HERD COMPOSITION AND MOVEMENTS IN LAMBING AREAS AND SUMMER RANGES OF BIG CREEK SHEEP IN CENTRAL IDAHO

by

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INTRODUCTION:

The population of bighorns wintering on Big Creek has had an abnormally low lamb:ewe ratio since the 1986-87 winter count. In 1988 research was initiated to assess the potential causes of this problem. This research endeavor involved three-way cooperation and coordination between the U of I Wilderness Research Center, Idaho Fish and Game Department, and the Foundation for North American Wild Sheep. The Foundation for North American Wild Sheep provided the primary financial support throughout the study through their grant-in-aid program.

STUDY AREA:

This study was conducted on Rocky Mountain bighorn sheep which winter in the lower 12 miles of the Big Creek drainage in central Idaho. Big Creek flows from west to east to its confluence with the Middle Fork of the Salmon River. During winter, Big Creek sheep are primarily found on the north side of the canyon which has a predominantly south aspect. The terrain in this area is rugged and broken. Mountain mahogany covered bluffs are interspersed with grassy slopes and benches. Approximately half of the estimated 225 Big Creek Sheep winter on the grass slopes of the Cliff Creek benches and adjacent bluffs.

The lambing and summer ranges of these ewes are scattered geographically but are similar in physical character. The greatest difference in these areas is their proximity to winter range. Habitats used range from mid-elevation cliffs, immediately adjacent the Cliff Creek winter range, to rugged mountainous, high elevation canyons over 25 miles southwest of the winter range. The primary lambing areas are located in the Cliff Creek, Marble Creek, and Monumental Creek drainages. The specific locations within the greater study area evolved as more radio-tracking data was accumulated. The Marble Creek lambing areas are in headwater tributaries, specifically Big Cottonwood and Dynamite Creeks where

there are extensive south facing cliff complexes. In Monumental Creek the lambing area is also in a south facing cliff formation located in the upper reaches of the West Fork of Monumental Creek (see maps: Seasonal Ranges of Big Creek Bighorn Ewes, Lambing Areas). All these lambing cliffs away from Big Creek are at elevations between 7,000-7,800 feet. Those occurring on Big Creek are much lower and range from 4,200-6,400 feet.

Research on this population of bighorns was conducted from the University of Idaho's Taylor Ranch Field Station, located immediately adjacent the Cliff Creek winter range on lower Big Creek. The Big Creek sheep are primarily located in Game Management Unit 26, where there are a total of 15 bighorn ram permits allocated each season.

JUSTIFICATION:

Low lamb:ewe ratios have persisted on Big Creek over the past five winters. Since the 1986-87 winter, aerial ratios have averaged 16:100 (see graph: Big Creek Ewe:Lamb Ratios). Our ground counts were approximately 12:100 for this same time period. This compares with ratios of 46:100 recorded from ground counts in the two years prior to 1986-87. Observations of small, sick lambs near Taylor Ranch in recent years suggest a disease problem. There are other factors which may also be important in causing a low lamb:ewe ratio. A persisting drought condition may have reduced the nutritional quality of the winter range. Another factor could be too many sheep for a given range, total bighorn numbers are the highest on record at this time. A fourth factor could be competition from elk and deer, particularly elk which have markedly increased in numbers the last five years (see graph: Bighorn Sheep and Elk Counts).

OBJECTIVES:

In assessing the causes of low lamb numbers during winter, the **first objective** was to locate lambing and summer ranges. This objective involved the radio-instrumentation of 12 ewes on the winter range. The **second objective** was to determine lamb production at the different lambing areas. **Objective three** was to determine when lamb mortality occurs, and the **fourth objective** involved collecting recently dead lambs for the cause of mortality. The **fifth objective** was to determine if there were differences in lamb survival among the various lambing areas and summer ranges. To accomplish these objectives a field crew was assembled to monitor radio-instrumented ewes in seasonal ranges, to make observations of lambs, and to get mortality samples out from the field as rapidly as possible for laboratory testing.

METHODS:

Two techniques were used to capture bighorns. During the late fall and early winter of 1989-90 a baited drop-net was set up on lower Cliff Creek. Ewes did not go to the bait predictably, which made coordinating a capture crew very difficult. Furthermore this system required frequent net maintenance during heavy snowfall. No sheep were captured with the drop-net. Twenty-one ewes were captured using the immobilizing drug Carfentnil and a dart gun. Ewes selected for capture were stalked and darted on the winter range. After the dart gun operator fired a shot, a capture crew moved in to work the immobilized ewe. A veterinarian was present on all captures and he coordinated blood, fecal, and body fluid sampling. Each captured ewe was evaluated on overall physical condition. The final capture procedure was to attach the radio-collar. Twelve ewes were instrumented by the 1990 field season. These ewes were selected from herds throughout the winter range. Not all the darted sheep were radio instrumented, particularly if a previously

radio-collared ewe was present in the bunch. From the first years data it was suspected that ewes from different lambing areas tended to segregate on the winter range. This winter range segregation was evident the second year. Because of this tendency there was great effort taken to radio instrument ewes from distinctly different herds, increasing the chances for finding as many lambing areas as possible. By mid-March the capture procedures had been completed.

Using a hand held antennae and receiver all the collared ewes were monitored from the ground for two weeks following their capture to make sure they did not suffer post capture mortality. Migration of ewes from winter range to lambing areas began around May 1. During spring migration, movements were monitored by both fixed-wing aircraft and ground tracking techniques. Aerial tracking was primarily done with a Piper Super Cub, although a Cessna 206 and 185 were also used. The field crew utilized two radio receivers when monitoring sheep in the lambing and summer ranges. The two receivers enabled triangulations when visual contact was obscured, and allowed field crew to search for multiple sheep. Multiple receivers were also employed when attempting to locate collared ewes suspected dead.

Sheep were observed intensively once positioned in their lambing areas. The Cliff Creek lambing area was monitored almost daily after lambs were first observed there. Aerial tracking and counts intensified after migration began May 1. Flights were conducted on a weekly basis, until mid-August. It was late May before field crews were able to get into the Big Cottonwood and Dynamite Creek lambing areas for ground observations.

During the month of May flying was done with the Super Cub to increase aerial count accuracy. Spotting scope and binoculars were used on the ground to observe ewes and lambs in lambing areas. Observers maintained a safe distance from ewes and lambs to minimize disturbance, and usually the sheep were

unconcerned by the observers presence. Observers were constantly alert for indications of lamb or ewe mortality. Common indicators of mortality were increased activity of ravens, eagles, and magpies. Less frequently observed scavengers were coyotes and bears. Another indicator was erratic behavior of the ewe, which involved bleating, running, and searching the area constantly. Usually all these signals occurred immediately after a lamb had died.

Once the lamb or ewe carcass was located field crew members worked as rapidly as possible to get the carcass, or organ samples, out of the field for laboratory testing. If it was not possible to recover the entire carcass, which was usually the case, the State Veterinarian provided sampling kits and instructions on there use. In the Big Cottonwood, Dynamite, and West Fork Monumental Creek areas the recovery of samples entailed a 10 to 12 hour procedure. This started with a 4 to 6 hour backpack to the vehicle and then a 5 or 6 hour drive to the State Veterinarian's laboratory in Boise.

The field crew was responsible for filling out an observation form every time a ewe-lamb group was observed. Information was recorded on: identifiable members in the group, ie. radio collar numbers, physical feature uniqueness; the group composition, ie. lambs:ewes and rams; general activities of ewes and lambs; and identification of habitat and physiographic description. As part of describing and identifying the location the observers referenced each group by code and then marked this code on maps at the location where the sheep were observed. The field crew also carried 35mm cameras, photographing the various lambing and summer range habitats. When dead bighorns were recovered, pictures were taken of the carcass and internal organs to help determine cause of mortality, and a mortality form was completed. For aerial radio-tracking, data collection was oriented towards sheep group composition and location. Group locations were recorded onto USGS quadrangle maps.

RESULTS:

1989 Field Season

The instrumentation of ewes began in early March of 1989. By April nine ewes had been radio instrumented. Only six of these survived to migrate to lambing areas. The cause of death on the three ewes could not positively be confirmed as all three had been dead for more than a month before being found. Laboratory tests of bone marrow indicated the presence of Pasteurella haemolytica in these ewes (pers. comm. Dunbar, 1989).

During May ewes were radio-tracked to locate lambing areas. In the 1989 field season ewes were seen with newborn lambs at six different locations. Four of these areas were used by Big Creek sheep, the other two sites were thought to be used by sheep from the Middle Fork of the Salmon River. Radio instrumented ewes led researchers to 2 of the lambing areas, in Cliff Creek and Big Cottonwood Creek. The other three areas found in 1989 were located through aerial searches of likely cliff habitat.

Ewes were observed with newborn lambs the last three weeks of May in 1989. Lambs were at peak numbers during the first week of June. In the Cliff Creek area 16 ewes were seen with 14 lambs. In Big Cottonwood Creek 21 ewes were observed with 12 lambs. By mid-July 57 ewes were counted in these two areas. The Cliff Creek count included 9 ewes and 1 lamb, whereas ground observations in Big Cottonwood Creek revealed 43 ewes with 4 lambs (see graphs: Big Cottonwood and Cliff Creek Lamb:Ewe Ratios, 1989).

It was documented in 1989 that five of six radio-instrumented ewes gave birth to lambs. Only one of these five lambs was alive in mid-July. One dead lamb was recovered from Big Cottonwood Creek, soon enough after death to enable thorough laboratory testing. The carcass was untouched by scavengers, and there was no indication of predation. Tests indicated the presence of Pasteurella haemolytica

titers. The respiratory problems resulting from Pasteurella was considered the probable cause of this lambs death (Dunbar, 1989).

In summary, during the 1989 field season we located an undocumented lambing area. We verified that lamb production was high initially and summer lamb mortality was the cause of low lamb:ewe ratios. Most lambs died between 4 and 6 weeks after birth, which is from mid-June to mid-July. Mortality occurred at a similar rate in both major lambing areas used by Big Creek sheep.

1990 Field Season

Data collection capability was increased for the 1990 field season. A field crew of three worked full-time on the project. In late winter of 1990 an additional six ewes were radio instrumented, bringing the total to twelve. During the two field seasons, a total of 21 ewes were captured and examined.

During the 1990 field season a third major lambing area was located in the West Fork of Monumental Creek. Also in 1990 radio-instrumented ewes were observed in lambing cliffs in Dynamite Creek. The Dynamite Creek ewes migrated from Big Creek with Big Cottonwood Sheep, but apparently split apart immediately prior to lambing. These ewes then reunited to share a common summer range. The West Fork Monumental, Big Cottonwood, and Dynamite Creek areas share very similar physiographic characteristics. These three areas are over 7,000 feet elevation. They all are south facing cliff complexes, a quality also found at Cliff Creek and the other lower elevation lambing areas on Big Creek.

The first lambs were seen on the Cliff Creek lambing area May 12. By May 23 twelve ewes were observed from the ground with 10 lambs. On May 25 lambs were seen in the West Fork of Monumental Creek, this was the first observed in lambing cliffs away from Big Creek. On May 28 aerial counts from the Super Cub revealed lambs in all the major lambing areas and one minor area in the Big Creek Gorge. In Big Cottonwood there were 10 ewes with 8 lambs, in Dynamite Creek 14

ewes with 8 lambs, the West Fork Monumental count was 11 ewes with 5 lambs, Cliff Creek had 14 ewes with 11 lambs, and in the Big Creek Gorge there were 2 ewes with 1 lamb.

Maximum lamb numbers were observed in most of these areas by early June. On May 28 in Big Cottonwood Creek 10 ewes were seen with 8 lambs, for a lamb:ewe ratio of 80:100. Cliff Creek also had a maximum count on May 28 when 14 ewes and 11 lambs were counted for a 79:100 ratio. On June 3 in Dynamite Creek there were 20 ewes seen with 17 lambs, for a 85:100 lamb:ewe ratio. Also on June 3 maximum numbers were seen in the Big Creek Gorge and West Lobauer Basin where the counts were 5 ewes and 3 lambs and 1 ewe and 1 lamb respectively. The maximum count in the West Fork of Monumental Creek did not occur until June 18, on that day 13 ewes were observed with 11 lambs for an 85:100 lamb:ewe ratio (see graphs, Lamb:Ewe Ratios 1990, for all lambing areas).

By mid-June a total of 65 ewes and 51 lambs had been counted in the known lambing areas for Big Creek sheep. The ratio of lambs:ewes over all areas in mid-June was 78:100. By this time the ewes had moved to their summer range, counts in Big Cottonwood and Dynamite Creek were combined since ewes and lambs from these two areas were mixing by then. Both ground and air counts reflected a sharp decline in lamb numbers around July 1. One exception to this observation was in the West Fork of Monumental Creek, which did not show a drastic drop in lamb numbers until 2 weeks later.

By the last aerial count on July 22 lamb numbers had plummeted in all areas, only 4 lambs were seen with 62 ewes throughout the summer range. Within one month lamb:ewe ratios had dropped from 78:100 to a mere 7:100. The twelve radio-instrumented ewes were documented having given birth to ten lambs. By late July none of the instrumented ewes had lambs with them. One lamb, from a radio instrumented ewe, was found and recovered immediately after it died.

MORTALITY:

A total of 10 dead bighorns were found in the 1990 field season. Samples of organs, tissue, and blood were collected from seven lambs and three ewes and delivered for laboratory testing. The weather was a significant mortality factor, snow storms with cold temperatures occurred during lambing of both field seasons. In late May of 1990 two lambs were found dead, one in Cliff Creek and one in Big Cottonwood Creek. Results from the Wildlife Lab indicated the presence of Pasteurella Haemolytica biotype T in both, and type A in the Big Cottonwood lamb. However, exposure was felt to be the immediate cause of mortality for both of these lambs (pers. comm. Hunter, 1990). Another lamb recovered from Dynamite Creek appeared to have died from emaciation. High numbers of Pasteurella haemolytica were also cultured from the lung tissue, and pneumonia and tracheitis were evident on necropsy (Hunter, 1990). A ewe found dead in Annie Creek tested positive for Pasteurella multocida, which was considered to be the cause of death by the Wildlife lab since it was cultured from bone marrow, tonsils, nasal swabs, and lungs. Laboratory results indicate that Pasteurella haemolytica type A and T and Pasteurella multocida are present throughout the lambing environments of Big Cottonwood, Dynamite, and Cliff Creek sheep (Hunter, 1990).

BIG CREEK BIGHORN ECOLOGY: ACTIVITIES OF RADIO INSTRUMENTED EWES:

Winter Range

All the ewes radio instrumented were captured on the Big Creek winter range between Cabin Creek upstream and the Big Creek Gorge downstream of Taylor Ranch. The largest winter concentration of bighorns along Big Creek occurs on the bunch grass slopes and benches east of lower Cliff Creek. The maximum number of bighorns on the Cliff Creek benches occur in late November or Early

December during rutting activities. During the rut between 80-100 bighorn sheep are present on this part of the winter range. Smaller rut congregations occur on grasslands and nearby bluffs at Lobauer Basin and Brown's Basin upstream on Big Creek. After the rut, and usually with the arrival of winter snow cover, these congregations disperse to more rugged bluff terrain. This habitat has thick mountain mahogany foliage, a primary winter browse species.

Winter Range Segregation

By January, mature rams separate from the ewe groups. At this time the ewes break into small groups and tend stay with other ewes from the same lambing areas. Ewes number 7 and 8 spent winter months in rugged bluffs between Cabin Creek and Brown's Basin. These two ewes had their lambs in the Cliff Creek cliffs. Ewes number 1, 2, 3, 5, 6, 9, and 11 spent the winter within 1 mile of the mouth of Cliff Creek. They all had their lambs in either the Big Cottonwood or Dynamite Creek drainages. Ewes number 12, 13, and 14 spent late winter months in the vicinity of Goat Creek and the Big Creek Gorge. Ewes number 12 and 14 lambed in the West Fork of Monumental Creek. Ewe number 13 stayed in the Big Creek Gorge to lamb, but when her lamb died she reunited with ewes 12 and 14 at the summer range in the headwaters of Monumental Creek.

Spring Migration

By April the bighorn ewes had moved back onto bunch grass hillsides where green-up is underway. Again the Cliff Creek benches become a staging place, this time the gathering is preliminary to the spring migration. Ewes congregate into their small migration herds. The ewes display a heightened state of activity and alertness immediately before the migration begins.

The spring migration is underway by the first couple days of May. The first instrumented ewes to leave the winter range were those heading to Big Cottonwood and Dynamite Creeks. Ewe number 1 and 2 were observed crossing Big Creek with

nine other ewes on May 3. On the May 7 radio-tracking flight, these two ewes were located in Big Cottonwood Creek lambing cliffs. Ewe number 9 was located in Dynamite Creek. Also, on that May 7 flight ewe number 12 was located 4 miles up Rush Creek. By May 12 ewes number 3 and 12 were located further up Rush Creek than Rush Creek Point Lookout. On May 13 these same ewes could not be located from Rush Creek Point by ground tracking. Ewe number 3 was located, from the air, in upper Little Cottonwood Creek. Her location was less than a mile southwest of the Shellrock Ridge Summit, which divides the Rush and Marble Creek drainages (see map: Seasonal Ranges of Big Creek Bighorn Ewes, Migration Routes).

All indications are that the Rush Creek drainage serves as the primary migration corridor for ewes dispersing to distant lambing areas from the Big Creek winter range. The general migration route to Big Cottonwood and Dynamite Creek lambing areas is up to the head of Rush Creek and over the top of Shellrock Ridge. Some of these ewes then move down Little Cottonwood Creek, across Marble Creek, and on up to the Big Cottonwood lambing cliffs. It is possible that those ewes destined for Dynamite Creek take a more southerly route, perhaps travelling down Buck Creek and Marble Creek to access the mouth of Dynamite Creek. The Dynamite Creek ewes may also cross over Red Ridge from Big Cottonwood, although snow depths could be prohibitive for such a route in early May. The West Fork Monumental ewes access that area by travelling up the West Fork of Rush Creek onto Lookout Mountain Ridge. From the ridgetop they then use Meadow or Milk Creek to reach Monumental Creek, and then proceed up the West Fork of Monumental to their lambing cliffs.

The remaining bighorn ewes on Big Creek move just a few miles at most to their lambing areas. Ewe number 7 and 8 moved downstream from Brown's Basin in early May enroute to Cliff Creek lambing cliffs. The other collared ewe

remaining on Big Creek, number 13, remained in the Big Creek Gorge to lamb on precipitous ledges of this narrow canyon.

Ewe movements were localized from mid-May through early June once they were positioned in their respective lambing sites. Pregnant ewes separated from ewe groups to give birth, but soon rejoined other ewes with lambs. When grouped together, individual ewes would trade off "babysitting" so several sheep could go to a water source. Lambs were much more active their second week of life, still their movements were mostly confined to terrain with good escape terrain. Some of the Cliff Creek ewes moved their lambs across the drainage within the first two weeks of life, yet in this area such a move can be done with little exposure to land predators. Through the rest of June ewe-lamb groups expanded their movements out of the lambing cliffs but still stayed in talus, bluffs, and other good escape terrain.

By early July the Big Cottonwood and Dynamite Creek ewes had moved to their shared summer range. On a July 8 flight there were six radio instrumented ewes, numbers 1, 3, 5, 6, 9, and 11, in a group of eleven ewes and no lambs in a grassy basin at the very head of Big Cottonwood Creek. On the same flight two ewe-lamb groups were seen at the head of the West Fork of Monumental Creek. Ewe number 12 was in a group with ten ewes and four lambs, and she had a lamb at her side. The other group consisted of three ewes with three lambs. Cliff Creek ewes stayed the longest in their lambing area. Ewes with lambs remained in or near these cliff formations until late July.

After lambing some long distance movements were observed by ewes having lost their lambs. In two successive years, ewe number 2 left Big Cottonwood Creek after her lamb died and returned to the Cliff Creek benches. In 1989 she made this journey twice. When she returned to Big Cottonwood she brought ewe number 11 with her. Ewe number 8 had lost her lamb earlier in the Cliff Creek lambing area. In 1990 ewe number 13 travelled to the West Fork of Monumental Creek after

losing her lamb in the Big Creek Gorge. She rejoined ewes number 12 and 14 on their summer range.

Ewe number 9 was located in Little Indian Creek on a May 25 flight, she had spent the previous three weeks in the Dynamite Creek lambing cliffs and presumably moved west of Red Peak after her lamb died.

LAMBING AREAS:

Before this study began there were two areas where Big Creek sheep were known to have their lambs. One of these areas is within view of Taylor Ranch, 1 1/4 miles upstream on Cliff Creek. We observed ewes lambing in these cliffs throughout the 1980's. The Dynamite Creek drainage was known to have a lambing area as a result of research done between 1975-77 (Ables and Bennett). They documented late May, June, and July movements of radio instrumented ewes, within ewe-lamb groups, in the upper Dynamite Creek and Red Peak vicinity.

After the 1989 field season we had confirmed the use of three lambing areas by Big Creek ewes. These were the Cliff Creek, Big Cottonwood, and West Lobauer Basin areas. By June of 1990 three more areas had been identified through locating radio instrumented ewes. These were the Dynamite Creek, West Fork Monumental, and Big Creek Gorge areas. (see map: Lambing Areas)

All lambing areas have similar physical features. They are in precipitous cliff formations having a general southern exposure. Heavily hedged or browsed mountain mahogany is found in all these sites. Grasses and forbs were not abundant in lambing areas, food was more available outside of these cliff formations. The areas do vary in elevation from 3,800 to 8,000 feet, in size from 5 to 300 acres, in proximity to winter range from 1 to 25 miles, and in amount of use from 1 to 21 ewes. Goats were also observed in the three lambing areas away from Big Creek, and usually were in nanny-kid pairs. The following is a descriptive comparison ot these six lambing areas.

Cliff Creek

The primary Cliff Creek lambing area is approximately 300 acres in size. It is not a contiguous area but is broken into several pockets and micro-sites. The majority of lambing sites are on the east side of Cliff Creek, which has the most massive cliffs and direct south exposure. New lambs were also observed on jagged ridges west of Cliff Creek. At the time of birthing ewes will generally be alone or in small groups. They seek out protected ledges usually surrounded by shear cliffs. Suitable sites of this description range from 5,200 to 6,200 feet in elevation. The shear cliff walls constitute 30% or less of the lambing area complex. The majority of the area is a mix of steep talus and rough mountain mahogany bluffs. There are scattered ledges and slopes with grass, predominantly cheat and bunch grasses. The dark basalt walls in this area provide thermal radiation. Once the ewes with lambs move off of the ledges they primarily utilize the mountain mahogany bluffs. The maximum number of ewes observed in this area was 28 in late May of 1989. In 1990 the maximum observed number of ewes was 18. Instrumented ewes number 7 and 8 used this area for lambing.

Big Creek Gorge

This is a small lambing area located 3 miles downstream from the Cliff Creek confluence with Big Creek. The lambing complex is approximately 10 acres in extent. The small group of ewes in this vicinity restrict their activities to just a couple ledge and cliff formations, which range in elevation between 3,800 and 4,200 feet. Vegetation is similar to Cliff Creek with clumps of mountain mahogany, scattered big sagebrush, and small patches of blue bunch wheatgrass and cheatgrass in the cliffs and bluffs. This site is the lowest in elevation of all the lambing areas. These cliffs are light colored granite and they do not have the thermal qualities of the black basalt cliffs of Cliff Creek. Food for ewes is also more scarce in the Gorge. Access to water is easy at this

site. The maximum number of ewes seen in the Gorge was 5 in 1990. This lambing area had not been located in 1989. Ewe number 13 was radio-tracked to this site in 1990.

West Lobauer Basin

This is the smallest and least used of the Big Creek lambing sites. It is located on the west side of Lobauer Basin, 3 miles upstream from Cliff Creek. The Cliff Complex is black basalt with a southern aspect. The cliffs being used comprise less than 5 acres in area. Mountain mahogany is scattered throughout this rock formation and a talus chute flanks the west side of the lambing cliff. There is some blue bunch wheatgrass in the cliffs and a bunch grass and sagebrush slope lie immediately to the east. The maximum number of ewes observed in this site was 2 in 1989, they had one lamb with them. In 1990 one ewe was located with one lamb. No radio-instrumented ewes were observed in this area during either summer. This lambing area has the best access to water.

Dynamite Creek

This is the most distant lambing area from Cliff Creek, approximately 25 miles to the southwest. The lambing area is a series of very rugged ridges spurring south off of Red Ridge. This lambing area is located 3-4 miles up Dynamite Creek in black and red rock of volcanic origin. The area spans 200 acres or more and is heavily dissected with narrow crevices and rock columns. There are several small pockets being used for lambing. The red and black rock, in combination with talus draws, create excellent thermal characteristics. This is an important quality, as it is common for snow to come and go during the lambing season. Elevations range from 6,800 to 8,000 feet where the lambing ledges occur. Mountain mahogany is scattered throughout the cliff complex and has been heavily browsed. Big sage, scrub juniper, and sparse grasses are also present at these sites. As many as 20 ewes were observed here during lambing. Ewe number 6, 9, and 11 utilized this lambing

area in 1990. Mountain goats were frequently observed in Dynamite Creek lambing cliffs.

Big Cottonwood Creek

This lambing area consists of two formations located 3 1/2 and 4 miles up the drainage on the north side between 6,800 and 7,600 feet elevation. The lower part consists of a continuous rock structure with shear cliff walls, crevices, ledges, and steep talus chutes. The upstream portion consists of heavily eroded talus chutes and rock bluffs adjacent ridges forested with Douglas fir. Combined, these sites cover over 250 acres. The vegetation component in the Big Cottonwood area is similar to that in Dynamite Creek. Both these areas are sparse in food available for nursing ewes when compared to Cliff Creek. Maximum ewe numbers observed were 21 in both 1989 and 1990. In 1989 ewe number 1, 2, 3, and 4 went to this lambing area. The same number of collared ewes went to Big Cottonwood in 1990, however, ewe number 4 died during fall on the winter range. A newly collared ewe, number 5, went to this lambing area in 1990.

West Fork Monumental Creek

This lambing site is approximately 22 miles west-southwest of the Cliff Creek winter range. It is located in the upper West Fork of Monumental Creek, approximately one mile above the confluence with the North Fork of Monumental Creek. These south facing cliffs range in elevation between 7,200 and 7,800 feet elevation and cover more than 50 acres. Several smaller outcrops are also used by ewes and newborn lambs. Vegetation consists of scattered mountain mahogany, Douglas fir trees, and sparse big sagebrush and blue bunch wheatgrass. These cliffs have a ledge component similar to Cliff Creek, although the complex is much smaller. The physiographic qualities of this area are very similar to the Dynamite and Big Cottonwood areas. The maximum number of ewes observed during lambing was 13. Radio instrumented ewes found here were number 12 and 14.

Summer Range

Summer habitat varied dramatically between sheep lambing on Big Creek and those going to distant lambing areas. The ewes from Cliff Creek, the Big Creek Gorge, and West Lobauer Basin moved very little from lambing areas to summer range. In these areas the summer range is within or adjacent the winter range. In 1988 the Golden Creek Fire burned 46,000 acres north of the Big Creek winter range. The southern edge of the burn is along the upper winter range, and Cliff Creek lambing area boundaries. Since this fire these ewes have been utilizing burned areas heavily in places where the pine grass is lush. Both Cliff Creek ewes and those in the Gorge can access the burn edges and still be close to escape terrain at the upper reaches of their respective lambing cliffs. The one or two ewes from West Lobauer Basin most likely reunited with the group of barren ewes and young rams that spend the summer between Lobauer and Brown's Basins. The sheep lambing in Cliff Creek also moved to the Brown's Basin area later in the summer (see maps: Summer Ranges, each lambing area).

In early June ewes from Big Cottonwood, Dynamite, and the West Fork of Monumental Creek began moving out of cliff terrain and into talus, bluff, and Douglas fir slopes up these drainages. They occupied these areas for 1-2 weeks before moving to the summer range. By mid-June these ewes had moved to their summer ranges in grassy alpine basins. Ewes from the Big Cottonwood and Dynamite Creek areas grouped together in the basins at the heads of Big Cottonwood Creek and Dynamite Creeks. They fed primarily on forbs and grass in meadows and then bedded in loose talus slopes with good visibility. When travelling these ewes preferred traversing ridge-tops, commonly at elevations of 9,000 feet or more. The summer range for the West Fork Monumental ewes is between 8,200 and 9,000 feet elevation in cirque basins. Sheep primarily used the basin surrounding Catherine Lake. This area has several springs and seeps with

associated lush vegetation. Ewe-lamb groups also use basins along northern aspects of Snowslide Creek and in the North Fork of Monumental Creek. As with Big Cottonwood sheep, these ewes favored bedding sites in open talus. These slopes offered good vantage points for predator detection.

Fall Migration

The fall migration occurs from late August through October. It is a more gradual movement than the spring migration. The fall migration pertains chiefly to Big Cottonwood, Dynamite, and West Fork Monumental Creek sheep since ewes from the Big Creek lambing areas are already on, or near, the winter range. Ground observations indicate that these ewes retrace their spring routes. Once in the lower six miles of Rush Creek the ewe groups slow down their movements to gradually move onto the Cliff Creek benches, which is the primary staging area for fall rutting activities.

CONCLUSION:

The radio instrumenting and tracking of bighorn ewes produced significant new information on Big Creek sheep. Previously, only the low elevation lambing area in Cliff Creek had been studied. The Monumental, Big Cottonwood and Dynamite Creek lambing and summer ranges, while structurally similar to Cliff Creek, differ in elevation, temperature, precipitation, timing of phenology, and quality and quantity of food. We expected to find different mortality rates among the various lambing and summer ranges, assuming a specific mortality factor was more prevalent in some areas. Instead, we found that lamb production was similar in all areas, summer mortality occurred close to the same time and lamb survival was consistently poor.

Laboratory analysis of carcasses and tissue samples revealed the same bacterial agents and diseases in animals collected from different summer ranges. Similar lamb survival of sheep herds summering in different areas suggest that summer lamb mortality is not site specific to one summer range. There are several possible causes of summer lamb mortality. The presence of Pasteurella haemolytica and other bacteria (Hunter and Dunbar 1990), indicate that this population is being stressed. The Big Creek sheep had not been sampled for disease antibodies before the summer mortality first occurred in 1986. It is unknown whether diseases have recently been introduced into these sheep by adjacent bighorn populations or whether additional stresses have caused the normal viral and bacterial flora to affect the sheep more adversely.

Additional health information on Big Creek sheep and bighorns from adjacent populations could help identify sources and effects of diseases. The Marble Creek lambing and summer ranges are likely places for Big Creek sheep to intermingle with bighorns coming from different winter ranges. The ram segment of the population could also be contracting diseases from neighboring "bachelor herds"

in shared summer ranges on the Shellrock Ridge complex. It was not an objective of this study to evaluate rams in this population. However, we asked several hunters on Big Creek during the 1989 season to collect organ samples if successful. Five hunters turned in tissue samples for evaluation. Laboratory tests revealed the presence of several bacteria including Pasteurella haemolytica (Dunbar 1989).

Several factors could be responsible for stressing the Big Creek bighorns. The current population is at a record high (see graph: Bighorn Sheep and Elk Counts). During late winter these sheep do not appear to be in poor shape, or in any worse condition than those sheep sampled in Morgan Creek (pers. comm., Dunbar 1989). The high numbers of sheep, in conjunction with a severe lamb mortality problem, suggests that these sheep may be exceeding their carrying capacity. Elk numbers are also at record levels over the past 20 years (see graph: Bighorn Sheep and Elk counts). Most elk winter upstream from the bighorn winter range, although as many as 50 head have been observed sharing the Cliff Creek winter range with sheep. Elk and deer are both potential competitors with these sheep, however the relatively snow-free winters of recent years should have dispersed animals over more winter range, resulting in less competition.

Another potential cause of stress on bighorns is the recent drought. Lower than normal precipitation has been recorded at the Taylor Ranch weather station every year since 1986. Drought conditions have an adverse affect on quantity and quality of food plants in summer and winter. It may also affect mineral uptake of vegetation. Extremely low blood levels of selenium and manganese were found in Big Creek bighorns (Dunbar, 1989). Low winter snow depths could also affect sheep habitat use. Sheep wintering on Cliff Creek usually move from grasslands into the mountain mahogany covered bluffs when snow depths are greater than 4 inches. Low snow levels may have affected where sheep feed and what they feed on in winter. The sheep may be utilizing less nutritious forage in low snow years. An

evaluation of range conditions and the effect of drought on food quality and availability could reveal the significance of habitat in the health of Big Creek bighorns.

Predation was not found to be a significant lamb mortality factor during the time when the sheep are in the lambing cliffs. Golden eagles were the predator most frequently observed at lambing sites. They were not observed killing lambs but spent considerable time in the vicinity of lambing activity. Coyotes were observed in the Cliff Creek cliffs on occasion but the terrain in this, and other lambing areas, makes access for most land predators difficult. Lambs are most vulnerable to predation during the time when they leave the lambing cliffs but have not yet reached their summer range. This time coincides with the June drop in lamb numbers, but of the 7 dead lambs recovered in 1990, none appeared to have died from predation.

RECOMMENDATIONS FOR MONITORING THE POPULATION STATUS OF BIG CREEK BIGHORNS:

Monitoring the Big Creek sheep population should continue. Aerial surveys are the most efficient way to assess lamb production and summer lamb mortality. It is essential to use a slow flying aircraft, such as a Super Cub. This count should be done during the first week of June when lamb numbers peak. All lambing areas could be assessed during three hours of flying. Summer lamb mortality and late summer lamb:ewe ratios can be determined through an aerial count of summer ranges in late July with a Super Cub, or similar plane. Most summer mortality has occurred by this time and sheep are still concentrated and visible in the heads of basins and on open mountain peaks.

REFERENCES

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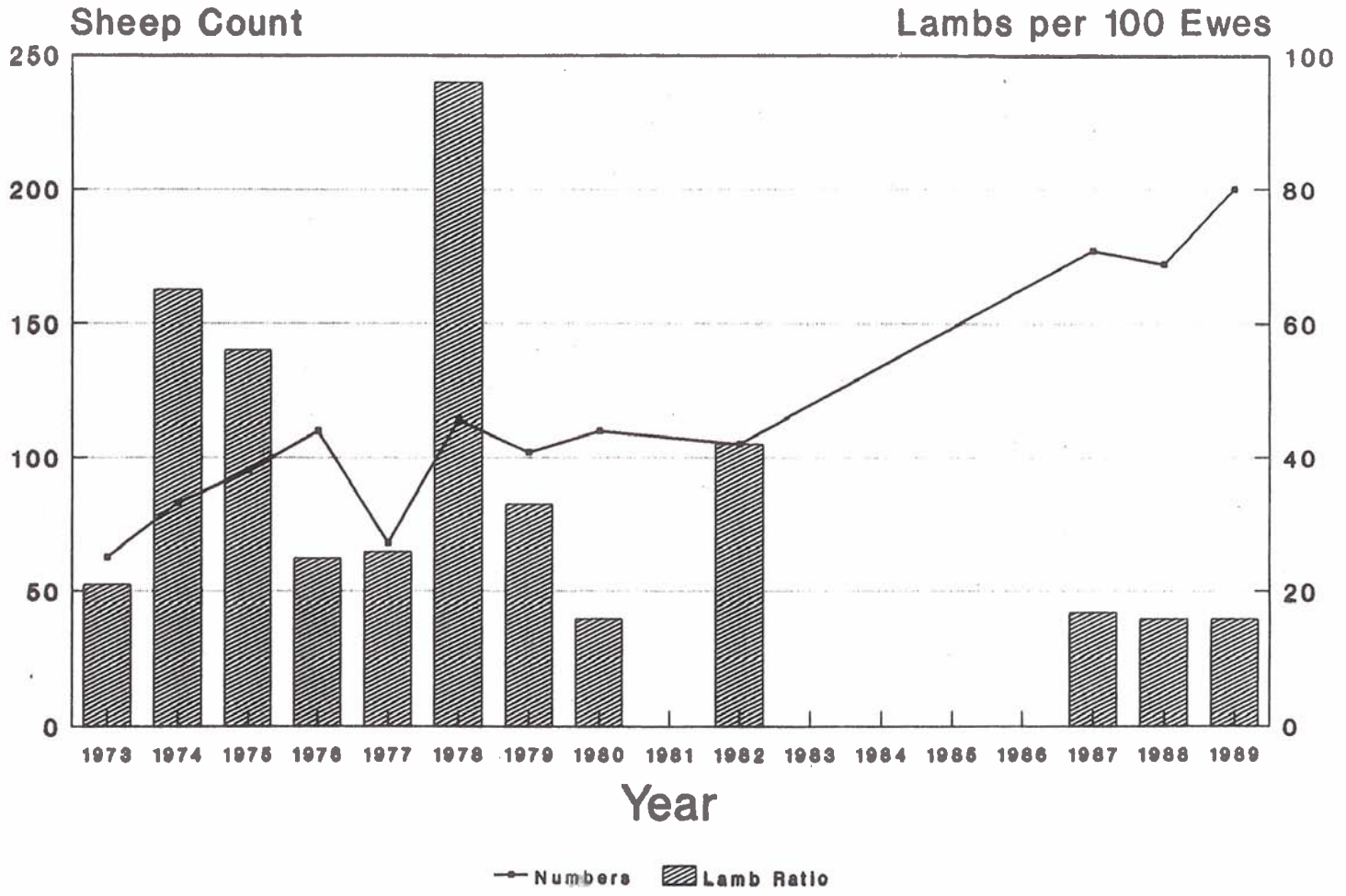
Dunbar, Mike R. 1989. Big Creek Bighorn Sheep Project Proposal - Supplement. Memo to Lloyd Oldenburg, November 17, 1989. 3pp.

Hunter, David. 1990. Big Creek Sheep Project - Lamb Necropsies. Memo to Lloyd Oldenburg, October 25, 1990. Idaho Department of Fish and Game. 2pp.

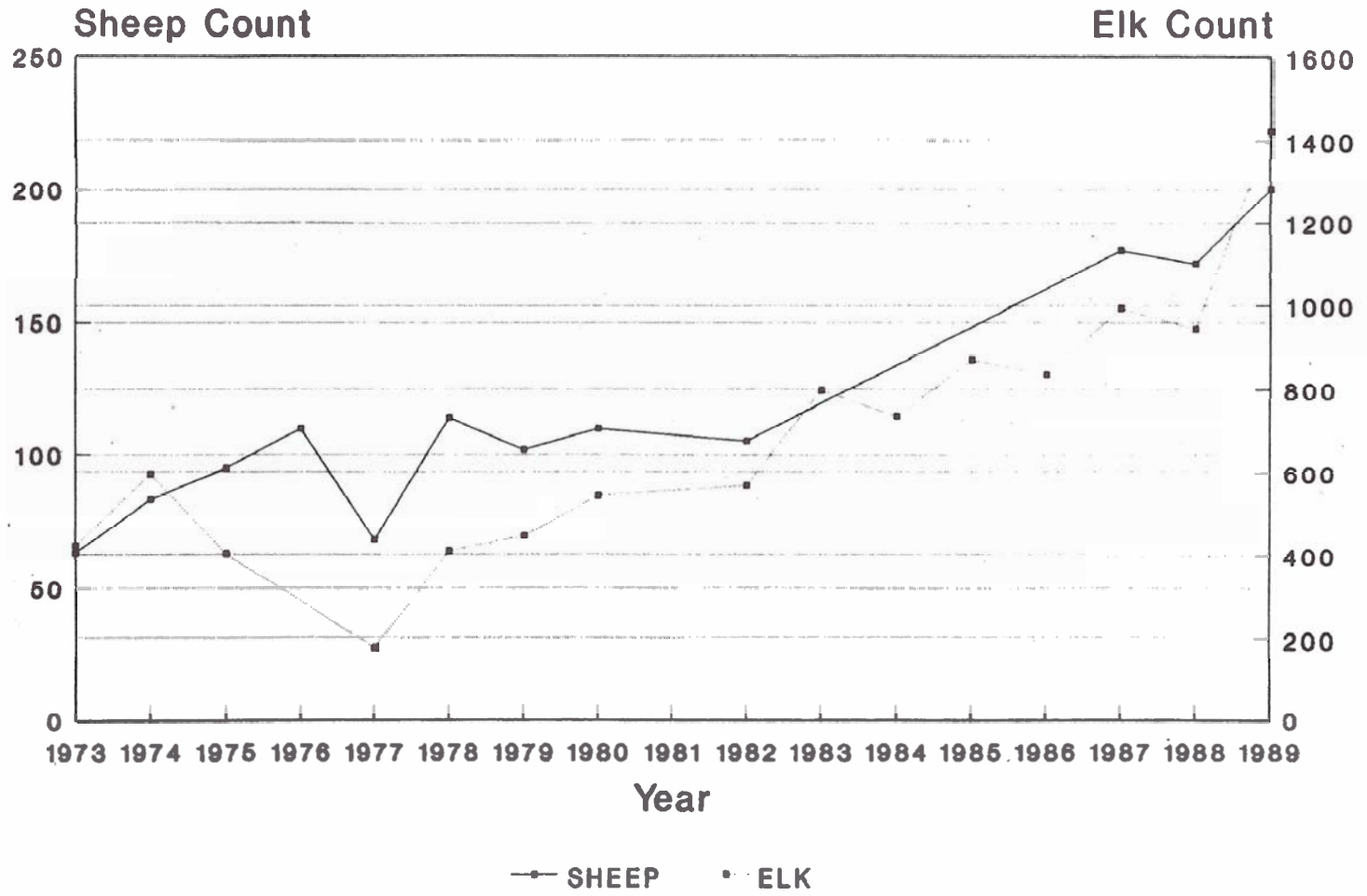
Schlegel, Mike. 1989 Idaho Department of Fish and Game, Aerial Surveys of Elk and Bighorn Sheep in Unit 26. Unpublished records.

Big Creek Lamb:Ewe Ratios
Unit 26 Yearly Counts



IDF&G Data (Schlegel 1989)

Bighorn Sheep and Elk Counts
Aerial Surveys of Unit 26



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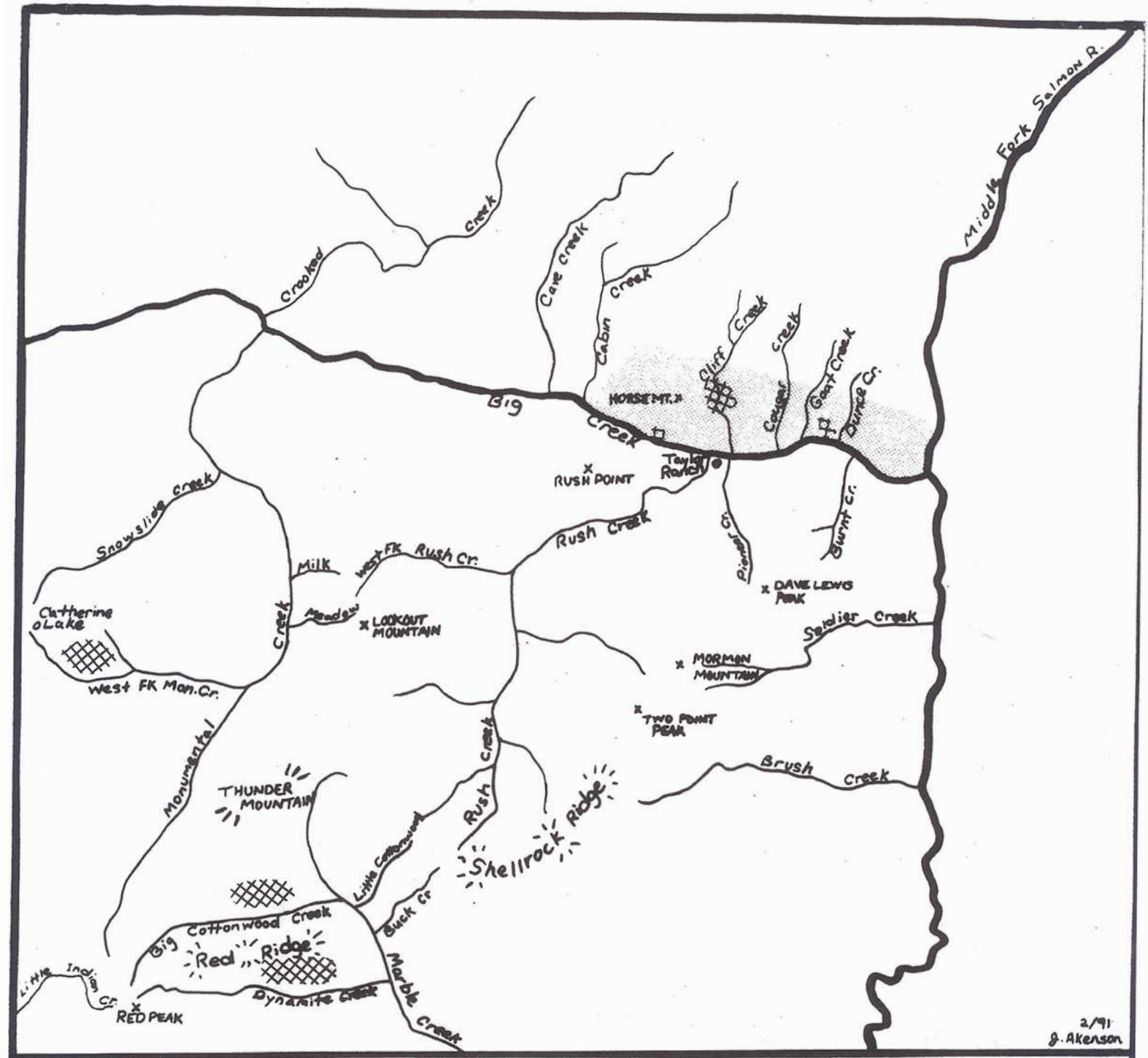


Lambing Areas

Winter Range

N

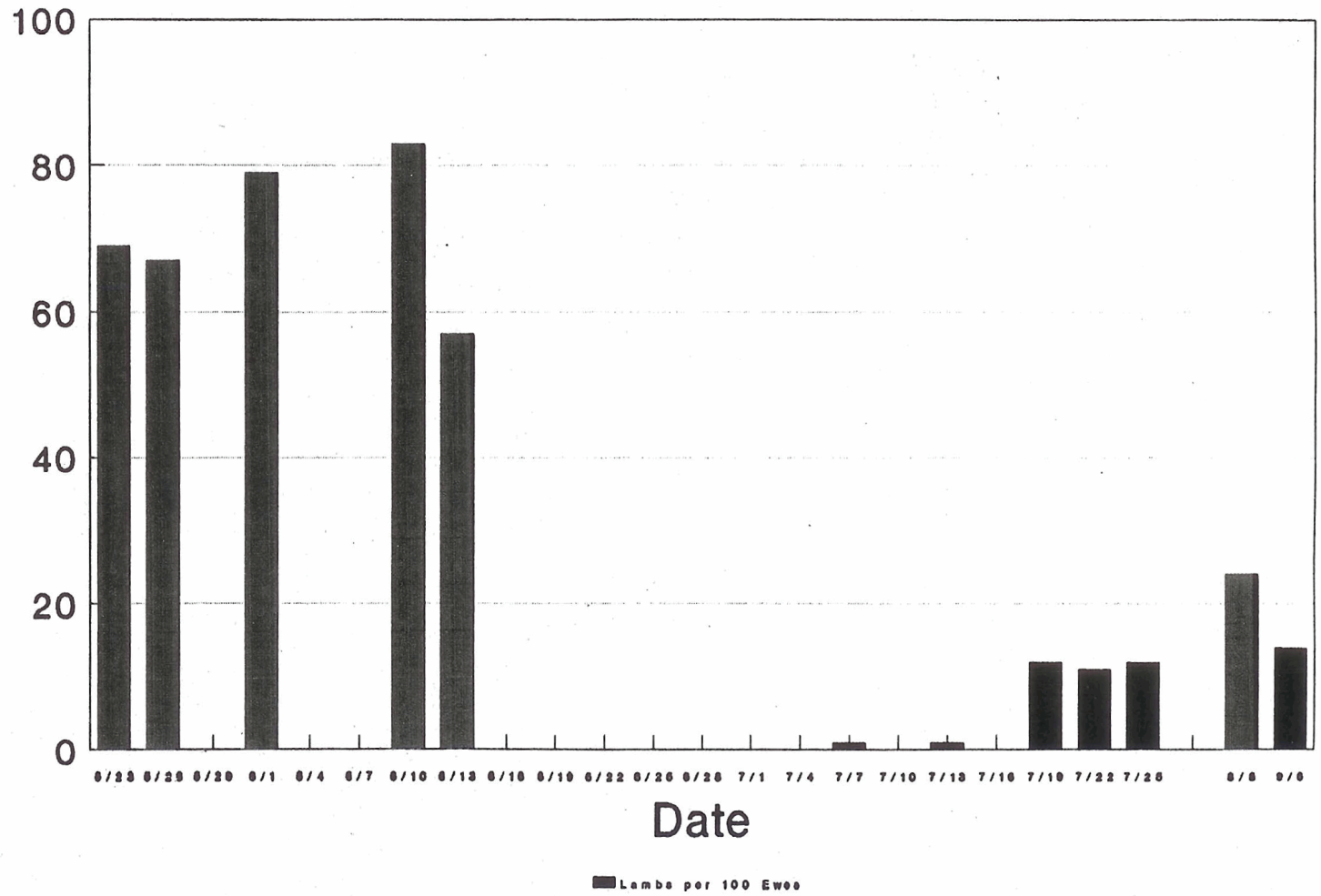
SEASONAL RANGES OF BIG CREEK BIGHORN EWES

Scale 1:250.000

5 0 5 10 15 20 Statute Miles

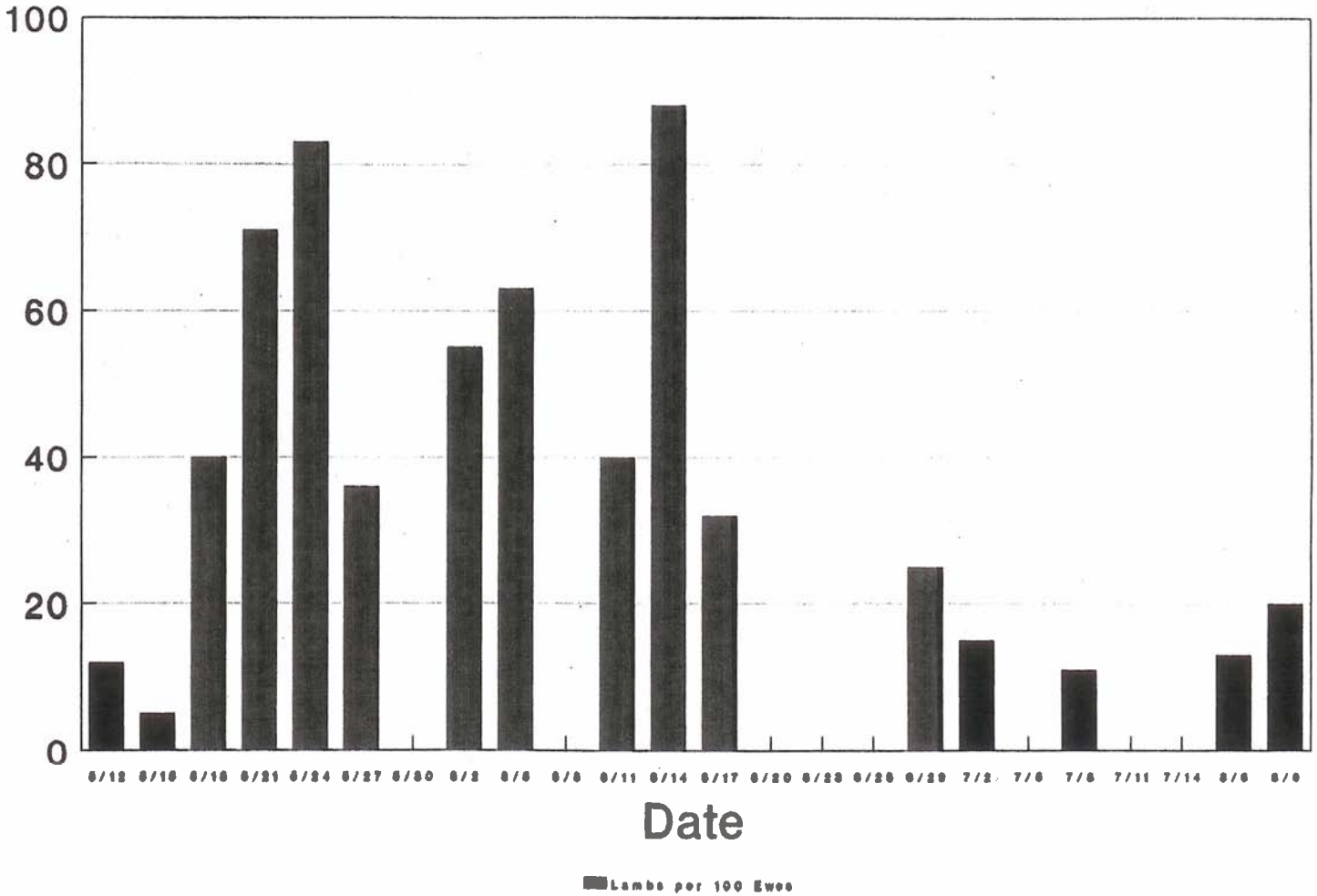
5 0 5 10 15 20 25 30 Kilometers

Big Cottonwood Lamb:Ewe Ratios 1989
Air & Ground Data



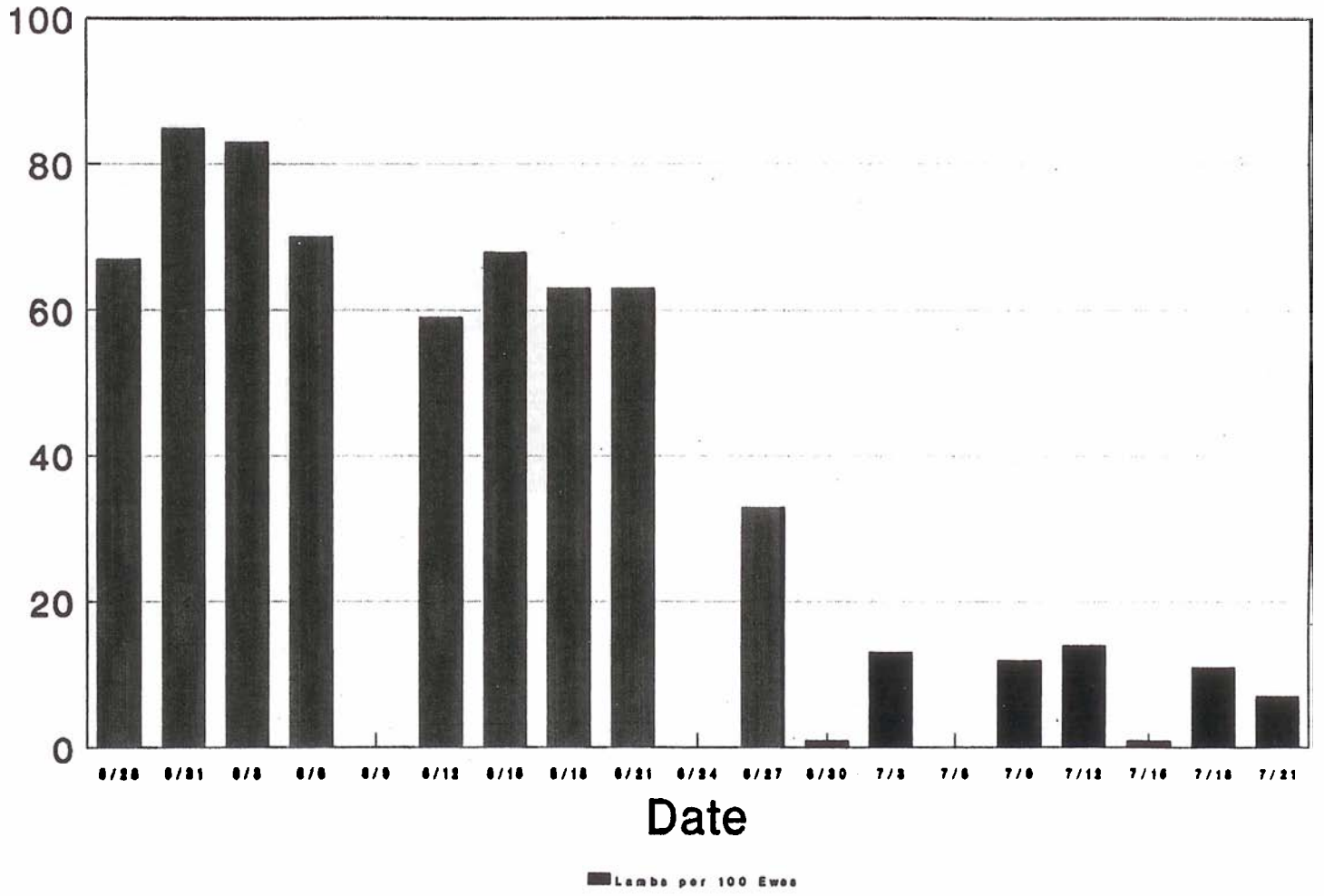
Highest Count In 3 Day Interval

Cliff Creek Lamb:Ewe Ratios 1989
Air & Ground Data



Highest Count In 3 Day Interval

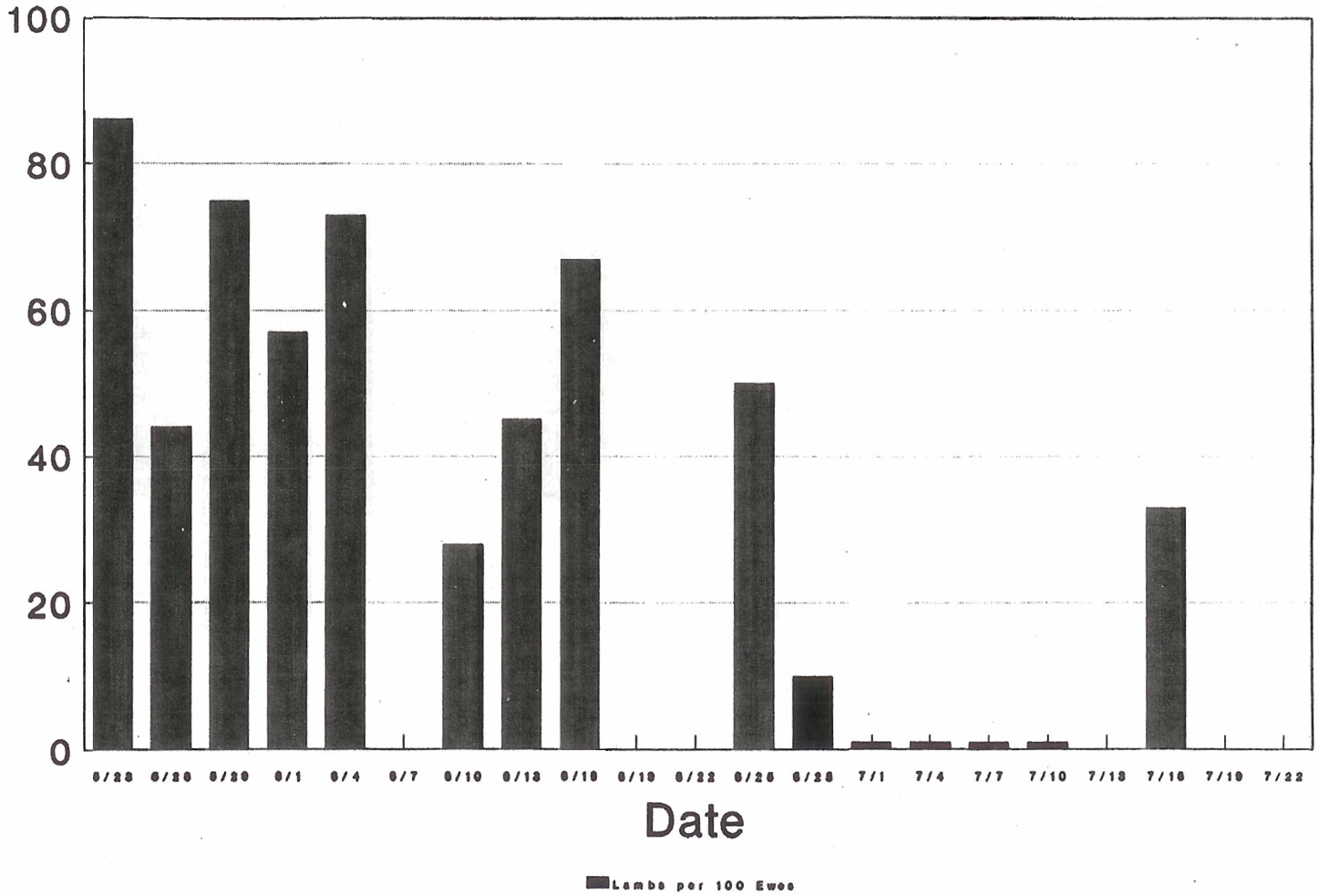
Big Cottonwood & Dynamite Creek 1990
Air & Ground Data



Highest Count in 3 Day Interval

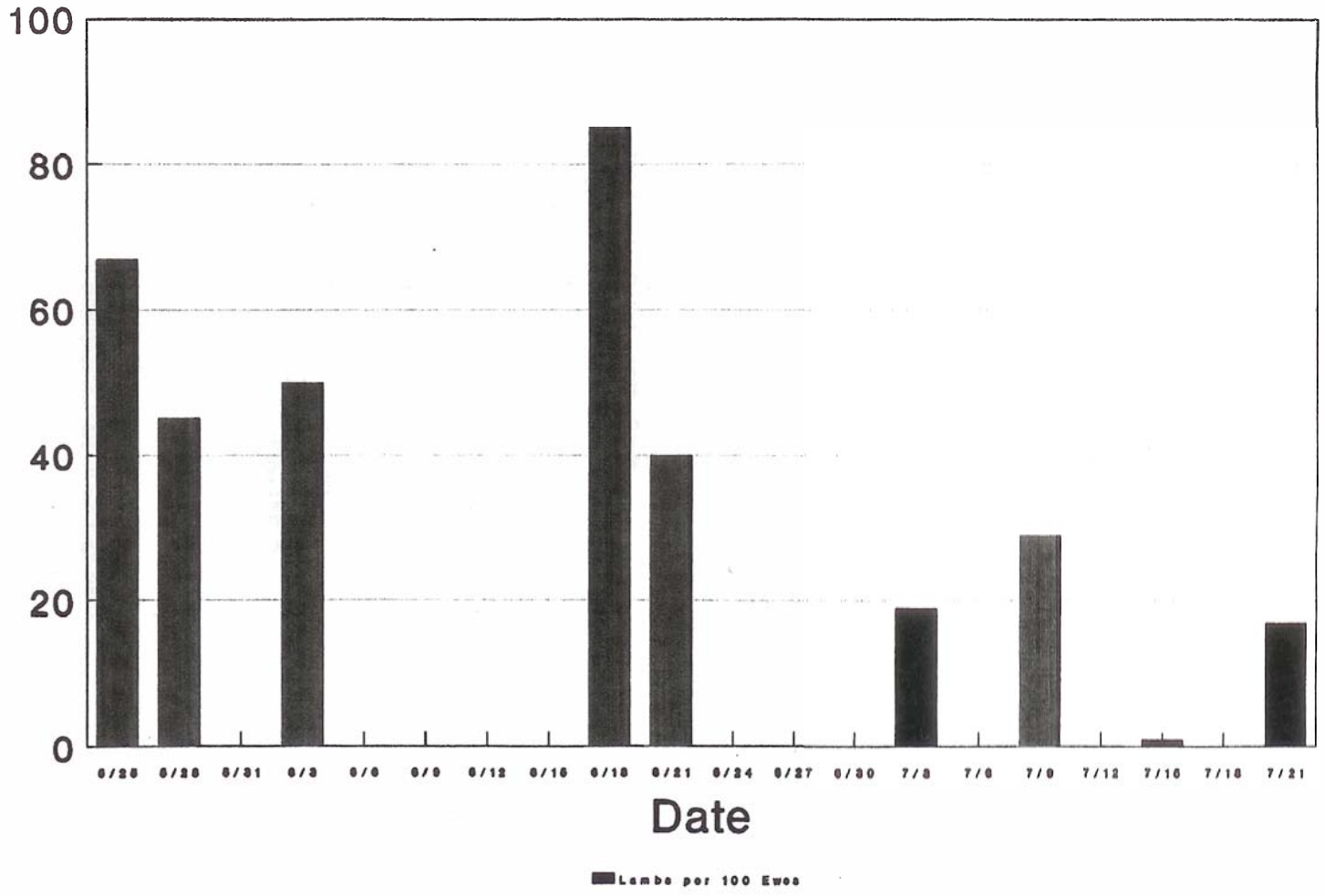
Cliff Creek Ewe:Lamb Ratios 1990

Air & Ground Data



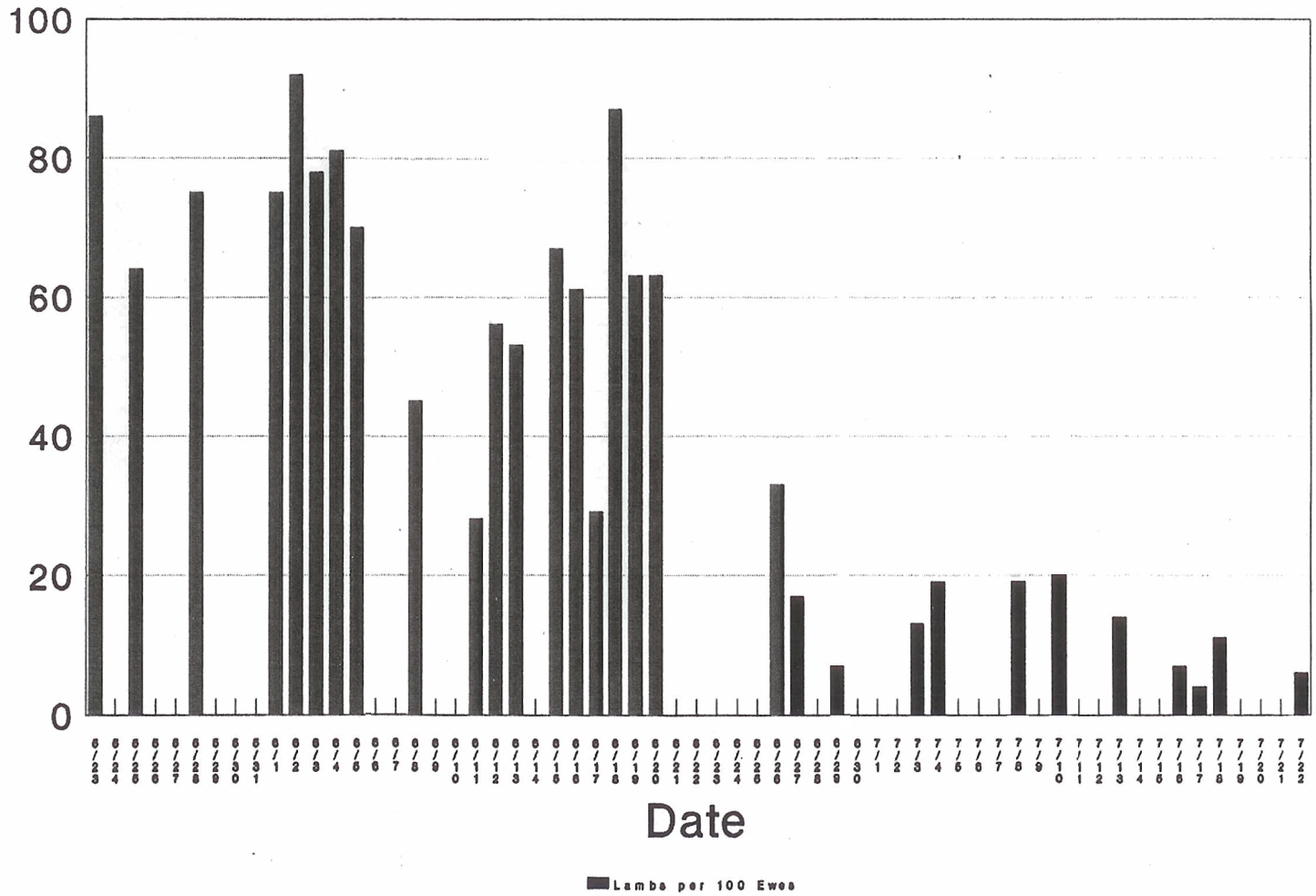
Highest Count in 3 Day Interval

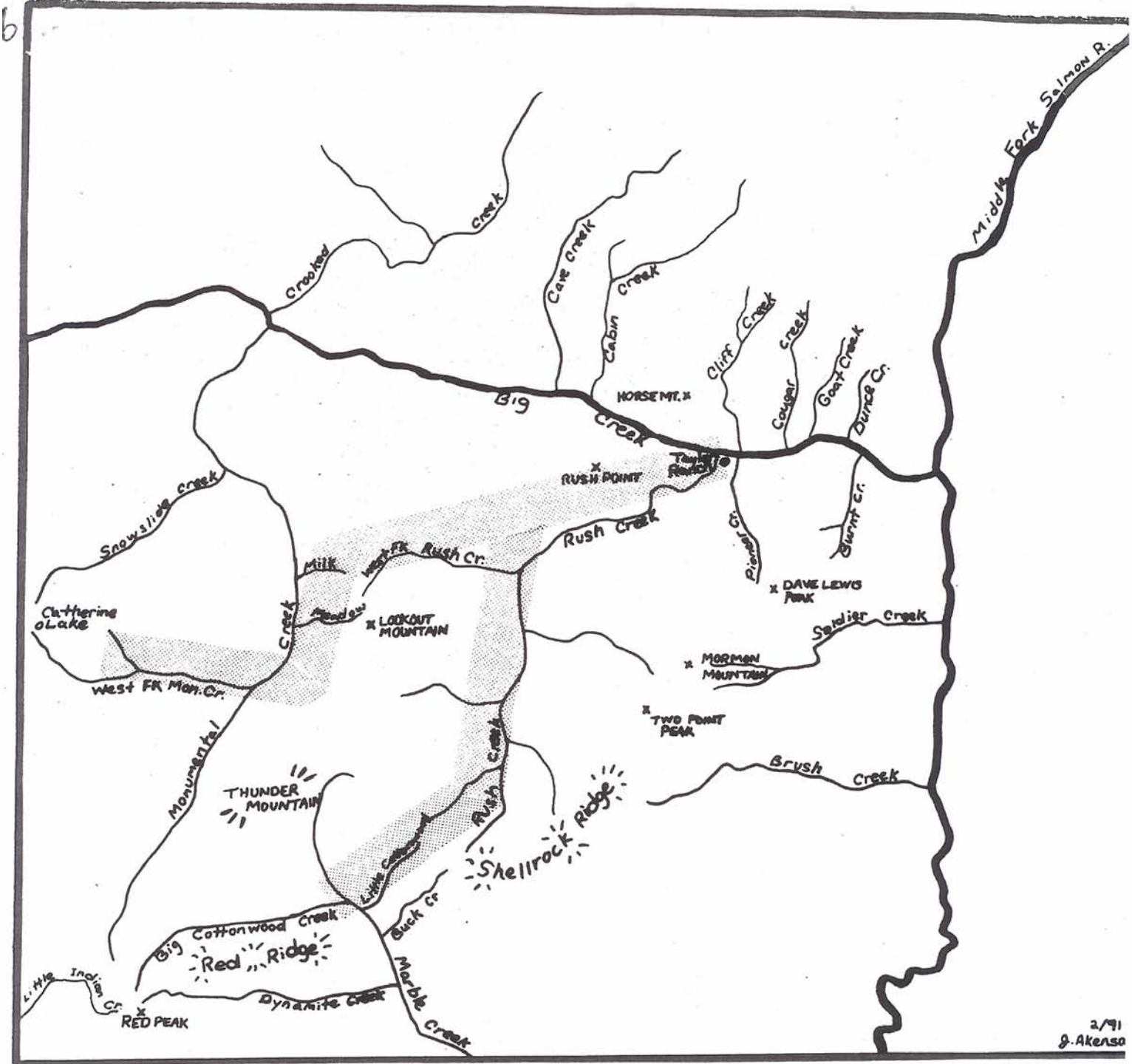
West Fk. Monumental Ewe:Lamb Ratios
1990 Air & Ground Data



Highest Count In 3 Day Interval

Big Creek Bighorn Lamb:Ewe Ratios
Air & Ground Data, All Ranges 1990





Migration Routes

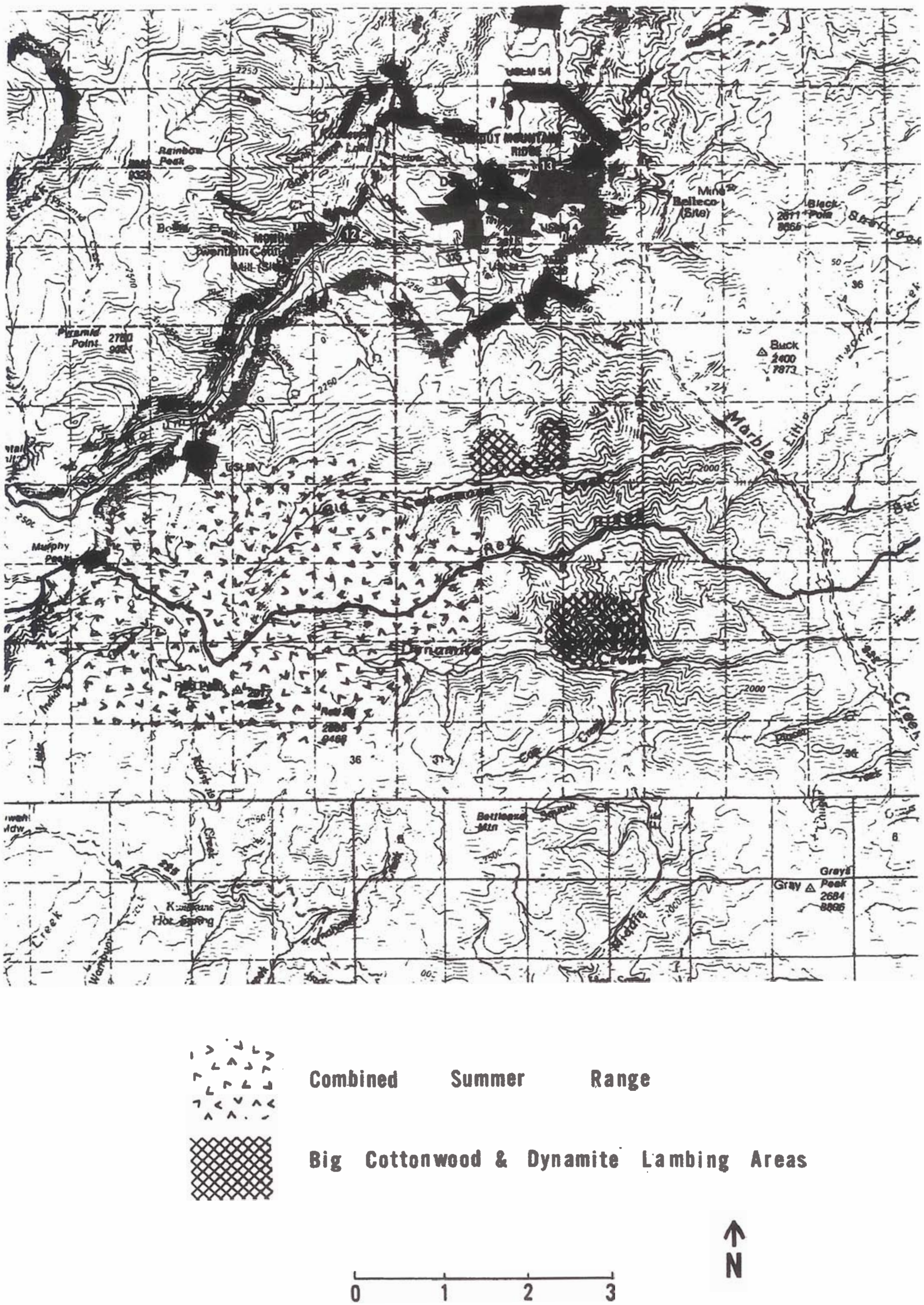
N

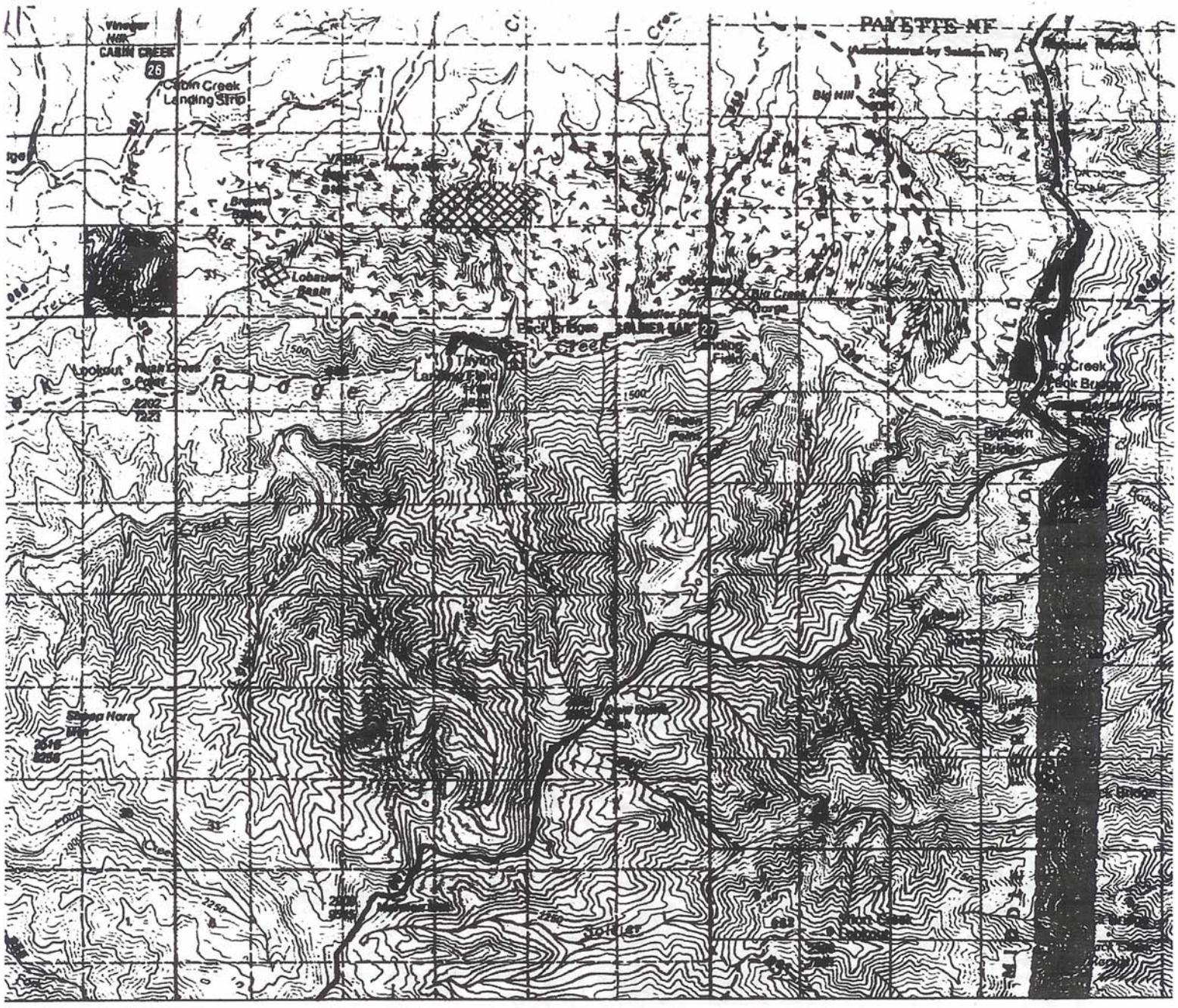
SEASONAL RANGES OF BIG CREEK BIGHORN EWES

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers


Rainbow Peak
Twentieth Century
Mill (Site)
Pyramid Point
Belleco (Site)
Buck
2400
7873
Marble
Murphy Peak
Dynamite
Creek
Gray
Grays Peak
2684
Hot Spring
Combined Summer Range
Big Cottonwood & Dynamite Lambing Areas
0
1
2
3
N



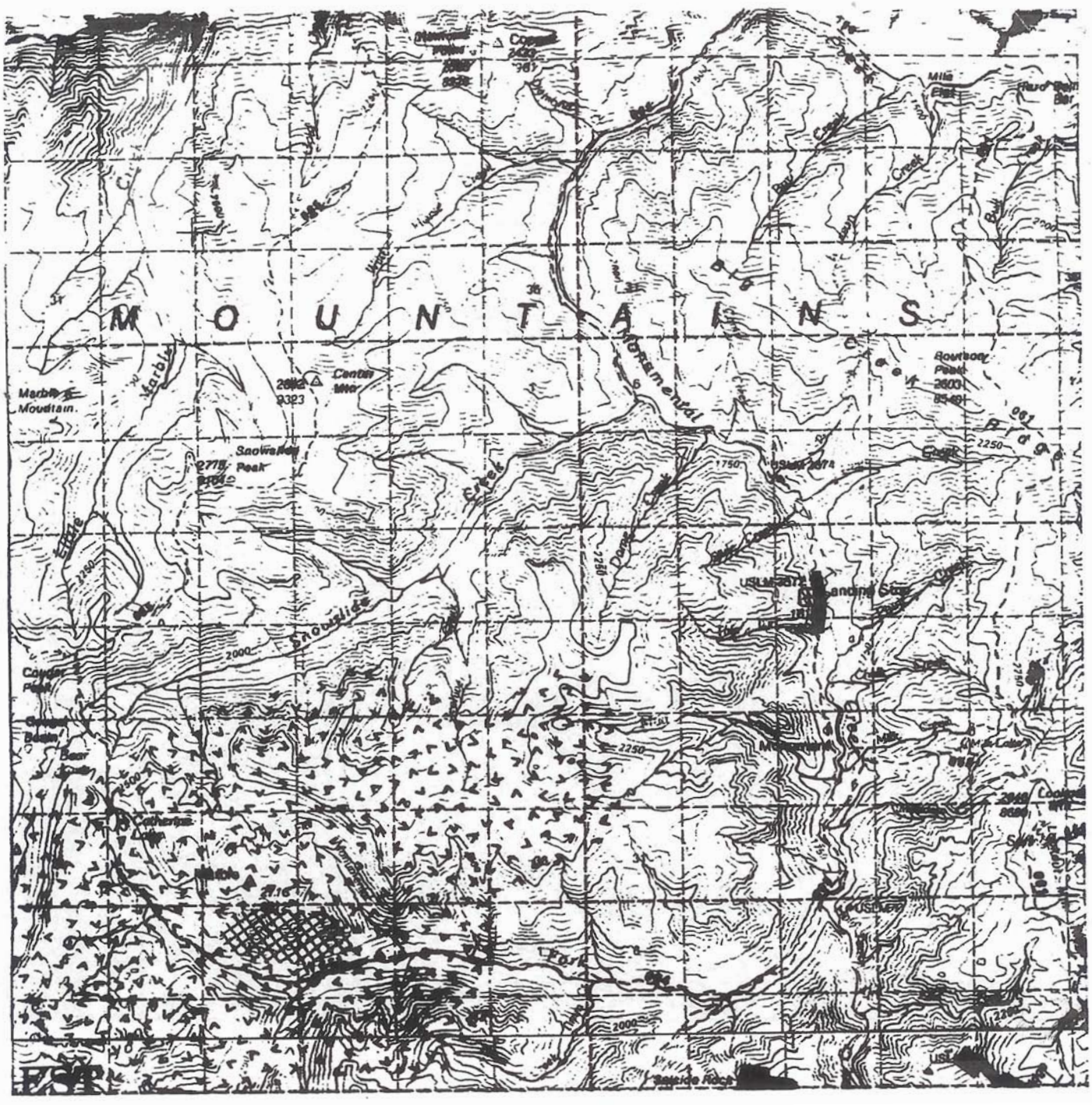
Combined Summer Range

Cliff Creek, West Lobauer, & Big Creek Gorge Lambing Areas

N

0 1 2 3

MILES



Summer Range

West Fork Monumental Lambing Area

N

0 1 2 3