Montana Fish, Wildlife & Parks
Region 2 Wildlife Quarterly
September 2020

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Mountain goat along Trout Creek, south of Superior, April 21, 2020.

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Region 2, 3201 Spurgin Road, Missoula MT 59804, 406-542-5500

Find the Quarterly online at fwp.mt.gov/regions/r2/WildlifeQuarterly

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The Region 2 Wildlife Quarterly is a product of Montana Fish, Wildlife & Parks; 3201 Spurgin Road; Missoula 59804. Its intent is to provide an outlet for a depth of technical information that normally cannot be accommodated by commercial media, yet we hope to retain a readable product for a wide audience. While we strive for accuracy and integrity, this is not a peer-refereed outlet for original scientific research, and results are preliminary. October 2015 was the inaugural issue.

RECEDING

Assuredly, glaciers and persistent summer snowpack in Montana have receded. Are receding.

In western Montana, where they've made their way since the Ice Age, mountain goats evolved with snow. In the heat of summer, as snowfields recede in their favored alpine cirques, mountain goats can be found receding synchronously.

While mountain goats don't just fall over and die when the last snow melts from beneath their hooves in mid-summer, no one had ever asked the goats how they feel about losing snow, however temporarily, until recently.

Wesley Sarmento overcame the language barrier by counting the breaths of mountain goats, not unlike Wilbur counting the number of times Mr. Ed used to stomp his horseshoe.

According to the mountain goats that Sarmento interviewed in Glacier National Park, they were 15 percent happier on snow than off. We infer this from the fact that his study animals registered 15 percent fewer breaths per minute on snow, on average.

Interestingly, shade was not equivalent to snow in modulating goat respiration.

That mountain goats are white, that they shed their winter coats down to their skivvies in summer, and that they rest on snow whenever they can are signals that heat stress in summer played a role in their evolution.

That mountain goats respond to a lack of summer snow by breathing faster suggests that they must sacrifice energy in a harsh environment to cool themselves, even if that must be done inefficiently.

So, Montana Fish, Wildlife & Parks (FWP) is paying more attention to mountain goats. And FWP hired Sarmento as a bear management specialist in Great Falls. The respiration aspect of Sarmento's graduate work on mountain goats can be found as follows:

Sarmento W, Biel M, Berger J (2019) Seeking snow and breathing hard – Behavioral tactics in high elevation mammals to combat warming temperatures. PLoS ONE 14(12): e0225456. https://doi.org/10.1371/journal.pone.0225456

Mountain goats above Heart Lake, south of Superior, on June 30, 2016. Photo by Liz Bradley.

Shedding Patterns

On July 17, 2016, we happened upon an interesting and entertaining display of pelage-shedding on the Beartooth Plateau, in south-central Montana.

Midsummer at 10,000 feet, in a stiff wind, posed difficult conditions to dress for. Thus, mountain goats seemed indecisive as to whether one should dress for winter or summer. Some, like this adult billy (above), appeared to model fashions appropriate for both seasons at once.—part winter, part summer.

Male goats—billies—tend to shed their winter coats earlier in summer than adult females—nannies. Broadly, adult goats not nursing kids tend to shed before adult nannies with kids. Shedding consumes energy, and individuals free from the energy drain of birthing and nursing have more energy for shedding and growing a new, clean coat earlier in summer.

Immediate left and below: Maternal nannies leading 6-week-old kids on the Beartooth Plateau on July 17, 2016. Compared with the adult billy pictured on the previous page, the nannies are delayed in their shedding processes, though in the case of the nanny below, clumps of winter pelage can be seen dragging behind her.

An adult nanny (above) was mostly shed on July 17, 2016, on the Beartooth Plateau. It might be surmised not only by its advanced shedding pattern, but also by the apparent hazing by other adults, that this mostly-shed nanny was not maternal. A 2-year-old goat (below) was only beginning to shed, illustrating the tendency for 1 and 2-year old animals to shed at a slower pace than adults. From the time a goat turns 1 until the time it turns 2, no animal sits lower on the social ladder in goat world, and the strain of a long year of social stress might be seen in its pelage.

Fearless

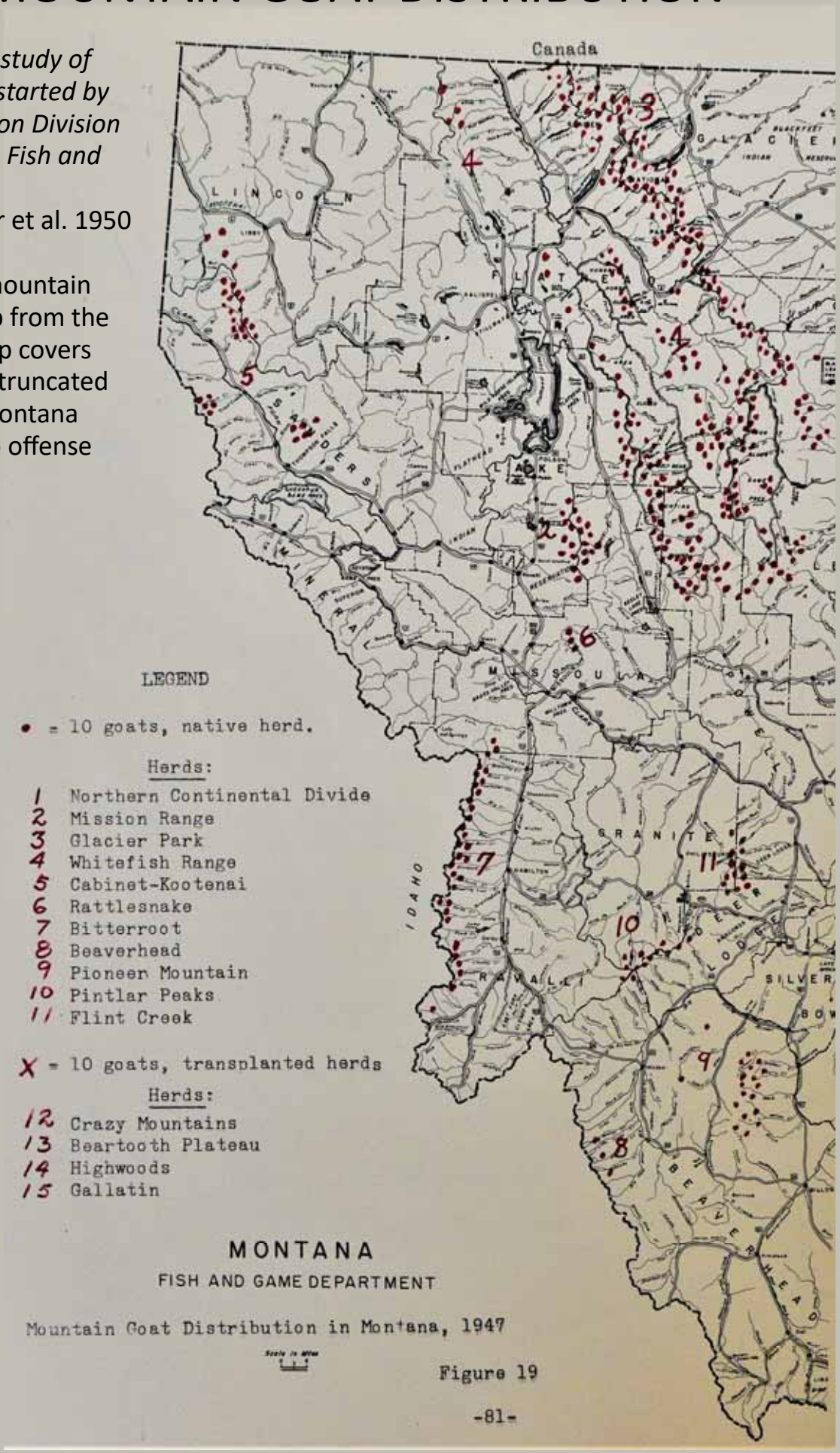
With absolute faith in well-evolved hooves on melting, rotten snow, and with a gale of hair blowing at its back, a 6-week-old kid gazes curiously into the maw of a deep crevasse. We can report that its faith was well-placed—this time—and the kid was able to continue forward on this day with its mom.

1947 MOUNTAIN GOAT DISTRIBUTION

In 1946 a long-range study of mountain goats was started by the Wildlife Restoration Division of the Montana State Fish and Game Department.

- Casebeer et al. 1950

Presented here is a mountain goat distribution map from the 1950 report. The map covers FWP Region 2, but is truncated to exclude most of Montana east of the Divide (no offense intended).



2020 MOUNTAIN GOAT DISTRIBUTION

In 2020, FWP updated its assessment of mountain goat distribution in Montana. The purpose of this 2020 update will be further described in this Quarterly. Presented here is a portion of that map from 2020, which approximately corresponds with the portion from 1947 that is reprinted on the previous page.

1 Cabinet Mountains
2 West Cabinets
3 Mission Mountains
4 Swan-Salmon
5 Swan-Clearwater
6 Swan-Bunker
7 Great Northern
8 Lower Middle Fork
9 Upper Middle Fork
10 Continental Divide
11 Danaher
12 Flint Range
13 Lost Creek
14 East Pintler
15 West Pintler
16 West Bitterroot
17 West Fork Bitterroot
18 Sapphire Range
19 East Fork Bitterroot
20 North Blackfoot
21 Pioneers
22 Crazy Mountains
23 Gallatin Range
24 Cooke City
25 Tobacco Roots
26 Medicine Lodge-Big Sheep
27 South Big Hole
28 South Absaroka
29 Spanish Peaks
30 Jack Creek-Indian Creek
31 Indian Creek-Wolf Creek
32 Wolf Creek-Papoose Creek
33 Papoose Creek-Rock Creek
34 Hellroaring Creek-Slough Creek
35 North Absarokas
36 Snowcrest Mountains
37 Sleeping Giant
38 Highland
39 Hebgen-Upper Madison
40 Cabin Creek
41 Radersburg (Elkhorns)
42 Bridger Mountains
43 North Teton
44 Birch Creek
45 South Teton
46 Square Butte
47 South Big Belts (Mt. Edith)
48 Highwoods
49 Line Creek
50 Rock Creek
51 Froze-to-Death
52 Fishtail
53 Rattlesnake
54 Great Burn
55 Sun River Game Preserve
56 North Big Belts
57 Big Snowy
58 Glacier National Park

Reintroductions

Mountain goats in the horse trailer, awaiting release up the Rattlesnake. Bob Henderson photo.

While today's mountain goat distribution in Region 2 broadly resembles their distribution in 1947, this result is due, in part, to the correction of mistakes made in harvest strategies before mountain goat ecology was better understood. In Region 2, mountain goats have been reintroduced in the Rattlesnake Wilderness and the Scapegoat Wilderness to restore extirpated populations.

The first mountain goat transplant to really reintroduce and restore an extirpated population to its native habitat was led by Dr. Bart O'Gara, Leader of the Montana Cooperative Wildlife Research Unit at the University of Montana. It was February 1984.

The National Bison Range wanted to move goats off the range. Rattlesnake Creek, near Missoula, was empty because of overharvest. The Forest Service had closed the road for the new National Wilderness and Recreation area. Bart was learning how to use the netgun and very interested in mountain goats. FWP agreed to the project. And along came Mutual of Omaha's Wild Kingdom TV program that wanted to do a show and was willing to pay for it.

It was a perfect storm. Netgunning was new, and this was the first attempt at netgunning mountain goats in Montana. It was really a big experiment that unfolded on national television. I think they are still there in the Rattlesnake. Do you know?

-Robert Henderson, FWP Wildlife Biologist, retired

Yes - Les Marcum saw 8 goats from Beeskove meadow a couple of weeks ago (early June 2020), and FWP Warden Derek Schott saw 6 a couple days before that. Most years we count around 5 or so. A lasting legacy for sure!

-Liz Bradley, FWP Wildlife Biologist, Missoula

Editor: Casebeer et al. (1950) estimated 25 goats in the Rattlesnake in 1947.

Wild Kingdom

Above: Bart O'Gara holding netgun upright, Jim Krueger, pilot, and the TV camera man outside next to Bart. Below: Grinning Bart O'Gara and Jim Fowler (Wild Kingdom host), holding down one of first mountain goats netgunned in MT. Photos courtesy Bob Henderson.

For the most satisfying experience while viewing this page, we highly recommend that you type: *Mutual of Omaha's Wild Kingdom White Beards on the Rattlesnake Range* in your Internet browser and let the voices of Marlin Perkins, Jim Fowler and Bart O'Gara soothe and inspire you to follow your calling. We used to make a little fun of Marlin when we watched him on TV, but we didn't miss many of his shows either.

Dunham Creek

Year	Month	Method	Total	Kids
1986	Aug	Helicopter	9	0
1988	July	Helicopter	16	3
1990	July	Helicopter	17	5
1992	July	Helicopter	19	6
1993	Sep	Ground	27	7
1994	June	Helicopter	41	10
1995	Sep	Citabria	56	15
1995	Oct	Citabria	49	7
1996	Jan	Helicopter (partial)	19	3
1996	July	Helicopter	40	10
1997	July	Helicopter (partial)	20	2
1999	Sep	Citabria	21	5
2000	July	Helicopter	24	6
2003	Sep	Helicopter (partial)	20	2
2008	March	Helicopter	32	8

Mountain goats along Dunham Creek, June 2008. Jay Kolbe photo, cropped.

Goat Surveys

Dunham Creek

Mountain goat overlooking Dunham Creek in June, 2007. Photo by Jay Kolbe.

Dunham Creek mountain goats have always lived betwixt and between.

Judging from the placement of dots on the map provided by Casebeer and crew (1950), and reprinted herein on page 8, it looks like Dunham Creek was attributed with about 10 goats in the 1947 survey, although the 20 attributed to Morrell Mountain or the 20 near Youngs Mountain might cover Dunham goats on a walkabout.

Fact is, we don't really know much about how Dunham Creek goats move and they're easily overlooked. Guides know as much as anyone. They'll hunt a goat on the Jenny Creek side when goats cross into the open hunting district in the Bob. But, on the Dunham Creek side, in the front country, there's not been an open goat season for decades.

We took extra interest in Dunham Creek goats in the mid-1990s when a student at the University of Montana, Jeff Van Zant, came to us looking for a senior thesis topic. After boarding a light plane and counting a record 56 goats in that area in September 1995, we were all hooked.

Even with Jeff's help, we couldn't seem to keep our eyes on Dunham Creek goats—not well enough to understand them. Weather in the goat rocks makes flights hard to schedule and to complete effectively when airborne. So, you see partial counts listed in the data on the previous page, which really don't help.

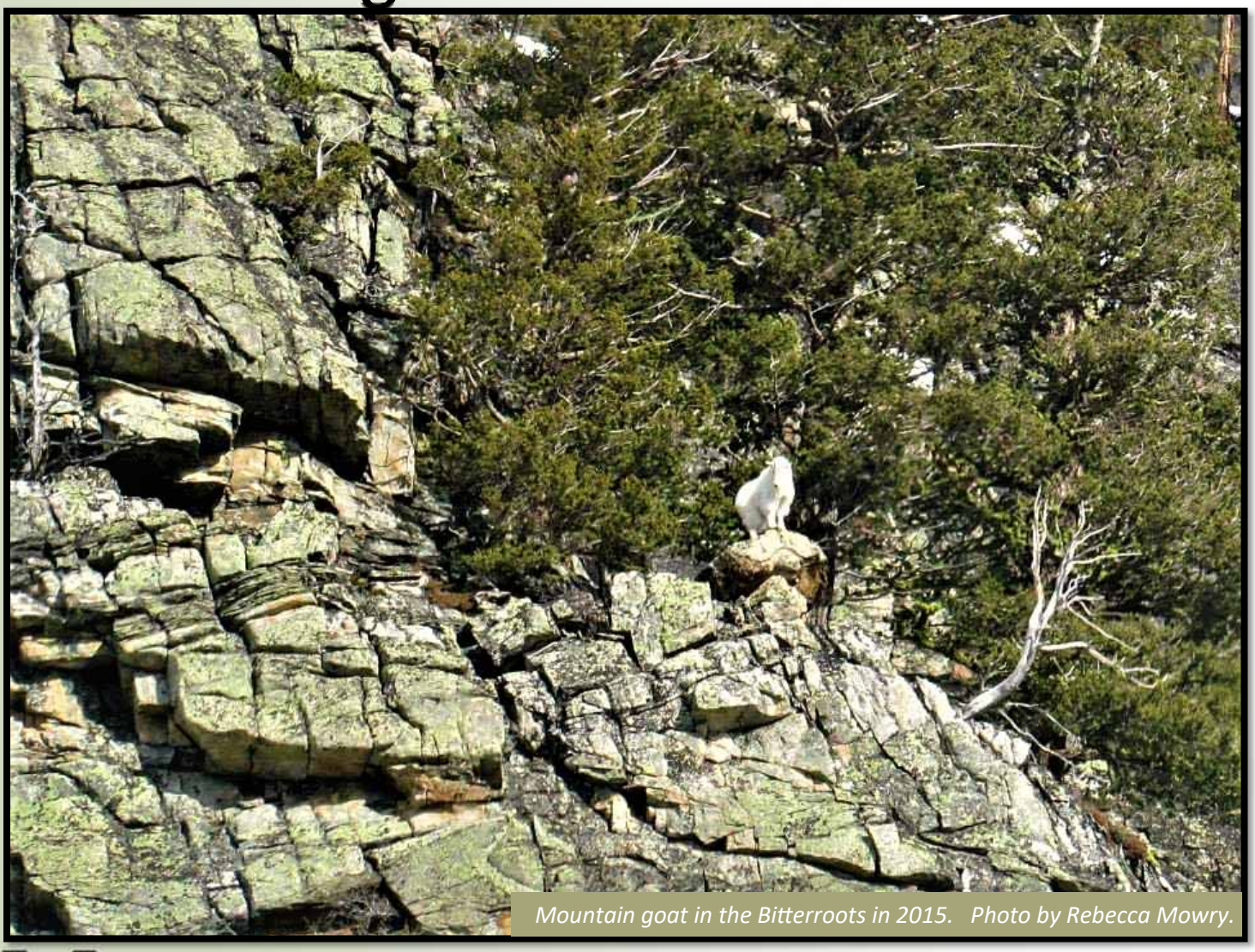
And when you're dealing with small populations, missing 10 here and there makes a big difference. Or, if billies show up one time, but not another; or if there are a lot of kids one year and not the next.

We invested a good effort toward understanding Dunham Creek goats, but after all that, we really don't know if their place on the landscape is secure or not.

In a nutshell, that mirrors the status of native mountain goats all across Region 2.

Case History

Awakening



Mountain goat in the Bitterroots in 2015. Photo by Rebecca Mowry.

Montana is home to a rich history of mountain goat investigations performed on individual populations. These studies have provided a broad baseline of observations and management case histories across a variety of habitats. Yet, they are remarkable, as well, for the opportunities missed to obtain data that address relevant questions today.

Followers of the Quarterly—and we know you are few—will recall the July 2020 edition, which was devoted to the comprehensive and coordinated research on elk in Region 2, directed and coordinated by FWP's Research and Technical Services Bureau. The result of that effort was a greatly expanded understanding of elk population dynamics and a path forward for future management.

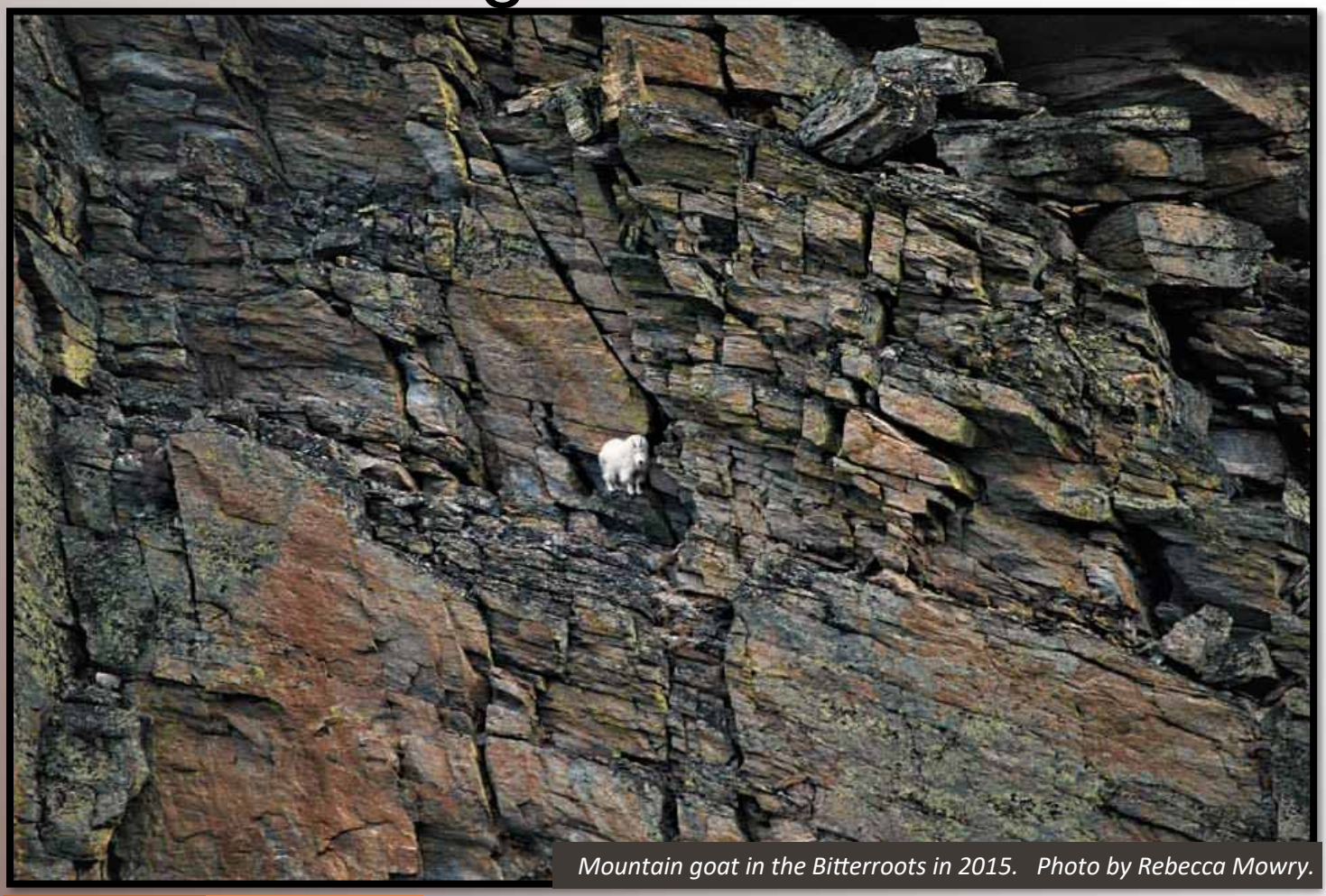
Mountain goat investigations offer an example of the opposite research approach, where many of us undertook individual projects without a rigorous and overarching study design in coordination. Unfortunately, for mountain goats, that result has been a collection of independent observations of short duration and with out any intentional relationship to one another. So, today we may feel as though we're flying blind, even when managing previously studied herds.

In 2015, FWP set about to correct this by developing a coordinated approach to mountain goat investigations and management recommendations across the state. Thus began a statewide status assessment for mountain goats, led by Bruce Smith and Nick DeCesare.

Dr. Smith is a widely recognized mountain goat expert, who began his career studying goats up Fred Burr Creek in the Bitterroot Mountains in the mid-1970s. Dr. DeCesare is an FWP research biologist who leads statewide moose research at present.

The status report is available at *http://fwp.mt.gov/fishAndWildlife/management/mountainGoat/* and is cited as follows: *Smith, B. L., and N. J. DeCesare. 2017. Status of Montana's mountain goats: A synthesis of management data (1960–2015) and field biologists' perspectives. Final report, Montana Fish, Wildlife and Parks, Missoula.*

Status in Region 2



Mountain goat in the Bitterroots in 2015. Photo by Rebecca Mowry.

Flints	25
Pintlers	20
Scapegoat	30
Dunham	25
Rattlesnake	10
Great Burn	45
Bitterroots	130
Sapphires	0

Table (left): Estimated population levels for mountain goats at the present time in Region 2, from Smith and DeCesare (2017) and with updates in some herds. Table (below): Comparison of total estimated mountain goats in Region 2, 1947 vs the present time.

Scapegoat Wilderness 2002. Photo by Pat Shanley.

Trout Creek, 2019. Mike Thompson and Sharon Rose.

Flint Mountains, 2008. Photo by Ray Vinkey.

Estimated Mountain Goats in Region 2	
Casebeer et al. 1950	Smith and DeCesare 2017[1]
625	285

[1]includes local updates to Smith and DeCesare 2017

Recommendations

Mountain goats have declined markedly in Region 2 since 1947, as have native goats across western Montana.

In response, FWP Region 2 offers only one license annually for the hunter-harvest of a mountain goat, valid in the Bitterroot Mountains.

While native populations have declined statewide, introduced populations have increased statewide, offsetting the decline somewhat (Smith and DeCesare 2017).

In 2018-2020, FWP acted on the status report of Smith and DeCesare by developing action recommendations. See Gude et al. (2020) at *http://fwp.mt.gov/fishAndWildlife/management/mountainGoat/*

For Region 2, the most meaningful action items are to add goats to populations at risk of extirpation, and to introduce new goat populations in unoccupied suitable habitats.

The recommendations in Gude et al. (2020) also inform decision-makers of potential disease risks when moving mountain goats from place to place and when mixing them with other goats or bighorn sheep.

Billy (right) and nanny in Trout Creek, south of Superior, 2019.

Information Needs

Great Burn Proposed Wilderness, July 2019, by Liz Bradley.

A principal finding of Gude et al. (2020) was that Montana, like most other states and provinces, is hampered by a lack of information on population dynamics of mountain goats:

> *This information need includes developing improved, Montana-specific estimates of mountain goat population sizes, vital rates, and age structures; and inferences regarding the effects of carnivore harvest, protection of habitat from human use, and translocations on mountain goat populations.*

From Gude et al. (2020), Table 1 displays vital rates for Alberta mountain goats. Such data are used to model the expected persistence of small goat herds into the future, which prompts certain management prescriptions. Any significant variance from these vital rates in Montana mountain goats makes such models unreliable and therefore may not justify proper actions that are expensive or introduce risk. If we want to move forward for goats, we need better population data for Montana mountain goats. ("Fecundity" means "reproductive rate" in the heading of Table 1.)

Table 1. Vital rate scenarios (mean and 95% Confidence Intervals) for adult females and newborns used to represent declining, stable, increasing, and uncertain population trends in the Leslie matrix population model for mountain goats in Montana. These vital rates were taken or derived from the Caw Ridge population in Alberta, one of the only long-term studies of mountain goat population dynamics ever undertaken.

	Adult female survival		*Newborn survival*		*Adult female fecundity*	
	Mean	*95% CI*	*Mean*	*95% CI*	*Mean*	*95% CI*
Declining	*0.87*	*(0.85,0.90)*	*0.48*	*(0.39,0.56)*	*0.38*	*(0.30,0.46)*
Stable	*0.92*	*(0.89,0.95)*	*0.59*	*(0.48,0.70)*	*0.67*	*(0.58,0.76)*
Increasing	*0.94*	*(0.90,0.99)*	*0.62*	*(0.49,0.75)*	*0.75*	*(0.65,0.85)*
Uncertain	*0.92*	*(0.85,0.99)*	*0.59*	*(0.39,0.75)*	*0.67*	*(0.30,0.85)*

Salt Hunger

Goat nannies and kids on salt around the ski lift along the Beartooth Highway on July 17, 2016. They staged their approach from a distant resting spot on a retreating snow cornice. After working up the nerve, we guessed, they made a direct and determined approach to the salt residue.

Mountain goats display a profound response to the presence of salt, whether found naturally or scavenged from human sources.

Goats may travel for miles to access salt periodically. When travelling from secure feeding or resting habitats to access salt, they move determinedly and do not dally, often crossing habitat features that they likely would not incorporate into their movement patterns otherwise. Upon reaching the salt source, they congregate, by necessity, in numbers and close proximity that they would not normally tolerate.

The explanation for salt hunger in mountain goats involves their consumption of succulent spring forage, which contains high levels of potassium that can lead to harmful losses of sodium and magnesium. So, goats seek to replenish lost minerals, which, in turn, allow the ungulates to continue feeding on a wide range of spring forages without side effects. Often, goats will lick and consume soil along with salts for added minerals. Mountain goats have been known to lick natural dry deposits, soil where salt blocks were historically placed for livestock, human urine around campsites, salt in sweaty clothes, and handrails in Glacier National Park.

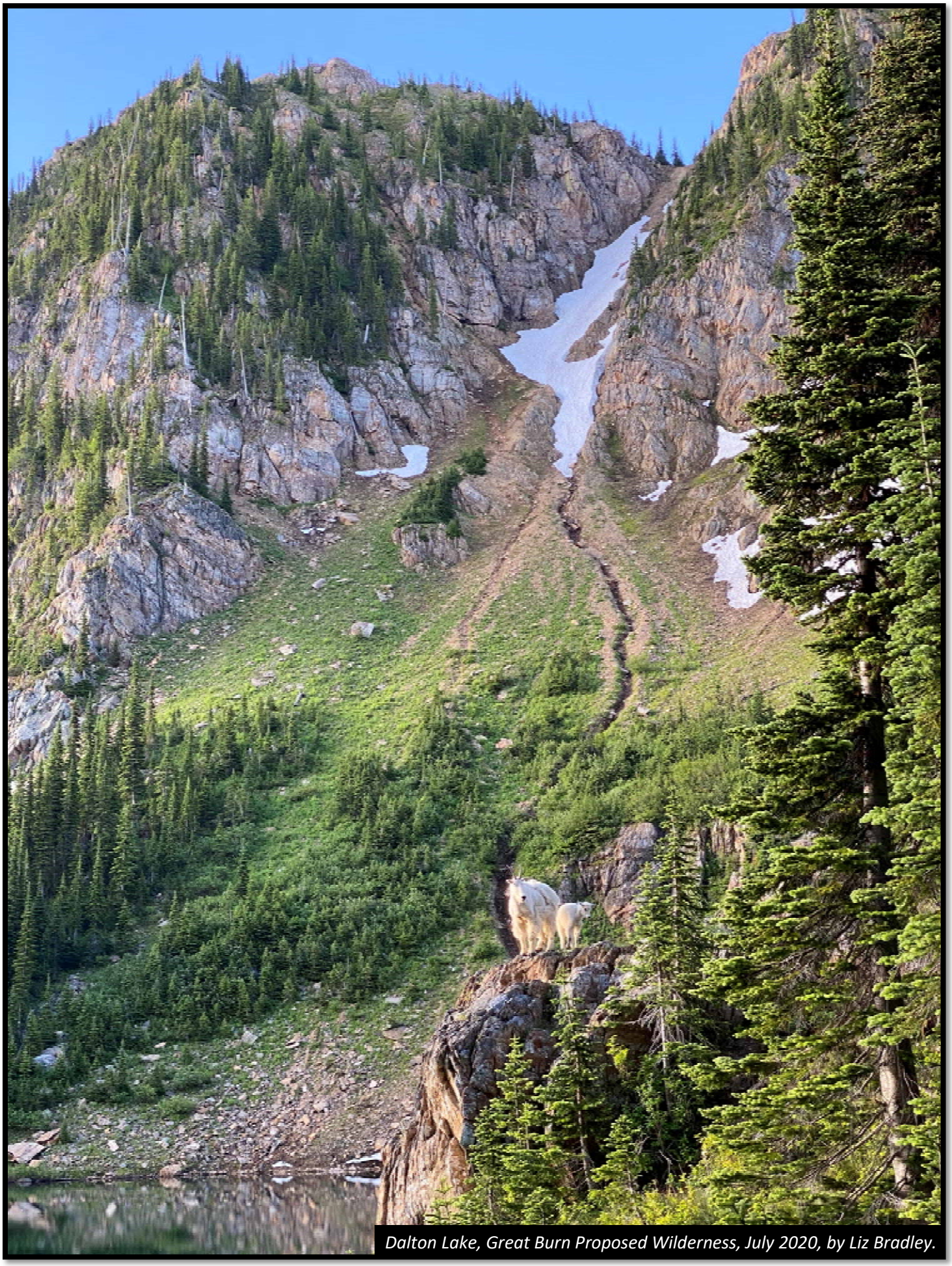
Adult nannies with kids are attracted to licks while nursing. Counts of mountain goats on a salt lick at any given day are likely not representative of the ratios of kids, billies, nannies and subadults in the larger population because differences in sex and nursing status lead to different levels of salt hunger. On the other hand, salt licks may provide a peak count of the population on a lucky day, especially when including billies that may have congregated from remote locations.

Social Dynamics

Consequences can be severe for mountain goats that fail to mind their personal space.

These goats wintering along Trout Creek, south of Superior, appear to have been injured, quite possibly by sternly wielded goat horns.

Pictures 1, 2 and 3 are of 3 different individuals photographed on April 28, 2019. Pictures 3a and 3b show different wounds on different sides of the same animal. Pictures 4a and 4b are of a single individual, taken the following year on April 19, 2020. Mortality from strife is not well documented.



Dalton Lake, Great Burn Proposed Wilderness, July 2020, by Liz Bradley.

Social Distancing

Dalton Lake, Great Burn Proposed Wilderness, July 2020, by Liz Bradley.

Mountain goats are inclined to enforce social distancing, not only upon others of their own species (as shown on page 19), but also upon humans, dogs and other intruders within their personal space.

Heart, Pearl and Dalton Lakes in the Great Burn Proposed Wilderness are popular recreation destinations in native mountain goat habitat on the Lolo National Forest, south of Superior. With concentrated human recreation in the backcountry comes salt: in urine, on sweat-soaked backpacks, on sleeping bags—you name it.

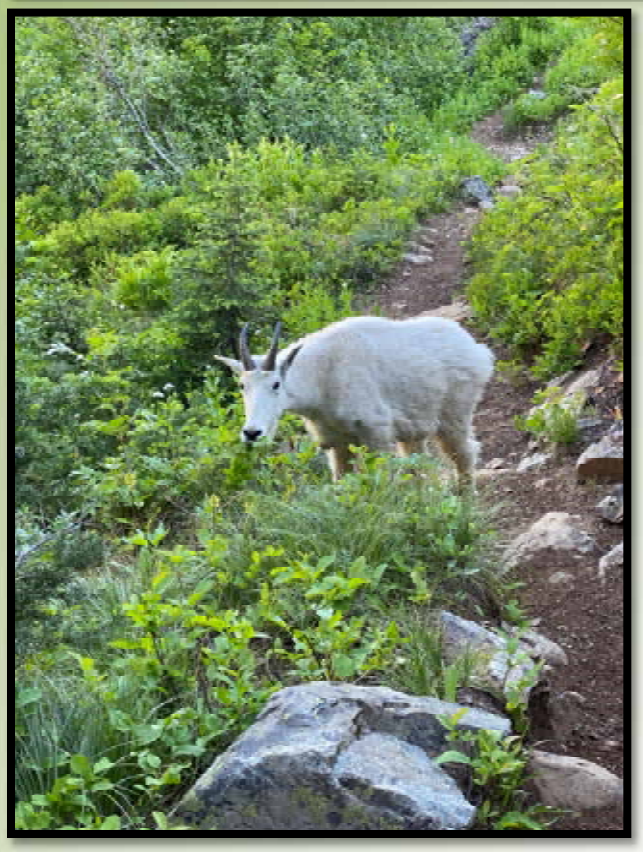
Mountain goats in these areas have learned to associate humans with salt, and they have learned to tolerate humans while acquiring it.

Humans who don't speak "goat" may not understand the rules under which mountain goats operate while seeking and licking salt. That's why FWP, the Superior Ranger District and the Great Burn Conservation Alliance have been working together to provide English translations at trailheads and destinations in the area.

As FWP biologist, Liz Bradley, recently advised in a timely article in the *Mineral Independent* https://vp-mi.com/news/2020/aug/12/fwp-studies-mountain-goat-declines-14/

> *"Because they [goats] are seeking salts that are found in urine and clothing, we encourage people to take their bathroom breaks at least 50 yards from trails and camping areas. The goats can be fairly bold about entering areas with people and it creates a potential safety situation," Bradley said.*

People should leash their dogs when goats approach to avoid serious injury to either species.



Above: Near Dalton Lake. Left: Near Heart Lake. Both pictures are of the Great Burn Proposed Wilderness in July 2020, and both were taken by Liz Bradley.

Habituation to humans is an issue for mountain goats and humans alike. Wesley Sarmento, now with FWP, examined consequences and drivers of goat habituation in Glacier National Park for his masters thesis at The University of Montana (published 2016). In partial summary:

> *Habituated goats reduced group size, vigilance, and use of cliffs. Such patterns were quickly reversible when human presence was excluded. Our findings hold conservation relevance at [two] levels. First, human visitation to protected areas is altering species interactions and causing – in this case – the loss of seasonal goat migrations for minerals. Second, habituated animals, including goats, have killed and injured visitors.*

(Sarmento, Wesley, "Human shields and redistribution of prey species complicate the utility of protected areas as ecological baselines" (2016). Graduate Student Theses, Dissertations, & Professional Papers. 10680. *https://scholarworks.umt.edu/etd/10680)*

Classifying Mountain Goats

Trout Creek, south of Superior, 2019.

How many male and female mountain goats are pictured on this page (other than kids)? It's hard to say! For one thing, nannies' horns grow to similar lengths as billies'. But, males (billies) have horns that are heavier at the base and sweep back in a more consistent arc from bases to tips. Males have scent glands at the base of their horns, which enhance the visual weight of the bases from far away. Females have thinner horns that appear straighter coming out of the skull and curve more sharply near the tips. Pictured above: A billy (judging from the horn bases) approaches a nanny from above. Below left: a billy. Below right: Two nannies with kids. The presence of kids is a clue, but not all nannies have them. Often, biologists can't get a good look at horns while surveying, which is a barrier to classifying goats.

Beartooth Mountains in July, 2016

Classifying Mountain Goats

Beartooth Mountains in July, 2016

Kids are born around the first of June, making these precocious youngsters (above) about 6 weeks of age. At this age, they are entirely without horns. By 10.5 months (below), the kids have grown visible horns, though quite short. Because goat horns are growing, slowly, throughout the animal's first year of life, a distinct ring is not apparent on the horn to indicate the kid's first winter. Not until the second winter of the goat's life, at approximately 1.5 years of age, does the first distinct horn ring appear.

Classifying mountain goats into age categories requires an awareness of the time of year. While the young-of-the year in the picture above are unambiguously classified as kids, the ones pictured below are practically yearlings, and are already facing more harassment from other goats as maternal females disassociate from their young. By late-April, as shown on page 19, "kids" are showing the scars that come with becoming yearlings—the most heavily harassed age-class in mountain goat society.

Trout Creek, south of Superior, 2020.

Liz Bradley photos.

Two yearlings and a 3-year-old mountain goat are shown above, below and at right, respectively. Each are examples in summer. Therefore, the yearlings depicted here are approximately 13-14 months old and by the start of winter their horns will extend beyond the tips of their ears. Lacking a photograph of a 2-year-old in summer, we can only advise that these yearlings will sport horns that are intermediate in length between theirs and the 3-year-old's next summer.

Aging Mountain Goats

How old am I?

Answer on next page . . .

Aging Mountain Goats

"How old am I?" is something of a trick question when considering the nanny on the previous page (p. 26). You need to know the date when the picture was taken to nail it.

If you look (on p. 26) where the arrow points to a place on the horn that indicates 4.5 years of growth, you might be able to see that the growth ring is not very distinct. In fact, the ring pretty much coincides with the base of the horn. It leaves you wondering whether the horn is finishing its growth as a 4-year-old, or whether it is barely beginning to grow as a 5-year-old.

It helps a ton to know that the picture was taken on July 17, and it's safe to assume that the goat's birthday is around June 1. If you look at the yellow ruler to guesstimate the amount of annual horn growth, you see that about 1/2-inch grew between the rings for 2.5 years and 3.5 years. A little bit less than 1/2-inch seems to separate the rings of 3.5 and 4.5 years, as well. Therefore, we're confident that all of the horn growth of a 4-year-old goat has taken place because goats grow less in length with every passing year. On July 17, most of the horn growth for the current season has not yet occurred and lies ahead before winter sets in. So, the nanny is 5 years old.

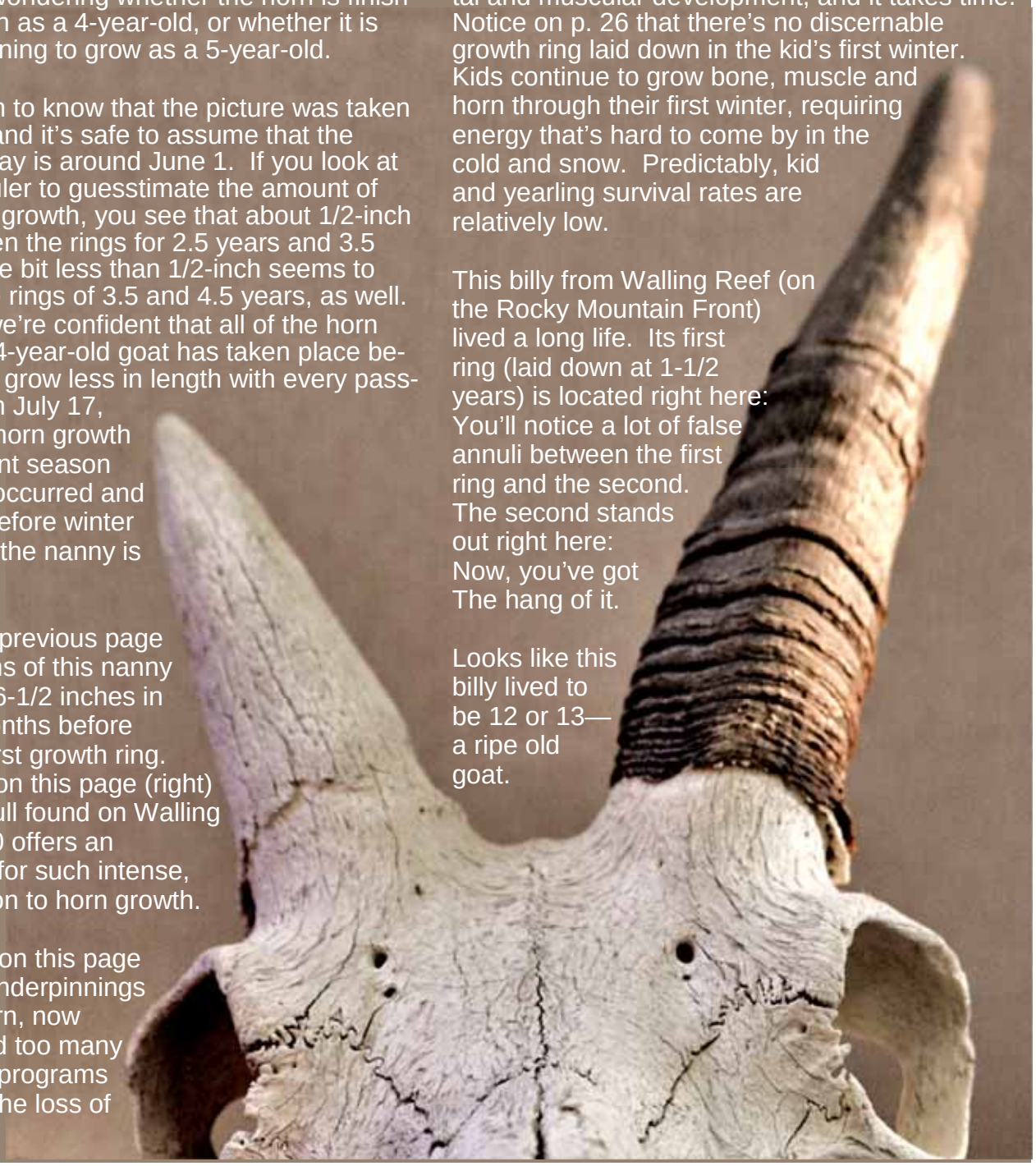
Note on the previous page that the horns of this nanny grew about 6-1/2 inches in about 18 months before leaving its first growth ring. The picture on this page (right) of a goat skull found on Walling Reef in 1980 offers an explanation for such intense, early devotion to horn growth.

This picture on this page shows the underpinnings of a goat horn, now that time and too many educational programs have led to the loss of the right-hand horn sheath. Remaining is what's called a bony core, upon which the horn sheath is supported as it grows.

If you remember the kid on page 2, you'll remember that kids are not born with big, bony cores for horns on the tops of their heads. Kids are born with flat-topped skulls. So, in their formative months, kids must grow those bony cores and horn sheaths, along with other skeletal and muscular development, and it takes time. Notice on p. 26 that there's no discernable growth ring laid down in the kid's first winter. Kids continue to grow bone, muscle and horn through their first winter, requiring energy that's hard to come by in the cold and snow. Predictably, kid and yearling survival rates are relatively low.

This billy from Walling Reef (on the Rocky Mountain Front) lived a long life. Its first ring (laid down at 1-1/2 years) is located right here: You'll notice a lot of false annuli between the first ring and the second. The second stands out right here: Now, you've got The hang of it.

Looks like this billy lived to be 12 or 13—a ripe old goat.



Goats in the Great Burn

Previous page: Heart Lake. Above: Dalton Lake. Photos by Liz Bradley, July 17, 2020.

Liz Bradley is getting the hang of finding, counting and classifying the mountain goats in the Great Burn Proposed Wilderness.

FWP's Missoula-based wildlife biologist for an area larger than Delaware began familiarizing herself with the mountain goats in the Great Burn in 2016, first with an aerial survey of 10 goats in June, followed by a ground survey of 17 goats in August.

Such is the nature of goat surveys that she was able to classify 2 billies, 4 nannies, 1 subadult and 3 kids in June, but could not obtain a vantage point to classify goats in August.

In 2017, she repeated the June aerial survey for a count of 13 adults, 3 subadults and 2 kids.

Come 2019, Bradley's counts practically doubled, and in 2020, she set yet another record for FWP goat counts in the Great Burn. There was nothing in the data to suggest that the mountain goat population had actually increased from 18 individuals in 2017 to 33 in 2019 and 36 in 2020.

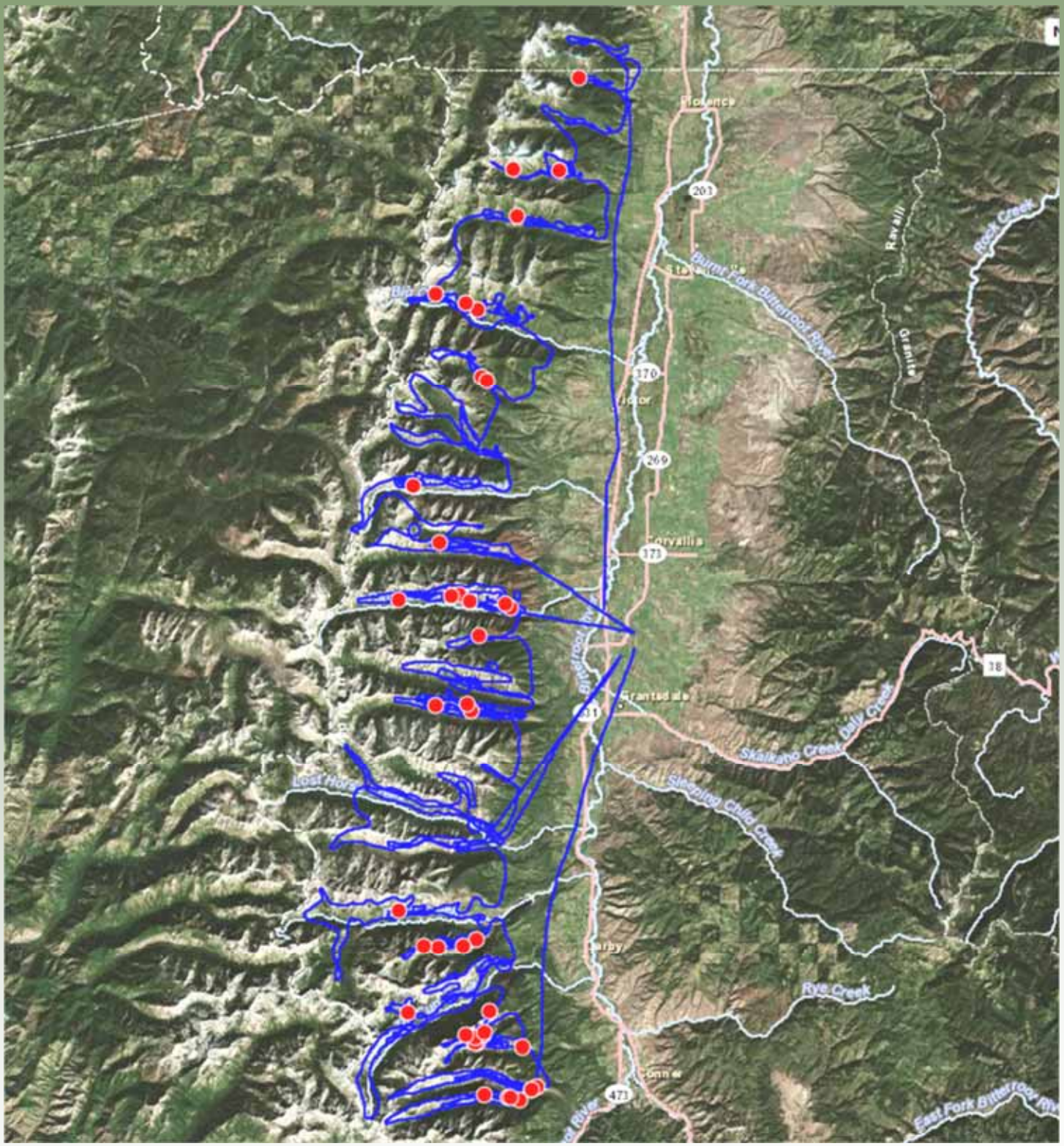
It was mostly a matter of finding them and learning when and how to look for them.

In 2019 and 2020, Bradley backpacked and camped overnight in July, systematically surveying Heart, Pearl and Dalton Lakes, resulting in comparable counts. In 2020, she classified 15 adult nannies, 2 adult billies,10 subadults and 9 kids—an encouragingly productive composition of sex and age-classes, assuming that more adult billies were in the population, but scattered and out of view.

Hunting for mountain goats has been closed south of Superior since 1991.

It seems that we now have a baseline from which to assess whether goats are increasing, decreasing or stable in future years in the Great Burn.

Bitterroot Mountain Goats



GPS waypoints (red) showing mountain goat distribution along the flight pattern (blue) in the Bitterroot canyons on February 11-12, 2015, by Rebecca Mowry.

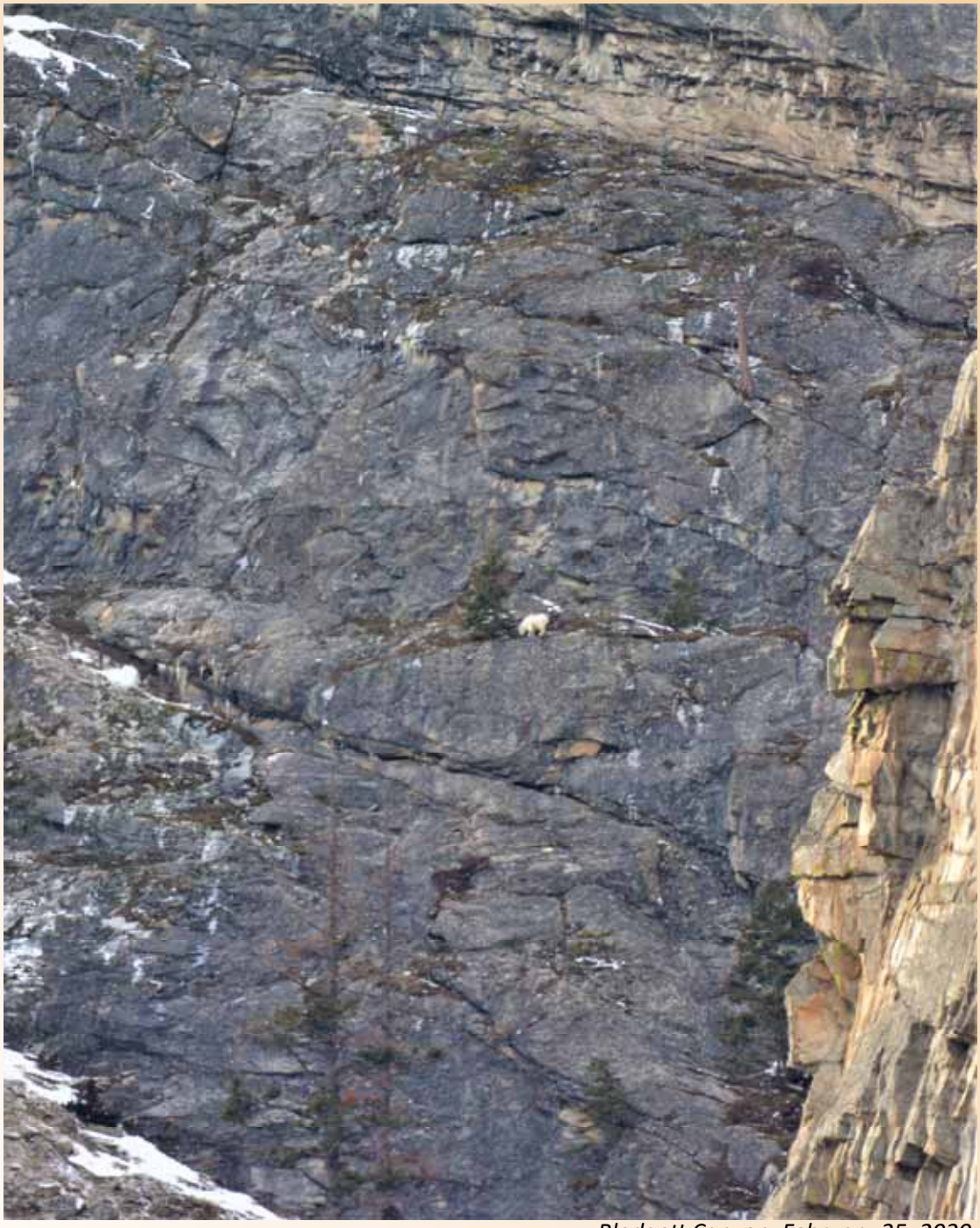
The Bitterroot Mountains, on the west side of the Bitterroot Valley, hold the largest mountain goat population in Region 2, hands down. Their deeply incised canyons make for an ideal landform to document goat populations over time. From Casebeer et al. (1950):

On the Montana side there are approximately 347,000 acres of mountain goat habitat extending from Lolo Peak south to the Nez Perce Fork of the Bitterroot. . . High basins, ridge spurs and cliff walls are numerous throughout the 20 major canyons which make up the drainage system for the east side of this range.

Bitterroot Mountain Goats

The store of systematic aerial survey data on Bitterroot mountain goats is shared in Tables 1 and 2 on the following pages. Surveys date back to 1948.

While goat surveys are infamously erratic in the amount of area covered, for a variety of good reasons, the Bitterroots afford an opportunity to correct for such discrepancies by comparing flights within individual canyons. So, even though different portions of the entire mountain range might be surveyed in one year, but not the next, at least the biologist can compare all the surveys in a given canyon to look for trends. It's not a perfect solution, but it's an improvement over the alternative.



Blodgett Canyon, February 25, 2020.

Something to highlight here is the survey strategy that FWP biologist John Vore (retired) employed in 2006-2008. This strategy might not leap out from Tables 1 and 2 without this further explanation. In 2006, Vore surveyed roughly 1/3 of the Bitterroot Mountains. In 2007, he surveyed the next third and he finished in 2008. So, the reader should sum the total counts from 2006 through 2008 to obtain a total count. That total was 220 goats--a fairly high count for that moment in goat history, which we've not been able to match since then, complicated by survey logistics.

The combined totals for Hunting Districts (HD) 240 and 250 are shown in the last column in Table 2. The highest combined total was 267 goats, counted in May 1989.

Casebeer et al. (1950) counted 111 goats in a survey of 17 of the 20 canyons during a 9.25-hour flight in September 1947. From this, they "conservatively" estimated a population of 310 goats in the Bitterroots, south of Lolo. The most recent, relatively comparable survey in terms of effort, resulted in a count of 80 goats by Rebecca Mowry in February 2015.

Only one license is available for hunting mountain goats in Region 2 and is valid only for HD 240.

Bitterroot Mountain Goats: HD 240

Table 1, Aerial trend counts of mountain goats in the Bitterroot Mountains 1948-2018

		HD 240										
Year	Dates	One-	Sween	Bass	Kootenai	Big	Sweatho	Bear	Fred	Sheaf-	Mill	Blodge
1948			12	4	15	11		4			1	18
1950		11	11	4	16	7		3			4	1
1954		6	4	1	6	10	2	6			2	6
1955		6	24	7	14	12	6	9		0	6	8
1956												
1957		6	6	8	7	6	3	3			3	5
1966						?		3			3	1
1967										0	1	13
1973					0	2	0	0			3	
1974		2	2	5	2	0	6	6		0	3	8
1975					5	19	2	6		0	3	5
1979		1	4	0	8	8	6	3		0	7	9
1981		2	1	4	11	20	4	15		0	3	9
1983		1	7	2	15	14	5	19		0	10	9
1985		1	5	9	21	25	5	7		0	4	14
1987		0	8	9	10	5	5	6		NS	10	7
1989	1-3 May	1	9	2	16	23	4	10	17	0	14	27
1993		5	9	10	18	20	1	10		0	8	12
1994		2	15	7	10	9	3	4		0	9	11
1998		NS	8	9	8	12	1	6			13	18
2003	20-21 May	1	3	8	4	9	7	9	4	0	8	7
2006	27-Mar	4	10	17	14	18	4	5				
2007	3-Apr								8	0	12	19
2008	6-7 Mar											
2011	Mar 23 -24,Apr 7											
2015	11-12 Feb	1	0	4	1	5	4	0	1	0	1	13
2018	21-Feb, 7-Mar	0	6	1	3	0	4	2	3	0	2	20
79-18 ave		2	7	6	11	13	4	7	7	0	8	13
Max		11	24	10	21	25	7	19	17	0	14	27
Ac. Win rg		1336	2845	1487	2994	4175	1679	1440	1413		1721	3229
Ac / goat		121	119	149	143	167	240	76	83		123	120

Bitterroot Mountain Goats: HD 240

Table 1. Aerial trend counts of mountain in the Bitterroot Mountains 1948-2018 continued

		HD 240								
Year	Dates	Canyon	Sawtooth	Roaring Lion	Lost Horse	S.F. Lost Horse	Rock	L. Rock	Tin Cup	Total
1948				7	3		4		5	96
1950				7	0		3		6	84
1954		0	1	6	8		7		3	73
1955			7	12	4		13		7	141
1956										
1957										47
1966					2					
1967		2	2	10	4					44
1973										
1974		1	5	3	4		1	4	1	62
1975		0	8	1						57
1979		2	7	12	2		14	1	6	100
1981		3	14	13	4		6	6	2	127
1983		3	19	10	4		17	10	1	168
1985		4	14	21	9		12	10	3	164
1987		1	8	17	11		8	6	2	113
1989	1-3 May	0	18	35	14		12	12	2	216
1993		1	4	29	8		2	1	1	139
1994		0	10	13	5		3	0	4	105
1998			8	17	15		5	9	5	134
2003	20-21 May	7	11	19	10		6	6	0	119
2006	27-Mar									
2007	3-Apr	7	14							
2008	6-7 Mar			13	10	3	3	11	5	45
2011	Mar 23-24,Apr 7				2	6	1	5	5	19
2015	11-12 Feb	3	0	8	0	0	7	7	2	57
2018	21-Feb, 7 -Mar	3	8	7	0	0	0	7	3	69
79-18 ave		3	10	16	7	2	7	7	3	113
Max		7	19	35	15		17	12	7	216
Ac. Win rg		455	1183	1573	1632	840	2484	1005	2262	
Ac / goat		65	62	45	109		146	84	323	

Bitterroot Mountain Goats: HD 250

Table 2. Aerial trend counts of mountain goats in the Bitterroot Mountains 1948-2018

		HD 250				Combined Total
Year	Dates	Chaffin	N. Trapper	Trapper	Total	HDs 240 & 250
1948		4				
1950		0				
1954		0		4		
1955		7		16		
1956						
1957						
1966				5		
1967						
1973						
1974		5	3	6	14	76
1975						57
1979		4	8	6	18	118
1981		3	13	5	21	148
1983		11	10	18	39	207
1985		16	17	20	53	217
1987		14	12	15	41	154
1989	1-3 May	22	15	14	51	267
1993		1	2	1	4	143
1994		9	5	15	29	134
1998		10	17	12	39	173
2003	20-21 May	19	11	21	51	170
2006	27-Mar					
2007	3-Apr					
2008	6-7 Mar	10	13	20	43	88
2011	Mar 23-24,Apr 7	7	10	5	22	41
2015	11-12 Feb	10	0	13	23	80
2018	21-Feb, 7 -Mar	NS	NS	NS	NS	69
79-18 ave		10	10	13	33	173
Max		22	17	21	53	267
Ac. Win		1087		2628		
Ac / goat						

Looking for Trends: Bitterroot

Sometimes lumping some data and creating some graphs can help identify trends. With that hope, we offer Figures 1-6.

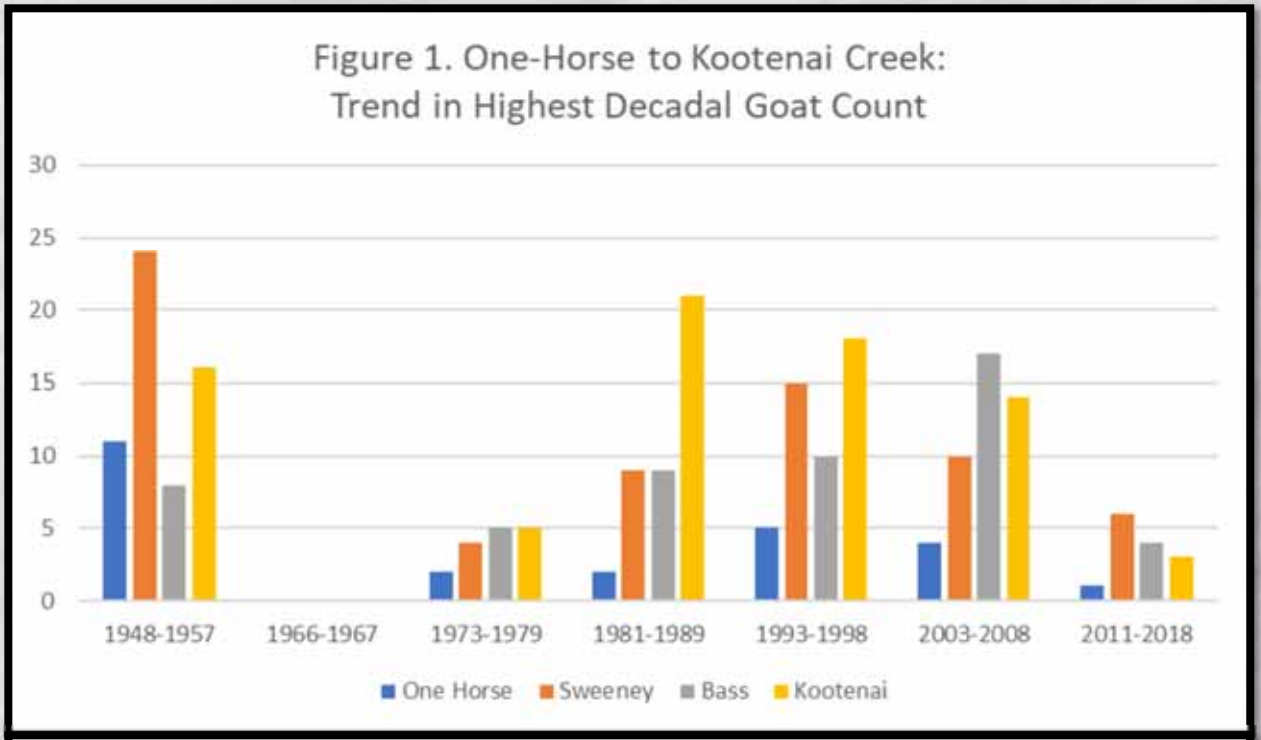
As we review the graphs, a few things jump out:

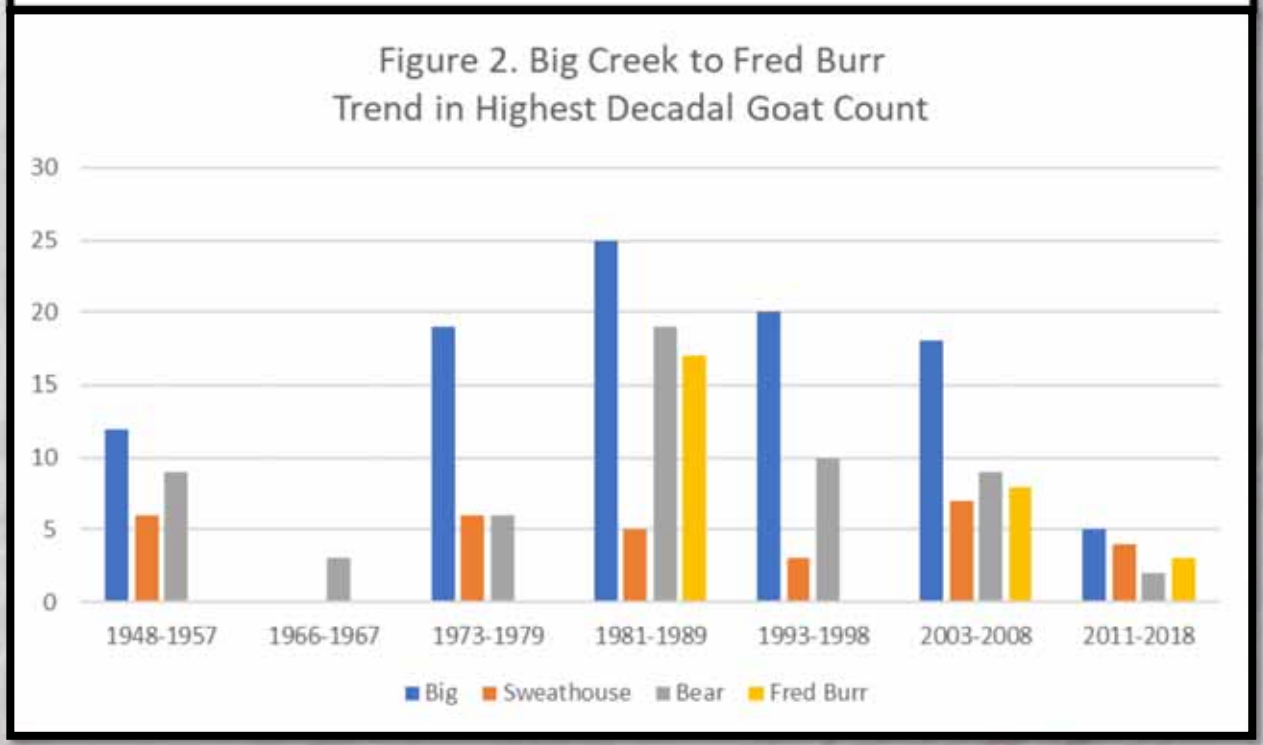
1.Goat counts in Blodgett Creek have held up relatively well over time (Figure 3).

2. Other than Blodgett Creek, the other canyons seem to be experiencing goat declines in this past decade. The consistency of the decline across the landscape stands out. And, in several cases, the data in the previous decade did not give forewarning of a decline on the horizon. In some cases, the drop between the 2000s and 2010s looks precipitous.

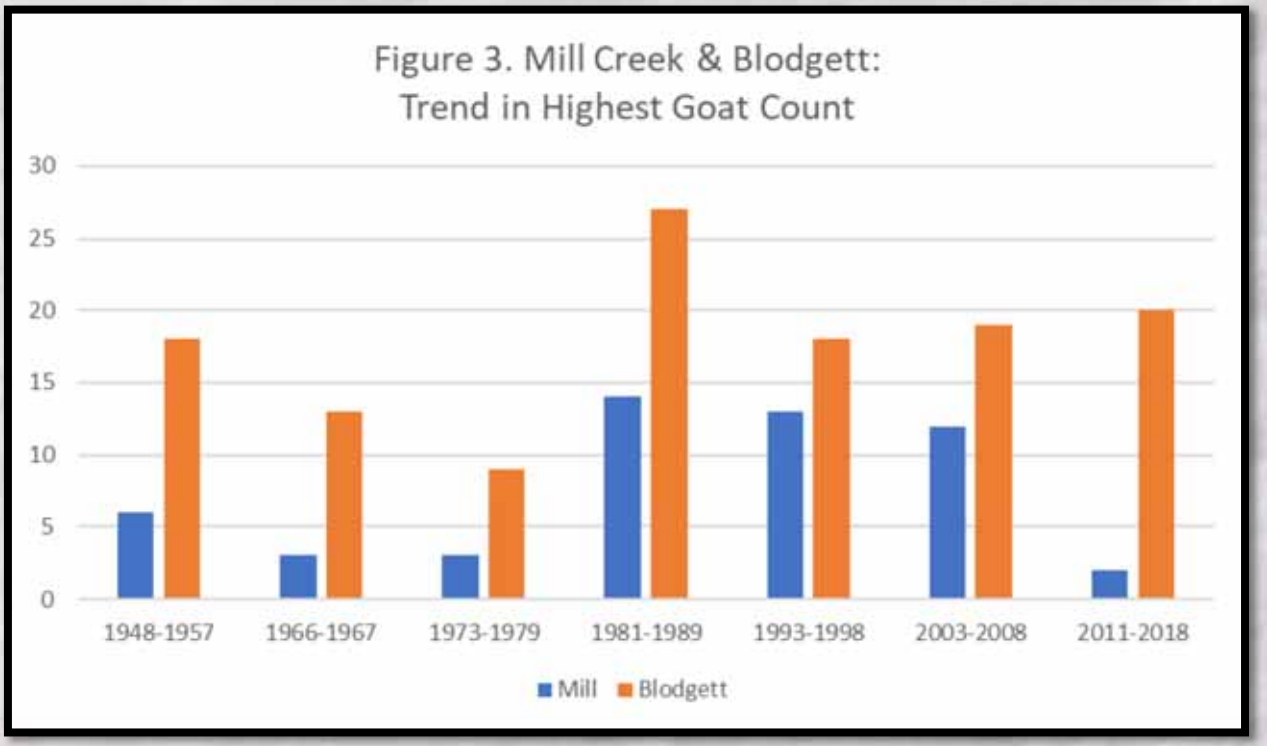
3. Large declines in Big Creek (Figure 2) and Rock Creek (Figure 5) are concerning.

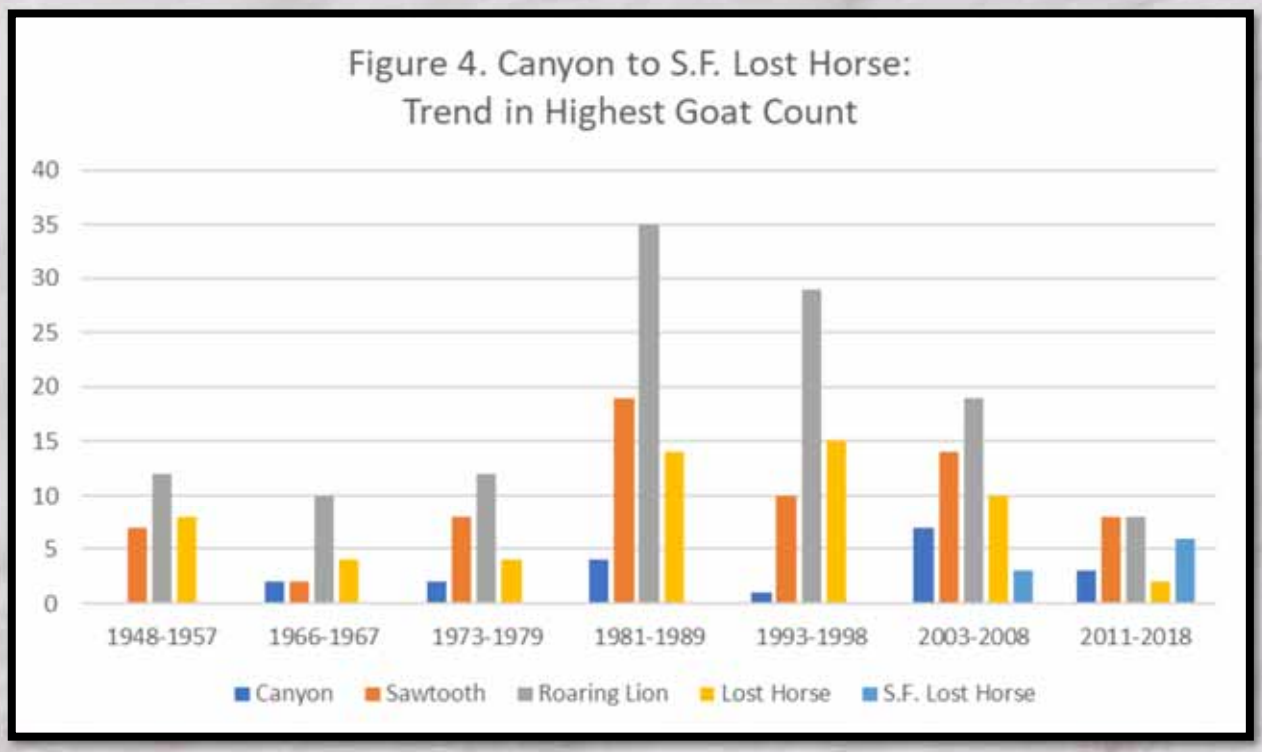
4. It looks like we've been at relatively low levels before—in the 1970s—and that goats increased to higher levels in the 1980s. There is precedent for recovery.



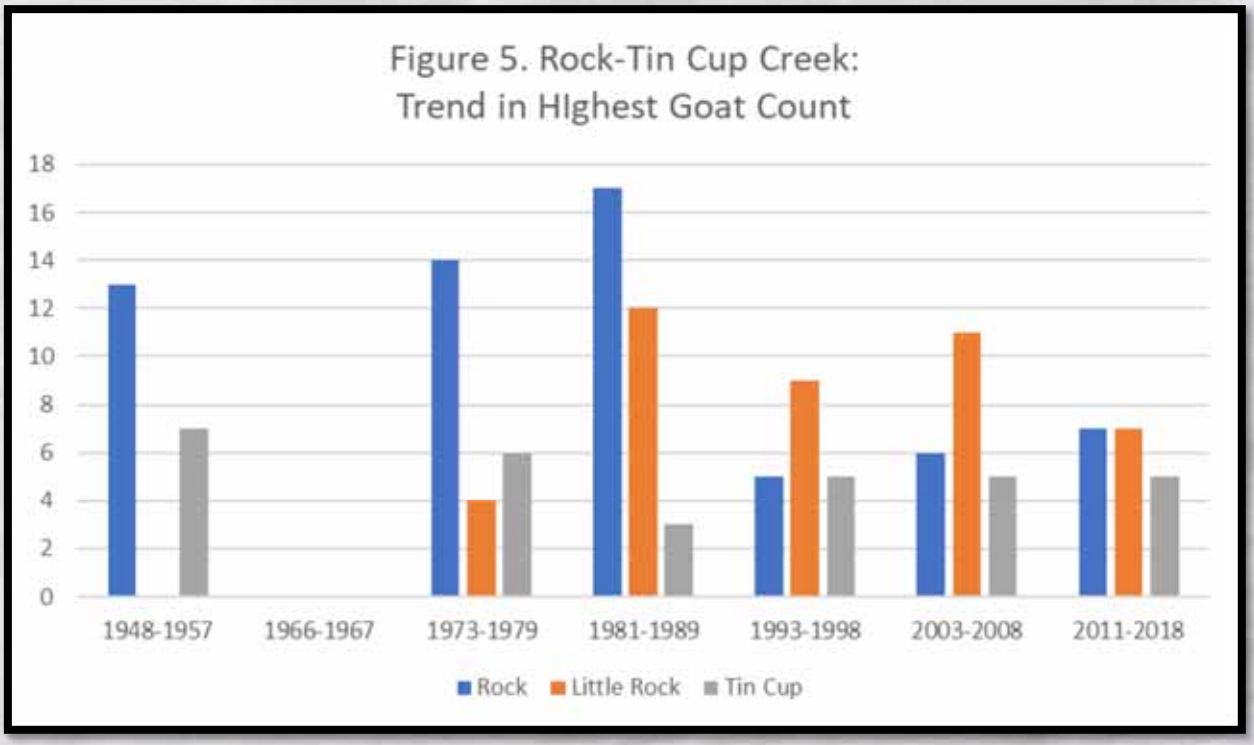


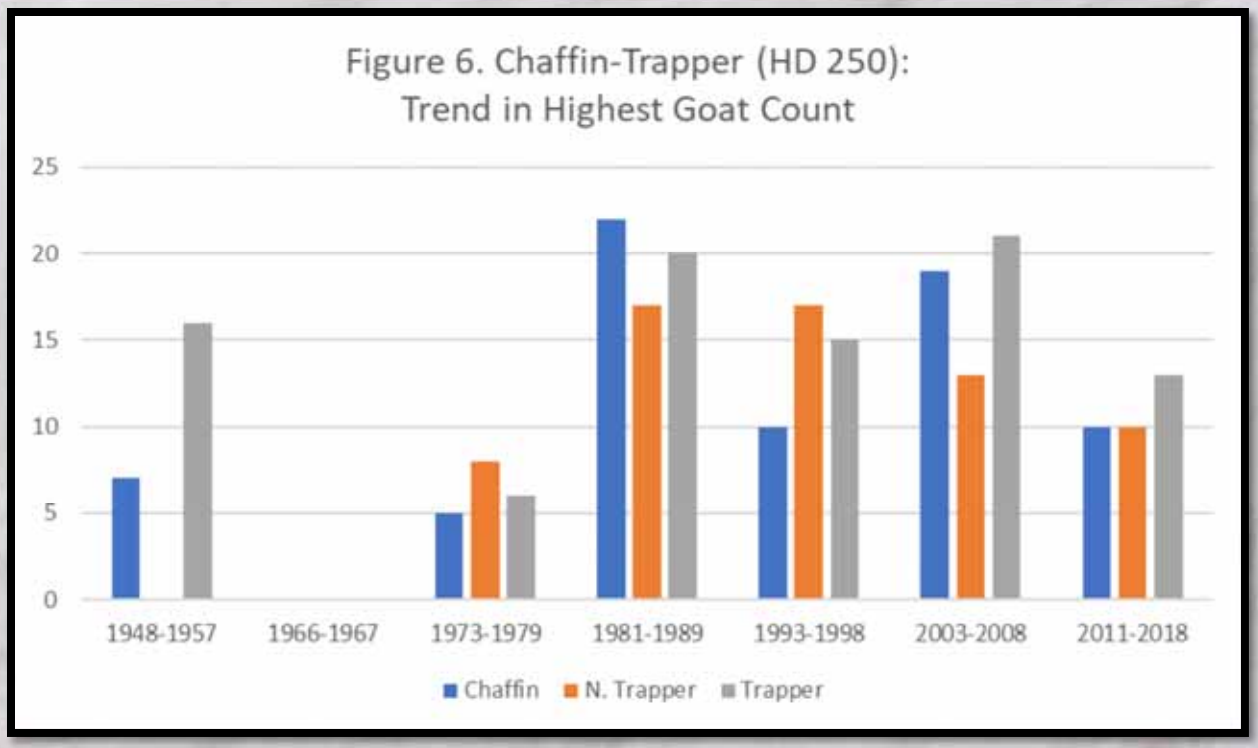
Looking for Trends: Bitterroot, cont.





Looking for Trends: Bitterroot, cont.



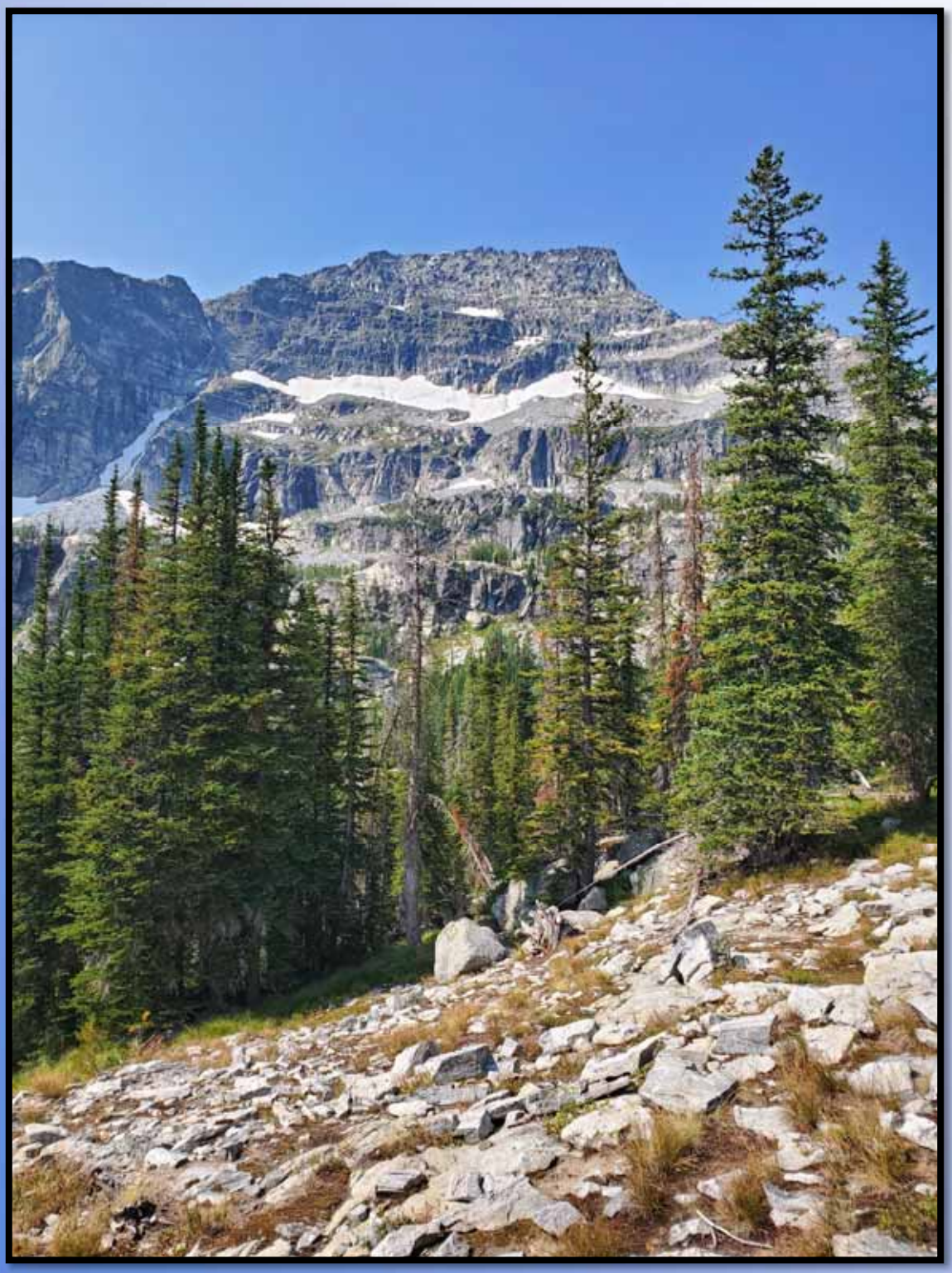


Future Management Options

By reducing hunting licenses for mountain goats in the Bitterroot Mountains to only 1 per year in 2015, have we already done all we can to enhance mountain goat production and survival in the coming years?

FWP's *Recommendations for Managing Mountain Goats in Montana* (Gude et al. 2020) explored that very question. They affirmed that curtailing human-caused, direct mortality in adult female mountain goats is critical for stabilizing declining native populations. In 2020, the Montana Fish and Wildlife Commission adopted a regulation that makes it unlawful to harvest *a female mountain goat accompanying a kid or a female in a group that contains one or more kids* in Regions 1, 2 and 4. Although the language might seem somewhat tortured, the intent of the regulation is to further reduce the odds of a hunter inadvertently harvesting a nanny.

But, Gude et al. (2020) point out that additional measures are available, and may be required if we want to increase native goat populations.



For instance, Rebecca Mowry, FWP wildlife biologist for the Bitterroot, is intensifying her efforts to count and classify mountain goats. She plans to conduct exploratory ground surveys for goats in the Bitterroot canyons this winter, as well as prioritize aerial surveys for mountain goats. Data in Figures 1-6 will help Mowry focus her survey efforts in the canyons where the most goats appear to have disappeared most recently. By focusing time and effort in canyons where the results will be most meaningful, she hopes to overcome the problems encountered by trying to cover the entire mountain range when her flight window is too narrow for that.

Certainly, kid production and survival are important considerations in prescribing management and we hope to get a better handle on that. Environmental stress caused by hot summers, disappearing summer snow patches, and deep late-winter snowpack may

Pictured above and on previous page: Rebecca Mowry and Liz Bradley teamed up to conduct ground checks on mountain goats this summer. Rebecca took these pictures up Little Rock Creek (HD 240) in late-August 2020, with El Capitan in the distance on the previous page.

show up in low kid/adult ratios. Conversely, normal to high kid/adult ratios—especially in winter or early spring—would tend to rule out climate as a detrimental factor at this point in time.

The recruitment of yearlings and 2-year-old goats in canyon subpopulations may be as important as kids in understanding mountain goat population dynamics. Kids and yearlings have the highest mortality rates in a goat population and mountain goats don't become reproductively mature until age 4 or 5, on average. It's not uncommon in native goat populations for several kids to translate into only a couple of two-year-olds, due to mortality throughout the first two years of life.

From Hamel et al. (2006), regarding mountain goat herds in Alberta:

> *Primiparity [age of first birth] occurred at 4 or 5 years of age for most females, and only 3.5% of 3-year-old females reproduced. Productivity increased slightly from ages 6 to 9, and reproductive senescence began at 10 years of age. Females produced an increasing proportion of sons as they aged. . .*
>
> *. . The strong effects of population size on viability could explain why some populations in Alberta have not recovered after 14 years without harvest. Our results suggest that only populations of 75-100 goats can sustain some harvest. Smaller populations appear more susceptible to stochastic events and appear unable to sustain any harvest. Even without harvest, populations of 25 individuals have on average a 50% chance of becoming extinct in 40 years. . . However, immigration can have a profound influence on the persistence of small populations, and we did not consider this in the models. Indeed, some small goat populations appear to persist over time, suggesting that some populations may be part of a metapopulation, where immigration could prevent population extinction or decline.*
>
> -Hamel, S., S.D. Cote, K.G. Smith, and M. Festa-Bianchet. 2006. Population Dynamics and Harvest Potential of Mountain Goat Herds in Alberta. The Journal of Wildlife Management 70(4).

Future Management Options, cont.

We should be reminded that Hamel et al. (2006) studied native mountain goats in Alberta, and we also have native goats in the Bitterroot and across Region 2. They acknowledged that introduced populations may tolerate greater harvest rates than native populations, which pertains to most goat populations east of the Continental Divide.

Little Rock Creek in the Bitterroots, August 2020. Photo by Rebecca Mowry.

In a nutshell, the material on pages 38-39 has been representative of the considerations that were discussed and investigated at length by biologists during FWP's recent structured decision-making process to make recommendations for next steps in managing Montana's mountain goats (Gude et al. 2020).

One of the key conclusions by Gude et al. (2020) was that translocating mountain goats is the most potentially powerful and practical option within FWP's control to address mountain goat distribution and to recover declining goat populations in native habitats. Small populations of wildlife are inherently more vulnerable to risk. For Montana's mountain goats in particular, there is good reason to believe that translocation from reservoir populations into Region 2 may offer a much-needed boost. The intended effect of translocation is to overwhelm the persistent impacts of climate stress, predation, accidents and other mortality on small populations, so that the normal and unavoidable loss of an animal here and there is something that the population can withstand.

Better understanding of population dynamics in the Bitterroot Mountains is important and recommended for identifying whether existing goat numbers are reasonably accurately represented in FWP's count data, and whether actual goat numbers can be expected to maintain themselves without an increase by translocation.

Better understanding disease pathogens in mountain goats is important and recommended for considering whether additional disease-causing pathogens potentially introduced with translocated mountain goats could mix with naturally-occurring pathogens in the endemic Bitterroot goat population to cause a die-off. Our worst nightmare would be for our intervention to cause the loss of goats in a canyon or across a larger landscape. Gude et al. (2020) pointed out that goat translocations into occupied goat habitat are accompanied by risk, which must be considered in advance of any possible translocation, and should be monitored with scientific rigor during and after translocation to help inform FWP's future mountain goat management in Montana.

Dalton Lake, Great Burn Proposed Wilderness, July 17, 2020. Photos by Liz Bradley.

By Torrey Ritter, Bridger Mountains, July 2009.

Find the Quarterly online at fwp.mt.gov/regions/r2/WildlifeQuarterly