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Division of Wildlife Conservation

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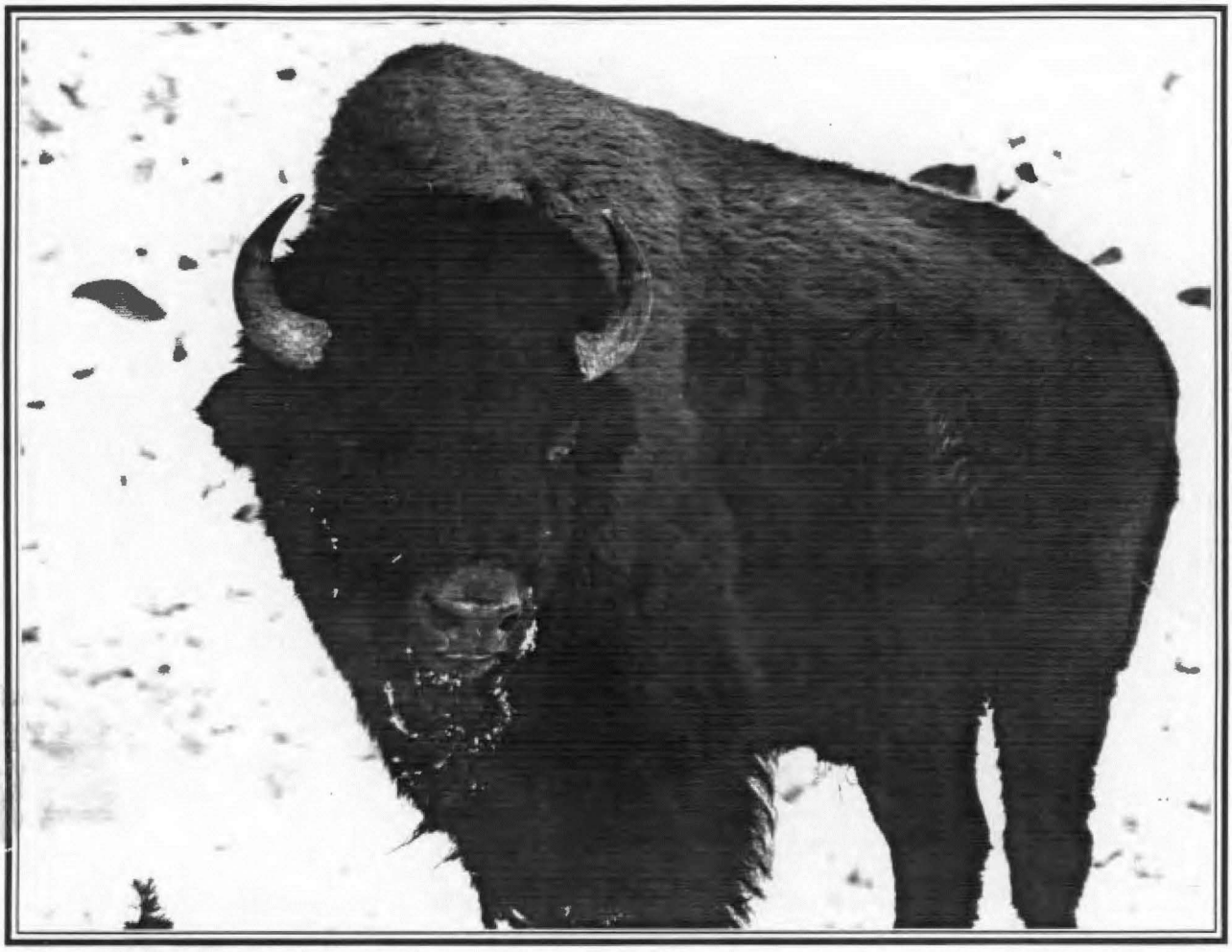
BISON

Mary V Hicks, Editor



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Study 9.0
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LOCATION

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. Until recently herd growth was limited primarily by human harvest.

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

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

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

METHODS

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

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

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

the herd following the severe winter of 1988-89 with the bison count declining 27%. Herd size increased slightly in 1991 and 1992, declined through 1996, but showed an increase in 1997 (Table 1).

Population Composition

Survey results included 70 adults and 17 calves observed during aerial surveys of the Copper River herd during 1997 (Table 1). The 17 calves observed were the most seen in this herd since 1987. However, calf production/survival has fluctuated considerably between years. The highest number of calves observed was 23 in 1979; the lowest calf count was in 1989 with only 3. The 70 adults observed represent a 32% increase (70 compared to 53) over the 1996 count. The highest adult count was 83 and occurred in 1987. The 1997 total count was 36% higher (87 compared to 64) than the 1995 and 1996 counts.

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 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 should cross the Copper River and feed extensively on the Kenny Lake farms, a serious conflict with farmers would arise.

MORTALITY

Harvest

Season and Bag Limit. The established season for resident and nonresident hunters in Unit 11 is 5 October to 10 November, for the area 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. The bag limit is 1 bison every 5 regulatory years by registration permit.

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

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

Hunter Harvest. There were no hunts held for Copper River bison during the current reporting period. The last hunt was held during 1988, when 7 bison were harvested (Table 2).

Permit Hunts. When held, the Copper River bison hunt is administered as a registration hunt where an unlimited number of registration permits are issued on a first-come, first-served basis. Permits are available only in Glennallen and all hunters must report hunt results there. Registration permits are not available until 1 day before the scheduled opening date (5 October). The hunt may be closed by emergency order if the desired harvest is reached before the season closes on 10 November. The most recent harvest quota is 8 bison. Hunters must carry a portable radio and listen to daily news announcements on the local radio station for emergency closure notification.

Hunter Residency and Success. There were no hunts held for Copper River bison during the current reporting period. Historically, the Copper River bison hunt has always been popular with local rural residents (Table 3). During the last hunt in 1988, 40% of the permittees were local residents.

Harvest Chronology. There was no harvest of Copper River bison during this reporting period. The last 3 hunts held for this herd lasted only 2 or 3 days before the desired harvest was reached and the season was closed by Emergency Order (Table 4).

Transport Methods. Historically, riverboats have been the most popular method of transportation (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. Between 1985 and 1988 winter severity indices at Dadina Lake varied from "mild" to "moderate." Snow depths observed during the winter of 1989 were 80% above normal and resulted in a winter snow severity index rate of "Severe". Yearly snowfall has been high since, and the winters of 1990 through 1995 were also classified as "severe." Snowfall in 1996 resulted in a "moderate" severity rating.

Observations of the Copper River herd indicate accidental death may be an important source of natural mortality to bison (Table 6). Sources of accidental mortality included falling off steep bluffs that border the Copper River and drowning in the river. During winter bison use the bluffs extensively for feeding. These slopes have predominantly clay soils, which hold moisture and freeze. The frozen clay creates a steep slide with little, if any, secure footing for the bison. In the spring of 1993, 6 bison were found dead along the Copper River; we believe at least 3 of the animals drowned. The drowning occurred because the bison fell through the ice and could not get out. 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 was at low numbers during the beginning of this reporting period but showed an increase in 1997. During the last 5 years (1993–97), the average calf production has equaled the historic (1964–92) average of 14. Recruitment of calves into the adult class has been low or adult mortality has equaled or exceeded calf recruitment.

Reasons for the decline in bison numbers from the early to mid 1990s are not documented because no research projects have been directed at determining the natural factors controlling the population. Snow survey results from a snow course at Dadina Lake, centrally located in the Copper River bison herd range, indicate the winters of 1990–95 had deep snow packs and severe winters. Deep snow conditions could have resulted in increased overwinter mortality and reduced recruitment similar to that observed in 1989 when the total count of bison declined by 27% (66 compared to 90) and calf numbers dropped by 79% (3 compared to 14) after the severe winter of 1988. The importance of winter snow depth is further supported by the 1997 count, which showed a 36% increase (87 compared to 64) in the total count and a 55% increase (17 compared to 11) in the number of calves after the moderate winter of 1996.

Field observations suggest accidental death has been an important source of natural mortality, but it seems improbable accidental death has been a factor only in recent years. Predation rates on the Copper River bison herd are unknown. Wolves, black bears, and brown bears are numerous on the home range of the Copper River bison herd. The influence of deep snow on predation rates during severe winters is also unknown. Bison probably become more vulnerable to predators during periods of deep snow.

Historically, human harvests have been an important factor in determining herd size. In years of poor recruitment or reduced numbers of adults, human harvest was lowered or eliminated. From 1964 through 1981 the yearly harvest quota was 15 bison. Between 1982 and 1988 bison numbers recovered more slowly following human harvest. In response to reduced calf recruitment during this period, the yearly harvest quota was reduced to 8 animals. It was also necessary to close the Copper River bison hunt in 1982 and 1985 to allow herd recovery. A hunt has not been held since 1988 (Table 3).

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

I recommend that the hunting season for the Copper River bison herd remain closed until the herd increases to 80 overwintering bison older than calves. More adult cows are needed to increase the annual calf production. In order to maintain more cows in the herd, it is necessary to have a larger herd because cows cannot be protected from harvest. Most of the hunting takes place in the timber where

sex identification is impossible. With a larger herd, an overharvest of a few cows would have less biological impact on the herd, making periodic seasonal closures necessary to rebuild numbers less likely. Another reason to postpone a hunting season is the increase in bison numbers observed in 1997 may be temporary. During a flight to this area on February 18, 1998, I noted deep snow and bison needing to crater for food. The extent of cratering is reduced during moderate and mild winters because many of the bluffs remain windswept and essentially free of snow. The effect of the winter of 1997 on bison numbers and calf production will not be known until surveys are flown in June–July 1998.

The Copper River bison range has supported more than 90 animals in the past. Body and blood condition parameters obtained from captured cows during winters with normal snowfall indicated adequate forage was available. However, no data has been collected recently to assess condition parameters, and it is not known if the range can support bison in the numbers observed in the past. If carrying capacity has been reduced due to habitat destruction, it may be necessary to modify population management objectives.

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Table 1 Copper River bison spring aerial composition counts and estimated population size, 1993–1997

Regulatory Year	Adults[a]	Calves	(%)	Bison Observed	Estimated Population Size[b]
1993/94	60	15	(20)	75	75
1994/95	54	15	(22)	69	69
1995/96	54	10	(16)	64	64
1996/97	53	11	(17)	64	64
1997/98	70	17	(20)	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, 1988–97

Hunt No. /Area	Regulatory Year	Permits Issued	Percent Did not Hunt	Percent Unsuccessful Hunters	Percent Successful Hunters	Bulls	(%)	Cows	(%)	Unknown	Total Harvest
450	1988/89	38	32	73	27	6	(86)	1	(14)	0	7
475	1989/97[a]	--	--	--	--	--	--	--	--	--	--

[a]Hunting season closed.

Table 3 Copper River bison hunter residency and success, 1988–97

Regulatory Year	Successful					Unsuccessful				Total hunters
	Local[a] Resident	Nonlocal Resident	Nonresident	Total	(%)	Resident[b]	Nonresident	Total	(%)	
1988/89	1	6	0	7	(27)	19	0	19	(73)	26
1989/97[c]	--	--	--	--	--	--	--	--	--	0

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

Table 4 Copper River bison harvest chronology percent, 1988–97

Regulatory Year	Harvest Period 9/21-27	*n*
1988/89	2 days – closed by Emergency Order 9/23	7
1989/97	No hunt	--

Table 5 Copper River bison harvest percent by transport method, 1988–97

Regulatoy year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway Vehicle	Unknown	*N*
1988/89	14%	--	86%	--	--	--	--	--	7
1989/97[a]	--	--	--	--	--	--	--	--	0

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

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. There has not been a Chitina bison hunt since 1988.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

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

METHODS

We conducted aerial surveys to determine composition of the herd in spring after the calving period. Survey techniques included flying transects throughout all bison habitat in the lower Chitina Valley to obtain a direct count. Six dead bison were examined in the field in an attempt to determine the cause of death. Hunting remained closed during this reporting period because minimum management objectives were not met.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The Chitina Bison Herd was stable for the 10-year period between 1976 and 1985. Between 1985 and 1989 the number of bison observed in the Chitina herd declined 46% from 56 to 30 animals. From 1989–95 the Chitina herd was relatively stable at 30 to 35 animals. Herd size increased in both 1996 and 1997. Continued herd growth in 1998 is unlikely. Field observations of dead bison in early May indicate that overwinter mortality rate was probably high enough to effect a population decline.

Population Size

I counted 46 bison during an aerial survey of the Chitina River in June 1997 (Table 1). This is the highest count recorded since 1985.

Population Composition

I observed 39 adults and 7 calves during aerial surveys of the Chitina Herd in 1997 (Table 1). The 7 calves observed during the 1996 and 1997 surveys represent the highest production/survival since 1992. Historically, calf production and survival have fluctuated considerably but are now at the 20-year (1976–1995) average. Timing of the surveys probably is not a factor in variable calf counts because surveys were usually conducted in June or early July every year.

Distribution and Movements

The Chitina Bison Herd ranges within the riparian and upland habitats below the 2000 feet elevation, along a 40-mile portion of the upper Chitina Valley. Although movements vary considerably, the herd can usually be located between the Tana River and Barnard Glacier. During the 1990s, biologists have observed especially heavy use of the riparian zone between Bryson Bar and Bear Island; survey efforts have focused on this area. Old bulls in this herd are loners and exhibit solitary behavior, often bedding in forested areas, making them difficult to count.

MORTALITY

Harvest

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

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

Hunter Harvest. No hunt was held during this reporting period. Hunters killed 4 bulls during the 1988 season, which was the last year a hunt was held.

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

Hunter Residency and Success. Historically, the Chitina bison hunt has been popular with local residents. Because of the interest in bison hunts by Alaska residents, nonresidents did not draw a tag during the last 6 Chitina hunts.

Transportation Methods. Historically, successful Chitina bison hunters used aircraft.

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 and poor recruitment during the early 1990s. 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 since 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 has 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 the range could not support a very large bison herd.

Appreciable vegetation loss occurred on the Chitina bison range during the early 1990s. This is a result of rechannelization of the Chitina River toward the north bank. The first area affected was the floodplain northeast of Bear Island. This was a heavily used riparian area before 1991 when flooding first occurred. 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. Small fluctuations in count data between years probably reflect survey technique rather than actual changes in bison numbers. Solitary bulls are especially difficult to find on aerial surveys. Legal harvests by sport hunting were stopped in 1989 after the herd declined. Because the herd continued to grow in prior years, even with a sport harvest, hunting is not considered a limiting factor on herd growth. Severe winters with deep snow and possibly little wind to clear bars of snow are now considered an important limiting factor on bison productivity and survival. Wolves and brown and black bears are abundant and could also influence herd size, but a lack of research precludes documenting predation

rates. Flooding of critical river bars and loss of vegetation cover have reduced carrying capacity, especially during periods of deep snow.

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 since 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 will depend 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 on both reaching the herd objective and reducing the impact of severe winters by lowering the number of susceptible old bison present in the herd. I recommend changing the current strategy that has eliminated all harvests over the last decade to allow the herd to increase. In order to provide for human use of this herd, management should focus on harvesting a limited number of adults every year. The objective would be to harvest adults, 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. Overwinter mortality of aged bison will occur during severe winters, 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 justified because of the popularity of all hunts on wild bison.

LITERATURE CITED

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Table 1 Chitina bison spring aerial composition counts and estimated population size, 1993–1997

Regulatory Year	Adults[a]	Calves	(%)	Bison Observed	Estimated Population Size[b]
1993/94	27	5	(16)	32	32
1994/95	27	3	(10)	30	30
1995/96	33	1	(3)	34	34
1996/97	32	7	(18)	39	39
1997/98	39	7	(15)	46	46

[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, 1988–97

Regulatory Year	Hunter Harvest										
	Reported						Estimated				
	M	(%)	F	(%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	Total
1988/89	4	100)	0	0	0	4	0	0	0	4[a]	8
1989/97[b]	--	--	--	--	--	--	--	--	--	0	0

[a]Radiocollaring mortalities
[b]Hunting season closed

Table 3 Chitina bison harvest data by permit hunt, 1988–97

Regulatory Year	Permits Issued	Percent Did not Hunt	Percent Unsuccessful Hunters	Percent Successful Hunters	Bulls	(%)	Cows	(%)	Unknown	Harvest
1988/89	6	33	0	100	4	(100)	0	--	0	4
1989/97[a]	0	--	--	--	--	--	--	--	--	0

[a]Hunting season closed.

Table 4 Chitina bison hunter residency and success, 1988–97

	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
1989/97[b]	--	--	--	--	--	--	--	--	--	0

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

Table 5 Chitina bison harvest percent by transport method, 1988–97

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway Vehicle	Unknown	*n*
1988/89	100	--	--	--	--	--	--	--	4
1989/97[a]	--	--	--	--	--	--	--	--	0

[a]Hunting season closed.

LOCATION

UNIT: 19

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

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

The Farewell bison hunt has generally been administered as a drawing permit hunt, although in 1979 and 1984 it was administered as a registration and "Tier II" subsistence hunt, respectively. From 1980 through 1983, 20 permits were allocated each year. From 1985 to 1988 the number of permits was increased to 40. During the 1989 and 1990 regulatory years, 70 drawing permits were awarded, 40 for fall hunts and 30 permits for spring (March) hunts. In the 1991 regulatory year, 80 permits were awarded, 40 for fall and 40 for spring hunting periods. From the period 1992–1994, a total of 50 permits were awarded, while in regulatory years 1995–1997, 20 permits each were issued for the spring and fall periods.

MANAGEMENT DIRECTION

The Farewell Bison Herd is managed for optimal sustained yield of animals while providing uncrowded and aesthetic hunting conditions. The herd generally ranges on the 1977 Bear Creek burn area or on the South Fork Kuskokwim River bars where available forage is adequate. Because range conditions are healthy, we will continue issuing the current number of drawing permits to allow the herd to slowly increase.

MANAGEMENT GOALS AND OBJECTIVES

- Maintain a minimum of 300 bison and determine the optimal sustainable harvest level.
- Conduct periodic aerial surveys of the range, size, and composition of the bison herd.
- Instrument and radiomonitor 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 (ADNR) 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 data. To assist in locating congregations of bison, we instrumented 3 adult cows during summer 1991, using helicopter-supported darting techniques to facilitate group locations. Three additional transmitter-equipped collars were deployed in summer 1992, and 6 transmitters will be deployed in spring 1998. Early spring flights were conducted within the traditional range of the herd to monitor the extent of winter and predation mortality.

Plans for enhancing habitat are underway. Cooperative work with the U.S. Bureau of Land Management and ADNR to formulate a controlled burn prescription was initiated. Plans should be formalized and in place by spring 1998. If weather parameters are met, a portion of the 1977 Bear Creek burn area will be subjected to a controlled burn in spring 1999.

Drawing permit hunts for Farewell bison were administered from the McGrath area office with permittees being assigned to 10- or 15-day hunt periods in September or March. No more than 10 hunters were allowed afield at a time to reduce crowding and provide a high-quality hunting opportunity. Hunters were required to check in at McGrath either by telephone or in person prior to and following their hunts. Hunters were also required to complete and return a mail-out questionnaire following their hunts. Questionnaire results and personal interviews formed the database for evaluating aspects of the hunt.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Between 1968 (when aerial surveys were initiated) and 1998, the Farewell Bison Herd experienced an average annual growth rate of about 10%. Since 1988 no complete surveys were accomplished, but I believe that hunting and natural mortality factors arrested the herd's growth (Table 1). In 1996 the number of drawing hunt permits was reduced to allow the bison herd to slowly increase.

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 320 bison (Table 1). Repeated attempts at completely enumerating herd size during each of the past 5 years have not been successful because of sporadic and unpredictable movements. The July 1995 composition survey tallied 260 bison, which probably represented about 80–90% of the total population. A July 1996 aerial survey resulted in composition data based on a sample of 276 bison, and the highest number counted in 1997 was 212 bison.

Population Composition

During the past 5 years, we conducted 22 surveys. Percent calves in the herd ranged from a low of 12.8 (5/92, precalving) to a high of 27.1 (7/93). During 4 surveys in June or July 1992–1995 when most of the herd was surveyed, calf percentages ranged from 16.8 to 24.0%, averaging 20.8%. 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 subherds pioneered a large lightning-caused burn area during summer 1991 on the east side of the South Fork Kuskokwim that shows potential as an area for herd expansion. During early spring 1998, this area was being used extensively by at least 150 bison. As the 1977 Bear Creek burn area matures, most, if not all, of the Farewell Bison Herd may adopt this "new" range as its primary habitat during winter and early summer.

MORTALITY

Harvest

Hunter harvest of bison from the Farewell Bison Herd during this reporting period is shown in Tables 2 and 3. Success rates for Hunt 351 (formerly Hunt 451) have been relatively low (mean 1992–1997 = 42%). Rather than reflecting a paucity of bison, I believe the low rate was caused by additional disturbance from increasing numbers of moose hunters in the traditional bison hunting areas. This forced bison to move to inaccessible areas, resulting in lower harvest rates. Hunter success rates in Hunt 352 (formerly Hunt 452), occurring in March, remained between 60 and 100%. I assume these higher hunter success rates during March are due to increased access opportunities (snowmachines and airplanes) and an absence of moose hunters in the area.

Season and Bag Limit.

Area/Bag limit	Resident Seasons	Nonresident Seasons
Unit 19: 1 bison every 5 regulatory years by drawing permit only.	1 Sep–30 Sep 1 Mar–30 Mar	1 Sep–30 Sep 1 Mar–30 Mar

Board of Game Actions and Emergency Orders. During the March 1989 meeting, the Alaska Board of Game approved the department's proposal to issue 100 drawing permits and extend the open season from 10 August through 31 March. Although that has allowed the option to greatly increase harvest, the department has elected to eliminate the August and October seasons to allow the herd to grow.

Hunter Residency and Success. The vast majority of applicants and permittees for the Farewell bison hunt are Alaska residents (Table 4). Nonresidents obtained 6 permits in the past 5 years, making up only 2% of the permittees, while "local" residents (permittees residing in Unit 19) obtained 17 permits (less than 6% of total permits). Nonresident aliens have obtained only 1 permit in the past 5 years.

Hunter success for both hunts averaged 50% and increased slightly annually. However, this figure includes all permit holders, both those who go afield and those who do not. During the past 5 regulatory years, 28% of the permit holders have not attempted to hunt (Table 2). Thus, more than half the hunters who go afield are successful at bagging a bison.

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

Transport Methods. During the fall hunt (Hunt 351), initial access to the Farewell area is typically by aircraft (Table 6). During the past 5 years no hunters reported using a boat for initial access. About half the fall hunters use all-terrain vehicles as a secondary access method. During the spring hunt (351/451), the primary access method is 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.

Other Mortality

Until 1988 natural mortality was relatively low. However, since then, while doing other work, we have located 6 dead bison. This information was presented in the FY92 bison management report. No systematic surveys have been conducted to document the extent of natural mortality, although it appears to be having a minimal effect on the population.

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 where forage seems 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 and BLM, a spring burn is being 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, being replaced by a successional reversion to black spruce.

CONCLUSIONS AND RECOMMENDATIONS

It is now evident that hunter harvest is but one of many factors affecting the Farewell Bison Herd. Total herd size must be monitored closely and permit numbers adjusted annually to manage the herd for continued growth. Based on a cursory examination of the range during summer 1995, the number of permits was reduced with the intention of allowing the bison population to slowly increase. Monitoring herd growth is important and will entail deploying additional radio collars and periodically monitoring those transmitters to obtain accurate estimates of herd size. The drawing permit hunt should continue to be administered from the McGrath area office to provide assistance to hunters and ensure timely and accurate hunt reports. A priority in management of the Farewell Bison Herd should be to encourage the establishment of a periodic prescribed burning program in the Farewell area.

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Table 1 Farewell Bison Herd aerial composition surveys and estimated population status, 1992–1997

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			22.0	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

Table 2 Farewell bison harvest data by permit hunt, 1992–1996[a]

Hunt nr	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
351	1992–1993	30	30	76	24	4 (80)	1 (20)	0	5
	1993–1994	30	37	58	42	7 (88)	1 (12)	0	8
	1994–1995	30	30	52	48	7 (70)	30 (30)	0	10
	1995–1996	20	30	64	36	2 (40)	3 (60)	0	5
	1996–1997	20	20	37	63	6 (60)	4 (40)	0	10
352	1992–1993	20	25	40	60	6 (67)	3 (33)	0	9
	1993–1994	20	30	14	86	2 (22)	7 (78)	3	12
	1994–1995	20	35	0	100	5 (38)	8 (62)	0	13
	1995–1996	20	20	6	94	10 (67)	5 (33)	0	15
	1996–1997	20	35	0	100	10 (77)	3 (23)	0	13
Total	1992–1993	50	28	61	39	10 (71)	4 (29)	0	14
	1993–1994	50	34	39	61	9 (53)	8 (47)	3	20
	1994–1995	50	32	32	68	12 (52)	11 (48)	0	23
	1995–1996	40	25	33	67	12 (60)	8 (40)	0	20
	1996–1997	40	11	36	64	16 (70)	7 (30)	0	23

[a] Figures only represent legally harvested animals.

Table 3 Farewell bison harvest, 1992–1996

Regulatory year	Hunter harvest									Total
	Reported						Estimated			
	M	(%)	F	%	Unk	Total	Unreported	Illegal	Total	
1992–1993	10	(71)	4	(29)	0	14	0	0	0	14
1993–1994	9	(53)	8	(47)	3	20	0	1	0	21
1994–1995	12	(52)	11	(48)	0	23	0	0	0	23
1995–1996	12	(60)	8	(40)	0	20	0	0	0	20
1996–1997	16	(70)	7	(30)	0	23	0	0	0	23

Table 4 Farewell bison hunter residency and success, 1992–1996[a]

Regulatory year	Successful						Unsuccessful						Total hunter
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	(%)	Local[b] 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	18	1	0	20	(50)	0	20	0	0	20	(50)	40
1996–1997	2	20	1	0	23	(58)	1	16	0	0	17	(42)	40

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

Table 5 Farewell bison harvest chronology, 1992–1996

Regulatory year	Harvest Period								
	8/22–31	9/1–10	9/11–20	9/21–30	3/1–10	3/11–20	3/21–30	Unk	*n*
1992–1993	0	1	4	0	4	3	2	0	14
1993–1994	0	2	3	3	3	1	1	7	20
1994–1995	0	3	4	3	4	0	3	6	23
1995–1996	0	1	3	0	6	5	3	1	19
1996-1997	0	3	2	5	9	2	2	0	23
Percent	2	9	14	14	24	13	15	8	99

Table 6 Farewell bison harvest percent by transport method, 1992–1996

Regulatory year	Harvest percent by transport method				*n*
	Airplane	Boat	Snowmachine	Unknown	
1992–1993	71	0	29	0	14
1993–1994	70	0	20	10	20
1994–1995	74	0	17	9	23
1995–1996	55	0	45	0	20
1996–1997	65	0	35	0	23

LOCATION

UNIT: 20D (5633 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 500 years ago probably due to changing climate. 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. 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 to establish additional herds.

As agriculture developed on their established range, the Delta Bison Herd began to include hay and cereal grains in their fall and winter diets. In 1976 the State of Alaska made agricultural development a priority within the established range of the Delta Bison Herd, and 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

1. 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.

2. 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.

3. Manage the Delta Bison Herd to provide the greatest opportunity to hunt and view bison.

    - Calculate an accurate annual budget for accomplishing recommended goals and objectives.

    - Attempt to acquire additional funding sufficient to accomplish all goals and objectives of managing the Delta Bison Herd on public lands.

    - Manage the Delta Bison Herd for maximum productivity with a sex ratio of no less than 30 bulls:100 cows.

    - Organize volunteer efforts to help accomplish goals and objectives.

    - Manage the Delta Bison Herd at 360 bison precalving from 1 July 1993 to 1 November 1995. The Delta bison management program will be evaluated in November 1995 to determine compliance with goals and objectives, funding and staffing levels, and biological capacity of public lands. Thereafter, herd size will be adjusted to include increasing or decreasing as required and to match resources with goals and objectives.

    - Administer the Delta bison hunt to reduce landowner/hunter conflicts and to maintain hunter access to private land in the DAP to the extent possible.

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

METHODS

DJBR MANAGEMENT 1996

Approximately 720 acres of perennial grasses were fertilized in the Panoramic and Gerstle Fields, including about 600 acres of nugget bluegrass and 120 acres of arctared fescue. Fertilizer was applied beginning 20 May in the Panoramic Fields and was completed in the Gerstle Fields on 30 May. Fertilizer consisted of 200 pounds/acre of N60-P20-K0-S10. Fertilizer was applied with an 8-ton capacity broadcast spin spreader, pulled by a John Deere 4250 tractor. Fertilizing cost was approximately $27,405.

Approximately 250 acres of the Panoramic Fields were planted with oats on 10 June, 18 June, and 25 June to provide oat forage having a variety of growth stages and forage quality. Prior to planting, fields were fertilized with about 200 pounds/acre of N60-P20-K0-S10 by broadcasting fertilizer onto the fallow soil with a broadcast spreader. Approximately 100 pounds/acre of oat seed were spread using the broadcast spreader, and the field was disked with a field disk to incorporate the fertilizer and seed into the soil. Acreage planted with oats had been disked annually since 1993 and left fallow to control the noxious bluejoint reedgrass (*Calamagrostis canadensis)* with nonherbicidal methods.

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 18 June, 8 July, and 14 August.

A prescribed burn was conducted 16 May in the Panoramic Fields. Vegetation in the burned acreage was primarily bluejoint with a height of 3–4 feet. The purpose of the burn was to remove the vegetation in preparation for disking the soil for fallowing. Burning was conducted in cooperation with the Alaska Division of Forestry. Ignition began when weather conditions reached the following burn prescription: 1) new regrowth $\leq$2 inches in height, 2) Fine Fuel Moisture Code = 85–92, 3) ambient air temperature $\geq$60 °F, 4) relative humidity (RH) <40%, and 5) wind speed 5–20 mph from any direction. Personnel using drip torches accomplished ignition.

Approximately 140 acres of the Panoramic Fields were mowed to remove growth of willows (*Salix* sp.) and aspen (*Populus tremuloides*). Mowing was conducted with a brush hog.

Red clover, enigmo timothy, and carlton bromegrass were planted to test their effectiveness as bison forage in DJBR soil types. Approximately 10 acres of each were planted in cleared berm rows of the Panoramic Fields. Before planting, we fertilized plots with about 200 pounds/acre of N60-P20-K0-S10 by broadcasting fertilizer onto the soil with a broadcast spreader. Seed was spread using the broadcast spreader. Clover was seeded at a rate of 4 pounds/acre, timothy at 6 pounds/acre, and bromegrass 12 pounds/acre. The plots were disked with a field disk to incorporate fertilizer and seed into the soil.

We analyzed forage quality 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 Cooperative Extensive Service, Palmer Research Center, Palmer, AK for analysis. Samples were analyzed moisture-free and as fed for the following values: dry matter crude protein, phosphorus,

potassium, calcium, acid-detergent fiber, in vitro dry matter disappearance, total digestible nutrients, metabolizable energy, and net energy-lactation.

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

DJBR MANAGEMENT 1997

Approximately 680 acres of perennial grasses were fertilized on the DJBR, including about 600 acres of nugget bluegrass and 80 acres of arctared fescue. Grasses were fertilized with N60-P20-K0-S10 at the rate of 200 pounds/acre. Fertilizer application began in the Panoramic Fields on 15 May and ended on 17 May. Fertilizer application began 17 May in the Gerstle Fields and ended 21 May. Fertilizer was applied with an 8-ton capacity broadcast spreader, pulled by a John Deere 4250 tractor. Fertilizer purchases totaled $21,851.

Approximately 350 acres were planted with oats in the Panoramic Fields, using methods described above for 1996 field operations. Oats were planted on 11 June, 19 June, and 27 June to provide a variety of maturation dates and forage quality. Oats were planted in acreage that had been heavily infested with bluejoint and had been disked and fallowed annually since 1993 in an attempt to kill bluejoint with nonherbicidal methods.

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 18 June and 8 July. No third mowing was conducted because the grass was too short.

Approximately 100 acres in the Panoramic Fields were mowed with a brush hog mower to remove aspen and willow growth. Basal diameter of the woody vegetation was approximately 2–3 in. Approximately 350 acres of slightly smaller woody vegetation were also mowed in the Gerstle Fields.

Approximately 102 acres in the Panoramic Fields were plowed with a heavy field disk to fallow soil overgrown with willow, aspen, and bluejoint. A private contractor, selected through competitive bid, plowed at a cost of $39.25/acre.

Forage quality was analyzed by techniques described above for 1996.

Red clover, enigmo timothy, and carlton bromegrass were replanted to test their effectiveness as bison forage in DJBR soil types. Approximately 10 acres of each were planted in cleared berm rows of the Panoramic Fields. Before planting, we fertilized plots with about 200 pounds/acre of N60-P20-K0-S10 by broadcasting fertilizer onto the soil with a broadcast spreader. Grass seed was mixed with oats to cause better spreading with the broadcast spreader. Seeding rates were increased over 1996 rates with clover seeded at 8 pounds/acre, timothy at 8 pounds/acre, and bromegrass 15 pounds/acre. The plots were disked with a field disk to incorporate fertilizer and seed into the soil.

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

HERD MANAGEMENT

Population Status and Trend

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

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

Population Composition

Sex and age composition surveys were conducted from the ground by locating groups containing radiocollared bison. Sex and age were determined by observing bison with 8 x 40 binoculars or a 15 to 60 power spotting scope. Bulls were differentiated from cows by body size, pelage, 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.

Distribution and Movements

We monitored bison movements by locating radiocollared bison and from reports of people observing 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 the general location of the bison. We obtained precise aerial locations by mounting antennas on an aircraft and locating the radiocollared bison.

We captured bison to attach radio collars to monitor herd movements. When bison first migrate from the area of the Delta River to the DJBR, they can be approached with a vehicle. We used a truck to slowly approach within 50 to 75 feet of bison and fire a syringe from a Cap-Chur rifle. The syringe was loaded with carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colorado) and xylazine hydrochloride (Anased®, Lloyd Laboratories, Shenandoah, Iowa). Once immobilized, bison were fitted with radio collars. After collaring, bison were injected with naltrexone hydrochloride (Trexonil®, Wildlife Pharmaceuticals) to reverse the immobilization.

Disease Management

Bison hunters were asked to collect approximately 30 ml of blood from the bison they killed. These samples were centrifuged and serum was removed by aspiration. Sera were frozen until tested for the following diseases: epizootic hemorrhagic disease, bluetongue, infectious bovine

rhinotracheitis, bovine viral diarrhea, respiratory syncytial virus, parainfluenza 3, *Brucella suis* IV, and Q fever.

Harvest Management

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

Bison hunters were required to checkout after their hunt. Hunters 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, hunters 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, department staff examined the carcass to record tooth eruption and 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.

RESULTS AND DISCUSSION

MANAGEMENT GOALS AND OBJECTIVES

The Delta Bison Work Group (DBWG) met on 19 February 1997 to review progress on accomplishing goals and objectives in the 1993–1998 Delta Bison Management Plan. The DBWG expressed the following 2 concerns about DJBR funding: 1) recent regulatory changes that required permit applicants to purchase a hunting license with the application may reduce the number of bison hunt applications and thus DJBR operating funds, and 2) recent legislation to remove the department's portion of income from the bison permit authorized for Alaska Fish and Wildlife Safeguard would also reduce DJBR funding.

There was discussion of herd size and related issues including: 1) continued damage to agricultural crops by bison, 2) the public's interest in maximizing hunting opportunity, and 3) ways to compensate farmers for crop damage. The DBWG reached a consensus to table herd size discussion until work began on the next 5-year plan.

The DBWG agreed with the department's recommendation to change the opening date of the bison hunt from 7 October to 1 October for the 1997–1998 hunting season. An earlier opening date, combined with hunter orientations every 5 days instead of every 7 days, would allow hunters more opportunity to hunt before weather conditions were extremely cold.

POPULATION STATUS AND TREND

Population Size

1995–1996. The 1996 precalving population was estimated to be 375 bison, which is above the management objective of 360 bison (Table 1).

1996–1997. Bison census flights were flown on 16 and 25 July, 27 August, and 9 September 1996 and resulted in a prehunt population estimate of 496 bison (Table 1) from the 9 September survey. During the September flight, bison were distributed throughout the DAP.

The 1997 precalving population was estimated to be 381 bison, which is above the management objective of 360 bison. Bison census flights were flown on 2 May, 23, 25, and 30 June, 29 August, and 5 September 1997. These flights resulted in a prehunt population estimate of 474 bison based on the 30 June count (Table 1). During the 30 June count, bison were along the Delta River.

Eighteen domestic bison escaped from the Hollembaek herd in the DAP on 18 April 1997. Twelve of the escaped bison were recovered within several days of escaping; however, 6 were never recovered and presumably joined the wild Delta Bison Herd.

Population Composition

1995–1996. We calculated sex and age composition from a sample of 231 bison counted on 26 and 28 September 1995. Calf survival was good with 52 calves:100 cows, and calves composed 22% of the sampled population. Survival to 18 months of age was good with 22 yearling bulls:100 cows. The bull:cow ratio was 87 bulls:100 cows, and adult bulls composed 27% of the observed population. Adult and yearling cows composed 42% of the herd (Table 2).

1996–1997. We calculated sex and age composition from a sample of 279 bison counted on 10 and 12 September 1996. Calf survival was good with 54 calves:100 cows, similar to the survival of 1995. Calves were 25% of the sample. Survival to 18 months of age declined to 13 yearling bulls:100 cows, and yearling bulls were 6% of the population (Table 2). The bull:cow ratio was 65 bulls:100 cows, and adult bulls composed 24% of the observed population. Adult and yearling cows composed 46% of the observed herd (Table 2).

Distribution and Movements

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

After calving along the Delta River and Fort Greely's Texas Range, bison began migrating back to the DJBR in late July 1995. Forty-four bison were in the Panoramic Fields of the DJBR on 27 July 1995, and large numbers of bison were in the Panoramic Fields by 31 July. Therefore, we did not achieve the management objective to keep 75% of the herd west of the Richardson Highway until 20 August.

The first observation of bison in the Gerstle Fields of the DJBR was on 2 August 1995, when 30 bison were seen. Large numbers of bison began moving from the Panoramic Fields to the Gerstle Fields on 16 August, and large numbers of bison used the Gerstle Fields through 27 August. Bison also used portions of the 22,400 acres that burned during the 1994 Hajdukovich Creek wildfire. During a 21 August census flight, we observed 291 bison in the burn south and west of

the Gerstle Fields. Bison moved back and forth between the Panoramic and Gerstle Fields during this entire time; however, movement between the fields increased during September.

Bison began moving into the DAP on approximately 25 August 1995, based on tracks of 30–40 bison seen north of the Gerstle Fields in Tract M of the DAP (D Bunselmeier, pers commun). These bison apparently moved into Tract M and then immediately returned to the Gerstle Fields. A cow and calf bison were reported in the DAP on 29 August (H Weiler, pers commun). A large group of about 200 bison were seen in Tract M on the evening of 31 August (D Bunselmeier, pers commun). Therefore, we did not achieve the management objective to keep the herd out of the DAP until 1 October.

Weather conditions were poor for harvesting crops in the DAP in late fall 1995, with prolonged periods of rain and poor drying conditions for crops. Farmers in the DAP began harvesting crops 1 September (B Frederick, pers commun). Bison began moving into the DAP shortly before harvest began; however, no farmers reported serious crop damage.

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

On 8 March 1996 tracks of numerous bison were seen west of the Panoramic Fields near Jarvis Creek. The tracks near Jarvis Creek indicate that some bison were beginning to move toward the Delta River by early March. On the same day, about 200 bison were seen in the Gerstle Fields, 40 bison were in the DAP, and many bison tracks were seen in the Panoramic Fields.

Four female bison were immobilized and fitted with radio collars on 31 July, 2 August, and 24 August 1995. We varied drug dosages while attempting to determine the optimum dose. Three bison were darted with dosages ranging from 4.2 mg to 4.5 mg carfentanil and 50 mg xylazine hydrochloride. Induction times varied from approximately 9 to 13 minutes. The recommended dose of naltrexone to reverse carfentanil is 100 mg naltrexone/mg carfentanil. Actual dosage given varied from 98–122 mg naltrexone/mg carfentanil and was injected intramuscularly. Reversal times varied from 3 minutes 30 seconds to approximately 5 minutes.

One bison was darted with 5.4 mg carfentanil and 50 mg xylazine hydrochloride. When darted, the bison became very excited and ran but was immobilized in 8 minutes. The induction time may have been prolonged due to the high level of excitation. This bison received only 56 mg naltrexone/mg carfentanil. When the naltrexone was injected, the bison began rolling over, jumped up, and ran away before the injection was completed.

There were no postcapture mortalities for any of the immobilized bison.

1996–1997. On 3 July 1996, bison were radiolocated from the ground and were along the Delta River from Black Rapids Glacier to the Buffalo Dome flats on the west side of the Delta River.

On 10, 16, and 25 July, most bison were estimated to be between Buffalo Dome and Washington Range on Ft. Greely. However, on 25 July a group of 55 bison were also located approximately 2 miles north of Donnelly Dome and were assumed to be moving from the Delta River area to the DJBR.

Bison were first observed on the DJBR on 28 July 1996, when approximately 200 bison were in the Panoramic Fields. These bison were first seen in the southeast corner of the Panoramic Fields feeding on bluegrass. Therefore, the management objective to keep 75% of the bison west of the Richardson Highway until 20 August was not accomplished in 1996.

Bison used both the Panoramic and Gerstle Fields of the DJBR until 19–22 August, when bison began moving into the DAP even though an abundance of bluegrass and oat forage remained on the DJBR. On 22 August about 100 bison were seen in Tract M of the DAP, and 200 were seen scattered in the Panoramic and Gerstle Fields of the DJBR (H Weiler, pers commun). Therefore, the management objective to keep bison out of the DAP until 1 October was not accomplished in 1996.

Although bison began moving into the DAP during 19–22 August, large numbers of bison continued to use the DJBR until at least 5 September. Grain harvest was late in the DAP due to dry and cool conditions which caused a late maturing grain crop. Harvest began on 29 August (B Fredericks, pers commun). The department received no reports of significant crop damage, although bison did cause some damage to grain and hay crops.

Although spring movement to the Delta River area was not monitored, bison were located in the Washington–Texas Range portion of Fort Greely Military Reservation by mid April; hunters killed bison in this area on 15, 19, and 25 April 1997 during an extended hunting season.

Five female bison were immobilized and fitted with radio collars on 7, 8, and 20 August. Bison were immobilized with 5.1 mg carfentanil and 60 mg xylazine hydrochloride. Induction times varied from 2 minutes 45 seconds to 4 minutes 0 seconds for 3 bison given this dosage. A fourth bison ran after it was darted, and we lost sight of the animal after 8 minutes but found it in sternal recumbence 16 minutes after darting. A fifth bison that was darted with 4.8 mg carfentanil and 60 mg xylazine was immobilized in 4 minutes 30 seconds. Based on these results, we determined that a dosage of 5.1 mg carfentanil and 60 mg xylazine hydrochloride works well for darting adult female bison from the ground in fall.

Carfentanil was reversed in the immobilized bison with naltrexone dosages that ranged from 118–127 mg naltrexone/mg carfentanil injected intramuscularly. Reversal times varied from 4 minutes 6 seconds to 5 minutes 18 seconds. There were no postcapture mortalities for immobilized bison.

MORTALITY

Harvest

Season and Bag Limit. The resident and nonresident bison hunting season was open from 20 July to 31 March during the 1995–1996 and 1996–1997 hunting seasons. However, hunting did not begin until 7 October each year so farmers in the DAP could finish harvesting their crops before

the hunt began. Participation in the hunt was by drawing permit for Hunt DI403 (bull only) and Hunt DI404 (cow only). The following conditions applied to each permit:

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

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

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

1995–1996 — During the 1995–1996 season, 120 total permits were issued, with 70 permits issued for the bull only hunt (DI403) and 50 permits issued for the cow only hunt (DI404) (Table 3). The bag limit was 1 bison every 5 years.

1996–1997 — During the 1996–1997 season, 120 total permits were issued, with 70 permits issued for the bull only hunt (DI403) and 50 permits issued for the cow only hunt (DI404) (Table 3). The bag limit was 1 bison every 5 years.

Board of Game Actions and Emergency Orders. At the March 1995 Board of Game meeting, the Board considered and rejected a proposal from the public to eliminate party hunts for Delta bison. The 1996–1997 hunting season was reopened by emergency order during 1–30 April 1997 to meet harvest goals.

Human-Induced Mortality.

1995–1996 — Total human-induced mortality was estimated to be 114 bison. Hunters killed 106 bison, 60 bulls and 46 cows. Additional mortality was estimated to be 7% wounding loss equal to 8 bison (Table 4).

Hunters with bull permits (DI403) killed 58 bulls and 2 cows. Hunters with cow permits (DI404) killed 44 cows and 2 bulls (Table 3).

Successful hunters with bull permits (DI403) hunted a mean of 5.1 days, and unsuccessful hunters hunted a mean of 10.1 days. Successful hunters with cow permits (DI404) hunted a mean of 3.8 days, and unsuccessful hunters hunted a mean of 5.0 days (Table 5).

The most commonly used firearm during 1995–1996 continued to be a 338-caliber rifle, used by 30% of successful hunters. Other commonly used firearms included the 300 Winchester Magnum (27%), 30-06 (20%), and 375 H&H (12%) (Table 6).

1996–1997 — Total human-induced mortality was estimated to be 117 bison. Hunters killed 103 bison, 56 bulls and 47 cows. Additional mortality was estimated to be 7% wounding loss equal to 8 bison, and an additional 6 bison mortalities resulted from other causes (Table 4). Hunters with

bull only permits (DI403) killed 53 bulls and 7 cows, and hunters with cow only permits (DI404) killed 40 cows and 3 bulls (Table 3).

Ten hunters were known to have killed bison of the wrong sex during the 1996–1997 hunting season. Therefore, several hunt administration changes were considered for implementation during the 1997–1998 hunting season. These included beginning the hunt on 1 October instead of 7 October and conducting hunter orientations every 5 days instead of every 7. Both of these changes are intended to allow hunters to begin hunting sooner in the fall when it is easier to identify the sex of a bison without complete winter pelage. Weather conditions and daylight are also more favorable for hunting earlier.

Successful hunters with bull permits (DI403) hunted a mean of 6.1 days, and unsuccessful hunters hunted a mean of 14.8 days. Successful hunters with cow permits (DI404) hunted a mean of 4.3 days, and unsuccessful hunters hunted a mean of 6.8 days (Table 5). Effort required to successfully kill a bull bison has increased in the last 2 years. This is probably due in part to a younger age structure in the bull segment of the population as bull:cow ratios have declined. Because younger aged bulls are more difficult to differentiate from cows than older bulls, hunters have more difficulty determining the correct sex of bison, which prolongs hunting effort. Another factor is continued loss of access to private farmland in the DAP for public hunting, which reduces access to bison for hunters.

The most commonly used firearm during 1996–1997 continued to be a 338-caliber rifle, used by 30% of successful hunters. Other commonly used firearms included the 300 Winchester Magnum (21%), 30-06 (15%), and 375 H&H (14%) (Table 5).

Permit Hunts. The number of applications for Delta bison permits increased to 15,257 applications in 1995 and 17,895 applications in 1996 (Table 7). 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 Alaska Board of Game passed a regulation that required applicants for all permit drawing hunts to purchase a hunting license and locking tag (if required) when applying for a permit. This regulation is probably responsible for the number of Delta bison applications declining to 15,479 in spring 1997. Fewer applicants reduced funding for the DJBR. In the past many hunters applied for bison permits for people who might not have purchased a hunting license otherwise. The Board of Game has modified this requirement for the 1998–1999 season to require only that a hunting license be purchased.

Hunter Residency and Success.

1995–1996 — Most Delta bison hunters continued to be nonlocal Alaskan residents. Permittees that hunted had a 91% success rate (Table 8) and 88% of all permittees killed bison (Table 3).

1996–1997 — Most Delta bison hunters continued to be nonlocal Alaskan residents. Permittees that hunted had a 90% success rate (Table 7) and 86% of all permittees killed bison (Table 3).

Harvest Chronology.

1995–1996 — Harvest occurred nearly the entire season from 7 October 1995 to 31 March 1996. However, most bison were harvested in 2 distinct periods during the hunting season. During the fall portion of the hunt, 68% of the harvest occurred during the first 9 weeks of the hunt (7 October–8 December 1993). Only 15% of bison were killed during weeks 10 to 19 (9 December 1995–16 February 1996). Hunting effort commonly increases about mid February, and the second distinct period of harvest occurred during weeks 20 to 25 (17 February–31 March 1996) when hunters achieved 20% of the harvest (Table 9).

1996–1997 — The first 9 weeks of the hunt (7 October–8 December 1996) continued to receive steady harvest with 61% of the bison killed during this time. The mid-season period from weeks 10–19 received 13% of the harvest. However, the anticipated increase in harvest after mid February was not as high as usual with only 18% of the harvest occurring in weeks 20–26. As a result, the hunting season was extended by emergency order through April 1997 to achieve a harvest that would meet the precalving population objective. As a result of the extended season, hunters killed 11% of the bison during the April emergency season (Table 9).

Transport Methods.

1995–1996 —Successful bison hunters (78%) preferred highway vehicles, while another 16% of successful hunters used snowmachines; these modes of transportation continue to be the two most common (Table 10).

1996–1997 — Again, successful hunters (78%) used highway vehicles, while 13% successful hunters used snowmachines (Table 10).

Harvest Locations.

1995–1996 — Most bison continued to be killed on private property in the DAP, although the proportion of bison being killed on private property decreased in 1995–1996. During the 1995–1996 hunting season, 68% of the bison were killed in the DAP, 26% were killed on the DJBR, and 6% were killed in other locations (Table 11).

1996–1997 — Most bison continue to be harvested on private property in the DAP. During the 1996–1997 hunting season, 56% of the bison were killed in the DAP, 32% were killed on the DJBR, and 12% were killed in other locations (Table 11).

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 1989–1990 because more farmers charge access fees to bison hunters and are steadily closing their property to them.

Other Mortality

Natural mortality has not been quantified for the Delta Bison Herd but it is probably low. Humans caused most nonhunting mortality through road kills, trapper snares, and other factors. However,

during this reporting period, wolves were observed either scavenging or preying on bison. In July 1996 2 subadult wolves were observed feeding upon a fresh bison carcass on the west side of the Delta River. In August 1996 a large humerus bone, suspected to be from a bison, was found at the den site of the 100-Mile wolf pack in eastern Unit 20A. Although wolves in these observations may have been scavenging on dead bison, wolves from the 100-Mile Pack were also seen stalking bison on 1–8 May 1997. These wolves were seen on gravel bar meadows on the west side of the Delta River within 100 yards of 20 bison that were tightly grouped together. Wolves were also observed scattered throughout alder thickets and stalking small groups of bison grazing in meadows (M McNay, pers commun).

Disease Management

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

During this reporting period, serum test results were received for 122 samples collected during 1993, 1994, and 1995. Bison continue to be free from most of the infectious diseases for which serum antibody tests are conducted. The exception is PI3 (Table 12). However, by itself, PI3 does not seem to pose a health problem to the herd at this time. The slight decrease in prevalence of PI3 in 1991 samples is probably due to different testing procedures and adjustment of titer thresholds with a new testing laboratory, rather than an actual decreased incidence of the disease (R Zarnke, pers commun).

Domestic bison that escape and join the wild herd continue to be a threat to the Delta Bison Herd. Approximately 20 domestic bison belonging to the Columbo herd escaped captivity on 7 August 1996. All of the Columbo bison were recaptured (F Columbo, pers commun). On 17 April 1997, 18 domestic bison escaped from the Hollembaek herd. Twelve of the Hollembaek bison were recaptured, but 6 probably joined the wild Delta Bison Herd. These incidents illustrate the potential for transmission of livestock diseases to the Delta Bison Herd via escaped domestic bison.

HABITAT

DJBR Habitat Management During 1996

Below average snowfall during winter 1995–1996 and a hard freeze on 5 June resulted in colder than normal soil temperatures during the early 1996 growing season. Low snowfall and low spring precipitation also caused drier growing conditions than usual. These conditions led to poor overwinter survival of perennial grasses in some areas of the DJBR, particularly in the Gerstle Fields. However, midsummer precipitation was adequate, and forage production was good on the DJBR.

The prescribed burn conducted on 16 May had very good burning conditions, and 500 acres of the Panoramic Fields were burned. Ignition began at 1330 hours when weather parameters reached prescription and personnel were prepared. When ignition began, ambient air temperature

was 62 °F, RH was 17%, and wind speed and direction was 4–5 mph at 60°. The fire burned well under these conditions with 3–8 foot flame lengths in the taller vegetation. Ignition ceased at 1700 hours with ambient air temperature of 55 °F, 44% RH, and wind 8–10 mph at 230°. This burn resulted in very good consumption of the vegetative duff layer in most areas.

When bison began arriving on the DJBR on 28 July 1996, they foraged initially on the youngest oats and on fertilized nugget bluegrass. The youngest oats were those planted on 25 June and were 6–8 inches high and in the tillering stage.

Forage samples were collected from various DJBR forage crops on 28 August to determine forage quality on the DJBR at about the time bison began leaving the DJBR and moving into the DAP. A forage sample from oats that had been planted on 25 June, grazed, and then regrown, had moisture free crude protein (CP) of 32.7% and in vitro dry matter disappearance (IVDMD) of 39% (this low value may be an error). Oats planted on 18 June had CP of 8.8% and IVDMD of 65% when sampled on 28 August. Forage samples were not collected from oats planted on 10 June. Nugget bluegrass samples collected on 28 August from the Panoramic Fields varied from 11.2–11.3% CP with IVDMD ranging from 65–86%. Nugget bluegrass samples collected on 28 August from the Gerstle Fields varied from 9.8–10.7% CP and had IVDMD ranging from 63–64%.

Anecdotal observations indicate that mowing bluejoint repeatedly is reducing the height of the plants in successive years. In 1995 bluejoint was 18–24 inches tall with 4–5 leaves when first mowed on 12 June 1995. In 1996 bluejoint in the same area was only 7–9 inches tall with 4–5 leaves when first mowed on 18 June. Soil moisture, soil temperature, and other factors may also be affecting plant height.

Another method for controlling bluejoint being tested is disking infested acreage and leaving it fallow for several years. Since 1993 a 100-acre plot in the Panoramic Fields has been repeatedly disked in the spring, planted with oats (which later are grazed by bison), and left fallow each winter. Anecdotal observations indicated this area was completely infested with bluejoint in 1993. However, the bluejoint has been significantly reduced and now occurs only randomly in clumps occupying approximately 10% of the total area.

Test plantings of red clover, enigmo timothy, and carlton bromegrass did not become well established because of poor seed germination due to inadequate seeding depth and weather conditions.

DJBR Habitat Management During 1997

Forage grew well on the DJBR during 1997. A rain gauge installed in the Panoramic Field collected 7.9 inches of precipitation during the summer growing season.

When bison began arriving on the DJBR on 27 July, oats varied from 7–8 inches tall for the youngest crops planted on 27 June to 20–24 inches tall in the heading stage for the oldest crops planted on 11 June. Bison grazed bluegrass and the youngest oat crops initially. Bison began moving into the Gerstle Fields on 5 August.

We collected forage samples from the Panoramic Fields on 29 August to measure forage quality at the time bison began leaving the DJBR. Oats from the 27 June planting were in the preboot-headed stage at the time of sampling and had CP of 28.8% and IVDMD of 73%. Oats from the 11 June planting were in the headed-mature stage and had CP of 17.1% and IVDMD of 59%. Nugget bluegrass had a CP of 12.1% and IVDMD of 66%.

When bison began leaving the DJBR, forage quality (CP and IVDMD) on the DJBR generally exceeded the average for oat hay produced in the Delta Junction area from 1982–1992. Crude protein for oat hay produced in the Delta Junction area averaged 11.0% (range = 6.2–17.7%) and IVDMD averaged 57.3% (range = 47.0–65.9%) (Quarberg and Corneau 1992). Therefore, when bison began leaving the DJBR in late August, there was still very high quality forage available that equaled or exceeded forage generally available in the DAP at that time. Fall forage was not a limiting factor solely determining when bison left the DJBR and moved into the DAP in 1997.

Attempts to control bluejoint with mowing are showing results after 3 years, particularly for plots that have been mowed 3 times each year. In 1995 bluejoint was approximately 10–11 inches tall, with 3 tillers, and 3–6 leaves when mowed the third time on 8–9 August 1995. During 1997 the plants were only 3–4 inches tall, with no tillers, and only 2 leaves, when mowing was scheduled for the third time on 12 August 1997. However, the grass was too short to mow with the mower. Therefore, repeated mowing is reducing the height of the plant and may be weakening the plant sufficiently that it will eventually die or be replaced by bluegrass. However, other environmental factors may also be effecting these results.

CONCLUSIONS AND RECOMMENDATIONS

The Delta Bison Herd continues to do well. Herd productivity and survival of calves continues to be good. Herd size exceeded the precalving objective in 1995–1996 and 1996–1997. Additional hunting permits will be issued to bring herd size in compliance with the management objective and to meet management goals to provide maximum hunting opportunity.

Herd health goals continue to be met. Although 100% of the herd was exposed to PI3, the herd apparently was not exposed to any other serious livestock diseases. Delta Bison Herd serology will continue to be monitored. The serologic health of the Delta Bison Herd 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 greatest challenges to DJBR management at this time continue to be 1) controlling the native grass, bluejoint reedgrass (*Calamagrostis canadensis*), with nonherbicidal techniques or developing techniques to make it more palatable for bison; 2) developing more cost effective forage management techniques; and 3) holding bison on the DJBR until the conclusion of harvest in the DAP. We will continue work to improve these aspects of DJBR management.

The objective to administer the Delta bison hunt to maintain hunter access to private property is only being partially met as more landowners are charging access fees or closing their property to hunters. Efforts will be made to work with landowners to maintain access to the DAP for bison hunters.

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Table 1 Precalving and postcalving population estimates for the Delta Bison Herd from 1983–1997

Year	Precalving[a] population estimate	Prehunt population estimate
1983	355	360
1984	300	356
1985	285	378
1986	300	361
1987	275	396
1988	337	426
1989	366	432
1990	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

[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 ratio counts and estimated population size, 1986–1987 through 1996–1997

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]

[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 Delta bison harvest data by permit hunt, 1986–1987 through 1996–1997

Hunt nr/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
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
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

Table 3 Continued

Hunt nr/Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful permittees	Percent successful permittees	Bulls (%)	Cows (%)	Unk (%)	Total harvest
	1990–1991	90	2	3	97	59 (67)	27 (31)	0 (0)	86
	1991–1992	100	0	9	91	50 (54)	43 (46)	0 (0)	93[c]
	1992–1993	100	3	1	99	62 (65)	33 (34)	1 (1)	96
	1993–1994	120	2	8	91	51 (47)	58 (53)	0 (0)	109
	1994–1995	40	3	3	95	20 (53)	18 (47)		38
	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

[a] Hunt 403 was an either-sex hunt from 1989–1990 through 1993–1994.
[b] One bull was harvested for the Alaska Wildlife Safeguard raffle.
[c] Two hunters killed 2 bison each.

Table 4 Delta bison harvest and accidental death, 1986–1987 through 1996–1997

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

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

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

Table 5 Mean number of days hunted for Delta bison, 1991–1992 through 1996–1997

	Mean number of days hunted			
	Hunt DI403		Hunt DI404	
Year	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

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

Table 6 Percent of successful Delta bison hunters using different firearms or bow and arrow during Hunts 403 and 404, 1989–1990 through 1996–1997

Weapon	% Successful hunters							
	1989–1990	1990–1991	1991–1992	1992–1993	1993–1994	1994–1995	1995–1996	1996–1997
338	29	28	31	25	29	47	30	30
30-06	25	15	24	23	18	24	20	15
300 Win Mag	11	27	15	20	14	3	27	21
375 H&H	14	10	11	17	18	9	12	14
300 Weatherby	7	4	5	2	4	0	0	1
8 mm Mag	4	3	2	3	2	0	2	2
458	3	3	1	1	1	0	1	0
350 Rem Mag	1	3	1	1	0	0	1	0
348 Win	0	1	0	1	0	0	0	0
300 H&H	0	0	0	0	0	6	0	0
Unk 300 Cal	0	0	0	0	7	0	0	0
Blackpowder	1	1	2	1	2	3	0	2
Bow & Arrow	0	1	2	1	0	0	0	0
Other	3	1	3	4	5	6	3	8
n	76	67	91	90	104	34	96	93

Table 7 Number of applications received for Delta bison Hunts 403 and 404 from 1977 through 1997

Year	Nr applications	Nr permits issued
1977	2121	20
1978	3555	15
1979	3970	25
1980	4561	35
1981	5237	55
1982	8105	75
1983	7889	75
1984	11,276	55
1985	666[a]	55
1986	6585	65
1987	6434	50
1988	9705	50
1989	10,151	65
1990	11,822	90
1991	11,057	100
1992	12,387	100
1993	13,654	120
1994	13,977	40
1995	15,257	120
1996	17,895	120
1997	15,479	130

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

Table 8 Delta bison hunter residency and success for hunters reporting for drawing Permit Hunts DI403 and DI404, 1986–1987 through 1996–1997

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

[a] Local residents reside in Unit 20D.

Table 9 Percent harvest of Delta bison by time period, 1986–1987 through 1996–1997. Each harvest period represents 7 days (except period 26 is 1 day only), beginning 7 October and ending 31 March.

Regulatory year	Harvest periods																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27[a]	*n*
1986–1987	7	13	9	16	20	0	7	9	9	0	0	2	7	0	0	0	0	0	0	0	0	0	0	0	0	0		45
1987–1988	9	9	9	9	11	17	9	2	4	0	0	0	0	0	0	0	0	0	4	4	4	4	2	0	2	0		46
1988–1989	4	4	13	2	11	13	11	0	2	2	0	0	2	4	0	0	0	0	4	4	7	9	2	2	0	0		45
1989–1990	6	14	16	6	14	6	14	8	4	0	0	0	2	0	0	0	0	2	2	0	2	0	2	0	0	4		50
1990–1991	2	6	13	14	13	7	13	9	2	2	1	1	1	0	1	1	0	0	0	1	2	1	2	5	0	1		86
1991–1992	11	5	6	11	15	8	14	2	0	0	1	1	1	0	2	2	1	1	3	2	2	5	3	2	0	0		93
1992–1993	14	12	13	10	10	12	9	5	1	0	0	0	0	0	2	0	1	0	2	5	2	1	1	0	1	0		94
1993–1994	14	3	11	11	8	8	10	3	2	0	0	1	2	0	3	1	0	2	2	2	0	2	4	6	6	1		109
1994–1995	26	8	18	8	3	0	5	0	0	11	0	0	0	0	0	0	0	5	0	0	0	8	3	5	0	0		38
1995–1996	16	9	9	12	7	6	6	2	1	0	1	2	7	0	0	2	1	1	1	3	4	2	5	4	2	0		106
1996–1997	12	5	7	6	4	5	10	11	1	0	1	0	0	0	4	1	1	3	3	5	0	0	1	5	7	0	11	103

[a] Hunt week 27 occurred in 1996–1997 only and includes the period of 1–31 April 1997 that was open to hunting by emergency order.

Table 10 Delta bison harvest percent by transport method for Hunts DI403 and DI404, 1991–1992 through 1996–1997

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

Table 11 Percent of Delta bison harvested by location during permit hunts DI403 and DI404 from 1989–1990 through 1996–1997

Year	Location of kill		
	Delta Agriculture Project	Delta Junction Bison Range	Other
1989–1990	95	5	0
1990–1991	91	9	0
1991–1992	77	23	0
1992–1993	78	17	5
1993–1994	75	24	1
1994–1995	86	14	0
1995–1996	68	26	6
1996–1997	56	32	12

Table 12 Serum antibody prevalence of infectious disease agents in the Delta Bison Herd, 1984–1995

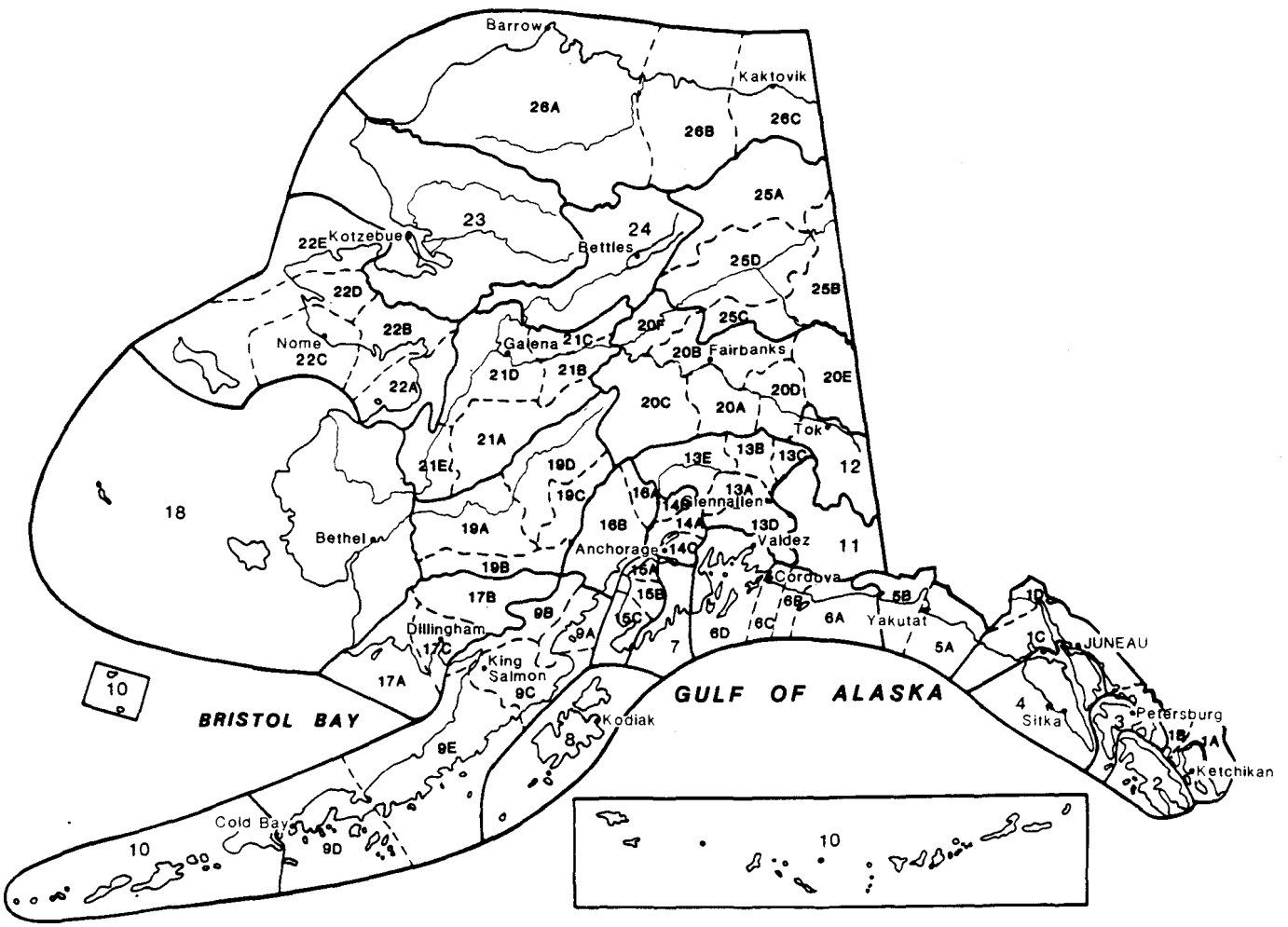
Agent	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Infectious bovine rhinotracheitis virus SN[a] (8)[b]	0/48[c]	0/29	0/52	0/42	0/43	0/38	0/43	0/59	0/74	0/67	0/49	0/6
Bovine viral diarrhea SN (8)	0/48	0/29	3/52	0/43	0/43	0/38	0/43	0/58	0/75	0/65	0/49	0/6
Parainfluenza 3 virus HI[a] (8)	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	0/6
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				

[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.

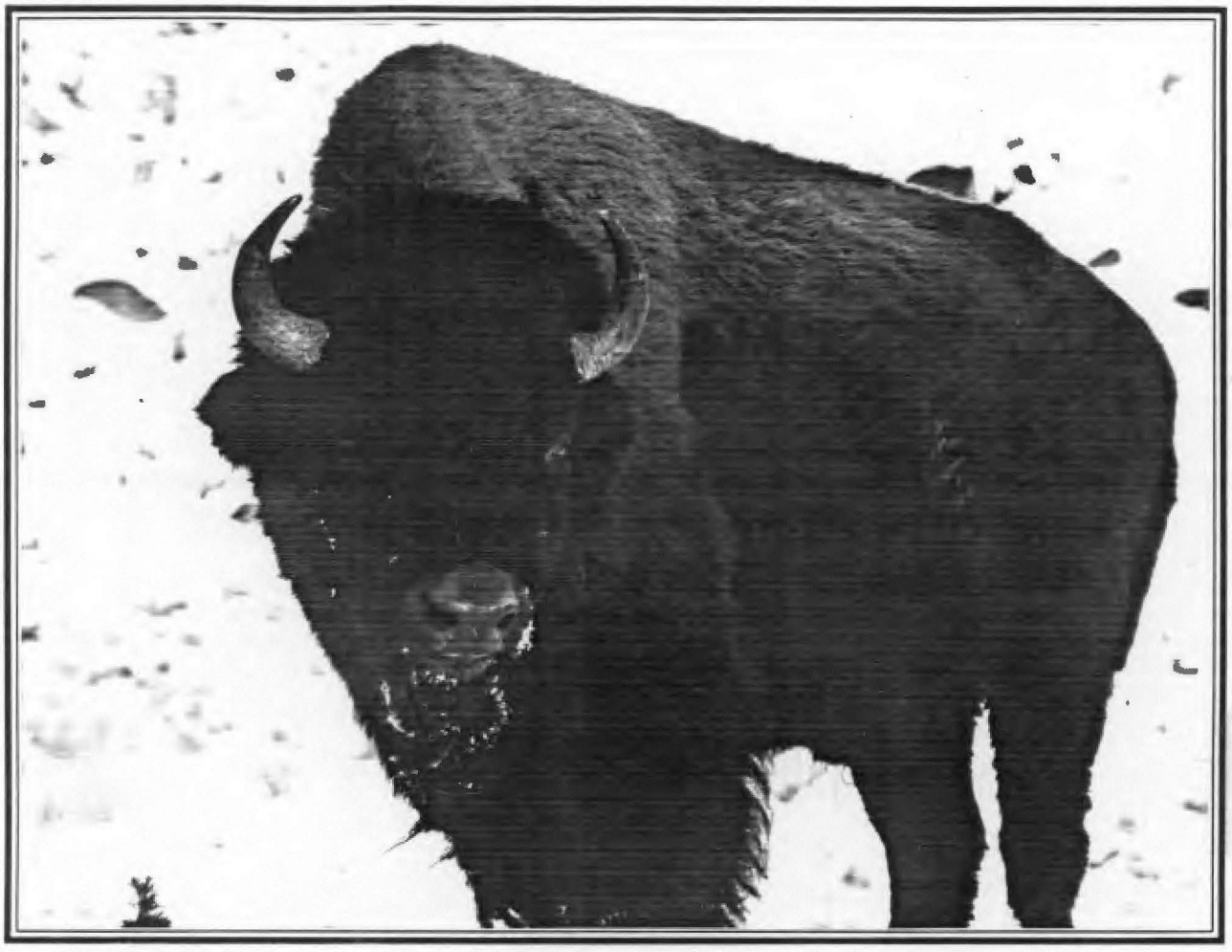
[b] Number in parentheses indicates minimum titer necessary to be considered evidence of exposure to agent in question. (+) indicates that test is interpreted as simply either "positive" or "negative."

[c] Number positive/number tested.

Alaska's Game Management Units



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



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