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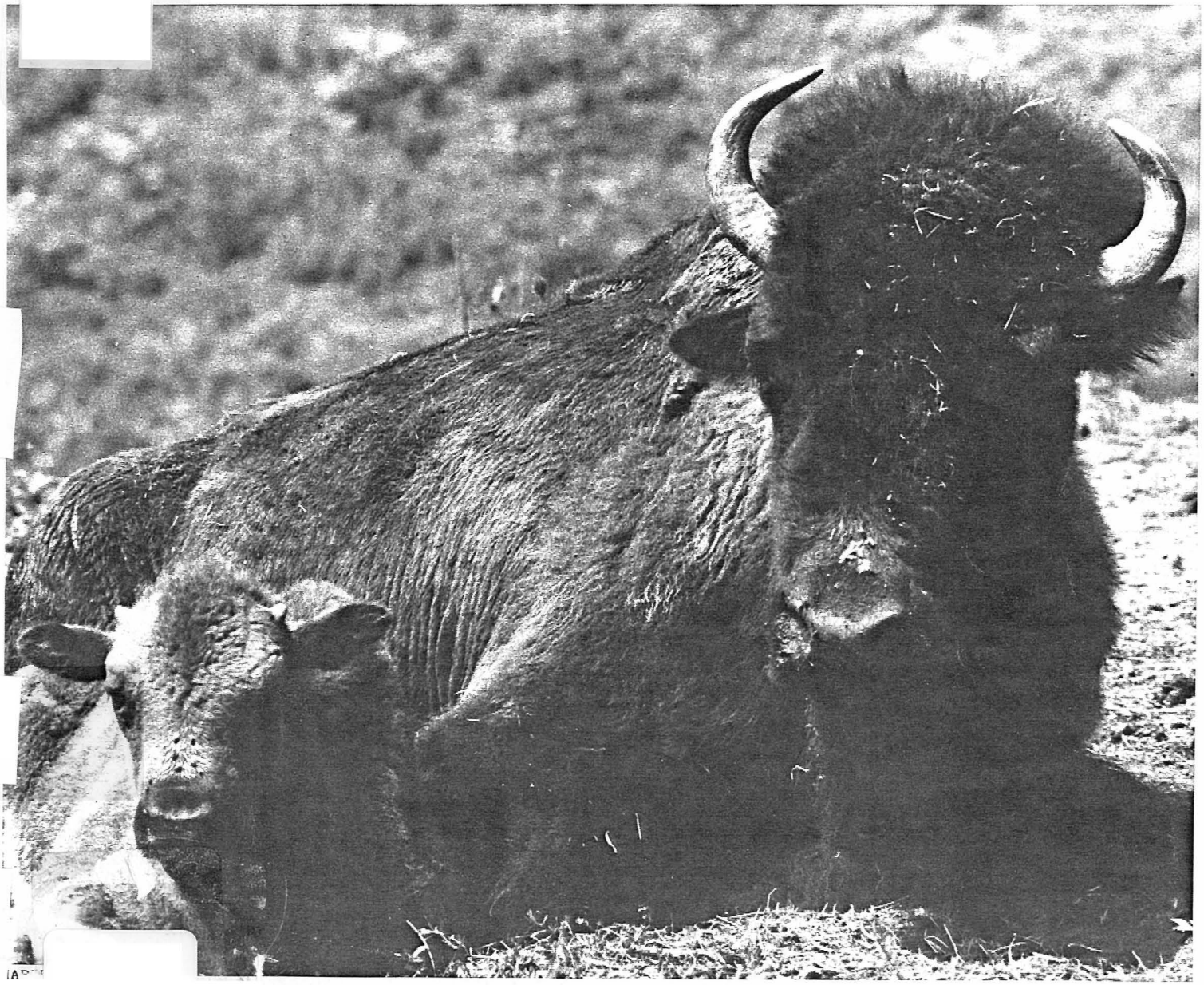
BISON

Mary V. Hicks, Editor



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DEPARTMENT OF FISH AND GAME
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LOCATION

Game Management Unit 11 (12,782 mi^2)

Geographical Description Copper 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 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 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. Hunters have harvested a total of 217 bison from this herd.

MANAGEMENT DIRECTION

Management Objectives

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

METHODS

Biologists conducted aerial surveys to determine composition of the herd in the spring following the calving period. Radiocollared animals in the herd declined from 5 to 2 adult cows. Radiocollars have been used since 1984 to facilitate finding the herd during spring surveys. In addition, bison surveyors flew transects through bison habitat between the Dadina and Chesnina Rivers to count animals not located with the radiocollared bison. Harvest and hunting pressure were controlled by registration permit. During open season, harvest was monitored 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

Population Size: Biologists counted 75 bison during an aerial survey in June 1993. Surveys were difficult because the herd was in a heavily timbered area. Slight variation in population estimates were attributable to survey conditions rather than changes in herd size. Surveys were repeated at various intervals to ensure a complete count.

The Copper River bison herd was stable during the late 1960s and 1970s after a period of growth in the 1950s. Survey data indicated a slight decline in herd size during the early 1980s, but by 1986 bison numbers had increased. There was a substantial decline in the herd following the severe winter of 1988-89 with the bison count declining 27%. In 1990, the herd size was estimated at 66 animals. Herd size increased slightly in 1991 and 1992 but declined in 1993 to an estimated 75 animals (Table 1).

Population Composition: Surveyors observed 60 adults and 15 calves during aerial surveys of the Copper River herd during 1993 (Table 1). Observed calf production has been high in 1991 and 1993. The lowest recruitment was in 1989, when we observed only 3 calves. Calf production over the past 5 years has averaged only 10 calves a year, compared to an average of 17 a year for the prior 5-year period. During the late 1960s and 1970s, the herd size averaged 78 adult bison. An average of 63 adult bison (range = 58-72) was observed between 1989 and 1993, slightly below the average of 68 (range = 52-76) between 1984 and 1988.

Distribution and Movements: The Copper River bison herd inhabited a home range bounded by the Dadina River on the north, the Copper River on the west, the Kotsina River to the south, and the Wrangell Mountains to the east. We seldom observed bison or bison sign north of the Dadina River or south of the Kotsina River. Seasonal distribution included intensive use of the Copper River flood plain and bluffs during winter and spring. This was followed by a movement to higher elevations along the Dadina and Chetaslina Rivers during the summer to feed on plants as they green-up later in the season. During the late 1970s and the 1980s, there were only occasional reports of bison along the western bank of the Copper River in Unit 13. We surmised human disturbance from the Kenny Lake area and hunting pressure prevented range expansion to the west. During the past 2 years, however, bison have been reported grazing in hay and crop fields in the Kenny Lake area. If this trend continues, we expect conflicts with farmers.

Mortality

Harvest:

Season and Bag Limit. The season for resident and nonresident hunters in Unit 11 for the area east of the Copper River, south of the Nadina River and Nadina and Sanford Glaciers, west of a line

from Mount Sanford to Mount Wrangell to Long Glacier, and west of the Kotsina River was 5 October to 10 November. The bag limit was 1 bison every 5 regulatory years by registration permit.

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

The bison hunt was closed by emergency order on 1 July 1989 and has not been reopened. Poor recruitment and a low count of adults were reasons for the closure. The closed season has been maintained because of either low adult or calf counts in subsequent years. The minimum herd objective of 60 overwintering adults could not have been achieved with human harvest. However, in 1992, low calf recruitment led to the decision to maintain a closed season.

Hunter Harvest: Hunters killed 6 bulls and 1 cow (Table 2) during the 1988 season, which was the last year a hunt was held. The 1988 hunting season was closed by emergency order in September after 7 bison were taken. This was the third consecutive year the season was closed after a 2 or 3-day hunt.

This herd is normally hunted in heavy timber, and mortality due to crippling loss probably occurs. Dense vegetation usually restricts hunters to shooting at bison from short ranges. Unless an animal is killed immediately, tracking in heavy timber without snow is difficult; wounded animals can be lost. The number of animals lost each year is not documented.

Permit Hunts. The Copper River bison hunt is a registration hunt with an unlimited number of registration permits issued on a first-come, first-serve basis (Table 3). Permits are available only in Glennallen, and all hunters must report hunt results there also. Registration permits are not issued until the day prior to the scheduled opening date (5 October). The hunt may be closed by emergency order if desired harvest is reached before the season closes 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. Hunter success data are included in Table 4. The Copper River Bison hunt has always been popular with local rural residents. During the last hunt in 1988, 40% of the permittees were local residents.

Harvest Chronology. Harvest chronology is summarized in Table 5. In recent years, the season was closed after only 2 days (Table 5).

Transport Methods. River boats were the most popular method of transportation (Table 6). Aircraft use declined in recent years because the season closed before 5 October. Use of mechanized vehicles, including aircraft, except on the Copper and Dadina Rivers and 4 designated lakes, was prohibited during past hunts until 5 October.

Other Mortality: Winter severity and the potential for winter starvation was monitored by recording snow depths at the Dadina Lake snow station. This station was near the bluffs along the Copper River where the herd winters. Snow depths observed during the winter of 1989 were 80% above normal and resulted in a winter snow severity index rate of "severe." Deep snows in early October 1989, 2 months earlier than usual, remained until late April. Yearly snowfall has been high since then, and the winters of 1990 through 1993 were also classified as "severe." One difference between years not indicated in the severity index was duration of the snowpack. In 1991, the deep snow condition did not last as long as in the previous 2 years. Between 1985 and 1988, winter severity indices at Dadina Lake varied from "mild" to "moderate."

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

Wolves, black bears, and brown bears are relatively abundant in the Copper River bison range. These predators are certainly capable of killing bison, but we have not researched predation rates on Copper River bison.

Habitat Assessment: ADF&G staff have not evaluated habitat condition on the Copper River bison range. Field observations along the Copper River floodplain and bluffs, and at some sedge meadows, indicated heavy use in preferred locations. Until recently, there has been little evidence of dispersal from the traditional range. If the Copper River herd is limited by range, movements of bison into ungrazed areas is expected. Favorable habitat is available in the Kenny Lake area on the western banks of the Copper River in Unit 13. The Kenny Lake area has numerous agricultural areas with extensive fields of hay and grain crops.

CONCLUSIONS AND RECOMMENDATIONS

The Copper River bison herd experienced a severe recruitment failure in 1989; only 3 calves were observed. This decline in recruitment was attributable to the severe winter of 1989, when snowpack was deep from early October until April. Calf production and/or survival increased in 1991 and 1993 but declined in 1992. The past 5 winters have been severe. In 1992, the spring and fall were cold with an early snowpack and record low temperatures. The only detectable difference among these 5 winters was the shorter duration of deep snow in 1991 and 1993.

Recent surveys indicated the Copper River bison herd was stable. Although calf production increased during the last 2 of 3 years, recruitment was offset by natural mortality. There obviously has been additional mortality of yearlings or adults over the past 5 years.

Observations indicated accidental death is an important source of natural mortality, and it seems improbable accidental death hasn't been a factor in herd growth in the past. Perhaps increased observations during winter have focused attention on sources of accidental loss, rather than a change in the accidental mortality rate.

Predation rates on the Copper River bison herd were unknown. Wolves, black bears, and brown bears were numerous on the home range of the Copper River bison herd. A brown bear was observed feeding on a bison carcass near the Copper River in 1993, but the bear may have been only scavenging a winter kill or drowned animal. The influence of deep snow on predation rates during the last 5 winters was unknown. Possibly bison were more vulnerable to predators during periods of deep snow.

In the past the Copper River bison range has supported more than 90 animals. Body and blood condition parameters obtained from captured cows during winters with normal snowfall indicated adequate forage was available. Habitat conditions may have deteriorated and precluded an increase in the bison population.

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. In recent years, however, bison numbers have recovered more slowly following human harvest. In response to reduced calf recruitment, the yearly harvest quota was reduced to 8 animals. In addition, the Copper River bison hunt has been canceled 7 times (1982, 1985, 1989-93).

Hunters have always been enthusiastic about the Copper River bison hunt. During the last 3 hunts, however, the number of permittees declined. Early closures, limiting seasons to only 2 days and reducing allowable take to 8 bison, have curbed hunter participation. Also, hunting conditions have deteriorated. Because of heavy hunting pressure on opening day and restricted access, hunters crowded together at popular hunting spots along the Copper River. The Copper River bison hunt has always been considered a quality hunting experience, but recent crowding of hunters, lower harvest quotas, and early season closures have threatened this status.

I recommend that before another hunt is held, the minimum number of adults in the Copper River bison herd should be increased from 60 to 80-90 overwintering bison older than calves. More adult cows are needed to increase the annual calf production. To maintain more cows in the herd, it is necessary to have a larger herd. Cows cannot be protected from harvest because this herd is hunted in the timber where sex identification is impossible. With a larger herd, an overharvest, especially of females, would have fewer biological effects on the herd, making periodic seasonal closures to rebuild numbers less necessary.

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Table 1. Copper River bison spring aerial composition counts and estimated population size, 1988-93.

Regulatory year	Adults[a]	Calves (%)	Total bison observed	Estimated population size[b]
1988/89	76	14 (16)	90	90
1989/90	63	3 (5)	66	66
1990/91	58	9 (13)	67	67
1991/92	60	13 (18)	73	73
1992/93	72	9 (11)	81	81
1993/94	60	15 (20)	75	75

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

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

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

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

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

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

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

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

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
1989/90[c]	--	--	--	--	--	--	--	0
1990/91[c]	--	--	--	--	--	--	--	0
1991/92[c]	--	--	--	--	--	--	--	0
1992/93[c]	--	--	--	--	--	--	--	0

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

Table 5. Copper River bison harvest chronology percent by time period, 1988-92.

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

Table 6. Copper River bison harvest percent by transport method, 1988-92.

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

[a]Hunting season closed

LOCATION

Game Management Unit 11 (13,300 mi^2)

Geographical Description Chitina River

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 1981, but has subsequently declined to 31.

The first Chitina bison hunt was held by drawing permit in September 1976. Permit hunts were held for 13 years between 1976 and 1988. During these permit hunts, sport hunters took 57 bison from the Chitina herd, with an average yearly kill of 4 animals.

MANAGEMENT DIRECTION

Management Objectives

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

METHODS

Biologists conducted aerial surveys to determine composition of the herd in the spring after the calving period. Survey techniques included flying transects through all the bison habitat in the lower Chitina valley to obtain a direct count. Hunting was curtailed 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 (Table 1). Between 1985 and 1989, the number of bison observed in the Chitina herd declined from 56 to 30 animals (46%).

Population Size: We counted 32 bison during an aerial survey in June 1993. Bison surveyors have not observed much change in the number of bison since 1989. The Chitina herd has stabilized at a reduced level.

Population Composition: Biologists observed 27 adults and 5 calves during aerial surveys of the Chitina Herd during 1993 (Table 1). There were 2 fewer calves present in 1993 than in the previous year. Calf production and/or survival has fluctuated over the last few years. Timing of the survey probably was not a factor in variable calf counts because the surveys were usually in June.

Distribution and Movements: The Chitina Bison Herd ranges within the riparian and upland habitats below the 2000 feet elevation, along a 40-mile portion of the upper Chitina Valley. Although movements vary considerably, the herd can usually be located between the Tana River and Barnard Glacier. During the past few years, biologists have observed especially heavy use of the riparian zone near Bryson Bar; survey efforts have focused on this area.

Mortality

Harvest:

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

Board of Game Actions and Emergency Orders. In 1985, the Board of Game changed the Chitina bison hunt from a sport hunt to a subsistence hunt. Only local rural residents were eligible for the permits. The Board reclassified the hunt as a sport hunt in 1986 and residents and nonresidents were eligible for hunts. Because the number of bison counted in spring of 1989 was well below the population objective, the department canceled the hunt in 1989 by Emergency Order. A hunt has not been held for the past 5 years.

Hunter Harvest: Hunters killed 4 bulls during the 1988 season, which was the last year a hunt was held (Table 2). Poachers have illegally taken bison from the Chitina River herd in past years. The number of animals illegally taken and effect of this poaching on the herd was unknown. However, in some years the illegal take probably equaled or exceeded legal harvest. One local resident admitted to taking a bison each year.

Permit Hunts. During the last hunt, the department issued 6 drawing permits for the Chitina Bison hunt (Table 3). Although up to 12 permits have been authorized by the Board of Game, for biological reasons the department reduced the number of permits issued.

In 1988, there were 423 applicants for a drawing success rate of less than 2%. The number of applications submitted for each of the last 3 hunts ranged between 359 and 423. Nonresident hunters have not received a permit during the last 6 hunts.

Hunter Residency and Success. Table 4 includes hunter success data for previous hunts.

Transportation Methods. In 1988, all successful bison hunters used aircraft (Table 5). Of the 26 successful bison hunters reporting transportation methods since 1983, 24 (92%) used aircraft, 1 (4%) used a riverboat and 1 (4%) used a dog team.

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

Habitat Assessment

Until 1980, the bison habitat in the upper Chitina Valley received substantial use from horses on 2 grazing leases in the area. Then, department biologists made a cursory evaluation of forage utilization in bison habitat and determined that browsing and grazing were heavy, especially on horse-grazing leases. It was also determined the bison herd should be held at 30 overwintering adults. Subsequently 1 grazing lease was canceled and the number of horses using this area has been reduced.

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

Appreciable vegetation loss has occurred on the Chitina bison range during the past 4 years. This is a result of rechannelization of the Chitina River toward the north bank. The first area affected was the floodplain northeast of Bear Island. This was a heavily used riparian area before 1991 when flooding first occurred. It was estimated over 50% of the vegetation has been washed away. Over the past 2 years, flooding has occurred east of Bear Island, near Bryson Bar, and extended toward Hubert's landing. It is impossible to predict effects of this flooding on the herd. At the very least, the herd must change short-term feeding patterns.

CONCLUSIONS AND RECOMMENDATIONS

The Chitina bison herd declined by 26 animals between 1985 and 1989, then stabilized. Calf production was especially low last year. This reduction in recruitment may have been a response to habitat change from flooding and rechannelization of the Chitina River through important feeding areas near Bear Island. The short-term effects of flooding and vegetation loss may have temporarily reduced carrying capacity. Legal human harvests were eliminated in 1989 when the Chitina bison hunt was closed by emergency order. The Chitina bison hunt should remain closed until the herd approaches the minimum population objective of 50 bison.

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Table 1. Chitina bison spring aerial composition counts and estimated population size, 1988-93.

Regulatory year	Adults[a]	Calves (%)	Total bison observed	Estimated population size[b]
1988/89	34	5 (13)	39	39
1989/90	26	4 (13)	30	30
1990/91	28	8 (22)	36	36
1991/92	28	3 (10)	31	31
1992/93	24	7 (22)	31	31
1993/94	27	5 (16)	32	32

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

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

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

[a]Radiocollaring mortalities
[b]Hunting season closed

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

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

[a]Hunting season closed

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

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

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

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

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

[a]Hunting season closed

LOCATION

Game Management Unit: Unit 19

Herd: Farewell

Geographical Description: All drainages of the Kuskokwim River upstream from Lower Kalskag

BACKGROUND

A transplant of 18 animals from the Delta bison herd established the Farewell bison herd in 1965. An additional 20 bison were transplanted to the area from Delta in 1968 to supplement the existing herd. This herd ranges along the upper drainages of the South Fork of the Kuskokwim River and through the Farewell burn area west of the South Fork.

The first legal harvest from this herd was in 1972 after aerial surveys revealed the herd could sustain nominal harvests. Hunting has generally been administered as a drawing permit hunt, although in 1979 and 1984 it was administered as registration and "Tier II" subsistence hunts, respectively.

From 1980 through 1983, 20 drawing 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 an additional 30 permits for spring (March) hunts. In the 1991 regulatory year, 80 permits were awarded, 40 for fall and 40 for spring hunting periods. The number of permits was reduced to 50 (30 fall and 20 spring) during the 1992 and 1993 regulatory years.

MANAGEMENT DIRECTION

The Farewell bison herd is managed for the optimal sustainable yield of animals while providing uncrowded and aesthetic hunting conditions. Availability of adequate forage within the range of this herd is questionable at this time. An upper limit for population growth of 300 bison has been considered until additional burns are created to provide additional vegetation.

Management Goals and Objectives

- Maintain a minimum of 200 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 in an attempt to more efficiently gather herd size, composition data, and habitat use patterns.

- Conduct late winter aerial surveys to determine extent of predation and/or starvation mortality.
- Work in cooperation with the Alaska Department of Natural Resources (DNR) and other landowners to complete a prescribed fire in the Farewell area in an attempt to increase seasonal bison forage abundance and availability.
- Administer and monitor the permit drawing hunts for the Farewell bison herd.

METHODS

We conduct aerial surveys annually to gather herd size and composition data. Postcalving surveys are in June to determine calf production. Early spring flights have been within the traditional range of the herd to monitor extent of winter and predation mortality. Six adult cows were instrumented during summer 1991 and 1992, using helicopter-supported darting techniques to facilitate group locations.

Plans to enhance habitat have not continued in the absence of the area biologist March 1993 through February 1994. A formal controlled burn prescription in a portion of the 1977 Bear Creek burn area is planned for 1995.

Drawing permit hunts for Farewell bison have continued. Hunts have been administered from the McGrath area office with permittees assigned one of various 10-day hunt periods in August, September, or March. To reduce crowding and provide quality hunting opportunity, no more than 10 hunters at one time are allowed afield. Hunters are required to check in at McGrath either by phone or in person before and after their hunts. Hunters are also required to complete and return a mail-out questionnaire after hunting. Questionnaire results and personal interviews form the database for evaluating aspects of the hunt.

RESULTS AND DISCUSSION

Population Status and Trend

Between 1968, when aerial surveys were first initiated, through 1988, the Farewell bison herd experienced an average annual growth rate of approximately 10%. Since 1988, no complete surveys have been accomplished. Increased harvests in the early 1990s coupled with natural mortality may have combined to arrest the growth of this herd. Sharp reductions in the number of permits issued during the past 2 regulatory years, however, may have been sufficient to stimulate herd growth.

Population Size: Recruitment, hunting mortality, and limited herd size data indicate the population remains at 280-300 bison (Table 1). Repeated attempts at complete counts of herd size during each of the past 6 years have been unsuccessful because of sporadic and unpredictable movements.

Population Composition: Seven surveys of Farewell bison have been conducted since 1989. During 1989, only 8% calves were recorded in the population (n = 230). However, that survey was conducted in early May before parturition was complete for the year. Composition surveys during 1992 and 1993 revealed 21% and 23% calves in the herd, respectively.

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 to the South Fork Kuskokwim River floodplain, generally moving south 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 River/Happy River headwaters). Bison have also been infrequently 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. A large lightning-caused burn during summer 1990 on the east side of the South Fork Kuskokwim has already encouraged bison herd movements in that direction and may increase available forage.

Mortality

Harvest: Hunter harvest of bison from the Farewell bison herd during the 1991 and 1992 regulatory years was 36 and 14, respectively. The 1991 harvest is the highest on record (Tables 2 and 3). However, this is a reflection of an increased number of available permits rather than increased hunter success rates. Permits issued were reduced from 80 to 50 for the 1992-93 season, and the resulting harvest of 14 bison (10 bulls and 4 cows) is the lowest recorded in recent years. All bison were taken in Subunit 19C.

Fall season hunters are in the field during moose, bear, and caribou seasons, and several have complained about hunter density during this season. Spring season hunters indicate a greater level of enjoyment because most other big game seasons are closed at this time, and there is less crowding.

Season and Bag Limit.

	Resident	Nonresident
1 bison every 5 regulatory years by drawing permit only.	Aug. 22-Sept. 30 Mar. 1-Mar. 31	Aug. 22-Sept. 30 Mar. 1-Mar. 31

During the March 1989 meeting, the Alaska Board of Game approved the department's proposal to issue up to 100 drawing permits and extend the open season from 10 August through 31 March. Permits were increased to 80 for the 1991-92 regulatory year and reduced to 50 for subsequent years.

Hunter Residency and Success. The vast majority of applicants and permittees for the Farewell bison hunt are Alaska residents (Table 4). Unit 19 residents and nonresidents each constitute less than 5% of permittees. No foreign nationals have obtained permits.

Permit success averages about 50%. However, this figure includes all permit holders, both those who go afield and those who do not. During the past 6 regulatory years, 20-30% of the permit holders have not attempted to hunt (Table 4). Thus, approximately two-thirds of the hunters who go afield are successful at bagging a bison. Hunter success is generally higher during the spring season than during fall. Success rate dropped considerably during the 1992 season due to early snowfall in September.

Transport Methods. During the fall hunt (Hunt No. 451), initial access to the Farewell area is typically by aircraft (Table 5). During the past 6 years only 1 hunter used a boat for initial access. About half of the hunters use all-terrain vehicles as a secondary access method. During the spring hunt (Hunt No. 452), the primary access method is also aircraft. However, during the March 1991 hunt, 5 of 18 (16%) successful hunters used snowmachines to get to the hunt area from McGrath. Generally hunters using aircraft to reach the hunting area in March use snowshoes or skis to stalk and retrieve bison.

Other Mortality: Until 1988 little natural mortality occurred. However, since that time, 6 dead bison have been incidentally located. Two of these kills seemed due to wolf predation. Two additional kills were attributed to starvation (winter kill): 1 adult cow and a 5- to 6-month-old calf. Cause of death of the 2 remaining kills was not determined, although I suspect they were wounded by hunters and not retrieved. Incidental reports of 3 additional deaths have been received but were not investigated; no cause of death was determined. No systematic surveys have been conducted in order to document the extent of natural mortality, although natural mortality now certainly affects the population.

Success rates vary by assigned hunt period (Table 6), but chronology of the harvest is probably affected more by weather conditions (directly affecting access) rather than bison vulnerability. Extremely poor weather conditions severely affected hunter participation during the 1992 fall season. Keeping with the general trend during the past 4 years, hunter success rates are higher in spring (Hunt No. 452) than during fall (Hunt No. 451).

Habitat

Little is known about range conditions for the Farewell bison herd. The herd spends winters on and adjacent to the Bear Creek burn where forage seems adequate. However, summer range is limited to river floodplains within the Alaska Range. Although no recent estimates of bison carrying capacity on summer range are available, high use or possible overuse is evident.

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

CONCLUSIONS AND RECOMMENDATIONS

Until 1988 we thought natural mortality was minimal within the Farewell bison herd. It is evident now, however, that hunter take is but one of the annual adverse factors affecting the herd. Total herd size must be monitored closely and permit numbers adjusted annually to manage the herd. Until range evaluations can be completed, the herd should not be allowed to exceed 300 animals. This will entail deploying additional radiocollars and periodically monitoring those transmitters to obtain herd size figures. 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 annual aerial composition counts and estimated population size, 1986-93.

Regulatory year	Adults	Calves (%)	Total bison observed	Estimated population size
1986-87	227	43 (16)	270	270
1987-88	61	20 (25)	81	300
1988-89	211	19 (8)[a]	230	300
1989-90	174	39 (18)	213	280
1990-91	107	20 (16)	127	280
1991-92[b]	117	31 (21)	148	280
1992-93[c]	171	51 (23)	222	290

[a] Bison survey conducted in early May before parturition was complete, thus percent calves is unrealistically low.
[b] June 30, 1992
[c] June 22, 1993

Table 2. Farewell bison harvest data by permit hunt, 1987-93[a].

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
451	1987-88	40	20	30	50	14 (70)	6 (30)	0	20
	1988-89	40	23	25	53	16 (76)	5 (24)	0	21
	1989-90	40	33	33	34	10 (71)	4 (29)	0	14
	1990-91	40	28	40	32	8 (62)	5 (38)	0	13
	1991-92	40	23	40	38	8 (53)	7 (47)	0	15
	1992-93	30	30	53	17	4 (80)	1 (20)	0	5
452	1987-88	--	--	--	--	--	--	--	--
	1988-89	--	--	--	--	--	--	--	--
	1989-90	30	27	10	63	8 (42)	11 (58)	0	19
	1990-91	30	17	23	60	8 (44)	10 (56)	0	18
	1991-92	40	20	28	53	11 (52)	10 (48)	0	21
	1992-93	20	15	40	45	6 (67)	3 (33)	0	9
Totals for all permit hunts	1987-88	40	20	30	50	14 (70)	6 (30)	0	20
	1988-89	40	23	25	53	16 (76)	5 (24)	0	21
	1989-90	70	30	23	47	18 (55)	15 (45)	0	33
	1990-91	70	23	33	44	16 (52)	15 (48)	0	31
	1991-92	80	21	34	45	19 (53)	17 (47)	0	36
	1992-93	50	24	48	28	10 (71)	4 (29)	0	14

[a] Figures only depict legally harvested animals.

Table 3. Farewell bison harvest, 1986-93.

Regulatory year	Hunter harvest: Reported M (%)	Reported F (%)	Reported Unk	Estimated Total	Estimated Unreported	Estimated Illegal	Estimated Total	Total
1986-87	unk	unk		unk	unk	unk	unk	19
1987-88	14 (70)	6 (30)		20	0	0	0	20
1988-89	16 (76)	5 (24)		21	0	0	0	21
1989-90	18 (53)	15 (44)		33	0	0	0	33
1990-91	16 (52)	15 (48)		31	0	0	0	31
1991-92	19 (53)	17 (47)	0	36	0	0	0	36
1992-93	10 (71)	4 (29)	0	14	0	1	1	15

Table 4. Farewell bison hunter residency and success, 1987-93[a].

Regulatory year	Successful: Local[b] Resident	Successful: Nonlocal resident	Successful: nonres	Successful: Unk	Unsuccessful: Local[b] Total (%)	Unsuccessful: Nonlocal Resident	Unsuccessful: Resident	Unsuccessful: nonres	Unsuccessful: Unk	Total Total (%)	Total hunters
1987-88	2	18	0	0	20 (50)	1	18	1	0	20 (50)	40
1988-89	2	19	0	0	21 (53)	1	17	1	0	19 (47)	40
1989-90	3	30	1	0	34 (49)	3	29	4	0	36 (51)	70
1990-91	5	26	0	0	31 (44)	0	39	0	0	39 (56)	70
1991-92	2	33	1	0	36 (45)	2	39	3	0	44 (55)	80
1992-93	1	13	0	0	14 (28)	1	35	0	0	36 (72)	50

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

Table 5. Farewell bison harvest percent by transport method, 1987-93.

Regulatory year	Percent of harvest			*n*
	Airplane	Boat	Snowmachine	
1987-88	97	3	0	32
1988-89	100	0	0	31
1989-90	98	0	2	33
1990-91	84	0	16	31
1991-92	81	0	19	36
1992-93	71	0	29	14

Table 6. Farewell bison harvest chronology percent by time period, 1987-93.

Regulatory year	Harvest periods								n
	8/22-31	9/1-10	9/11-20	9/21-30	10/1-10	3/1-10	3/11-20	3/21-20	
1987-88	--	25	25	30	20	--	--	--	20
1988-89	--	29	33	19	19	--	--	--	21
1989-90	18	8	8	6	--	15[a]	24	21	34
1990-91	10	10	10	13	--	22	16	19	31
1991-92	3	6	11	22	--	19	17	22	36
1992-93	--	7	29	--	--	29	21	14	14

[a] Includes 1 illegal kill (multiple bag).

LOCATION

Game Management Unit: Unit 20D (5,720 mi^2)

Herd: Delta

Geographical Description: Central Tanana Valley near Delta

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, two 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 climatic conditions. Bison lived along the Delta River near Delta Junction before their extinction in Alaska (D. Guthrie, pers. commun.).

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

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

In 1979, the Alaska Legislature established the 90,000-acre Delta Junction Bison Range (DJBR), south of the Alaska Highway 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. Funds from the fee increase were intended for management of the DJBR. Since 1984, the appropriated funds have been used to develop 2,800 acres of bison forage on the DJBR in 2 field complexes named the Panoramic and Gerstle fields, purchase equipment for forage management, and hire personnel to accomplish these tasks.

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

MANAGEMENT DIRECTION

Management Goals and Objectives

1. Maintain a healthy, free-ranging bison herd.
   a. Prevent the transmission of livestock diseases to the Delta bison herd.
   b. Prevent the spread of diseases from Delta bison to other wildlife species.

2. Manage the Delta Junction Bison Range to reduce conflicts between bison and agriculture.
   a. Use Delta bison hunt permit application fees to manage bison forage on the range.
   b. Provide direct assistance until 1 October each year to landowners experiencing bison/agricultural conflicts inside fenced areas.

3. Provide the greatest opportunity to hunt and view bison.
   a. Manage for a precalving population of 360 bison (430 postcalving before hunting).
   b. Administer the Delta bison hunt to reduce landowner/hunter conflicts and maintain hunter access to private land in the Delta Agricultural Project.

METHODS

DJBR Management

A prescribed grass burn was conducted in the Panoramic Fields on 8-10 June 1992. Approximately 700 acres of bluegrass and mixed bluegrass/fescue was fertilized in the Gerstle Fields with N60-P30-K20-S10 from 28 May to 5 June 1992. Dr. Steve Sparrow (Univ. Alaska, School of Ag. and Land Resource Manage., Fairbanks) conducted studies on the DJBR to evaluate legumes for forage and soil enhancement (Karczmarczyk 1992). Additional bison attractants on the DJBR were numerous 50-pound trace element salt blocks placed at various locations and two 660-gallon stock tanks kept full of water.

Approximately 45 acres were disked and planted with oats in the Panoramic Fields on 1-5 May 1993. Oat seed was planted using a fertilizer spin spreader to spread seed on the surface of disked soil. A Brillion soil packer was then pulled over the soil to pack seeds and fertilizer into the soil and increase seed-to-soil contact. Oats were fertilized with N60-P20-K0-S10 (Karczmarczyk 1993).

Approximately 800 acres of bluegrass and mixed bluegrass/fescue were fertilized in both the Panoramic and Gerstle fields with N60-P20-K0-S10 from 10 May to 5 June (Karczmarczyk 1993).

Approximately 3-4 tons of barley feed grain were spread in the Gerstle Fields on 18-20 August to test the effectiveness of providing supplemental feed to hold bison on the DJBR in the fall. On

26 August approximately 1.5 tons of timothy hay were also spread in the Gerstle Fields as an additional supplemental forage.

About 45 acres of bluegrass heavily infested with bluejoint (*Calamagrostis canadensis*) were mowed in the Panoramic Fields from 1 July to 30 August to weaken the bluejoint. Acreage was mowed with a New Holland disk mower.

Soil samples were collected in both the Panoramic and Gerstle fields for soil analysis. A soil probe was used to take soil samples to a depth of 6 inches at 10 random sites within each field. The samples from each field were pooled into one field sample. Samples were analyzed by the University of Alaska Agricultural Experiment Station (P.O. Box AE, Palmer, AK 99645).

Herd Management

Population Status and Trend: Prehunt herd population size was estimated by aerial censuses. Bison were located from a Piper Supercub PA-18 by visual searching and by locating aggregations that contained a radiocollared bison. Aggregations were counted visually if possible. We photographed and attempted a visual count of aggregations difficult to accurately count. We also counted these aggregations from the photographs. The prehunt population size is considered the maximum number of bison counted during the photocensuses.

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

Population Composition: Herd sex and age composition data were collected by locating groups containing radiocollared bison on the ground and classifying bison in each aggregation. Using 8 x 40 binoculars or a 15-60 power spotting scope, we determined sex and age by observing bison. Bulls were differentiated from cows by body size, pelage, horn shape, and presence of a penis sheath. Yearling bulls were differentiated from adult bulls by horn size and shape.

Distribution and Movements: We monitored fall bison movements by locating radiocollared cow bison and from reports by people observing bison moving through the area. Locations of radiocollared bison were obtained from the ground by using a single antenna and listening for peak signal strength to determine the general location of the bison. For precise aerial locations, we mounted a pair of antennae on an aircraft and located the radiocollared bison.

Disease Management: A serologic survey was conducted by asking all bison hunters to collect approximately 30 ml of blood from the bison they killed. Blood 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, parainfluenza 3, brucellosis, and Q fever.

Harvest Management: Bison hunters were required to attend a check-in orientation to learn to differentiate between bull and cow bison, review land status in the hunt area, and receive supplies and instructions for collecting biological samples from their bison.

Bison hunters were required to check out after their hunt. Hunters were given a questionnaire asking the following information: date of kill, location of kill, number of hunting days, number of shots required, caliber of weapon, and weight of bullet.

During the 1992-93 hunting season, hunters were provided with a self-checkout procedure. Hunters were provided the hunter questionnaire during the check-in orientation and instructed to leave the questionnaire and blood samples in a drop box at the Delta Junction office. If hunters checked out during working hours, department staff would examine the carcass, record tooth dentition, and extract an I1 tooth from bison that had all permanent teeth. Teeth were sent to Matson Laboratories (P.O. Box 308, Milltown, MT 59851) for aging. Horns were measured according to the Boone and Crockett Club scoring system. If hunters checked out after working hours, they were asked to extract a tooth themselves and mail it to the Delta Junction office.

RESULTS AND DISCUSSION

Population Status and Trend

Population size and trend is regulated through annual harvest by hunters. Estimates of precalving and prehunt population size exceeded the management objective of 360 bison precalving or 430 prehunt. Precalving population estimates were 384 bison in spring 1992 and 392 bison in spring 1993. Maximum prehunt population size decreased from 484 in fall 1991 to 465 in fall 1993 (Table 1).

Population Size:

1992-93. A population census flight was conducted on 23 June 1992. We estimated maximum prehunt herd size at 482 bison, consisting of 381 adults and 101 calves. We calculated a spring 1993 precalving population estimate of 392 bison (Table 1).

1993-94. Population census flights were conducted on 10 and 26 July and 4, 24, and 25 August 1993. Multiple census flights were flown in 1993 because I questioned the accuracy of results from population estimates conducted before 25 August and because the population estimates were significantly lower than expected. Initial population estimates ranged from 347 to 411 bison. The 25 August 1993 census resulted in a prehunt estimate of 465 bison and revealed that a number of bison had been missed during earlier censuses (Table 1).

Population Composition:

1992-93. Sex and age composition data were collected on 13 August 1992, and 381 bison were classified. Calf survival to fall was 46 calves:100 cows observed; calves composed 20% of the

population. Survival to 18 months of age was good with 14 yearling bulls:100 cows and yearling bulls were 6% of the population (Table 2). The ratio of bulls in the herd rose slightly to 87 bulls:100 cows (Table 2), but the proportion of adult bulls and cows in the herd decreased to 31% and 43%, respectively (Table 3).

1993-94. Sex and age composition data were collected on 17 and 26 August, 29 September, and 4 October 1993. The largest sample of bison was classified during the 4 October count and totaled 308 bison. Calf survival to fall remained high with 62 calves:100 cows; however, an unusually large number of young red calves was observed (approximately 20 red calves or 24% of all calves observed) Calves composed 27% of the population. Survival to 18 months of age decreased to 9 yearling bulls:100 cows; yearling bulls composed 9% of the population (Table 2). The ratio of bulls in the herd decreased to 67 bulls:100 cows (Table 2). Adult bulls decreased to 20% of the herd (Table 3). The decreasing proportion of bulls is intended to produce a more productive herd to provide greater hunting opportunity without increasing herd size.

Distribution and Movements:

1992-93. During late June and early July 1992, bison were observed along the Delta River near Buffalo Dome and the Texas and Washington ranges of Fort Greely Military Reservation. One notable observation was a group of 18 bison west of the Delta River about 4-5 miles northwest of Buffalo Dome in the area of the 1991 Buffalo Dome wildfire. This was the first evidence of bison using this new source of forage adjacent to the Delta River.

By early to mid July 1992, bison had moved north along the Delta River to the vicinity of Beales Range on Fort Greely. During mid to late July, some bison began migrating east from the Delta River to the DJBR, and others continued moving north along the Delta River. The first observation of bison beginning their fall eastward migration was on 13 July when a group of 200-250 bison was reported along Jarvis Creek east of Pump Station 9 (B. Brant, pers. commun.). On 18 July another group of 100 bison was observed lying in lower Jarvis Creek west of the Jarvis Creek Bridge crossing the Richardson Highway.

On 21 July 1992 numerous sightings indicated bison were widely scattered from the Delta River to the Gerstle Fields on the DJBR. Bison observations on 21 July included 1) ground tracking of radiocollared bison; bison were located along the Delta River from Washington Range on Fort Greely to approximately 1.5 miles north of Delta Junction, 2) 5 bison moving eastward across the Richardson Highway near Fort Greely Allen Army Airfield (K. Spiers, pers. commun.), 3) about 100 bison in the Panoramic Fields (W. Heimer, pers. commun.), and 4) about 30 bison crossing the road to the U.S. Army Gerstle River Test Center near the Gerstle Fields of the DJBR (K. Spiers, pers. commun.).

Some bison continued to use the summer range until at least early August. The last bison reported on the summer range were 60-80 bison on the Texas Range portion of Fort Greely on 6 August.

Bison continued to use the Panoramic and Gerstle fields of the DJBR early to mid August but began leaving the DJBR late August. Bison were reported in the DAP on 22 August 1992, and 100 bison were in the DAP on 26 August (G. Champlin, pers. commun.). From 26 August until the end of August, most bison left the DJBR and moved into the DAP. On 2 September, a local pilot reported large numbers of bison in the DAP and only 2 in the DJBR (D. Quarberg, pers. commun.).

DJBR management met the objective of reducing conflicts between bison and agriculture, although conflicts were not eliminated. Bison migrated from the summer range to the DJBR between 13-21 August. Bison began moving from the DJBR into the DAP between 22-26 August. If 13 August is used as the day bison began moving into the DJBR and 22 August is used as the day bison began moving into the DAP, then DJBR management delayed movement of the Delta bison herd from the summer range into the DAP by approximately 40 days. Although segments of the Delta bison herd began moving into the DAP on approximately 22 August, typically the entire herd does not move simultaneously. Therefore, even though segments of the herd were in the DAP by approximately 22 August, the DJBR also delayed the entire herd's movement into the DAP about 1-2 weeks.

The end of harvest in the DAP occurred about 12 September due to early deep snows (B. Fredrichs, pers. commun.). Therefore, portions of the Delta bison herd were in the DAP for approximately 22 days before completion of harvest. Bison caused significant damage to the crops and fence surrounding Tract F. The most significant crop damage fall 1992 occurred to Tract F in the DAP. Crops in Tract F were swathed and left in the field due to the early snow.

Seasons influence bison movements. Winter of 1992-93 the Delta bison herd foraged in the DAP and the DJBR. Most bison were in the DAP nearly all winter. Bison began migrating west to their summer range in early March 1993. Bison were first seen on the Texas Range portion of Fort Greely between 8-10 March 1993 (J. Storey, pers. commun.). During the first or second week of June 1993, bison were along the Richardson Highway opposite Black Rapids Glacier (R. Joslin, pers. commun.). This observation is unusual because bison rarely cross to the east bank of the Delta River in this area.

1993-94. On 10 July 1993 most bison were on the Texas and Washington ranges of Fort Greely. Bison began migrating eastward from the Delta River in late July. During an aerial census on 26 July, most bison were still on the Texas and Washington ranges, but bison tracks were seen north along the Delta River to the vicinity of the Jarvis Creek confluence, and one group of 57 bison had begun an eastward movement toward the DJBR and were near Butch Lake.

Bison first arrived on the DJBR from 26-29 July 1993. On 29 July 1993 a local pilot reported seeing a group of about 40 bison in the Gerstle Fields and about 12-15 bison in the Panoramic Fields (D. Quarberg, pers. commun.). This is probably the same group of bison seen near Butch Lake on 26 July.

After 29 July bison moved rapidly to the DJBR and most of the herd was on the DJBR by early August. During a census flight on 4 August 1993, most bison were seen in the Panoramic Fields, 40 were still on the Delta River near Beales Range, and 18 were in the Granite Creek burn enroute to the Panoramic Fields. The last bison reported on Fort Greely were 20 on Texas Range on 9 August 1993 (Sacilotto, pers. commun.). About 15 bison were seen on Jarvis Creek on 15 August by a local pilot, and this group may have been one of the last groups moving east to the DJBR (H. Weiler, pers. commun.).

Upon arriving on the DJBR, bison initially foraged on oats planted in the Panoramic Fields and then moved between the Panoramic and Gerstle fields to feed on annual grasses. On 10 August 175-200 bison were in the Panoramic Fields, and no bison were in the Gerstle Fields (D. Quarberg, pers. commun.). On 15 August about 200 bison were in the Gerstle Fields, and 100 were in the Panoramic Fields (H. Weiler, pers. commun.). During an aerial census on 24 August, 105 bison were in the Panoramic Fields and about 300 were in the Gerstle Fields. On 29 August, 14 bison were in the Gerstle Fields; 350 were in the Panoramic Fields.

Bison began moving from the DJBR into the DAP in late August 1993. A group of 15 bison left the DJBR by 27 August and moved from the Panoramic Fields to the University of Alaska Experimental Farm at Milepost 1408 Alaska Highway but returned overnight to the DJBR. During an aerial census on 24 August, tracks of approximately 10 bison were observed south of the Panoramic Fields along the fence surrounding Tract F in the DAP. Large numbers of bison probably began moving out of the DJBR and into the DAP on 30 August when 50-75 were observed crossing the Alaska Highway at Milepost 1403 and moving into Tract J of the DAP. On 1 September an estimated 100 bison were on Tracts 3 and 5 of the DAP (D. Bunselmeier, pers. commun.).

Most bison moved from the DJBR into the DAP during early September. A local pilot reported seeing only 65-75 bison on the DJBR on 9 September (D. Quarberg, pers. commun.). During a ground composition count on 29 September, most of the herd was observed on Tracts 3 and 5 of the DAP. Essentially the entire herd remained on Tracts 3 and 5 until the bison hunting season began on 7 October 1993. By 9 October hunters had caused the herd to disperse throughout the DAP, and some bison returned to the DJBR.

DJBR management met the objective of reducing conflicts between bison and agriculture by delaying movement of the Delta bison herd from their summer range into the DAP. If we assume that bison began arriving on the DJBR on 13 July and began moving into the DAP on 30 August, the DJBR delayed movement of Delta bison herd animals into the DAP by 36 days. Harvest of crops was completed in the DAP on approximately 24 September (B. Fredrichs, pers. commun.); therefore, bison were in the DAP approximately 24 days before completion of the harvest. However, bison damage to crops was minimal because most of the herd remained on Tracts 3 and 5 where harvest was completed before 24 September. During winter 1993-94 bison moved between the DAP and the DJBR but spent most of their time in the DAP.

Mortality

Harvest:

Season and Bag Limit. The resident and nonresident bison hunting season was open from 7 October to 31 March. Participation in the hunt required a drawing permit for a bison of either-sex (permit hunt 403 in 1991-92, D403 in 1992-93, and DI403 in 1993-94) or for a cow bison (permit hunt 404 in 1991-92, D404 in 1992-93, and DI404 in 1993-94). We assumed that the majority of permittees with either-sex bison permits would shoot a bull. The following conditions applied to each permit:

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

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

3. Permittees were required to use a rifle capable of shooting a 200-grain bullet with 2,000 ft-lbs of retained energy at 100 yards. Bows had to comply with 5 AAC 92.075(4) to be legal means of harvest. Crossbows are prohibited. Certain muzzleloading firearms qualified.

During the 1991-92 season, 70 permits were issued for the either-sex hunt (hunt 403) and 30 permits were issued for the cow-only hunt (hunt 404). During the 1992-93 season, 80 permits were issued for hunt D403 and 20 for hunt D404. During the 1993-94 season, 90 permits were issued for hunt DI403 and 30 for hunt DI404 (Table 4). The bag limit was 1 bison every 5 years for each season.

Board of Game Actions and Emergency Orders. The Board of Game increased the maximum number of Delta bison permits ADF&G was authorized to issue from 100 to 150.

Human-induced Mortality.

1991-92. Total human-induced mortality during 1991-92 was estimated at 100 bison. Hunters killed 50 bulls and 43 cows during the 1991-92 hunting season. Additional mortality was estimated to be 7% wounding loss equal to 7 bison (Table 5). Hunters with either-sex permits (hunt 403) killed 74% bulls and 26% cows. Successful hunters for both hunts averaged 3.5 days hunting to kill a bison and unsuccessful hunters averaged 10.6 days.

The most commonly used weapon during 1991-92 was a .338 caliber rifle, used by 31% of the hunters. Other commonly used weapons included the .30-06 caliber rifle, used by 24% of hunters, and the .300 Winchester Magnum rifle, used by 15% of hunters (Table 6). Hunters took a mean of 2.0 shots to kill a bison.

1992-93. Total human-induced mortality during 1992-93 was estimated to be 106 bison. Hunters killed 62 bulls and 33 cows. Additional mortality included 3 bison killed during

collisions with highway vehicles and an estimated 7% wounding loss equal to 7 bison (Table 5). Hunters with either-sex permits (hunt D403) killed 82% bulls and 17% cows. Successful hunters averaged 2.2 days hunting to kill a bison and unsuccessful hunters averaged 1.0 days hunting.

The most commonly used weapon during the 1992-93 hunting season was the .338 caliber rifle, used by 25% of hunters. Other popular weapons included the .30-06 caliber rifle, used by 23% of hunters, and the .300 Winchester Magnum rifle, used by 20% of hunters (Table 6). Hunters required a mean of 2.0 shots to kill a bison.

Permit Hunts. The number of applications for Delta bison permits continued to increase from 11,057 applications in 1991 to 12,387 applications in 1992 and 13,654 applications in 1993 (Table 7). The increase in the number of permit applications has significant effects on DJBR management because $5 from each application is intended for DJBR management.

Hunter Residency and Success.

1991-92. Most bison hunters were Alaska residents, although 2 nonresidents hunted (Table 8). Hunters had a 91% success rate.

1992-93. Most bison hunters were Alaska residents, although 1 nonresident hunted (Table 8). Hunters had a 99% success rate.

Harvest Chronology.

1991-92. Most bison were harvested in two distinct periods during the hunting season. During the 1991-92 hunting season, 70% of the bison were killed during the first 7 weeks of the hunt (7 October-24 November 1991). The second distinct period of harvest occurred during weeks 19-24 (10 February-23 March 1992) when 17% of the harvest occurred (Table 9).

1992-93. During the 1992-93 hunting season, harvest again occurred in two distinct periods. The first period of harvest was during weeks 1-8 (7 October-1 December 1991) when 85% of the bisons were harvested. Only 4% of the harvest occurred during weeks 9-18 (2 December 1992-9 February 1993). The second distinct period of harvest occurred during weeks 19-25 (10 February-30 March 1993) when 12% of bison were harvested (Table 9).

Most harvest occurs during fall; however, a significant number of permittees hunt late in the season from approximately mid February until the season closes. They hunt late for a variety of reasons including: failure to kill a bison earlier, inability to hunt earlier, or selection of a trophy animal increased hunting time. Weather also influences harvest chronology. Most bison are killed early in the season when temperature and day length are conducive to hunting. By early December, short days and cold temperatures impede a hunt. When days are longer, hunting activity increases mid February.

Transport Methods. Highway vehicles and snowmachines are the two most commonly used modes of transportation by successful bison hunters. Highway vehicles were used by 67% and

41% of successful hunters during 1991-92 and 1992-93, respectively. During 1991-92 and 1992-93, snowmachines were used by 14% and 49% of successful hunters, respectively (Table 10).

Harvest Locations.

1991-92. Hunters killed 77% of the bison in the DAP and 23% on the DJBR (Table 11).

1992-93. Hunters killed 78% of the bison on the DAP, 17% were killed on the DJBR, and 5% were killed in other locations (Table 11). Thirty bison (34%) were killed on Tract F in the DAP. Barley crops were swathed and left over winter in Tract F due to an early snowfall, and bison foraged on the swathed barley extensively, making them easy for hunters to locate.

Most bison are killed in the DAP where the herd spends most of the open hunting season; the DAP is also much more accessible than the DJBR during hunting season. However, the percentage of harvest in the DAP declined during this reporting period because more farmers charged access fees to bison hunters. The number of farmers who closed their property to bison hunters also increased. As a result, more bison hunters hunted on the DJBR this reporting period than in previous years.

Other Mortality:

Natural mortality has not been quantified for the Delta bison herd but it is probably low. There are no records of predation on Delta bison even though coyotes, wolves, grizzly bears, and black bears are in the area. Weather is rarely a mortality factor; however, the Delta Junction area does occasionally receive sufficient snowfall and accumulation to result in overwinter mortality of calves as occurred winter 1990-91.

Disease Management. The greatest potential for nonhunting mortality to Delta bison is diseases transmitted from domestic livestock in the Delta Junction area. Cattle in the Delta Junction area have infectious bovine rhinotracheitis, bovine viral diarrhea, bovine respiratory syncytial virus, infectious bovine kerato conjunctivitis, and parainfluenza III (PI3) (D. Quarberg, pers. commun.).

Bison continue to be free from most of the infectious diseases for which serum antibody tests are conducted. The exception is PI3 (Table 12) (Zarnke 1993). However, this disease alone does not seem to pose a health problem to the herd at this time. Analyses of samples collected during 1991, 1992, and 1993 will complete our serologic tests.

Habitat

DJBR Habitat Improvement During 1992:

The prescribed grass burn in the Panoramic Fields from 8-10 June 1992 went well. The highest priority of the burn was to burn decadent bluejoint and fescue; however, bluegrass was also burned. Total cost of this burn was approximately $500 (Karczmarczyk 1992).

Response of the bluegrass in the 700 acres fertilized in the Gerstle Fields from 28 May-5 June 1992 was excellent. Bluejoint is not as prevalent in the Gerstle Fields as in the Panoramic Fields, so there were no disadvantages to fertilizing early in the spring and allowing bluejoint to be fertilized during its active growing season. No acreage was fertilized in the Panoramic Fields. Total cost of the fertilizer application was approximately $15,000 (Karczmarczyk 1992)

Results of the cooperative legume/grass project with the University of Alaska are pending.

DJBR Habitat Improvement During 1993:

Portions of the Panoramic Fields were burned in April 1993. The quality of this burn was poor due to cool, wet atmospheric and field conditions (Karczmarczyk 1993).

Approximately 800 acres of bison forage were fertilized from 10 May to 5 June 1993. The cost for fertilizer was $17,000. Approximately 600 acres were fertilized in the Gerstle Fields and 200 acres were fertilized in the Panoramic Fields (Karczmarczyk 1993).

Using a New Holland disk mower, we mowed approximately 45 acres of bluejoint in the Panoramic Fields from 1 July-30 August. This acreage was mowed to further test the effectiveness of mowing as a tool to weaken and eliminate bluejoint. Results will be evaluated summer 1994 (Karczmarczyk 1993).

Growth and forage yield of oats seeded on about 45 acres of the Panoramic Fields were good, considering the reduced cost of planting by spreading seed with a fertilizer spin spreader. When bison first arrived on the DJBR in July 1993, they foraged extensively on the oats. Bison foraged very little on supplemental hay and barley grain spread on the Gerstle Fields. Small numbers of bison ate small quantities of barley, but available barley did not delay their movement into the DAP. There was no evidence that bison foraged on the timothy hay. The crude protein of the hay was only 4.75-5.25%, below the minimum crude protein of 8% specified in the purchase contract. Bison may have used a hay of higher quality.

Assessment and Enhancement:

A graduate student from the University of Alaska Fairbanks began research during summer 1990 to evaluate bison summer range on the Delta River. The research is designed to determine bison diet composition, forage availability, and forage utilization. Results of this study will be reported later.

Results of soil samples taken in the Panoramic Fields fall 1993 indicated a soil pH of 6.11, low residuals of nitrogen (2 ppm) and phosphorus (10 ppm), and medium residual of potassium (84 ppm). The recommended fertilizer application rate per acre was N60-P20-K0-S10. Potassium was to be eliminated from the fertilizer mixture to determine if adding potassium to the Panoramic Fields was cost-effective.

Results of soil samples taken in the Gerstle Fields during fall 1993 indicated a soil pH of 6.23, very low residuals of phosphorus (5 ppm) and potassium (30 ppm), and a low residual of nitrogen (2 ppm). The recommended fertilizer application rate per acre is N60-P30-K30-S10.

Delta Bison Management Plan

The 1993-98 Delta bison management plan was completed and distributed to the public in August 1993. Bison management goals and objectives from the plan are listed below.

Herd Health Management Goal: Maintain a healthy, free-ranging bison herd in the Delta Junction area.

Herd Health Management Objectives.

Objective 1: Prevent the transmission of diseases from livestock to the Delta bison herd.
Objective 2: If diseases are transmitted from livestock to the Delta bison herd, prevent the spread of diseases from bison to other wildlife species.

Conflict Management Goal: Reduce conflicts between bison and the public, including but not limited to agricultural interests in the Delta Junction area.

Conflict Objectives.

Objective 1. 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.
Objective 2. Keep the Delta bison herd out of the Delta Agricultural Project until 1 October annually.
Objective 3. The department will provide assistance to the public experiencing bison conflicts.

Herd Size Management Goal: Manage the Delta bison herd to provide the greatest opportunity to hunt and view bison by providing maximum biological yield from public lands, while accomplishing herd health, free-ranging, and conflict goals and objectives.

Herd Size Objectives.

Objective 1. Calculate an accurate annual budget for accomplishing recommended goals and objectives.

Objective 2. Attempt to acquire additional funding sufficient to accomplish all goals and objectives of managing the Delta bison herd on public lands.

Objective 3. Manage the Delta bison herd for maximum productivity with a sex ratio of no less than 30 bulls:100 cows.

Objective 4. The department will organize volunteer efforts to help accomplish goals and objectives.

Objective 5: 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 increased or decreased as required to match resources with goals and objectives.

Objective 6: Administer the Delta bison hunt to reduce landowner/hunter conflicts and to maintain hunter access to private land in the Delta Agricultural Project to the extent possible.

Objective 7: Investigate methods and funding sources to improve bison viewing opportunities for the public.

The Delta Bison Working Group agreed to meet each November to review bison management goals and objectives and advise the department on bison management.

CONCLUSIONS AND RECOMMENDATIONS

The Delta bison herd continued to do well through this reporting period but declined after the 1993-94 hunting season when 120 permits were issued and harvest of females increased dramatically. Fewer permits will be issued during the 1994-95 season in an attempt to return the precalving population of this herd to 360 bison.

Although 100% of the herd has been exposed to PI3, the herd does not appear to have been exposed to any other serious livestock diseases at this time. Delta bison herd serology will continue to be monitored.

The DJBR continues to be managed with permit application fees, funds from the Alaska Fish and Wildlife Safeguard bison raffle, and the Fish and Game Fund. The DJBR met the objective of reducing conflicts between bison and agriculture. The greatest challenges to DJBR management are 1) controlling the native grass bluejoint (*Calamagrostis canadensis*) or developing techniques to make it more palatable for bison, 2) developing more cost-efficient forage management techniques, and 3) holding bison on the DJBR until the conclusion of harvest in the DAP. Work improving these aspects of DJBR management will continue. Bison continue to move earlier from the Delta River summer range to the DJBR.

The 1993-98 Delta Bison Management Plan was completed and distributed to the public. The plan will guide management of the Delta bison herd for the next 5 years. The citizens' Delta Bison Working Group will meet with the department annually to review and advise the department on bison management goals and objectives.

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Table 1. Precalving and postcalving population estimates for the Delta bison herd from 1983-93.

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

[a] Calculated by subtracting known mortality from previous postcalving population count.

[b] Includes 17 domestic bison that escaped and were incorporated into the herd.

Table 2. Delta bison fall ground composition ratios counts and estimated population size, 1986-87 through 1993-94.

Year	Bulls/ 100 Cows	Yrlg bulls/ 100 Cows	% Yrlg Bulls	Calves/ 100 Cows	Percent calves in herd	Total sample size	Estimated prehunt pop. size
1986-87	44	10	5	47	25	119	361
1987-88	--	--	--	--	--	--	--
1988-89	72	17	8	45	21	141	426
1989-90	106	25	10	50	20	225	432
1990-91	114	19	7	47	18	110	440
1991-92	74	10	5	29	14	201	484[a]
1992-93	87	14	6	46	20	381	482
1993-94	67	21	9	62	27	308	465

[a] Includes 17 domestic bison that escaped and were incorporated into the herd.

Table 3. Delta bison fall ground composition data and estimated population size, 1985-93.

Regulatory year	Adults		% Yearling bulls	% Calves	Total sample size	Estimated prehunt pop. size
	% Bulls	% Cows[a]				
1985-86	28	72	5	25	283	378
1986-87	38	62	7	24	119	361
1987-88	--	--	--	--	--	--
1988-89	42	58	8	21	141	426
1989-90	51	49	10	20	225	432
1990-91	53	47	7	18	110	440
1991-92	42	58	5	14	201	484[b]
1992-93	31	43	6	20	381	482
1993-94	20	44	9	27	308	465

[a] Includes yearlings.

[b] Includes 17 domestic bison that escaped and were incorporated into the herd.

Table 4. Delta bison harvest data by permit hunt, 1986-87 through 1992-93.

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk (%)	Total harvest
403[a]	1986-87	10	0	0	100	9 (100)	0 (0)	0	9
	1987-88	35	0	0	100	33 (100)	0 (0)	0	33
	1988-89	20	10	0	100	18 (100)	0 (0)	0	18
	1989-90	30	3	4	96	21 (81)	5 (19)	0	26
	1990-91	70	0	3	97	59 (87)	9 (13)	0	68[b]
	1991-92	70	0	6	94	50 (74)	18 (26)	0	68[c]
	1992-93	80	4	1	95	62 (82)	13 (17)	1 (1)	76
404	1986-87	55	0	0	100	6 (11)	47 (89)	0	53
	1987-88	15	0	0	100	2 (15)	11 (85)	0	13
	1988-89	30	0	10	90	3 (11)	24 (89)	0	27
	1989-90	35	0	0	100	1 (3)	33 (97)	0	34
	1990-91	20	5	5	95	0 (0)	18(100)	0	18
	1991-92	30	0	17	83	0 (0)	25(100)	0	25
	1992-93	20	0	0	100	0 (0)	20(100)	0	20
Totals for all permit hunts	1986-87	65	0	0	100	15 (24)	47 (75)	0	6
	1987-88	50	0	0	100	35 (76)	11 (24)	0	46
	1988-89	50	2	7	96	21 (47)	24 (53)	0	45
	1989-90	65	2	2	98	22 (37)	38 (63)	0	60
	1990-91	90	2	3	97	59 (67)	27 (31)	0	86
	1991-92	100	0	9	91	50 (54)	43 (46)	0	93[c]
	1992-93	100	3	1	99	62 (65)	33 (34)	1 (1)	96

[a] Hunt 403 was a bulls-only hunt for 1986-87 through 1988-89 and was an either-sex hunt from 1989 through 1990-91.
[b] One bull was harvested for the Alaska Wildlife Safeguard raffle.
[c] Two hunters killed two bison each.

Table 5. Delta bison harvest and accidental death, 1986-87 through 1992-93.

Regulatory year	Hunter harvest							Other Mortality	Grand total
	Reported				Estimated				
	M (%)	F (%)	Unk.(%)	Total	Unreported[b]	Illegal	Total		
1986-87	15 (24)	47 (75)	0	62	5	0	5	0	67
1987-88	35 (76)	11 (24)	0	46	4	0	4	0	50
1988-89	21 (47)	24 (53)	0	45	4	0	4	0	49
1989-90	22 (37)	38 (63)	0	60	5	0	5	0	65
1990-91	59 (67)[a]	27 (31)	0	86	6	0	6	2	94
1991-92	50 (54)	43 (46)	0	93	7	0	7	0	100
1992-93	62 (65)	33 (34)	1 (1)	96	7	0	7	3	106

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

Table 6. Percentage of successful Delta bison hunters using different weapons during hunts 403 and 404 1989-90 through 1992-93.

Weapon	% Successful Hunters			
	1989-90	1990-91	1991-92	1992-93
338	29	28	31	25
30-06	25	15	24	23
300 Win Mag.	11	27	15	20
375 H&H	14	10	11	17
300 Weatherby	7	4	5	2
8mm Mag.	4	3	2	3
458	3	3	1	1
350 Rem. Mag.	1	3	1	1
348 Win.	0	1	0	1
Blackpowder	1	1	2	1
Bow & Arrow	0	1	2	1
Other	3	1	3	4
n	76	67	91	90

Table 7. Number of applications received for Delta bison hunts 403 and 404 from 1977 through 1993.

Year	No. applications	No. Permits Issued
1977	2,121	20
1978	3,555	15
1979	3,970	25
1980	4,561	35
1981	5,237	55
1982	8,105	75
1983	7,889	75
1984	11,276	55
1985	666[a]	55
1986	6,585	65
1987	6,434	50
1988	9,705	50
1989	10,151	65
1990	11,822	90
1991	11,057	100
1992	12,387	100
1993	13,654	120

[a] 8,931 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 403 and 404, 1986-87 through 1992-93.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonres	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonres	Unk	Total (%)	
1986-87	4	57	0	1	62 (100)	0	0	0	0	0 (0)	62
1987-88	1	44	0	1	46 (100)	0	0	0	0	0 (0)	46
1988-89	2	40	1	2	45 (94)	0	3	0	0	3 (6)	48
1989-90	3	57	0	0	60 (98)	0	1	0	0	1 (2)	61
1990-91	4	31	0	0	85 (97)	0	3	0	0	3 (3)	88
1991-92	3	86	2	0	91 (91)	2	7	0	0	9 (9)	100
1992-93	6	87	1	2	96 (99)	0	1	0	0	1 (1)	97

[a] Local residents reside in Subunit 20D.

Table 9. Percent harvest of Delta bison by time period, 1986-87 through 1992-93. Each harvest period represents 7 days, beginning 7 October and ending 31 March.

Regulatory year	Harvest periods																									n
	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	
1986-87	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
1987-88	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
1988-89	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
1989-90	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
1990-91	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
1991-92	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
1992-93	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

Table 10. Delta bison harvest percent by transport method for Hunt 403 and 404, 1991-92 and 1992-93.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n
1991-92	1	0	0	1	14	3	67	14	93
1992-93	0	0	0	4	49	1	41	5	96

Table 11. Percent of Delta bison harvested by location during permit hunts 403 and 404 from 1989-90 to 1992-93.

	Location of Kill		
Year	Delta Ag. Project	Delta Jct. Bison Range	Other
1989-90	95	5	0
1990-91	91	9	0
1991-92	77	23	0
1992-93	78	17	5

Table 12. Serum antibody prevalence of nine infectious disease agents in the Delta bison herd, 1984-91.

Agent	1984	1985	1986	1987	1988	1989	1990	1991
Infectious bovine rhinotracheitis virus SN[a] (8)[b]	0/48[c]	0/29	0/52	0/42	0/43	0/38	0/43	0/20
Bovine viral diarrhea virus SN (8)	0/48	0/29	3/52	0/43	0/43	0/38	0/43	0/20
Parainfluenza 3 virus HI (8)	41/41	28/29	52/52	38/38	42/43	38/38	42/42	19/20
Respiratory syncytial virus IFA (20)	--	--	0/52	0/43	0/43	0/38	4/43	0/20
Epizootic hemorrhagic disease virus ID (+)	0/48	0/229	0/52	0/43	0/10	0/33	0/43	0/20
Bluetongue virus ID (+)	0/48	0/29	0/52	0/43	0/10	0/33	0/42	0/20
Brucella suis IV bacterium BAPA (+); STT (50)	0/48	0/1	0/52	0/43	0/43	0/41	0/41	0/20
Q fever rickettsium CF (20)	1/48	0/29	0/50	0/39	0/6	0/33	0/8	--
Leptospira interrogans bacterium MAT (100)	--	--	5/52	4/42	0/10	--	1/43	0/13

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

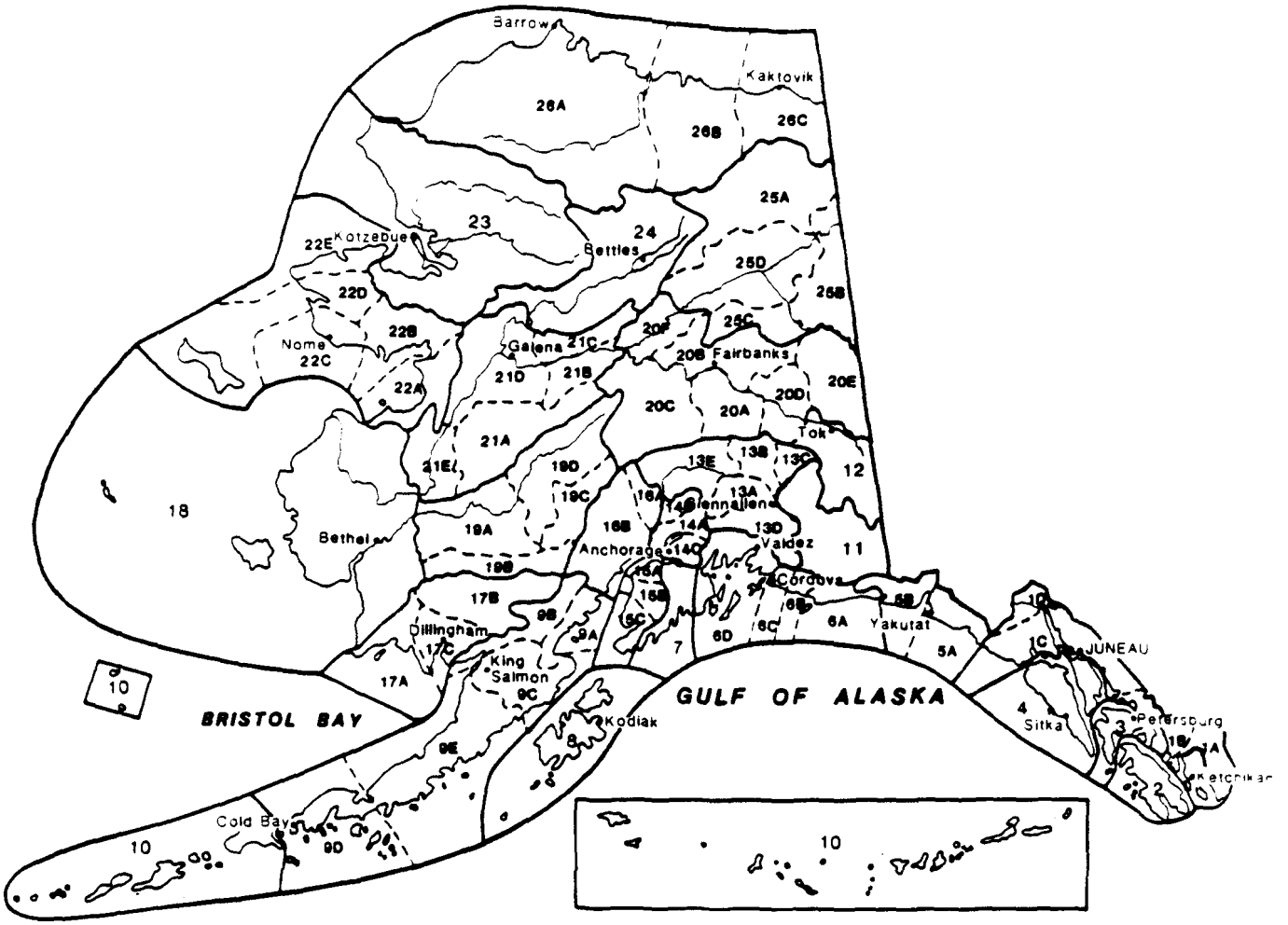
[b] Number in parentheses indicates minimum titer necessary to be considered evidence of exposure to agent in question. (+) indicates that test is interpreted as simply either "positive" or "negative".

[c] Number positive/number tested.

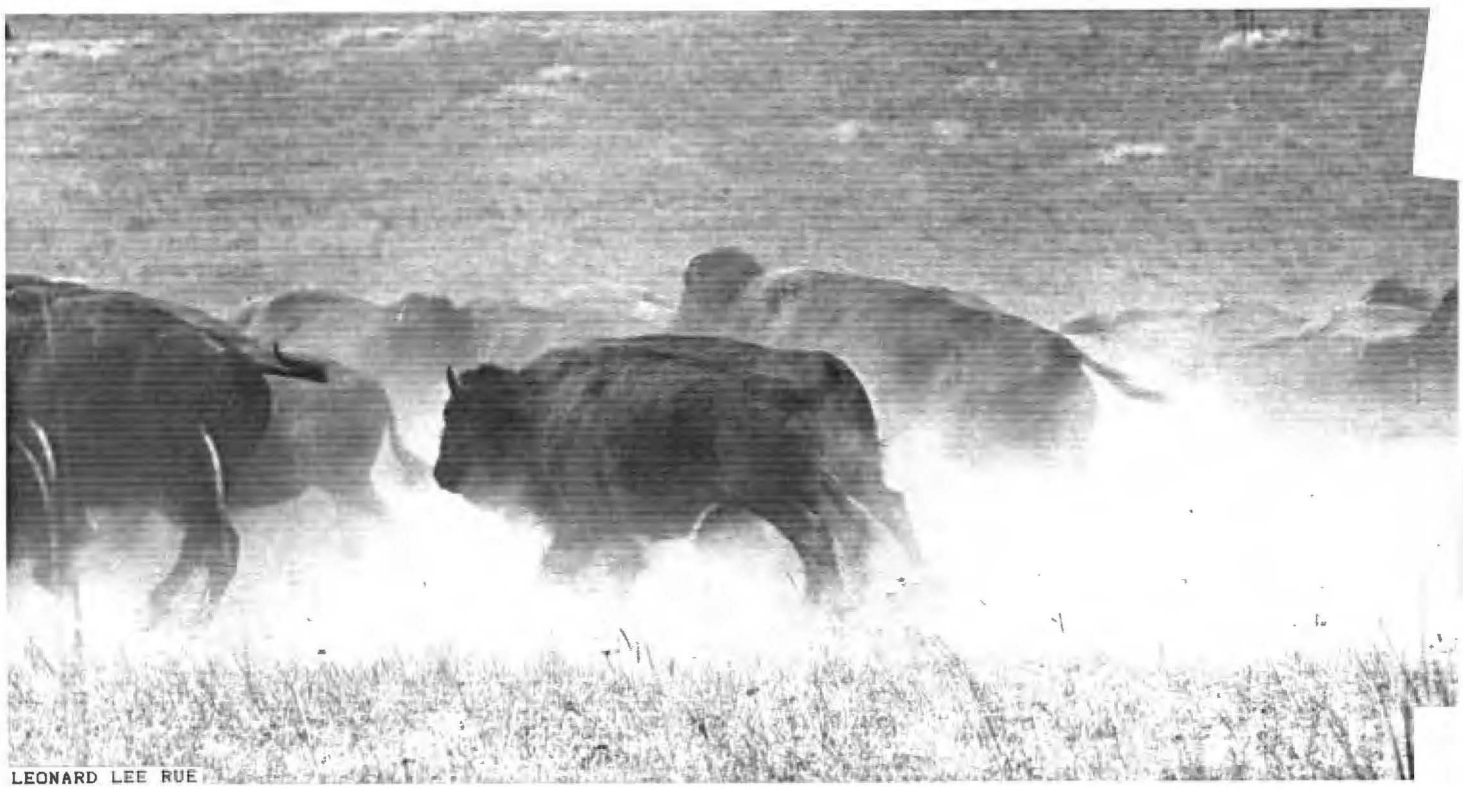
NOTES

NOTES

Alaska's Game Management Units



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



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