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The Bison Population

The Historic Population

THE GENUS *Bison* PROBABLY INVADED North America during the later part of the early Pleistocene. The bison occupying the continent in historic times were descendants of a second migration of *Bison* from Eurasia, which crossed the Bering Straits at the start of the late Pleistocene according to Skinner and Kaisen (1947). Of the invading species, only one persisted to give rise to *B. occidentalis*, the ancestor of *B. bison*, the modern form. Two subspecies, *B. b. bison* and *B. b. athabasca*, are recognized by cranial evidence, although historical accounts suggest there may have been others (Roe 1951). The form *athabasca* is apparently the more primitive of the two subspecies (Skinner and Kaisen 1947).

Just when bison first reached the Yellowstone plateau is not known, but modern bison inhabited the area before historic times, perhaps before the most recent period of intermountain glaciation. Bone fragments from bulls, cows, and calves (*B. bison*) were found near the edge of a glacier northeast of

Yellowstone National Park (Pattie and Verbeek 1967). In 1964 a fossil cranium (*B. b. athabasca*) was found embedded in a natural oil seep on the Mirror Plateau in the park.

The Yellowstone bison of historic times were a remnant of a once much more extensive bison population, known to trappers and Indians, which inhabited the mountain ranges and the intermountain valleys of the Rockies and extended on west into Washington and Oregon. Most of these bison were gone by the 1840s (Aubrey Haines 1968 pers. comm.). According to the distribution map of Skinner and Kaisen (1947), these were mountain bison. Considerable numbers of bison once lived close to the park. Many skulls have been found in the Red Rock Lakes area, approximately 35 miles west of Yellowstone (Owen Vivion 1968 pers. comm.) Frank Childs, former Yellowstone ranger who worked on Red Rocks land acquisition matters during the mid-1930s, heard that 300 bison died there during a bad winter many

years earlier (1965 pers. comm.). Many skulls have also been taken from the Mud Lake area of Idaho, approximately 55 miles southwest of Yellowstone (Richard Wilson 1968 pers. comm.). Osborne Russell, writing in 1835, mentions the large numbers of buffalo (bison) seen in both the Red Rock and Mud Lake areas (Haines 1955). Doane (1876) comments that "buffalo skulls are strewn by thousands—" in the Yellowstone valley about 40 miles north of the park. Accounts of wild bison adjacent to and within the park, dating from 1860 through 1902 (Appendix II), leave no doubt that substantial numbers of bison inhabited the Yellowstone Plateau at all seasons, and long before the killing of the northern herd of Great Plains bison in the early 1880s.

A misconception of some writers—that Yellowstone's bison of historic times were displaced survivors from the Great Plains slaughter—probably stems from: (1) the lack of recognition of two subspecies of *Bison bison*; and (2) the impression that early explorers found little "game" in the Rocky Mountains. Three factors contribute to the idea that bison were sparse in the mountains. Compared to the abundance of certain large mammals on the plains, the mountains probably seemed almost uninhabited. Secondly, travel routes followed river valleys and drainages, crossing small areas of high summer range at few loca-

tions, often at a season when biting insects may have driven the game from the lower elevations of passes to adjacent higher slopes and ridges. Finally, the few early travelers who wrote of their journeys, including official government parties, often commented only on wildlife which was actually sought out or shot for food.

Mountain Bison

The existence of mountain bison, different in appearance and behavior from the plains type and gone from much of their range by the 1840s, has generally been little known. Christman (1971) reviews historical evidence for the subspecies, their distribution to the west of the plains type, and reasons for their early disappearance. He believes the Indians' acquisition of the horse was the factor underlying the extermination of mountain bison from extensive areas of original range, particularly in Washington, Oregon, and Idaho.

Many early references to Yellowstone bison use the term "wood" or more commonly "mountain" bison or buffalo (Fig. 9); some of the characteristics of the race were recognized by a number of early travelers and observers. Historical accounts generally agree that, compared with the plains bison, these mountain animals were more hardy, fleet, and wary, and had darker, finer, curl-

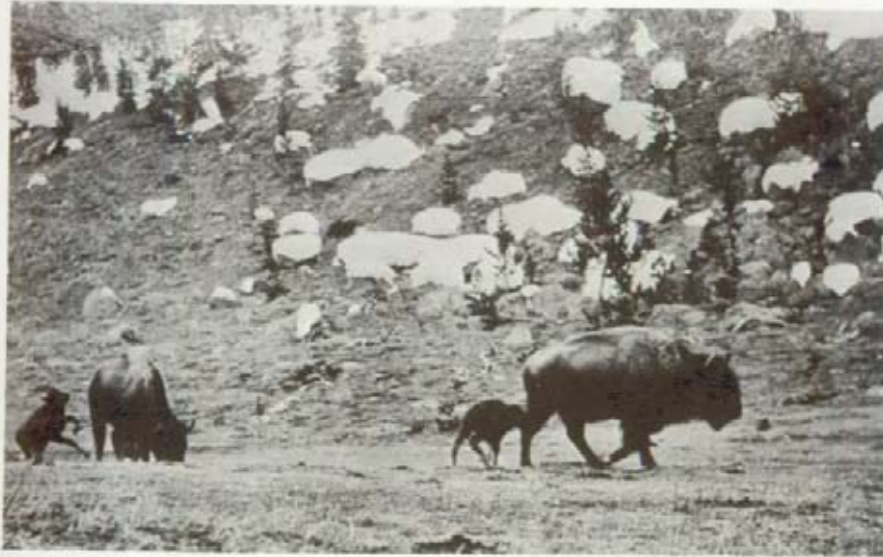


Fig. 9. Cows and calves photographed in a remote part of Hayden Valley sometime before 1894. These bison were frequently called mountain bison by early observers. Photo by John Folsom, a winterkeeper at Canyon.

ier hair. Sex and age differences among animals seen may account for discrepancies in description of size. The geologist Arnold Hague (1893) provides the following:

The Park buffalo may all be classed under the head of mountain buffalo and even in this elevated region they live for the greater part of the year in the timber. . . . most unusual, save in midwinter, to find them in open valley or on the treeless mountain slope. They haunt the most inaccessible and out-of-the-way places, . . . living in open glades and pastures, the oases of the dense forest, . . . the rapidity of their disappearance on being alarmed. It is surprising how few buffalo have been seen in midsummer, even by those most familiar with their haunts and habits. They wander about in small bands. . . .

Blackmore (1872) was informed that the mountain buffalo congregated usually in bands of 5-30, rarely more. Other observers agree that the bands were small, and the animals quite wary. Superintendent Norris described them as "most keen of scent and difficult of approach of all mountain animals" (Superintendent of the Yellowstone National Park 1880).

Altitudinal migrations were another characteristic of mountain bison (Christman 1971). Historical accounts from Yellowstone also suggest this habit. Superintendent Norris, in his annual report of 1880, describes summer and winter distributions of bison in the

park, stating clearly:

... summer in the valleys of the Crevice, Helroaring, and Slough Creeks, and the mountain spurs between them, descending with the increasing snows, to winter ... East Fork [Lamar], and as the snows melt ... returning to their old haunts.

The historical accounts of dates and locations of bison (Appendix II) collectively also show a repetitive pattern of seasonal bison distribution which reflects altitudinal movements.

Historical accounts recognizing a mountain buffalo are supported

by limited cranial evidence. Skinner and Kaisen (1947) show an overlap in general distribution between mountain and plains bison along the east slopes of the Rockies, including Yellowstone, but state that ranges for historic times must be based on early accounts plus occasional bones or crania. Seven skulls from Yellowstone's original wild herd were picked up on the ground along the Gardner River and at Mammoth in 1902. All had weathered surfaces. These were considered as most likely representing *athabasca*. The 1964 skull (Fig. 10) found



Fig. 10. Skulls of *Bison bison athabasca* (left) and *B. b. bison* from the Mirror Plateau, Yellowstone National Park. Photo by David Love, U.S. Geological Survey.

on the Mirror Plateau was identified by Skinner (1965) as "an exceptionally long horned, apparently young Mountain bison = *B. (B.)b. athabascae* . . ." No Yellowstone skulls which predate the 1902 introduction have been identified as plains type.

Numbers and Distribution through 1902

Numbers and distributions from the historical accounts of Appendix II are shown in Table 2. Norris (Superintendent of the Yellowstone National Park 1880) estimated a total of 600, dividing the population into three herds according to area. By this date, poaching had certainly begun inside the park, along with increasing pressure on an ever-shrinking mountain bison population outside. Numbers in a given area fluctuated then as now. After consideration of all the listed reports of numbers and distribution, the historical population, ranging in part beyond the park boundaries, is estimated to have been perhaps 1000 animals. This seems reasonable when bison habits and behavior and difficulties of making counts are all considered. Subestimates by area and season are at the bottom of Table 2. They are made to provide a reference point and must be considered educated guesses.

Table 2 also shows the decline of the population to an actual count of 23 in 1902. Again—considering habits, behavior, and census difficulties—the population probably was higher; perhaps 40-50 mountain bison survived. The near-extinction in about 25 years was the result, initially, of sport and table hunting on both sides of the park boundary, plus market hunting, particularly in the Lamar, by both the park hotel construction crews and the Cooke City miners. The capture of calves by local ranchers interested in starting private herds was probably most prevalent in Lamar and the west-side wintering areas. Finally, as bison everywhere verged on extinction, the price paid for heads, plus the minor penalties if caught, attracted poachers who killed all ages and both sexes in the wintering areas. Known losses as listed do not reflect the extent of the kill. Although the Howell poaching case resulted in passage of the Lacey Act in 1894, the population declined further as poaching, primarily from the west side, continued. Natural losses, coupled with scattering of the few remaining animals, left a minimal breeding population in the most remote places of the Pelican-Mirror-Upper Lamar country.

The distribution, to the extent known, of the original population was similar to the present distribution, but larger numbers used certain areas more extensively and

TABLE 2. Summary, native bison information, 1860-1915.

Year	West of Firehole ^a	Firehole	Hayden Valley	Pelican Valley	Mirror-Upper Lamar	Lamar Valley	North of Lamar	Other	Location not stated	Known losses	Official estimate (total)
1860	one band ^b										
1863	many trails						herd				
186-							thousands				
1870		numerous sign			some						
1871		tracks									
1872						herd groups				7 calves captured	
1875									abundant	scores hunted	
1877									300-400		
1878	signs										
1880	300								100	200	600
1881		small band	small band			some					
1883						presumed				400; one band	market hunting

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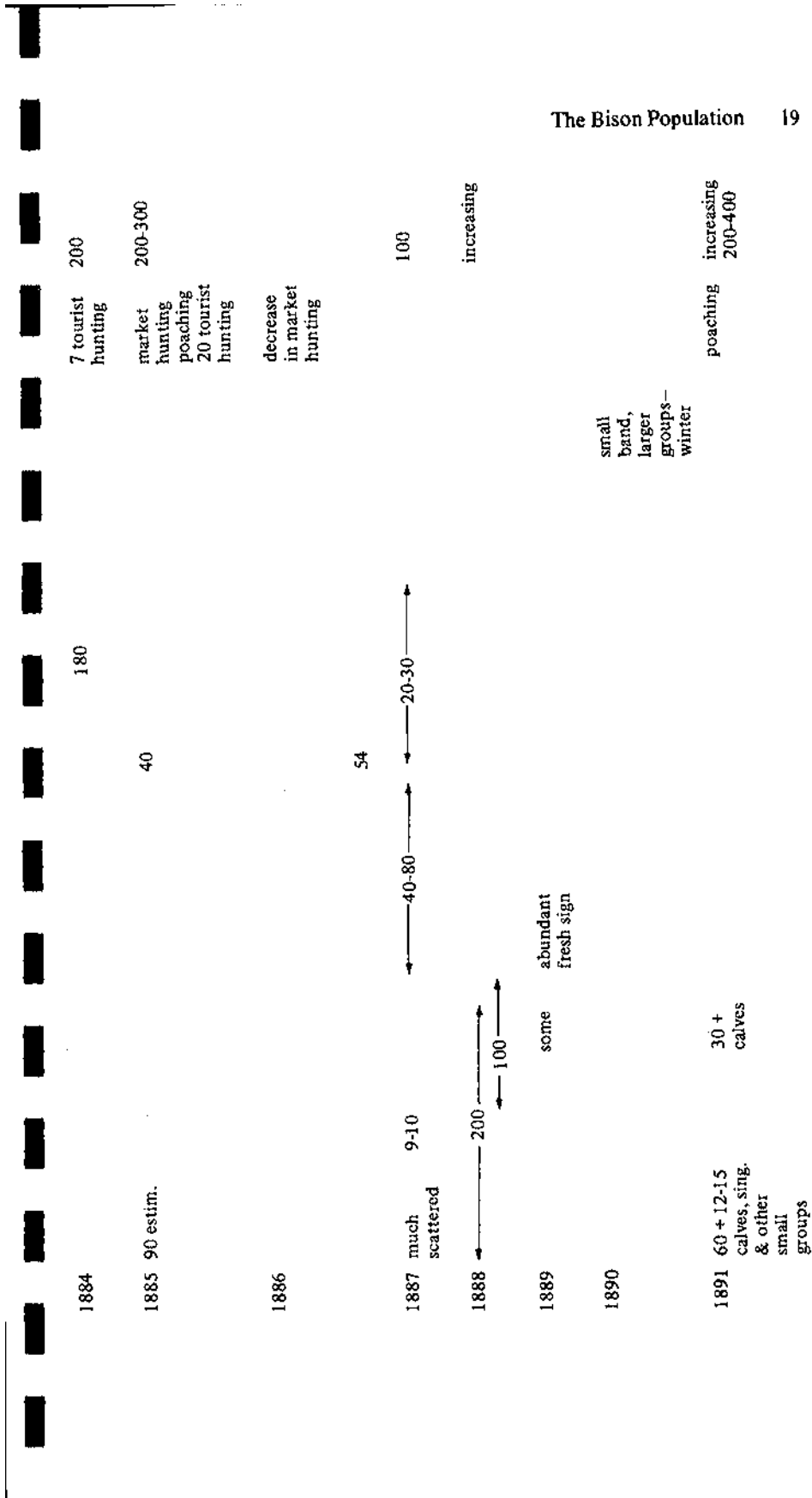


TABLE 2. (continued) Summary, native bison information, 1860-1915.

Year	West of Firehole ^a	Firehole	Hayden Valley	Pelican Valley	Mirror-Upper Lamar	Lamar Valley	North of Lamar	Other	Location not stated	Known losses	Official estimate (total)
1892			300		some					poaching implied 2 calves captured	400; 20% calves
1893		50-60 inc. 13 calves					seen often			12 poached	400
1894			103	6 + 7			a few inc. calves			24 45-50	200 150
1895	100 (rumor)		30				3 + 4 + 10			3 calves west side poaching	200
1896	presumed			presumed			3 + 12 + 3 sign 9			10 est. west side poaching	25-50
1897	sign 20		sign 5	sign 2							24-50
1898	1 + 5	sign 3; sign 2; sign 4; 1 + 2	sign 5-6	1 + 5 sign 21	some						50
1899			5 + 1	20	2 + 4 + 3 + 15		1-Thorofare 2-Snake R.			1 calf	50 +

1900			29	poaching implied	39
1901					25
1902	1	22			25
1903		16 adults 3 calves 19 adults— winter		2 ♂ calves captured for introduced herd	
1904	2	11 (5 ♀ 6 ♂) 12 (summer)		1 ♀ calf captured for introduced herd, 4 Ad. 1 Yrlg.	
1905		30			30
1907 sign 6	4	sign 15			25
1908		2 adults ♂ 20 maximum			increasing
1909 sign		23 + sign spring, summer		1 ♂ calf captured for introduced herd	
1910		29 max. 5 + sign			

TABLE 2. (continued) Summary, native bison information, 1860-1915.

Year	West of Fuchole ^a	Firehole	Hayden Valley	Pelican Valley	Mirror-Upper Lamar	Lamar Valley	North of Lamar	Other	Location not stated	Known losses	Official estimate (total)
1911		8	27 inc. 2 calves	sign 1							
1912	1 ♂			48 including 10 calves							49 thriving
1913			53								increasing
1914									considerable numbers		increasing
1915			31 (5 ♂, 6 yrly., 4 calves inc.)			200-300					
Estimate of Historic Population, Winter		some	300	200		200-300					
Estimate of Historic Population, Summer	300	200	200	300-400		400					

^a Primarily Madison-Pitchstone Plateaus.

^b Just outside the West boundary.

ranged beyond the park boundaries part of the time. Figure 11 shows the probable general distribution and population movements of mixed herd groups. The term "mixed group," as in Fuller (1960), is used here also for groups which usually contain some mature bulls as well as cows and young. Four areas of summer range and five of winter range are indicated. In two locations the population probably moved across present boundary lines in numbers.

From northeast to southwest, the four areas of historic summer range were: north of Lamar, Upper Lamar-Mirror Plateau, Hayden Valley, and Madison-Pitchstone plateaus. Large numbers of bison apparently ranged at least three of the four areas. North of Lamar, the summering herds of the northern part of the Absaroka Range split south to the Lamar Valley and north beyond the park to other valleys to winter. On the west side, the greater part of the summering herds of the Madison-Pitchstone plateaus probably moved southwest beyond the park toward the east end of the Snake River plains (Mud Lake area) as Norris presumed (Superintendent of the Yellowstone National Park 1880). Historically, as now, the Upper Lamar-Mirror Plateau was used extensively. The importance of Hayden Valley as historic summer range is less clear. Some of the bison which wintered in Hayden Valley apparently moved west to

the Madison Plateau in summer. People, traveling perhaps when the bands were south of the main valley in the forested areas, may rarely have seen a group. Hague's (1893) reference to the borders of Elephant Back (south of Hayden Valley) as summer range suggests that bison did regularly summer in the area. Perhaps it was the least important summer range.

Large numbers of bison regularly wintered in Lamar, Pelican, and Hayden valleys (Fig. 12). The Firehole seems to have been less important. Snow conditions common in the Bechler Meadows make it unlikely that large numbers habitually wintered there, but certainly small groups must have since calves were captured there in early spring (Murri 1968).

Historical reports do not indicate groups along the Madison and Gallatin rivers to the northwest, within the park, but Reynolds (1867), while crossing from Henry's Lake to the Madison River, just west of the park, in 1860 reported bison "among the hills, . . ." Small groups of bison, also unreported, may have used the large grasslands just north of the Madison River (south of Cougar Creek) as they did in the 1950s.

Knowledge of travel routes used by people during the early days of the park, which probably followed main game trails, suggests relative game population numbers, locations, and movements (Fig. 11).

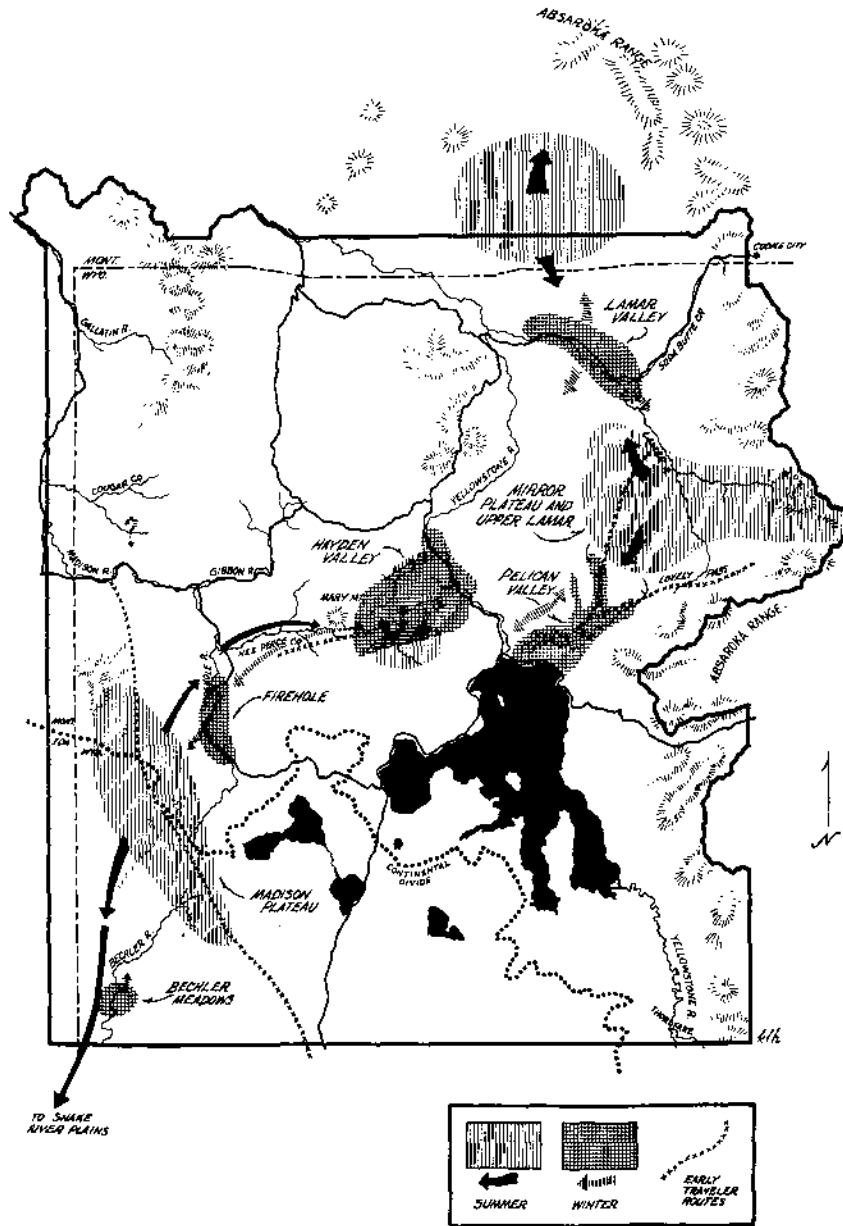


Fig. 11. Map of general distribution and movements of bison mixed herd groups in historic times.



Fig. 12. Bison wintering in Hayden Valley prior to 1894. Photo probably by John Folsom, early Canyon winterkeeper.

Hague (1893) mentions the lack of buffalo trails, but he was comparing Yellowstone to the plains. Definite buffalo trails did exist (DeLacy 1876). Norris' (Superintendent of the Yellowstone National Park 1880) map shows a trail northeast across the Mirror Plateau which follows the route of present buffalo trails. The usual Pelican-Upper Lamar route (in part an elk trail) once crossed Lovely Pass between Raven and Mist creeks (Superintendent of the Yellowstone National Park 1897). Movement of bison across the Mary Mountain route between Hayden Valley and the Firehole, commonly used by people prior to construction of a road along Yellowstone Lake, was implied by earlier writers, and stated as fact by Hough in 1894. Routes in use by

patrols on the Madison Plateau further support early reports of size and distribution of a large west-side summering population which may have extended north across the Madison River.

Finally, scattered individuals, probably bulls, must occasionally, then as now, have been found in peripheral areas. Although early reports of live bison are lacking, some animals must surely have inhabited places in the northwest quarter of the park outside the known or presumed distribution of herd groups. In the southeast, Holt (1899) recorded a buffalo in the Thorofare area. A skull from Two Ocean Pass (Fryxell 1926) just south of the boundary, found before 1925, presumably belonged to another such individual.

The Present Population

Origins

As stated previously, the Yellowstone bison of the present derive from two subspecies: plains bison from Montana (Pablo-Allard herd) and Texas (Goodnight herd), introduced in 1902, and a remnant of the original wild population of mountain bison. Skinner and Alcorn (1942-51) summarize the introduction, numbers, and subsequent management practices pertaining to the introduced herd at the Buffalo Ranch in Lamar. Population numbers are from that source and other official reports. Skinner also provides a resumé of official information concerning the wild bison, but does not attempt to evaluate the question of their survival. Information scattered in the diaries, reports, and correspondence of park personnel (Yellowstone National Park Archives) provides the basis for the following.

Before 1915, introduced bison of plains stock could not have escaped to form a wild group. The introduced herd was in a small fenced pasture at Mammoth from 1902 until moved to the Buffalo Ranch at Lamar in 1907. From 1907 until at least 1915, these animals were closely day-herded, and apparently put in a fenced pasture at night. Although one plains bull from the fenced herd was turned out in 1903, and one or two stray bulls were mentioned later in scout reports, these appar-

ently never joined the wild bison. Twenty bulls from the Buffalo Ranch were driven 14 miles up the Lamar River in 1914; these all returned.

Members of two other small groups of semidomestic bison, those of the Yellowstone Lake Boat Co. and some from Henry's Lake west of the park, never mixed with the wild herd (Appendix III).

In spite of very low numbers and a pessimistic outlook, the original wild herd did persist, and gradually increased once protection from poaching was assured. The critical survival period extended from 1902 until about 1920; thereafter, groups of bison which did not frequent the Buffalo Ranch were more common. These probably contained escapees from the introduced herd as well as native animals. Table 2, from sources listed in Appendix III, shows dates, locations, and numbers for the wild herd from 1903-15. Later official estimates of wild herd numbers are not used, since there was some possibility of wild and introduced animals intermingling after 1915. The table shows clearly the presence of a remnant wild herd in Pelican Valley in winter, and on the Mirror Plateau in summer, as well as a few individuals elsewhere. There was a steady increase, indicated both by calves and by total bison seen. The known population more than doubled between 1903 and 1912.

An actual count was difficult, as Nowlin (1912) of the Biological Survey found: "I have never seen buffaloes on the range so wary and difficult to locate as the wild ones in the Yellowstone Park."

Official population estimates of the time did not allow for more animals than were actually seen; they were undoubtedly conservative. By 1912, as Nowlin's classification of 35 animals shows, the survival of calves (8) and yearlings (7) was encouraging, and the potential for increase (13 females) was apparent. By 1915, the population may have been nearing 100. Known mortality is shown only in 1904. While winter loss probably occurred during other years, the death of many animals would surely have been observed and reported by Army patrols or scouts.

Present composition

An estimate of the contribution of the two subspecies to the present population gene pool is, at best, rough but is preferable to having none. Table 3 shows the sex and adult-calf composition of the fenced herd from 1902 through 1915. The addition to this herd of four calves captured by Army scouts (Fig. 13) from the wild herd for the purpose of adding a second bloodline is also shown. From these numbers, Table 4 was compiled to show the age classes according to sex. The bulls 4 years and older were assumed to have done the breeding in this fenced situation, although younger bulls may have been physically capable. Females were assumed to breed as 2-year-olds and to calve at 3. From these assumptions and the



Fig. 13. Buffalo Jones and Army Scout Holt with a captured bison calf on a sled. Photo from Yellowstone National Park files.

TABLE 3. *Composition of fenced herd, 1902-15*

Year	Males		Females		Total	Male calves	Female calves	Total calves	Herd total	Show herd ^b
	yr/ig & over	yr/ig & over	yr/ig & over	yr/ig & over						
1902	8	18			21				21	
1903	2	18			20	2 + 2 wild	3	7	27	
1904	6	20			26	6	6 + 1 wild	13	39	
1905	12 ^a	27 ^a			39 ^a	3 ^a	2	5	44	
1906	15 ^a	29 ^a			44 ^a	9 ^a	4 ^a	13	57	
1907	22 ^a	32 ^a			54 ^a	3 ^a	2 ^a	5	59	
1908	25 ^a	34 ^a			59 ^a	7 ^a	7 ^a	14	73	
1909	30 ^a	42 ^a			72 ^a	13 + 1 wild	9	23	96	14
1910	41	51			92 ^a	19	9	28	120	16
1911	56 ^a	56 ^a			112 ^a			29	141	15
1912	58	61			119 ^a	14	10	24	143	yes
1913	66 ^a	66 ^a			132 ^a	15	15	30	162	yes
1914	77	82			159 ^a	20	15	35	194	16 + 20
1915	94 ^a	96			190 ^a	28	21	49	239	yes

^aCalculated.^bShow herd is included in herd total.

tables, the wild strain in the fenced group was estimated at a maximum of 10% by 1910. Further dilution of the wild strain in the fenced herd was assumed until perhaps 1917.

Sometime between 1915 and 1920, intermingling of the introduced and wild animals began. At first this was probably gradual. Park records do not show the specific year, but after 1915 the close herding practices in use with the introduced herd were abandoned, and the animals were kept on open range all summer. Close account was kept of most of them for several more years, but there were some escapees. After 1921, with construction of a log drift fence across the Lamar Valley above Soda Butte Creek, deliberate efforts were made to keep the introduced herd on the higher summer ranges, where intermingling with the wild bison must have quickly increased.

After intermingling of wild and introduced animals began, several factors tended to increase the wild strain in the total population, although the plains type outnumbered the wild roughly 3:1 about 1917, and perhaps 4:1 in 1921. The number of males in the introduced herd was reduced by the yearly segregation of a show herd of bulls beginning in 1909. Additional bulls were removed by live shipment and slaughter. To further reduce the male surplus (from a ranch operation view-

point), castration of bull calves averaged slightly over 50% from 1916 through 1931. As a result, the number of aggressive, dominant plains-type bulls with the intermingled groups would have been considerably decreased.

Table 5 shows the presumed numbers of freeranging males in various age classes for both wild and introduced herds in 1921. An estimated 40% of the bulls older than 5 years were of the mountain bison strain. Their contribution to the breeding activity may have been larger, as discussed above, than their numbers indicate.

The trend toward increased mountain bison strain would have continued during the 1920s. On this basis, a reasonable estimate of wild strain in the present bison population would seem to be 30-40%.

Numbers and distribution

Management practices for many years made little attempt to re-create a natural, wild bison population in the park. Efforts concentrated on ensuring bison in numbers sufficient to guarantee perpetuation. Through 1938, horseback riders rounded up as many bison as possible in late fall and drove them into the Lamar Valley for feeding and reductions. To cut population numbers to desired levels during these reductions (and in most later ones), cripples,

TABLE 4. Presumed age and sex composition, fenced herd, 1903-10.

Year	Age:	Males										Females													
		7	6	5	4	3	2	Yrlg	Calf	Adult	7	6	5	4	3	2	Yrlg	Calf							
1903	2-P																		3-P						
1904	2-P																		3-P	1-W	6-P				
1905	2-P																		3-P	1-W	2-P	6-P			
1906	2-P																		3-P	1-W	2-P	4-P	6-P		
1907																			3-P	1-W	2-9	4-P	2		
1908																			3-P	1-W	2-P	4-P	2	7	
1909																			3-P	1-W	2-P	4-P	2	7	9
1910 ^a																			3-P	1-W	2-P	4-P	2	7	9

P -- plains type; W -- wild type.

^aFor 1910, the number of females, yearlings and older, does not agree with table 3 because of discrepancies in available records.

TABLE 5. Presumed age classes of male bison on the range, 1921.

Age classes	Wild herd	Introduced herd
1	7	21
2	5	47
3	4	30
4	3	30
5	2	23
6+	30	47
Total males 1 year and older	51	198 ^a
Total population	125 estimated	526

An equal sex ratio is assumed.

^aNumber includes 96 steers among the 1-5 year olds.

aged animals, and those infected with brucellosis or otherwise considered undesirable were removed to improve the herd, in keeping with the ranching viewpoint (W.S. Chapman 1969 pers. comm.). In 1939, a hay-baiting operation was substituted for the roundup. Hay was fed to some extent every winter through 1952. Before 1936, most animals wintered in Lamar, with some in Pelican. During summer, bison concentrated on the Mirror Plateau and Upper Lamar, with scattered bulls and a few small groups to the north. In spite of very large populations wintering in Lamar, natural reestablishment of the population west beyond the Pelican area into Hayden Valley and the Firehole did

not occur, although a 1946 file report contains a penciled notation of some bison in Hayden Valley in 1930-31.

In 1936, animals were trucked to the Firehole and Hayden valleys for release. They were thought to have formed separate herds, but as numbers increased, some movement between the two valleys became obvious, and they were called the Mary Mountain herd. Two other herds were distinguished, on the basis of wintering areas, as the Lamar and Pelican. None of these herds is geographically isolated at all seasons of the year, but the names are still used to designate the wintering populations.

Population counts, estimates, and known losses (mainly reductions) are listed in Appendix IV by the three wintering populations and as park totals. Aerial counts were started for the four main wintering valleys (Lamar, Pelican, Hayden Valley, Firehole) in 1949. These counts were not made every year, nor were all main areas checked each time. Usually no attempt was made to count scattered animals in fringe areas, nor to check the Bechler Meadows before 1965 (Jim Stradley 1968 pers. comm.). When aerial counts were not available, winter ground counts were made. Estimates based on previous counts, reduction figures, and presumed increases were made by park personnel when counts were not available. Because of possible population shifts, these may be unreliable. Population numbers are for winter seasons, after reductions, but before calving.

Bison increased steadily after 1902 until, with a gradual change in policy about 1930 from one of ranching to one of preservation of bison in a natural state, the National Park Service decided to cut the numbers wintering in Lamar. The decision was based on the gradual elimination of artificial management practices and supported by information derived from a range-condition and carrying-capacity study (Rush 1932b). Lamar-wintering bison numbered over 1000 from 1929 through

1932, before Rush recommended a maximum of 1000. Later decisions lowered the maximum number until frequent reductions had cut Lamar herd numbers to a count of 143 in 1952. After an aerial count for all main wintering valleys totaled 1477 in January 1954, reductions were made on all population segments. An aerial count for the entire park of 397, made in March 1967, was considered very accurate. Thus, the park population of bison for most of the study period was lower than at any time since the early years of the introduced herd.

Winter and summer distributions for mixed herd groups and separate bulls at population levels of the study period are shown in Table 6. Divisions between major areas indicate geographic separation but do not imply population isolation. Bulls were found in all areas of herd use and also were scattered in places where herd groups were seldom or never seen. Past records indicate that mixed herd groups used some of these areas when population numbers were higher. In effect, places most frequented by mixed herd groups probably represent core areas or population centers from which bulls and mixed herd groups move into less-favored locations as the population increases.

Although Firehole and Hayden valleys are combined as the Mary Mountain area, winter distribution of total numbers and mixed herd

groups favored Hayden Valley, according to available counts since the 1950s. During the reductions of 1964-65 and 1965-66, animals were herded from Hayden Valley to the Nez Perce trap on the Firehole side with helicopters, but a prereduction count in December 1964 showed 436 bison in Hayden Valley, and only 54 on the Firehole. Prereduction counts of 1965-66 also located most animals in Hayden Valley. Groups released from the trap usually remained on the west side the rest of the winter, but movements by them between the two wintering valleys were known for all seasons. Groups were seen only in the two main valleys and the intervening Nez Perce Creek drainage during the study period, but a group of 20-23 was seen at Beach or Dryad lakes, 5 miles south of Hayden Valley, the winter of 1955-56 (Jim Stradley 1968 pers. comm.).

The majority of the wintering mixed herd groups of the Mary Mountain area summered in Hayden Valley and to the south of it as far as Beach and Dryad lakes, although some animals from the same population summered to the west of the Firehole. Ranger reports indicate that infrequent mixed herd use of the Madison Plateau began in 1939, 3 years after the bison were released on the Firehole. By the early 1950s, use had become common, but apparently almost ceased after the 1955 reduction. But in 1963 as many as

50 ranged from the Little Firehole Meadows to the Pitchstone Plateau. In spite of more reductions, small mixed herd groups were seen during the summers of 1965, 1966, and 1967.

After the early 1900s, animals were not again reported wintering in the Bechler Meadows southwest of the Madison Plateau until February 1955, when three bulls were seen just outside the park. An occasional bull may have wintered in the meadows earlier, since a few animals again began to summer on the Madison Plateau in 1939. Observations and reports indicate a few animals in that area nearly every winter since the mid-1950s, in spite of considerable decrease in the Mary Mountain herd, from which these animals probably came. No mixed herd groups were reported wintering in the Bechler Meadows until 1962-63, but the area is seldom visited in winter. Periodic plane flights begun in March 1965 showed a small group there in 1964-65 and 1965-66.

Lamar and Pelican populations are isolated from each other during most of the winter except for occasional movements of a few hardy bulls. Table 6 shows the valleys as distinct wintering areas. Groups in Lamar ranged the valley from Soda Butte west to the Hellroaring Slopes. In Pelican, group use extended from the Mushpots-Mudkettles of Pelican Creek downstream to Vermilion Hot Springs and included the lower parts of Astringent Creek and

TABLE 6. *Distribution of the present population, 1969.*

Winter		Summer	
Bulls	Mixed herd groups	Mixed herd groups	Bulls
Mixed group areas	Soda Butte area	^a Mt. Norris	mixed group areas
Round Prairie	^a upper main Lamar Valley	Cache-Caifee ridge	widely scattered north
Cache Cr.	lower main Lamar Valley	Miller Cr. ridge	of Lamar Valley
Slough Cr.	^a Hellroaring Slope area	Canoe Lake-Hoodoos	and on the
Hellroaring-Tower		^a Saddle Mt.	Mirror Plateau
Jct. area		^a Little Saddle Mt.	Cache Cr.
		head of Flint Cr.	Miller Cr.
Mixed group areas	^a Mushpots-Mudketetics	to heads of Pelican,	along the upper
Ponuntpa Hot Sp.	main valley from	Timothy, Raven Cr.	Lamar R.
Heads of Opal and	Pelican Sp. to		
Flint Cr.	Vermilion Sp.		
White Lake	^a Turbid Lake area	^a head of Opal Cr.	
Astringent Cr.	^a thermal areas west	^a head of Buffalo Fork	
Upper Pelican Valley	of Astringent Cr.	of Timothy Cr.	
Mouth Pelican Cr.			
Lakeshore from			
Steamboat Pt. to			
the Yellowstone R.			
		west and southwest	mixed group areas
		part inc. Highland	Cygnets Lakes
		Hot Sp.	lower Sour Cr.
Mixed group areas	west of Yellowstone	upper Alum Cr.	Arnica Cr.
East side of	River:	^a upper Trout Cr.	
Yellowstone R.	southwest corner	^a central valley	Hayden
Mud Volcano	northeast to junction	^a upper Nez Perce Cr.	Valley
Entire main valley	Alum-Violet Cr.	upper Spruce Cr. to Beach	Area
Beach Lake		Lake and area	

TABLE 6. (continued) *Distribution of the present population, 1969.*

Winter		Summer	
Bulls	Mixed herd groups	Mixed herd groups	Bulls
Mixed group areas	^a Upper Nez Perce Cr.	from Little Firehole	
Entire Firehole area	lower Nez Perce Cr.	Mdws. south across	Madison
from Old Faithful	entire Lower Geyser	Summit Lake area	and
through the Lower	Basin	to west end of	Pitchstone
Geyser Basin	^a Midway Geyser Basin	Pitchstone Plateau	Plateaus
Madison Jct. area	^a Biscuit Geyser Basin	^a Upper Boundary Cr.	
Smokejumper Hot Sp.			
Bechler Ford	Bechler Ford		
Dunanda Hot Sp.	Bechler		

^aLess used.

adjacent hot-spring areas to the west. Although no groups frequented Ponuntpa Hot Springs (6 miles north of Pelican Valley) during the study, both historic records and reports of the mid-1950s (Jim Stradley 1969 pers. comm.) indicated some previous mixed herd use.

Bison from both Pelican and Lamar Valley wintering populations ranged widely during summers on the Mirror Plateau and the Upper Lamar. Neckband observations and aerial counts showed that the two populations, except scattered bulls, combined on the east boundary for several weeks in 1967. Main use areas in the Upper Lamar region during the study period were the Cache-Calfee and the Miller Creek ridges from the east boundary down, and the series of meadows and parks on the east rim of the Mirror plateau extending from the head of Flint Creek to the heads of Pelican-Timothy-Raven creeks. At higher population numbers, as reports of the 1930s and 1950s indicate, herd-group use included most of Specimen Ridge north and west of Flint Creek as well.

To the north of Lamar Valley, where at present only bulls summer, past reports indicate small mixed herd groups on the upper Slough Creek meadows and the Buffalo Plateau (Jim Stradley, Dave Pierson 1968 pers. comm.). In August 1943, a report was received of an estimated 150 bison

near Lake Abundance, just outside the northeast corner of the park.

Two small areas, separated by distance and topography from the four main valleys, have had small wintering mixed herd groups before the study period, according to recent records. Approximately 40-50 bison wintered north of the Madison River on the flats just southwest of the Cougar Creek patrol cabin in 1955-56. Some were also seen in 1959. In the Antelope Creek basin on the northeast flank of Mount Washburn (no date), 45-70 wintered one year (Jim Stradley 1968 pers. comm.). There were no summer reports of groups north of the Madison River, although the bison wintering there in the 1950s may also have summered there.

Bulls were not distributed proportionately among the four main wintering valleys, as shown in Table 7. Most of the Mary Mountain area bulls wintered in Hayden Valley. Lamar Valley had more bulls than did the Pelican area. In summer, bull distribution was widespread. Animals were so scattered that preference for certain general areas by a large percent of the bulls was not observed.

Recent and present population distributions generally resemble those described by historical sources (Fig. 11). Winter distributions within the park approximate those of early times, as do summer distributions on the Mirror-Upper

TABLE 7. Comparative distribution of bulls wintering apart from mixed groups.

Year	Lamar			Pelican			Hayden Valley			Firehole		
	No. bulls	Total pop.	% Bulls	No. bulls	Total pop.	% Bulls	No. bulls	Total pop.	% Bulls	No. bulls	Total pop.	% Bulls
1965-66	36	66	55	29	100	29	—	—	—	—	—	—
1966-67	48	82	56	28	124	23	89	135	66	15	54	26
1967-68	44	89	54	33	160	19	73	131	56	11	57	19

Lamar. Other summer distributions have changed most. The herd which summered north of the Lamar-Yellowstone rivers in historic times is now gone. The large numbers which once ranged the west side (Madison-Pitchstone plateaus) in summer are reduced to comparatively few. The segments of these two historical summer herds which wintered beyond the park boundaries are also gone. The recent Hayden Valley summering population seems larger than the historic population. Bison use of the valley may actually have increased, compared to former times, as the population

became reestablished. Or the increase may not be real, but may result from incomplete historical information.

Although present winter distributions seem little altered (except in total numbers) compared to historic times, the Firehole population may be larger now. Changes in the summering distributions of Hayden Valley to the east and the Madison-Pitchstone plateaus to the west may have caused changes on the Firehole, or unrecorded poaching in that wintering valley may have resulted in apparent early low numbers.