996	20	6 (30)	9 (64)	5 (36)	3 (60)	2 (40)	0	5
	1996–1997	20	4 (20)	6 (37)	10 (63)	7 (70)	3 (30)	0	10
	1997–1998	20	8 (40)	7 (58)	5 (42)	2 (40)	3 (60)	0	5
	1998–1999	20	3 (15)	12 (71)	5 (29)	3 (60)	2 (40)	0	5
	1999–2000[c]	20	3 (15)	4 (24)	13 (76)	8 (62)	5 (38)	0	13
	Subtotal	190	53 (28)	76 (55)	61 (45)	41 (67)	20 (33)	0	61
DI352	1992–1993	20	5 (25)	6 (40)	9 (60)	6 (67)	3 (33)	0	9
(Spring)	1993–1994	20	6 (30)	2 (14)	12 (86)	2 (22)	7 (78)	3	12
	1994–1995	20	7 (35)	0 (0)	13 (100)	5 (38)	8 (62)	0	13
	1995–1996	20	4 (20)	0 (0)	16 (100)	11 (69)	5 (31)	0	16
	1996–1997	20	4 (20)	0 (0)	16 (100)	12 (75)	4 (25)	0	16
	1997–1998	20	3 (15)	3 (18)	14 (82)	12 (86)	2 (14)	0	14
	1998–1999	20	6 (30)	3 (21)	11 (79)	8 (73)	3 (27)	0	11
	1999–2000	20	4 (20)	0 (0)	16 (100)	12 (75)	4 (25)	0	16
	Subtotal	160	39 (25)	14 (13)	107 (87)	68 (64)	36 (36)	3	107
Regulatory	1992–1993	50	14 (28)	22 (61)	14 (39)	10 (71)	4 (29)	0	14
year	1993–1994	50	17 (34)	13 (39)	20 (61)	9 (53)	8 (47)	3	20
totals	1994–1995	50	16 (32)	11 (32)	23 (68)	12 (52)	11 (48)	0	23
	1995–1996	40	10 (25)	9 (30)	21 (70)	14 (67)	7 (33)	0	21
	1996–1997	40	8 (20)	6 (36)	26 (64)	19 (73)	7 (27)	0	26
	1997–1998	40	11 (28)	8 (28)	19 (72)	14 (74)	5 (26)	0	19
	1998–1999	40	9 (23)	15 (48)	16 (52)	11 (69)	5 (31)	0	16
	1999–2000[c]	40	7 (18)	4 (12)	29 (88)	20 (69)	9 (41)	0	29
Total	1992–2000	350	92 (26)	88 (34)	168 (66)	109 (66)	56 (34)	3	168

[a] Figures only represent legally harvested animals.

[b] Successful/Unsuccessful Hunter information only includes those who actually hunted, not total permittees.

[c] Hunters were allowed to hunt anytime in September 1999; specific periods were not assigned.

Table 3 Farewell bison harvest, regulatory years 1992–1993 through 1999–2000

Regulatory year	Reported						Estimated			
	M	(%)	F	(%)	Unk	Total	Unreported	Illegal	Total	Total
1992–1993	10	(71)	4	(29)	0	14	0	0	0	14
1993–1994	9	(53)	8	(47)	3	20	0	1	1	21
1994–1995	12	(52)	11	(48)	0	23	0	0	0	23
1995–1996	14	(67)	7	(33)	0	21	0	0	0	21
1996–1997	19	(73)	7	(27)	0	26	0	1	1	27
1997–1998	14	(74)	5	(26)	0	19	0	0	0	19
1998–1999	11	(69)	5	(31)	0	16	0	1	1	17
1999–2000	20	(69)	9	(41)	0	29	0	0	0	29
Totals	109	(66)	56	(34)	3	168	0	3	3	171

Table 4 Farewell bison harvest chronology, regulatory years 1992–1993 through 1999–2000

Regulatory year	Harvest period						Unk	*n*
	9/1–10	9/11–20	9/21–30	3/1–10	3/11–20	3/21–31		
1992–1993	1	4	0	4	3	2	0	14
1993–1994	2	3	3	3	1	1	7	20
1994–1995	3	4	3	4	0	3	6	23
1995–1996	1	3	0	7	5	3	2	21
1996–1997	3	2	5	9	2	2	3	26
1997–1998	3	1	1	9	3	2	0	19
1998–1999	2	0	1	4	4	1	4	16
1999–2000	4	3	4	7	7	2	0	27
Total (%)[a]	19 (34)	20 (36)	17 (30)	47 (42)	25 (22)	16 (14)	22 (22)	166

[a] Percentage is calculated for each season.

Table 5 Farewell bison hunter residency and success, regulatory years 1992–1993 through 1999–2000 (hunters and nonhunters combined)

Regulatory year	Successful					Unsuccessful					Total permits
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
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
1995–1996	1	19	1	0	21 (52)	0	19	0	0	19 (48)	40
1996–1997	2	23	1	0	26 (65)	0	13	1	0	14 (35)	40
1997–1998	0	17	2	0	19 (48)	0	18	3	0	21 (52)	40
1998–1999	0	16	0	0	16 (40)	1	22	1	0	24 (60)	40
1999–2000	3	25	1	0	29 (73)	0	11	0	0	11 (27)	40
Totals	11	150	7	0	168 (48)	4	173	5	0	182 (52)	350

[a] "Local resident" refers to hunters living in Unit 19.

Table 6 Farewell bison harvest by primary transport method, regulatory years 1992–1993 through 1999–2000

Regulatory year	Harvest percent by transport method				*n*
	Airplane (%)	Boat (%)	Snowmachine (%)	Unknown (%)	
1992–1993	10 (71)	0 (0)	4 (29)	0 (0)	14
1993–1994	14 (70)	0 (0)	4 (20)	2 (10)	20
1994–1995	17 (74)	0 (0)	4 (17)	2 (9)	23
1995–1996	11 (52)	0 (0)	8 (38)	2 (10)	21
1996–1997	15 (58)	0 (0)	8 (31)	3 (11)	26
1997–1998	11 (58)	0 (0)	8 (42)	0 (0)	19
1998–1999	7 (39)	0 (0)	10 (55)	1 (6)	18
1999–2000	12 (41)	0 (0)	16 (55)	1 (4)	29
Totals	97 (57)	0 (0)	62 (36)	11 (7)	170

LOCATION

UNIT: 20D (5637 mi^2)

HERD: Delta

GEOGRAPHIC 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 200–300 years ago probably due to changing climate or overhunting (Skinner and Kaisen 1947; Guthrie, pers commun). Bison lived along the Delta River near Delta Junction before their extinction in Alaska (D Guthrie, pers commun).

In 1928, 23 plains bison were translocated from the National Bison Range in Montana to the Delta River. At the time biologists were unaware of the existence of wood bison in Canada. By 1947 the herd increased to 400 animals. Hunting began in 1950 and is now one of the most popular permit drawing hunts in the state. Hunting is used to manage the size of the herd. Delta bison have been translocated to other parts of Alaska, and 3 other herds have been established (i.e., Farewell, Chitina River, and Copper River herds).

As agriculture developed on their established range, the Delta bison herd (DBH) 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 DBH, and large-scale agricultural land disposals began in 1978. Eventually bison began to negatively impact agricultural harvests by feeding on crops in the fall before harvest.

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 hire personnel, purchase equipment for forage management, and develop 2800 acres of bison forage on the DJBR in 2 field complexes, the Panoramic and Gerstle Fields.

Bison damage to farms in the DAP was significantly reduced in 1985 with the first substantial forage production 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.
  - 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.
  - 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.
  - Organize volunteer efforts to help accomplish goals and objectives.
  - Manage the Delta bison herd at 360 bison precalving. The Delta bison management program was evaluated in 1995 to determine compliance with goals and objectives, funding and staffing levels, and biological capacity of public lands. Herd size is adjusted 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

Perennial grasses were fertilized on the DJBR each year. Grasses were fertilized with N60-P20-K0-S10 at the rate of 200 lb/acre. Fertilizer was applied with an 8-ton capacity broadcast spreader, pulled by a John Deere 4250 tractor.

Oats were planted each year. Prior to planting, fields were fertilized with about 200 lb/acre of N60-P20-K0-S10 by broadcasting fertilizer onto the fallow soil with a broadcast spreader. Approximately 100 lb/acre of oat seed were then spread using the broadcast spreader, and the field was disked with a field disk to incorporate the fertilizer and seed into the soil.

We analyzed forage quality during 1998 and 1999 by collecting forage subsamples and pooling the subsamples into 1 composite sample by forage type and location. Samples were sent to the University of Alaska Plant and Soils Lab, Palmer, Alaska for analysis. Samples were analyzed moisture-free and as fed for dry matter crude protein, phosphorus, potassium, calcium, acid-detergent fiber, in vitro dry matter disappearance, total digestible nutrients, metabolizable energy, and net energy-lactation. For the purpose of evaluating forage quality, comparisons were made of percent crude protein and percent acid-detergent fiber.

We monitored rain gauges in both the Panoramic and Gerstle Fields.

1998

We fertilized 720 acres of nugget bluegrass and 80 acres of arctared fescue. Application in the Panoramic Fields was 25–27 May and in the Gerstle Fields 27 May–2 June.

Approximately 400 acres were planted with oats in the Panoramic Fields. They were planted on 17 and 29 June and 3 July to provide a variety of maturation dates and forage quality. Fertilizer purchases for perennial grasses and oat plantings totaled $26,264.

Oats were planted in acreage that had been heavily infested with bluejoint reedgrass (*Calamagrostis canadensis*) and had been disked and fallowed annually since 1993 in an attempt to kill bluejoint with nonherbicidal methods. Acreage infested with bluejoint was initially disked 2–3 times during the summer with a heavy field disk to expose the bluejoint root system to desiccation. The acreage was left fallow overwinter to subject the exposed root systems to overwinter freezing and further desiccation to reduce overwinter survival of the plants. The areas were then disked annually to further break up the root clumps and expose the root systems before being planting with oats.

Nonherbicidal control of bluejoint was also tested in the Panoramic Fields by mechanical mowing with a disk mower. Mowing was conducted on acreage that had been mowed 2–3 times each year in previous years. The test areas were mowed on 24–25 June, 18 July, and 18 August.

Approximately 635 acres were mowed with a brush hog mower to remove aspen and willow growth, including approximately 200 acres in the Panoramic Fields and 435 acres in the Gerstle Fields. Maximum basal diameter of the woody vegetation was approximately 3 inches.

Test plantings of 10 acres each of red clover, enigmo timothy, and carlton bromegrass were mowed on 15 July to provide regrowth of each when bison arrived in the Panoramic Fields.

Additional bison attractants provided on the DJBR included 3 stock watering tanks with total capacity of 1820 gallons and numerous 50-lb trace element salt blocks placed at various locations.

1999

We fertilized 720 acres of nugget bluegrass and 80 acres of arctared fescue. Application in the Panoramic Fields was during 17–18 May and in the Gerstle Field 19–25 May. Approximately 80 acres of bluegrass in the Panoramic Fields was fertilized a second time on 15 June to test effects of an additional application on fall forage quality.

Approximately 375 acres were planted with oats in the Panoramic Fields. Oats were planted on 16, 25, and 30 June to provide a variety of maturation dates and forage quality. They were planted in acreage that had been heavily infested with bluejoint and had been disked and fallowed annually since 1993 to kill bluejoint with nonherbicidal methods. Fertilizer purchases for perennial grasses and oat plantings totaled $26,264.

Nonherbicidal control of bluejoint reedgrass was also tested in the Panoramic Fields by mechanical mowing with a disk mower. Mowing was conducted on acreage that had been mowed 2–3 times each year in previous years. The test areas were only mowed 1 time on 7–8 July.

Approximately 640 acres were mowed with a brush hog mower to remove aspen and willow growth, including approximately 200 acres in the Panoramic Fields and 440 acres in the Gerstle Fields. Maximum basal diameter of the woody vegetation was 3 inches.

Test plantings of 10 acres each of red clover, enigmo timothy, and carlton bromegrass were mowed on 15 July. One-half of each 10-acre plot was mowed to test bison preference for mowed versus unmowed forage when they arrived in the Panoramic Fields.

A winter forage technique called swath grazing was tested in the Panoramic Fields. Approximately 30 acres of oats planted on 16 June were swathed on 27 August. Oats were swathed by cutting the grain with a swathing mower in alternating rows with unswathed oats to test bison preference for each. Rows were approximately 40 ft wide by ½ mi long. The swathed oats should retain higher forage quality through the winter, and thus be more palatable to bison than oats that senesce through the fall. Swath grazing may be useful to attract bison to the DJBR for longer periods of time during the winter, reducing winter conflicts in the DAP and making them more accessible to hunters.

Additional bison attractants provided on the DJBR included 3 stock watering tanks with total capacity of 1820 gal and numerous 50-lb trace element salt blocks placed at various locations. An additional 300 gal capacity water tank was placed at the east end of the Panoramic Fields to provide an additional water source in that area.

2000

We fertilized 720 acres of nugget bluegrass and 50 acres of arctared fescue. Application in the Panoramic Fields was during 22–23 May and in the Gerstle Fields during 31 May–7 June. Fertilizer purchases for perennial grasses totaled $14,460.

Approximately 350 acres were disked and prepared for planting with oats. Approximately 260 acres of oats had been planted at the time of this report. Oats were planted on 8 June (75 acre), 20 June (50 acre), 23 June (75 acre), and 29 June (60 acre). Fertilizer purchases totaled $6595 for oat plantings at the time of this report.

HERD MANAGEMENT

Population Status and Trend

We used aerial censuses to estimate herd size. A Piper Super Cub (PA-18) or Bellanca Scout fixed-wing aircraft, or a Robinson R-22 helicopter 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. We conducted replicate censuses and considered the prehunt population size to be the maximum number of bison counted during a single census.

A precalving population estimate was obtained 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 from the ground by locating groups containing radiocollared bison. We determined the sex and age of bison by observing them with 8×40 binoculars or a 15–60 power spotting scope. Bulls were differentiated from cows by body size, head size, pelage, circumference of horn bases, horn shape, and presence of a penis sheath. Yearling bulls were differentiated from adult bulls by horn size and shape. We conducted multiple surveys, and the survey that resulted in the largest sample size was used to calculate composition data. Composition data were summarized by regulatory year (RY = 1 Jul through 30 Jun, e.g., RY98 = 1 Jul 1998 through 30 Jun 1999).

In fall 1997 and 1999, bulls were further classified into 4 different horn categories to evaluate the possibility of determining age structure for the bull segment of the population based on horn morphology. Yearlings were bulls with straight horns, without any upward curvature. "Tweens" were young bulls with horn tips that were starting to curve upward (vertically relative to the horn base) but were not pointing straight up. "Spikes" were bulls with horn tips turned 90° vertical, relative to the horn bases. "Mature" bulls were those with horns whose tips curved inward toward the center of the skull. To aid in the classification of age relative to horn shape, photographs were taken of all bison and were viewed by hunters at the department's Delta Junction office. Horn morphology relative to age will be evaluated by comparing horn shape to age based on tooth eruption and wear.

Fuller (1959) classified bull age categories as: calf, < 1-year-old; yearlings, 1–2 years old; spike-horns, 2-, 3-, and some 4-year-olds; young adults, 4 years old to possibly 7 or 8 years old; and adults and aged, >7 or 8 years old. Fuller reported that for male wood bison, yearlings were easily identifiable based on body size and horn shape, 2- to 3-year-olds were difficult to distinguish from each other and may be difficult to differentiate from some bison up to 4 years old. Adults older than 7–8 years old were identified by blunted and shredded horn tips.

The Canadian wood bison recovery team (Taxonomy Subcommittee of the Wood Bison Recovery Team 1991) illustrates and describes bison horn morphology as:

- Calf
- Yearling
- B1 juvenile: age 2–3 years; horn tips point straight up
- B2 subadult: age 4–6 years; horn tips point straight up or slightly curved
- B3 adult: age 7,8, or older; horn tips curved inward, smooth with no steps in horn
- B4 prime: age older than B3; horn tips curved inward, step in the horns a short distance from the tips, light to moderately broomed
- B5 old: older than B4; horn tips heavily broomed

Berger and Cunningham (1994), studying marked plains bison, aged bulls as calves, yearlings, 2-year olds, or adults. Adults were classified as "spikes" having upturned horns, or "bulls" having horns curved inward or worn short. They further classified "spikes" as young, 2–3 years old; medium, 3–4 years old; and old, 4–5 years old. "Bulls" were further classified as young, 5–6 years old; prime, 7–12 years old; and old, >13 years old.

Distribution and Movements

We monitored bison movements by locating radiocollared bison and from reports of people observing and reporting bison moving through the area. We located radiocollared bison from the ground by using a single antenna and listening for peak signal strength to determine general location. We also obtained more precise aerial locations using aircraft.

We captured bison to attach radio collars by immobilizing with darts from a Cap-Chur rifle. Darts were loaded with 5 mg carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colorado USA) and 60 mg xylazine hydrochloride (Anased®, Lloyd Laboratories, Shenandoah, Iowa USA). Once immobilized, bison were fitted with radio collars. After collaring, they were given an intramuscular injection of naltrexone hydrochloride (Trexonil®, Wildlife Pharmaceuticals) at a dose of 100 mg naltrexone citrate/mg carfentanil citrate to reverse the immobilization.

When bison first migrate from the area of the Delta River to the DJBR, they can be approached with a vehicle. On 31 July and 4 August 1997, we used a truck to slowly approach within 50 to

75 feet of bison and fire a syringe from a Cap-Chur rifle. On 24 June 1999, bison were darted from a Robinson R-22 helicopter.

Disease Management

Bison hunters were asked to collect approximately 30 ml of blood from their kills. These samples were centrifuged and serum was removed by aspiration. Sera were frozen until tested for diseases that included epizootic hemorrhagic disease, bluetongue, infectious bovine rhinotracheitis, bovine viral diarrhea, respiratory syncytial virus, parainfluenza 3, *Brucella suis* IV, *Leptospira interrogans*, *Toxoplasma gondii*, and Q fever. Samples of uncoagulated whole blood were also collected for future genetic work.

Harvest Management

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

Bison hunters were required to check out within 24 hours after their hunt. They completed a questionnaire concerning date and location of kill, number of days afield, number of shots required, weight of bullet, and caliber of weapon. If hunters checked out after normal office hours, they put the 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, we examined the carcass to record tooth eruption and to extract an I1 tooth from bison that had all permanent teeth. We sent teeth to Matson Laboratories (PO Box 308, Milltown, Montana 59851) for aging. Horns were measured according to the Boone and Crockett Club scoring system and photographed.

Bison Viewing

A bison viewing informational sign was erected at Milepost 227 Richardson Highway at the Black Rapids Glacier pullout. The sign was a cooperative project between the department and the Alaska Department of Transportation and Public Facilities (DOT&PF), and DOT&PF provided funding for the sign.

RESULTS AND DISCUSSION

MANAGEMENT GOALS AND OBJECTIVES

The department began work in July 1998 to update the 1993–1998 Delta Bison Management Plan. A meeting of the citizen's Delta Bison Work Group (DBWG) was held on 29 July 1998 to began the planning process. Additional planning meetings were held on 4 August, 27 October, and 10 December 1998, and 19 January, 16 February, and 17 March 1999. A public meeting was held in Delta Junction on 18 November 1998 to gather public comments and concerns about bison management and the planning process. A draft 2000–2005 Delta Bison Management Plan was developed for public review and presentation to the Alaska Board of Game.

The 2000–2005 Delta Bison Management Plan was approved by the Alaska Board of Game in March 2000 as discussed in board actions below. The plan had the following goals and objectives that will be implemented during the next reporting period.

Goal: Ensure that the DBH remains healthy and free of any diseases that might threaten the herd or other wildlife species.

Objective 1: Monitor the DBH by collecting at least 30 serum samples annually and test them if funding is available to determine if any diseases are present that might threaten the health of the herd or other wildlife species.

Goal: Manage the DBH to accomplish a reasonable balance between providing the greatest opportunity to hunt and view bison while keeping negative impacts to private property at a minimum.

Objective 1: Manage the DBH to maintain a herd size of approximately 360 bison at the precalving count.

Objective 2: Manage the DBH to maintain a sex ratio of no less than 50 bulls (≥ 1-year-old):100 cows.

Goal: Minimize conflicts between bison and the public, including but not limited to agriculture interests, in the Delta Junction area.

Objective 1: Administer the Delta bison hunt by opening the hunting season on October 1 each year to minimize landowner/hunter conflicts to help maintain bison and hunter access to private agricultural land to the greatest extent possible.

Objective 2: Manage the DJBR to encourage the DBH to remain south of the Alaska Highway and out of private agricultural land as late in the fall as possible and to attract more bison to the DJBR in the winter and provide greater accessibility to the herd for hunters by using Delta bison permit application fees to manage the DJBR.

Goal: Provide opportunities for nonconsumptive enjoyment of the DBH, such as bison viewing, interpretation, and education.

Objective 1: Investigate methods and funding sources other than bison permit fees to improve bison viewing opportunities for the public.

POPULATION STATUS AND TREND

Population Size

RY97. Estimated prehunt population in fall 1997 was 474 bison (Table 1) from surveys flown on 2 May; 23, 25, and 30 June; 29 August; and 5 September 1997. The highest count was achieved during the 30 June survey while the bison were along the Delta River. Estimated precalving population in spring 1998 was 349, which was approximately 3% below the population objective.

RY98. Estimated prehunt population during fall 1998 was 414–471 (Table 1), based on bison surveys flown on 16, 25, and 26 June; 19 and 20 August; and 22 September 1998. The highest count was achieved during the 25 June count while the bison were along the Delta River. However, this count of 471 may have been erroneous, with a group of bison possibly being counted twice. The next highest count was 414 on 19 August in the DAP. However, this count did not include 1 radiocollared bison and an unknown number of other bison located in forest canopies and not seen, resulting in a low count. Estimated precalving population in spring 1999 was 335–393, depending on the prehunt population size used to calculate the precalving estimate. Because of the uncertainty of the population estimate, I was unable to evaluate accomplishment of the population objective.

RY99. Estimated prehunt population size in fall 1999 was 434 bison (Table 1) from surveys flown on 20 May; 11 June; 11 and 26 August; and 16, 22, and 29 September 1999. The highest count was achieved during the 29 September survey when the bison were located in the DAP. Estimated precalving population in spring 2000 was 359, which essentially met the population objective.

One aerial census was flown on 30 May 2000 to estimate the RY00 prehunt population size. We counted 373 bison. We will fly additional surveys during summer and fall 2000.

Population Composition

RY97. We calculated sex and age composition from a sample of 200 bison counted on 11 September 1997. Calf survival was good with 47 calves:100 cows. Calves were 24% of the sample. Adult and yearling cows composed 50% of the observed herd (Table 2).

The bull:cow ratio was 53:100, which met the objective, and bulls ≥1-year-old composed 25% of the observed population. The yearling bull:cow ratio was 3:100 and was much lower than in previous years, possibly due to attempts to distinguish yearling from "tween" bulls. Forty-nine bulls were observed during composition surveys. The largest bull age class (45% of all bulls) was "tween" bulls (Table 3). Berger and Cunningham (1994) report large overlap in this category, with bulls ranging from 2–5 years old. "Mature" bulls, with horns turning inward, composed 12% of the DBH bull population. Berger and Cunningham (1994) classified adult bulls as those that had "horns curving tightly around the head or worn short," and further subdivided them as young bulls (5 or 6 years old), prime (7–12 years old), and old (> 13 years old). We saw no bulls with horns curved tightly around the head or worn short. Therefore, our "mature" bulls probably correlated most closely with Berger and Cunningham's "old spikes" or "young adults," and were probably 4–6 years old. These results will be compared with photographs and tooth replacement to estimate horn/age relationships for the DBH. However, based on horn morphology, we saw no bulls as old as Berger and Cunningham's "prime adult bulls." Prime adult bulls are rare in the herd.

RY98. We calculated sex and age composition from a sample of 354 bison counted on 23 and 24 September 1998. Calf survival was good with 53 calves:100 cows, and calves composed 27% of the sampled population. The bull:cow ratio was 48:100 which met the objective, and bulls ≥1-year-old composed 19% of the observed population. The yearling bull:cow ratio increased from

last year to 9:100. Adult and yearling cows composed 50% of the herd (Table 2). Bull horn morphology was not recorded during this regulatory year.

RY99. We calculated sex and age composition from a sample of 270 bison counted on 9 and 10 September 1999. Calf survival was good with 43 calves:100 cows, and calves composed 22% of the sampled population. Adult and yearling cows composed 51% of the herd (Table 2).

The bull:cow ratio was 54:100, which met the objective, and bulls $\geq$ 1-year-old composed 22% of the observed population. The yearling bull:cow ratio of 8:100 was similar to last year's ratio. We observed 74 bulls during composition surveys; 15 of these were not classified by horn morphology. Based on the sample of 59 classified bulls, "tweens" were the largest component, composing 44% of all bulls (Table 3).

Distribution and Movements

RY97. On 3 July 1997, ground tracking indicated that most radiocollared bison were located on the west side of the Delta River in the general vicinity of Buffalo Dome. On 18 July, radiocollared bison had moved north along the Delta River and were located generally in the area of Texas Range on Fort Greely.

Bison began moving from the Delta River area to the DJBR about 24 July. Ground tracking that day indicated that most radiocollared bison were located along the Delta River generally between Texas Range and opposite of Big Lake. However, 1 radiocollared bison (150.973) was heard east of Windy Ridge on Fort Greely, and this bison may have been east of the Richardson Highway. One radiocollared bison was first located on the Panoramic Fields on 31 July. A group of 60 bison were located on the Panoramic Fields of the DJBR on 27 July with 1 radiocollared bison that had been on the Delta River east of Big Lake on 24 July. Ground tracking on 28 July located only 1 radiocollared bison along the Delta River, but this bison was located on the Panoramic Fields on 30 July. Bison were first located in the Gerstle Fields on 5 August.

The first bison were seen in the DAP on 10 August, when about 200 were located in Tract M. At the time, there was an abundance of high quality forage remaining on the DJBR, so bison did not leave the DJBR due to lack of forage.

On the same day, we located 75 bison in the Gerstle Fields and 30 in the Panoramic Fields. The large group of 200 that were in the DAP returned to the Gerstle Fields on 13 August. Bison continued to move between the DAP and the DJBR through early October. On 29 August and 5 September during aerial censuses, 4 of 5 aggregations were seen in the DAP and 1 of 5 were seen in the DJBR each day, respectively. However, 6 radiocollared bison were located in the Panoramic Fields on 29 September and again on 1 October.

Data is not available to determine when bison moved from the DAP/DJBR area to the Delta River in spring 1998. However, on 14 April 1998, 9 of 14 radiocollared bison were located on the Delta River, and Delta farmer Scott Schultz reported 12 bison on his farm in the DAP, indicating bison were present in both areas.

During ground tracking on 11 June 1998, radiocollared bison were distributed along the Delta River from the vicinity of Black Rapids Glacier to the Texas/Washington Range area on Fort Greely. During an aerial bison census on 16 June, bison were generally located in the Texas/Washington Range area, with a small group of 9 bison on the Buffalo Dome flats on the west side of the Delta River. Bison were also located along the Delta River on aerial census flights on 25 and 26 June 1998.

We immobilized and radiocollared 3 cow bison on 31 July and 4 August 1997. Immobilizing the bison from a truck worked well. By slowly and patiently approaching them during 30–60 min, it was possible to approach a herd and have them remain relatively calm. After darting, induction times were 3 min 45 sec, 4 min 39 sec, and unknown for the third bison. Time required to attach the radio collar and process each animal was 10–20 min. Recovery time after an intramuscular injection of naltrexone was 5 min 29 sec for 1 animal, and approximately 7 min for the other 2. There were no postcapture mortalities.

RY98. On 9 July 1998, radiocollared bison were located from the ground and were along the Delta River from near McGinnis Creek to the Texas/Washington Range area on Fort Greely, although 6 of 14 could not be located. As recently as 29 June 1998, most of the radiocollared bison had been further downstream along the Delta River. However, it appeared that a significant amount of military testing between 29 June and 9 July had caused many to move upstream away from the Texas/Washington Range area. On 16 July military personnel reported seeing more than 100 at Black Rapids Glacier and 80–100 on Texas Range. On 24 July a helicopter pilot reported counting 92 bison at Black Rapids Glacier.

Bison were first observed on the DJBR on 14 July 1998, when 7–8 were spotted in the Panoramic Fields. On 20 July, 3 radiocollared bison were located but not seen west of the Panoramic Fields. From 20 July–4 August, only a few small groups were present on the DJBR. On 4 August 1998, 7 radiocollared bison were located in a group of approximately 100 in the Panoramic Fields, and by 8 August a group of 150 was present in the Panoramic Fields.

The first bison located in the Gerstle Fields was a group containing 9 radiocollared animals on 12 August 1998. Bison continued to move between the Panoramic and Gerstle Fields through the fall.

Bison were first reported in the DAP on 16 August 1998 when approximately 200 moved into Tract M. At the time, there was an abundance of high-quality forage remaining on the DJBR, so bison did not leave the DJBR due to lack of forage.

During an aerial census flight on 19 August, 29 bison were seen in the Gerstle Fields and the remainder were in the DAP. During aerial census flights on 20 August and 22 September, all bison were seen in the DAP.

Visual observations indicate that bison use of the DJBR increased in February and March 1999. Also, they began moving west toward the Delta River in February. On 22 February, approximately 100 were seen moving west near Butch Lake, close to Jarvis Creek. On 26 February, "many" bison were reported near Washington Range on Fort Greely. Several sets of

bison tracks were seen in the 33-Mile Loop Road area of Fort Greely approximately 25–27 February 1999 (J Hicks, pers commun). On 26 February, a hunter killed a bison near the Richardson Highway at the "12-mile crossing trail." On 4 March 1999, I saw extensive tracking along the Tanana River between DAP Tracks 1, 8, and 9. I also saw tracks of 10–20 bison that crossed from the south to the north bank of the Tanana River east of Tracts 8 and 9.

Five adult cows were immobilized on 24 June. Immobilization times for 4 bison were 2–8 min when darting sites were a large muscle mass in the hindquarter. One bison was hit in the ribs and was not immobilized after 15 min. The animal required additional carfentanil for immobilization. Process time for the bison was 6–32 min for 3 bison and was unknown for 2 bison. After an intramuscular injection of naltrexone, recovery time was 4–8 min for 4 bison, and no data was recorded for 1 bison.

RY99. Although the DBH began moving toward the Delta River in February 2000, a few animals were still east of the Richardson Highway long after most of the animals had migrated west. A group of 9 bison were seen moving south along Granite Creek near the base of the Granite Mountains on 5 May. A group of 5 females and 3 newborn calves were seen on approximately 20 May on DAP Tracts 4, 5, and H (S Schultz, pers commun). This was the first report of bison calving in the DAP that I am aware of.

A group of 10 bison were seen on the Panoramic Fields during 30 May–12 June. During an aerial census flight on 30 May, most bison were distributed along the Delta River from Buffalo Dome to approximately 2.5 mi north of Bolio Lake, with some bison also in the Texas Range area of Fort Greely.

Three female bison were darted from a Robinson R-22 helicopter on 28 July and fitted with radio collars. Induction time was 3–4 min. After an intramuscular injection of naltrexone, recovery time was 4–7 min. There were no postcapture mortalities.

MORTALITY

Harvest

Season and Bag Limit. The resident and nonresident bison hunting season was 20 July–31 March during the RY97, RY98, and RY99 hunting seasons. Hunting did not begin until 1 October each year so farmers in the DAP could finish harvesting their crops. However, the 1 October opening date beginning in RY97 was a change from a 7 October opening date in previous years. The opening date of the hunt was changed to 1 October to allow more hunters into the field while hunting conditions were better and when it was easier to identify the sex of bison. The goals of this change were to increase hunter success early in the season and reduce the number of hunters that killed bison of the wrong sex. Hunter orientations were also scheduled every 5 days instead of every 7 days, as in previous years, to give hunters more chance to hunt early in the season. The RY99 season was extended by emergency order to 15 April to allow additional harvest of bison during that year.

Participation in the hunt was by drawing permit. Hunt DI403 was for bulls only, and hunt DI404 was for cows only. The following conditions applied to each permit:

- Permittees were required to attend an orientation course before hunting.
- Permittees were assigned specified periods to begin hunting that were determined by the order permits were drawn.
- Permittees were required to use a rifle capable of shooting a 200-grain bullet with 2000 ft/lb of retained energy at 100 yards. Bows had to comply with 5 AAC 92.075(4) to be legal means of harvest. Crossbows were prohibited. Certain muzzle loading firearms qualified.

Additional permits were issued some years by the department and the Governor's office to Alaska Fish and Wildlife Safeguard and the Foundation for North American Wild Sheep. These permits were raffled by each organization to raise funds. Recipients of these permits were required to follow all regulations and permit conditions that applied to the drawing permits. These hunts are designated as DI405.

RY97 — During RY97, we issued 130 permits, 60 for the bull-only hunt (DI403) and 70 for the cow-only hunt (DI404) (Table 4).

RY98 — During the RY98, we issued 102 permits, 45 for the bull-only hunt (DI403) and 55 for the cow-only hunt (DI404) (Table 4). In addition, Alaska Fish and Wildlife Safeguard was authorized to raffle 1 permit, and 1 Governor's permit was issued.

RY99 — During RY99, we issued 101 permits, 50 for the bull-only hunt (DI403) and 50 for the cow-only hunt (DI404). One permit was also issued to Alaska Fish and Wildlife Safeguard (Table 4).

Board of Game Actions and Emergency Orders. At their March 1998 meeting, the Board of Game considered a proposal from the department to increase the maximum number of permits that may be issued for bison in Unit 20D from 150 to 200. The board adopted the proposal.

At the March 2000 Board of Game meeting, the department presented the draft 2000–2005 Delta Bison Management Plan for review and approval. The board adopted the plan with no recommended changes. The board also considered and did not adopt a public proposal to establish a 1 October–31 March hunting season for muzzleloader hunting only.

The hunting season was changed by emergency order during RY99. The closing date was extended from 31 March to 15 April to allow the opportunity for hunters to harvest additional bison. Anticipated harvest was lower than expected and additional harvest was desirable to accomplish the precalving population objective.

Human-Induced Mortality.

RY97 — Total human-induced mortality was 135 bison. Hunters reported killing 118 (57 bulls and 61 cows), estimated wounding loss was 9 (7%), and 8 were found dead, probably from wounding (Table 5).

Hunters with bull permits (DI403) killed 51 bulls and 2 cows. Hunters with cow permits (DI404) killed 59 cows and 6 bulls (Table 4). Of the 126 DI403 and DI404 permit recipients that actually hunted, 8 (6%) killed bison of the wrong sex.

Successful hunters with bull permits (DI403) hunted a mean of 5.6 days, and unsuccessful hunters hunted a mean of 9.0 days. Successful hunters with cow permits (DI404) hunted a mean of 4.4 days, and unsuccessful hunters hunted a mean of 9.7 days (Table 6).

The most commonly used firearm continued to be a 338-caliber rifle, used by 41% of successful hunters. Other commonly used firearms included the 300 Winchester Magnum (14%), 30-06 (14%), and 375 H&H (9%) (Table 7).

RY98 — Total human-induced mortality was 83 bison. Hunters killed 72 (27 bulls, 44 cows, and 1 unknown sex), estimated wounding loss was 7 (7%), and loss from other causes was 4 (Table 5). Hunters with bull-only permits (DI403) killed 26 bulls, 4 cows, and 1 bison of unknown sex. Hunters with cow-only permits (DI404) killed 39 cows and 0 bulls (Table 4). Of the 96 DI403 and DI404 permit recipients that actually hunted, 4 (4%) killed bison of the wrong sex.

Two special use permits were issued during RY98. A permit was issued to Alaska Fish and Wildlife Safeguard who raffled it to a hunter who killed a cow. A Governor's permit was issued to the Foundation for North American Wildlife Sheep who raffled it to a hunter who killed a bull (Table 4).

Successful hunters with bull permits (DI403) hunted a mean of 6.0 days, and unsuccessful hunters hunted a mean of 9.4 days. Successful hunters with cow permits (DI404) hunted a mean of 7.0 days, and unsuccessful hunters hunted a mean of 10.4 days (Table 6).

Firearm data used by successful hunters was not available for RY98 (Table 7).

RY99 — Human-induced mortality was 77 bison. Hunters killed 67 (30 bulls and 37 cows), estimated wounding loss was 7 (7%), and loss from other causes was 3 (Table 5). Hunters with bull-only permits (DI403) killed 29 bulls and 3 cows, and hunters with cow-only permits (DI404) killed 34 cows and 0 bulls. Of the 96 DI403 and DI404 permit recipients that hunted, 3 (3%) killed bison of the wrong sex. One special use permit was issued to Alaska Fish and Wildlife Safeguard, and the hunter who received the permit killed a bull (Table 4).

Successful hunters with bull permits (DI403) hunted a mean of 7.0 days, and unsuccessful hunters hunted a mean of 14.1 days. Successful hunters with cow permits (DI404) hunted a mean of 6.7 days, and unsuccessful hunters hunted a mean of 22.8 days (Table 6).

The .338 caliber rifle continued to be the most popular weapon used during the hunt, with 375 H&H, 300 Winchester Magnum, and 30-06 caliber rifles also common (Table 7).

Permit Hunts. The number of permits is critical to DJBR operating funds because this is the only funding source for DJBR management at this time, and legislative intent is that $5 from each application be used for DJBR management. The number of applications for Delta bison permits decreased from the all time high of 17,895 in 1996 to 15,479 applications in 1997, even though

the number of drawing permits increased to 130 in 1997. The number of applications has continued to fluctuate at a relatively high number with 16,188 in 1998 and 15,443 in 1999 (Table 8).

Hunter Residency and Success.

RY97 — Most Delta bison hunters were residents of Alaska and did not live in Unit 20D. They were 85% of all permittees that hunted. Four percent of permittees that hunted were local residents, residing within Unit 20D (Table 9). Data indicate that 12 hunters were nonresidents; however, I believe this is a data coding error, and the actual number was significantly less. Permittees that hunted had a 94% success rate. Three percent of all permit recipients did not hunt, 91% of all recipients were successful, and 6% were unsuccessful (Table 4).

RY98 — Most Delta bison hunters continued to be nonlocal Alaskan residents, with 99% of all hunters residing outside of Unit 20D (Table 9). Permittees that hunted had a 74% success rate. This was a substantial decrease from the previous 12 years, when hunter success was 90–100%.

Seventy-one percent of all permit recipients killed bison, 26% were unsuccessful, and 4% did not hunt (Table 4).

RY99 — Most Delta bison hunters continued to be nonlocal Alaskan residents, with 98% of all hunters residing outside of Unit 20D (Table 9). Permittees that hunted had a 69% success rate, which is a continuation of the decreased hunter success since RY98. Sixty-six percent of all permit recipients killed bison, 30% were unsuccessful, and 4% did not hunt (Table 4).

Decreased hunter success in RY98 and RY99 may have been due to a combination of below average snowfall and recent wildland fires, which allowed bison better access to winter forage outside of the agricultural fields. In these winters, I observed numerous bison tracks in the Granite Creek (1987) and Hajdukovich Creek (1994) burns and in natural areas such as dry ponds vegetated with bluejoint. Average late March–early April snowfall at the Natural Resource Conservation Service Granite Creek snow depth survey site was 17.8 inches during 1968–2000. Snow depth was 12 inches on 1 April 1999 and 16 inches on 1 April 2000. Therefore, because shallow snow made forage within the wildland burns and other nonagricultural sites more accessible, hunting pressure may have forced bison to feed more extensively in nonagricultural areas which are less accessible to hunters.

Several other factors may also be contributing to lower hunter success rates. Bison may be harder to find. Hunters in recent years have commented that bison are spending a lot of time in forested areas instead of cleared land (this may also be a result of below average snowfall) and feeding nocturnally within the agricultural areas. Hunters may be having more difficulty determining the correct sex of bison. The age of bulls in the herd has probably decreased in recent years, and the younger bulls are more difficult to differentiate from cows than older bulls, prolonging hunting effort and lowering success. Also, hunters are losing access, and hunting fees are increasing for private farmland in the DAP. As the tracts of land in the DAP have been resold in recent years, they have commonly been subdivided into smaller parcels. Hunters are forced to contact more landowners for permission to hunt. During a hunt it is more difficult for hunters to determine

parcel boundaries, especially when bison move more quickly from 1 parcel to another, complicating hunters' chances of acquiring permission to hunt on private property and ultimately reducing hunter success.

Harvest Chronology.

RY97 — Harvest occurred during nearly the entire hunting season (1 Oct–31 Mar). However, most bison (72%) were taken during October and November. The rate of harvest was slow (14%) during December–February when severe weather and little daylight make hunting difficult. The rate of harvest increased (14%) in March when hunting conditions improved (Table 10).

RY98 — Harvest chronology was similar to chronology in previous years, with most harvest (61%) in October and November and with rate of harvest slowing during December–February and increasing during March (Table 10).

RY99 — Harvest chronology was similar to chronology in previous years, with most harvest (58%) in October and November and with rate of harvest slowing during December–February and increasing during March (Table 10).

Transport Methods.

RY98 — Successful bison hunters used highway vehicles most commonly (59%), while another 33% of successful hunters used snowmachines; these modes of transportation continue to be the 2 most common (Table 11).

RY98 — Again, most successful hunters (74%) used highway vehicles, while 19% of successful hunters used snowmachines (Table 11).

RY98 — Successful bison hunters used highway vehicles most commonly (58%), while another 33% of successful hunters used snowmachines; these modes of transportation continue to be the 2 most common (Table 11).

Harvest Locations.

RY97 — Most bison continued to be killed on private property in the DAP. During RY97, 70% were killed in the DAP, 21% were killed on the DJBR, 4% were killed in other locations, and 4% were killed in unknown locations (Table 12).

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 RY89 because more farmers charge access fees to bison hunters, and others are closing their property to hunters.

RY98 — Data on location of kill were not available (Table 12).

RY99 — Most bison (51%) continue to be killed on private property in the DAP; however, the proportion of bison killed in this area decreased from 95% in RY89 to 51% in RY99 (Table 12).

The number of bison killed on the DJBR was similar to recent years, with 29% of bison killed there. However, this relatively high kill rate on the DJBR reflects forage management practices aimed at providing overwinter forage on the DJBR to attract bison there during the hunting season. Also, the number of bison killed in other areas increased substantially this year, with 19% of all bison killed in "other" areas. Most of these were killed west of the DJBR in the Granite Creek-Jarvis Creek area as bison migrated toward the Delta River during the extended hunting season. There were also several bison killed this year on state land in the Gerstle River greenbelt through the DAP.

Other Mortality

Natural mortality has not been quantified for the DBH. Humans caused most nonhunting mortality through road kills, trapper snares, and other factors.

Disease Management

Disease transmission from domestic livestock in the Delta Junction area is the greatest potential source of nonhunting mortality. Cattle in the area have had infectious bovine rhinotracheitis, bovine viral diarrhea, bovine respiratory syncytial virus, infectious bovine kerato conjunctivitis, parainfluenza 3 (PI3), Johne's disease, and Neospora caninum (D Quarberg and C Crusberg, pers commun). During this reporting period, serum test results were received for 169 samples collected during 1996, 1997, and 1998. Testing was conducted for only *Brucella suis* IV and *Toxoplasma gondii* because of reduced funding for serology. All samples were negative (Table 13).

HABITAT

1998 DJBR Habitat Management

Bluegrass and oats produced on the DJBR were high quality based on forage analysis and were similar or better than forage samples collected in the DAP. Bison first moved into Tract M of the DAP on 16 August. To compare DJBR and Tract M forage at about that time, forage samples were collected on the DJBR on 24 August and in Tract M on 27 August. Bluegrass in the DJBR was higher quality at the time than perennial grass (timothy) in Tract M. Bluegrass samples collected in the Panoramic Fields of the DJBR were 10.4% and 12.8% crude protein (CP) and 28.0% and 30.5% acid-detergent fiber (ADF). Bluegrass in the Gerstle Fields was slightly lower quality than in the Panoramic Fields, with 9.5% CP and 31.4% ADF (Table 14). Timothy in Tract M, where bison first moved into the DAP, had lower forage quality values than DJBR bluegrass (Table 14). Oats in the Panoramic Fields were very high quality with 17.8–34.5% CP and 20.5–31.4% ADF, compared to barley in Tract M with 10.7% CP and 30.0% ADF (Table 14). When bison left the DJBR and moved into Tract M, there was an abundance of high-quality forage remaining in the DJBR. Therefore, it appears that bison did not leave the DJBR and move into the DAP in search of high-quality forage, and other factors were probably responsible for their movement.

A controlled burn was conducted on approximately 508 acres in the Panoramic Fields on 21 May. Vegetation in the burn site consisted of bluejoint approximately 3–4 ft tall, surrounded by shorter vegetation of primarily nugget bluegrass. Relative humidity was approximately 28%

with 5–9 mph wind. The purpose of the burn was to recycle soil nutrients and to remove decadent vegetative material to facilitate disking the soil and planting oats. The fire successfully burned through the duff layer.

Mowing bluejoint test plots 3 times per year since 1995 has not stressed the bluejoint sufficiently to eliminate it from the area. However, the plants appeared shorter and had fewer tillers late in the growing season than when mowing trials began (Table 15). The second nonherbicidal method tested for eliminating bluejoint has been more successful. After several years of disking and fallowing large plots infested with bluejoint, the bluejoint has been progressively eliminated from the plots.

Test plantings of red clover, engimo timothy, and carlton bromegrass survived the previous winter. Of the 3 species, bison appeared to prefer red clover. However, none of the 3 species appeared to be preferred more than nugget bluegrass.

Bison first arrived on the DJBR 14 July 1998 and began moving into the DAP on 16 August. Bison continued to use DJBR forage intermittently through the fall and winter months until they migrated near the Delta River in the spring. Additional details about bison use of the DJBR were discussed earlier in the Distribution and Movements section of this report.

1999 DJBR Habitat Management

Forage samples collected in the DJBR and the DAP were comparable in quality to samples collected in 1998. Oats and barley collected in Tract F of the DAP on 20 August had similar CP (10.3% and 10.4% CP, respectively) but had lower ADF (23.7 and 24.0% ADF, respectively) than barley collected in Tract M in 1998 (Table 14). Bluegrass in the Gerstle Fields of the DJBR had 9.3% CP and 31.2% ADF in 1999, compared to 9.5% CP and 31.4% ADF in 1998.

Forage samples were collected for several forage management tests on the DJBR. Bluegrass in the Panoramic Fields that received 2 applications of fertilizer had a significant increase in forage quality with 20.9% CP and 26.9% ADF on 20 August (Table 14). This bluegrass also produced a larger quantity of forage but there was not an apparent increased use of this area by bison. Test plots of brome had significant quality differences between brome that was mowed on 8 July compared to brome that was not mowed. The mowed brome had 22.8% CP and 30.5% ADF on 20 August compared to the unmowed brome with 5.8% CP and 33.6% ADF. Oats that were swathed on 27 August had 8.8% CP and 33.3% ADF when sampled on 19 October (Table 14). Bison did not prefer swathed oats to unswathed oats overwinter, based on visual observations of postwinter grazing. Part of these results may have been due to a midwinter thawing/freezing cycle that may have made the swathed oats more difficult to graze.

The bluejoint mowing trial was reduced to 1 mowing this year due to time limitations. The grass was mowed on 7–8 July and was 13–24 inches high, generally with 1 tiller and 3 leaves (Table 15).

The second nonherbicidal method of controlling bluejoint, disking and fallowing, is proving more effective than repeated mowing. About 110–120 acres in the northeast corner of the Panoramic Fields was originally planted with nugget bluegrass but became infested with

bluejoint. The field was disked in summer 1993 to eliminate the bluejoint by killing the plants through root desiccation. The acreage has been disked annually and planted with oats for bison forage. Bison grazed the oats during fall, and the soil was then left fallow overwinter in an attempt to reduce overwinter survival of bluejoint by root desiccation. In 1995 visual estimates indicated that about 75% of the bluejoint had been eliminated. We continued disking and fallowing the acreage to determine the time required to eliminate bluejoint. In summer 1999 we estimated that bluejoint was growing on only 1–5% of the acreage and attempts to reduce it further through fallowing were not efficient. The acreage will be replanted to bluegrass in summer 2000. Earlier attempts to make bluejoint more palatable for bison (and a preferred forage species) through mowing and fertilizing were ineffective. Therefore, it appears that the most practical nonherbicidal method of controlling bluejoint on the DJBR is through disking and fallowing over a 3–7 year period, depending on the degree of elimination required.

Test plantings of red clover, engimo timothy, and carlton bromegrass from 1996 survived the winter. The test plantings were each mowed on 8 July to provide bison with higher quality regrowth to determine forage preference for these species. When bison arrived on the DJBR, they grazed most extensively on the mowed red clover and did not graze the unmowed grasses. However, the bison did not appear to prefer the mowed red clover to the nugget bluegrass elsewhere on the DJBR. Therefore, any acreage planted to perennial grasses in the near future will be planted with nugget bluegrass.

Approximately 640 acres of trees and brush were cut using a brush hog mower.

2000 DJBR Habitat Management

Results of summer 2000 DJBR habitat management practices were not available at the time of this report.

Bison Viewing

The Black Rapids Glacier viewing site at Richardson Highway milepost 227 was chosen as the location to erect a bison viewing sign because it is an established pullout and bison are very viewable at times from the site during the tourist season.

CONCLUSIONS AND RECOMMENDATIONS

The DBH continues to do well. Herd productivity and survival of calves continue to be good. Precalving herd size was slightly below the objective in RY98 but was essentially met during other years. The bull:cow ratio objective was met all years.

Herd health goals continue to be met; however, the ability to monitor herd serology has been reduced due to funding cuts. DBH serology will continue to be monitored. The serologic health of the DBH continues to be jeopardized by close contact with domestic livestock in the Delta Junction area and by the potential for domestic bison to escape captivity and join the wild herd. Interagency efforts should continue to encourage regulatory changes that provide greater oversight of domestic bison to assure they do not escape captivity and are disease-free.

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 and/or reducing bison movements into the DAP. Specific objectives to keep 75% of bison west of the Richardson Highway until 20 August and keep bison out of the DAP until 1 October were not met. Keeping the bison west of the Richardson Highway until 20 August will be very difficult without habitat improvement in that area. Keeping bison out of the DAP until 1 October is proving to be very difficult, despite the availability of high-quality forage, water, and mineral blocks on the DJBR. Bison do not seem to be leaving the DJBR because of forage limitations.

The Delta Bison Management Plan was updated for 1 July 2000–30 June 2005. New objectives resulting from the planning process will be applied during the next reporting period.

The greatest challenges to DJBR management continue to be 1) controlling the native grass, bluejoint reedgrass (*Calamagrostis canadensis*), and woody regrowth with nonherbicidal techniques; 2) developing more cost-effective forage management techniques; and 3) holding bison on the DJBR as late in the fall as possible. We will continue work to improve these aspects of DJBR management.

Hunter success declined significantly during RY98 and RY99. The decline in hunter success will be monitored closely in the future to determine if it is an anomaly or a trend. During this reporting period, the opening date of the bison hunting season was changed from 7 October to 1 October, and the time interval between hunter orientations was reduced from 7 to 5 days.

The objective to administer the Delta bison hunt to reduce landowner conflicts and to maintain hunter access to private property is only being partially met because more landowners are charging access fees or closing their property to hunters. Efforts will be made to work with landowners to maintain good relations and access for bison hunters. To enhance public viewing of bison, the department placed a bison viewing informational sign along the Richardson Highway.

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Table 1 Delta bison precalving and postcalving population estimates, 1983–2000

Year	Spring precalving[a] population estimate	Fall 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	373	440
1991	378	484[b]
1992	384	482
1993	392	465
1994	340	446[c]
1995	397	485
1996	375	496
1997	381[d]	474
1998	349	414–471
1999	335–393	434
2000	359	

[a] Calculated by subtracting known mortality from previous prehunt population estimate.
[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 in May 1994.
[d] Includes 6 domestic bison that escaped and were incorporated into the herd in April 1997.

Table 2 Delta bison fall ground composition count data and estimated population size, regulatory years 1986–1987 through 1999–2000

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[b]									
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[c]
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[d]
1995–1996	87	22	52	27	42	9	22	231	485
1996–1997	65	13	54	24	46	6	25	279	496[e]
1997–1998	53	3	47	25	50	2	24	200	474
1998–1999	48	9	53	19	50	5	27	354	414–471
1999–2000	54	8	43	22	51	4	22	270	434

[a] Includes yearlings and adult cows.
[b] No data.
[c] Includes 17 domestic bison that escaped and were incorporated into the herd.
[d] Includes 15 domestic bison that escaped and were incorporated into the herd.
[e] Includes 6 domestic bison that escaped and were incorporated into the herd.

Table 3 Percent Delta bull bison with different horn categories based on horn morphology

		Horn Category			
Date	Yearling	Tween	Spike	Old	Total
Sep 1997	6	45	37	12	49
Sep 1999	19	44	27	10	59

Table 4 Delta bison harvest data by permit hunt, regulatory years 1986–1987 through 1999–2000

Hunt/Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful permittees	Percent successful permittees	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
	1995–1996	70	6	10	85	58 (97)	2 (3)	0 (0)	60
	1996–1997	70	4	9	86	53 (88)	7 (12)	0 (0)	60
	1997–1998	60	3	8	88	51 (96)	2 (4)	0 (0)	53
	1998–1999	45	2	29	69	26 (84)	4 (13)	1 (3)	31
	1999–2000	50	2	34	64	29 (91)	3 (9)	0 (0)	32
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
	1995–1996	50	2	6	92	2 (4)	44 (96)	0 (0)	46
	1996–1997	50	0	12	86	3 (7)	40 (93)	0 (0)	43
	1997–1998	70	3	4	93	6 (9)	59 (91)	0 (0)	65
	1998–1999	55	5	24	71	0 (0)	39 (100)	0 (0)	39
	1999–2000	50	6	26	68	0 (0)	34 (100)	0 (0)	34

Hunt/Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful permittees	Percent successful permittees	Bulls (%)	Cows (%)	Unk (%)	Total harvest
405	1998–1999	2[bc]	0	0	100	1 (50)	1 (50)	0 (0)	2
	1999–2000	1[b]	0	0	100	1 (100)	0 (0)	0 (0)	1
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)	0 (0)	38
	1995–1996	120	4	8	88	60 (57)	46 (43)	0 (0)	106
	1996–1997	120	3	10	86	56 (54)	47 (46)	0 (0)	103
	1997–1998	130	3	6	91	57 (48)	61 (52)	0 (0)	118
	1998–1999	102	4	26	71	27 (38)	44 (61)	1 (1)	72
	1999–2000	101	4	30	66	30 (45)	37 (55)	0 (0)	67

[a] Hunt 403 was an either-sex hunt during regulatory years 1989–1990 through 1993–1994.
[b] One permit was issued for an Alaska Fish and Wildlife Safeguard raffle.
[c] One permit was issued for a Governor's permit.

Table 5 Delta bison harvest and accidental death, regulatory years 1986–1987 through 1999–2000

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
1995–1996	60 (57)[b]	46 (43)	0 (0)	106	8	0	8	0	114
1996–1997	56 (54)	47 (46)	0 (0)	103	8	0	8	6	117
1997–1998	57 (48)	61 (52)	0 (0)	118	9	0	0	8	135
1998–1999	27 (38)[b]	44 (61)[c]	1 (1)	72	7	0	7	4	83
1999–2000	30 (45)[b]	37 (55)	0 (0)	67	7	0	7	3	77

[a] Estimated wounding loss equal to 7% of the permits issued.
[b] One bull was harvested via the Alaska Wildlife Safeguard Raffle.
[C] One cow was harvested via a Governor's permit.

Table 6 Delta bison mean number of days hunted for hunts DI403 and DI404, regulatory years 1991–1992 through 1999–2000

Regulatory year	Mean number of days hunted			
	Hunt DI403		Hunt DI404	
	Successful	Unsuccessful	Successful	Unsuccessful
1991–1992	3.8	4.3	3.5	15.6
1992–1993	2.2	1.0	1.9	0.0[a]
1993–1994	4.3	7.2	3.5	5.0
1994–1995	3.0	0.0[a]	3.0	2.0
1995–1996	5.1	10.1	3.8	5.0
1996–1997	6.1	14.8	4.3	6.8
1997–1998	5.6	9.0	4.4	9.7
1998–1999	6.0	9.4	7.0	10.4
1999–2000	7.0	14.1	6.7	22.8

[a] Zero days hunted indicates there were no unsuccessful hunters.

Table 7 Percent of successful Delta bison hunters using different firearms or bow and arrow during Hunts D1403 and D1404, regulatory years 1989–1990 through 1999–2000

Weapon	% Successful hunters by regulatory year										
	1989–1990	1990–1991	1991–1992	1992–1993	1993–1994	1994–1995	1995–1996	1996–1997	1997–1998	1998–1999[a]	1999–2000
338	29	28	31	25	29	47	31	32	41		39
30-06	25	15	24	23	18	24	21	16	14		13
300 Win Mag	11	27	15	20	14	3	28	23	14		17
375 H&H	14	10	11	17	18	9	13	15	9		22
300 Weatherby	7	4	5	2	4	0	0	1	3		0
8 mm Mag	4	3	2	3	2	0	2	2	1		3
458	3	3	1	1	1	0	1	0	2		0
350 Rem Mag	1	3	1	1	0	0	1	0	0		2
348 Win	0	1	0	1	0	0	0	0	0		0
300 H&H	0	0	0	0	0	6	0	0	0		0
Unk 300 Cal	0	0	0	0	7	0	0	0	4		2
Black powder	1	1	2	1	2	3	0	2	0		0
Bow & Arrow	0	1	2	1	0	0	0	0	0		0
Other	3	1	3	4	5	6	3	9	12		2
n	76	67	91	90	104	34	96	93	112		64

[a] No data.

Table 8 Delta bison hunts DI403 and DI404 applications received and permits issued, 1977–1999

Year	Applications received	Permits issued
1977	2,121	20
1978	3,555	15
1979	3,970	25
1980	4,561	35
1981	5,237	55
1982	8,105	75
1983	7,889	75
1984	11,276	55
1985	666[a]	55
1986	6,585	65
1987	6,434	50
1988	9,705	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
1996	17,895	120
1997	15,479	130
1998	16,188	100
1999	15,443	100

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

Table 9 Delta bison hunter residency and success for drawing permit hunts DI403, DI404 and special use permits, regulatory years 1986–1987 through 1999–2000

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonres	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonres	Unk	Total (%)	
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
1995–1996	3	103	0	0	106 (91)	0	10	0	0	10 (9)	116
1996–1997	2	97	1	3	104 (90)	0	11	0	1	12 (10)	116
1997–1998	5	101	12	0	118 (94)	0	6	2	0	8 (6)	126
1998–1999	0	72	0	0	72 (74)	0	25	1	0	26 (27)	98
1999–2000	0	67	0	0	66 (69)	2	27	1	0	30 (31)	96

[a] Local residents reside in Unit 20D.

Table 10 Delta bison percent harvest by time period, regulatory years 1994–1995 through 1999–2000

Regulatory year	Month							
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	*n*
1994–1995[a]	61	11	8	0	5	16	0	38
1995–1996[a]	42	25	8	5	8	14	0	106
1996–1997[a,b]	23	34	3	6	11	13	11	103
1997–1998	46	26	6	0	8	14	0	118
1998–1999	45	16	4	1	13	21	0	71
1999–2000[c]	39	19	2	5	14	14	9	65

[a] The hunting season opened on 7 October versus 1 October.
[b] The hunting season was extended by emergency order to include 1–31 April 1997.
[c] The hunting season was extended by emergency order to include 1–15 April 2000.

Table 11 Delta bison harvest percent by transport method for Hunts DI403, DI404 and special use permits, regulatory years 1991–1992 through 1999–2000

Regulatory year	Harvest percent by transport method								
	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
1995–1996	0	0	0	3	16	2	78	0	116
1996–1997	0	0	0	2	13	4	78	3	100
1997–1998	0	0	1	3	33	3	59	2	118
1998–1999	0	0	0	1	19	1	74	4	72
1999–2000	0	0	0	9	33	0	58	0	67

Table 12 Delta bison harvest percent by kill location during permit hunts DI403 and DI404, regulatory years 1989–1990 through 1999–2000

Regulatory year	Location of kill		Other	Unknown
	Delta Agriculture Project	Delta Junction Bison Range		
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	
1995–1996	68	26	6	
1996–1997	56	32	12	
1997–1998	70	21	4	4
1998–1999[a]				
1999–2000	51	29	19	2

[a] Data not available.

Table 13 Delta bison serum antibody prevalence of infectious disease agents, 1984–1998

Agent	Year														
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
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	0/67	0/49	0/6			
Bovine viral diarrhea SN (8)	0/48	0/29	3/52	0/43	0/43	0/38	0/43	0/58	0/75	0/65	0/49	0/6			
Parainfluenza 3 virus HI[a] (8)	41/41	28/29	52/52	38/38	42/43	38/38	42/42	54/59	74/74	63/67	49/49	6/6			
Respiratory syncytial virus IFA[a] (20)			0/52	0/43	0/43	0/38	4/43	1/53	0/70	1/64	0/49	0/6			
Epizootic hemorrhagic disease virus ID[a] (+)	0/48	0/229	0/52	0/43	0/10	0/33	0/43	0/59	0/75	0/67	0/49	0/6			
Bluetongue virus ID (+)	0/48	0/29	0/52	0/43	0/10	0/33	0/42	0/59	0/75	0/67	0/49	0/6			
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	0/68	0/49	0/69	0/70	0/93	0/6
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							
Toxoplasma gondii						1/12	0/41	0/17	0/11	0/45	1/36	0/61	0/18		

[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.

Table 14 Delta Junction Bison Range (DJBR) and Delta Agricultural Project (DAP) forage quality, 1998 and 1999

Date/Location/Forage	% Crude protein	% Acid-detergent fiber
1998		
DAP Tract M		
Barley @ 27 Aug	10.7	30.0
Timothy @ 27 Aug	6.2	31.4
DJBR Panoramic Flds.		
Bluegrass (airstrip) @ 24 Aug	10.4	30.5
Bluegrass (tanks) @ 24 Aug	12.8	28.0
Oats planted 17 June @ 24 Aug	17.8	31.4
Oats planted 29 June @ 24 Aug	30.4	23.9
Oats planted 3 July @ 24 Aug	34.5	20.5
DJBR Gerstle Fields		
Bluegrass @ 24 Aug	9.5	31.4
1999		
DAP Tract F		
Barley @ 20 Aug	10.4	23.7
Oats @ 20 Aug	10.3	24.0
DAP Tract 1B		
Brome @ 15 Sep	14	25.9
DJBR Panoramic Fields		
Bluegrass 2X fert. @ 20 Aug	20.9	26.9
Brome (uncut) @ 20 Aug	5.8	33.6
Brome (cut 8 Jul) @ 20 Aug	22.8	30.5
Oats (swathed 27 Aug) @ 19 Oct	8.8	33.3
DJBR Gerstle Fields		
Bluegrass @ 20 Aug	9.3	31.2

Table 15 Delta Junction Bison Range (DJBR) mowing trials to eliminate bluejoint reedgrass (*Calamagrostis canadensis)* from nugget bluegrass acreage, 1995–1999

	First Mowing			Second Mowing			Third Mowing		
Year	Date	Plant Ht	Leaf Stage	Date	Plant Ht	Leaf Stage	Date	Plant Ht	Leaf Stage
1995	12–14 Jun	18–24"	1 tiller, 4–5 leaf	4 Jul	17–18"	2 tiller, 2–3 leaf	8–9 Aug	10–11"	3 tiller, 3–6 leaf
1996	18 Jun	7–9"	1 tiller, 4–5 leaf	8 Jul	9–14"	1 tiller, 2 leaf	14 Aug	11–12"	4 tiller, 2–3 leaf
1997	18–19 Jun	12–17"	0 tiller, 4–5 leaf	8 Jul	9"	2 tiller, 5 leaf	12 Aug	3–4"	0 tiller, 2 leaf
1998	24–25 Jun	5–8"	0 tiller, 6 leaf	18 Jul	7–9"	0 tiller, 9 leaf	19 Aug	3–5"	0 tiller, 2 leaf
1999	7–8 Jul	13–14"	1 tiller, 3 leaves	None			None		

Alaska's Game Management Units