

## Mount Norquay Bighorn Sheep Lambing Study 2019



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*Report Title: Mount Norquay Bighorn Sheep Lambing Study 2019*

*Authors: Beth MacCallum, Suzanne Stevenson, Bighorn Wildlife Technologies Ltd.*

*GIS: Alice Paquet, Bighorn Wildlife Technologies Ltd.*

*Front Cover: Andrew Godsolve, Bighorn Wildlife Technologies Ltd.*

*Front Cover Picture: Members of the nursery herd, Norquay Meadows, June 3, 2019.*

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## Executive Summary

During a workshop convened to discuss the Mount Norquay gondola development proposal bighorn sheep were identified as a species of concern due to potential alterations in the alpine area impacting sensitive lambing grounds (Lee et al. 2019). This study investigates whether lambing occurs on Mount Norquay in the vicinity of the proposed gondola and boardwalk site on the Norquay ski resort and Via Ferrata site using ground-based direct observation. Ground-based surveys are useful when sex and age classification is required, and where little empirical information is available.

The peak time frame for lambing in the Alberta Rocky Mountains occurs during the last two weeks of May and first week of June with peak lambing occurring during the last week of May. For this study, ground observations occurred between May 22 - June 11, 2019 to ensure that the primary lambing period was included. Four survey routes/sites were established and designed to facilitate observation of bighorn sheep in the Mount Norquay study area during the lambing period. The routes/sites were:

Route 1. Areas Observed: Norquay Access Road and Green Spot

Route 2. Areas Observed: Norquay Ski Slopes

Route 3. Areas Observed: Via Ferrata to ridgeline

Route 4. Areas Observed: Slopes in the Unnamed Valley on the W side of the Via Ferrata ridgeline and location of proposed gondola terminal and boardwalk

The west slopes of Cascade Mountain were also searched using a spotting scope from the ridgeline above the Via Ferrata beginning June 4 when access became available. Bighorn sheep that were observed during surveys were counted and classified by age and sex, where possible, and the centre of the group plotted on a large-scale air photo. Locations were determined after transposing air photo locations to Google Earth.

Seventy-four groups of bighorn sheep were observed during 17 days of survey between May 22 and June 11, 2019. Group size ranged from 1 to 32 individuals and most individuals were classified in 96% of the groups observed. Bighorn sheep observations were concentrated in three areas: 1) Green Spot/Norquay access road; 2) ski runs above the North American lodge and 3) on the west slopes of Cascade Mountain. The number of adult ewes using the Mount Norquay study area declined between May 27 to June 4, 2019. Corresponding with this time frame, ewes with new lambs were observed on Cascade Mountain's west slopes on June 5, 6, 8 and 9, 2019, however, it is not possible to know if the ewes observed on Cascade Mountain had been the same ewes using the slopes on Mt Norquay. Ewes were not observed lambing within the Mount Norquay study area.

Nursery groups of ewes with lambs were observed on Mount Norquay on June 14 by Norquay staff and through the end of June and July at higher elevations. It is unknown where these lambs were born. These ewes appear to be using the Mt Norquay ski slopes as summer range. It is not known where the ewes that occupied Mount Norquay before lambing went for lambing. Telemetry/GPS techniques would be required to answer this question.

## Acknowledgements

Thanks to the staff of Norquay Ski Resort for providing access to staff buildings, the North American chairlift and making field work efficient and pleasant. John Thorington and Carter Jewett provided useful observations of bighorn sheep. Bill Hunt and Bryan Macbeth, Banff National Park, provided helpful background information. Observations during this study were made by Jon Jorgenson, Beth MacCallum, Suzanne Stevenson, Andrew Godsolve, and Emily Bradford.

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## Mount Norquay Bighorn Sheep Lambing Study 2019

### 1.0 INTRODUCTION

The Mount Norquay Ski Resort provides habitat for a variety of wildlife species including bighorn sheep, elk, mule deer, white-tailed deer and mountain goat, particularly in the period May through mid-July. The ski area and adjacent landscapes (Figure 1) support some of the highest concentrations of ungulates in the Bow Valley (Banff National Park, 2011). Ungulate availability and vegetation quality provide prey and forage resources for the large carnivores, grizzly bear, black bear, gray wolf, coyote and cougar, all of which occur in the Mount Norquay area. Bighorn sheep lambs and ewes have been reported within the Norquay Via Ferrata during monitoring by Mount Norquay staff and there is a historical record of lambing on the north side of Mount Norquay (Skjonsberg, 1993 *in* Lee et al., 2019).

During a workshop convened to discuss the Mount Norquay gondola development proposal (Lee et al. 2019), bighorn sheep were identified as a species of concern due to potential alterations in the alpine area impacting sensitive lambing grounds. Bighorn sheep were prioritized as a conservation challenge. As there is very little documentation on lambing in Banff National Park, a literature review and expert opinion were used to model key habitat features associated with lambing habitat to identify possible locations of bighorn sheep lambing habitat in proximity to the gondola terminus and boardwalk in the alpine region. Results suggested that: Mount Norquay has suitable conditions for lambing; potential lambing habitat did not occur within a 150m buffer of the gondola and boardwalk and; potential lambing habitat could occur within a 500m buffer of the development.

Lee et al. (2019) indicated that they were not confident in their ability to map potential lambing habitat as habitat features were derived from the literature based on other regions and the resolution of the data likely limited the ability to identify smaller areas of potential lambing habitat. They noted that other studies have used telemetry/GPS and location of ewes from May to July to identify lambing sites and concluded that they “*do not know if lambing actually occurs on Mount Norquay or if the North side of Mount Norquay is still an active lambing site*”.

Bighorn sheep ewes are known to withdraw from the nursery groups prior to giving birth (parturition). Their departure is marked by an increase in the proportion of yearlings and young ewes in the nursery groups and a drop in the number of adult ewes, hence identification of the beginning of lambing period will be aided by repeat observation and classification of bighorn sheep groups prior to and through the lambing period. Pregnant ewes withdraw from the nursery groups and select broken, rugged cliffs for lambing in terrain that is inaccessible by larger predators – wolves, bears and coyotes (Geist 1971, MacCallum and Geist 1992).

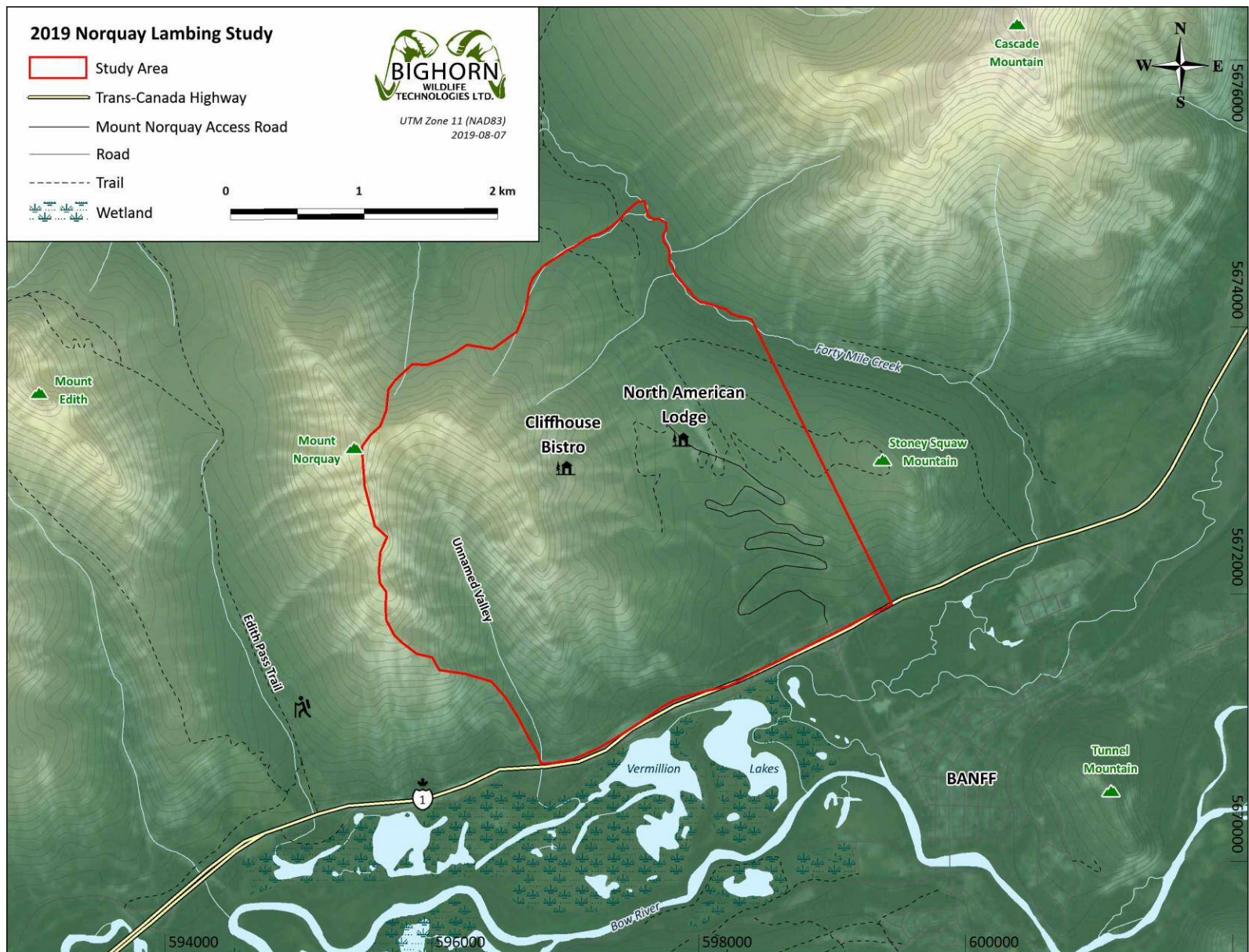


Figure 1. Mount Norquay Lambing Study Area

## 2.0 PURPOSE

This study investigates whether lambing occurs on Mount Norquay in the vicinity of the proposed gondola and boardwalk site on the Norquay ski resort and Via Ferrata site using ground-based direct observation. Ground based surveys involve counting animals directly but require large open areas where animal observability is high and where there is ability to cover a substantial part of the study area on a regular basis. Ground-based surveys are useful when sex and age classification is required, and where little empirical information is available. They are, however, limited in that they require the ability to readily observe animals that are present on the study area. In mountainous areas with large pockets of forested areas and difficult terrain to access, it is always possible to miss observing individual animals. The study relied on the ability to scan open areas and be able to observe the presence of any animals. Radio-collars or aerial surveys were not part of this study

## 3.0 METHODS

The peak time frame for lambing in the Alberta Rocky Mountains occurs during the last two weeks of May and first week of June with peak lambing occurring during the last week of May. Some lambs may be born before or after this prime period, but numbers will be small. This information is based on studies conducted annually at Ram Mountain (pers. comm. Jon Jorgenson). For this study, ground observations occurred between May 22 - June 11, 2019 to ensure that the primary lambing period was included. Four survey routes/sites were established and designed to facilitate observation of bighorn sheep in the Mount Norquay study area during the lambing period. Areas observable and viewing stops used during the survey are mapped on Figure 2. The routes/sites were:

### Route 1. Areas Observed: Norquay Access Road and Green Spot

Driving and viewing from Norquay access road.

### Route 2. Areas Observed: Norquay Ski Slopes

Viewing from Road 1-3, and the North American Lodge; hiking to and viewing from Station 2 on ski run 60; hiking to and viewing from the top of the Spirit Chair; viewing from the Cliffhouse Bistro and Scrambler's Trail.

### Route 3. Areas Observed: Via Ferrata to ridgeline

Viewing from North American Lodge, Cliffhouse Bistro and Scrambler's Trail; scrambling the Via Ferrata descent gulley beginning June 4.

### Route 4. Areas Observed: Slopes in the Unnamed Valley on the W side of the Via Ferrata ridgeline and location of proposed gondola terminal and boardwalk

Hiking to and viewing from Station 1 on "Tick Ridge"; viewing from the Via Ferrata ridgeline beginning June 4.



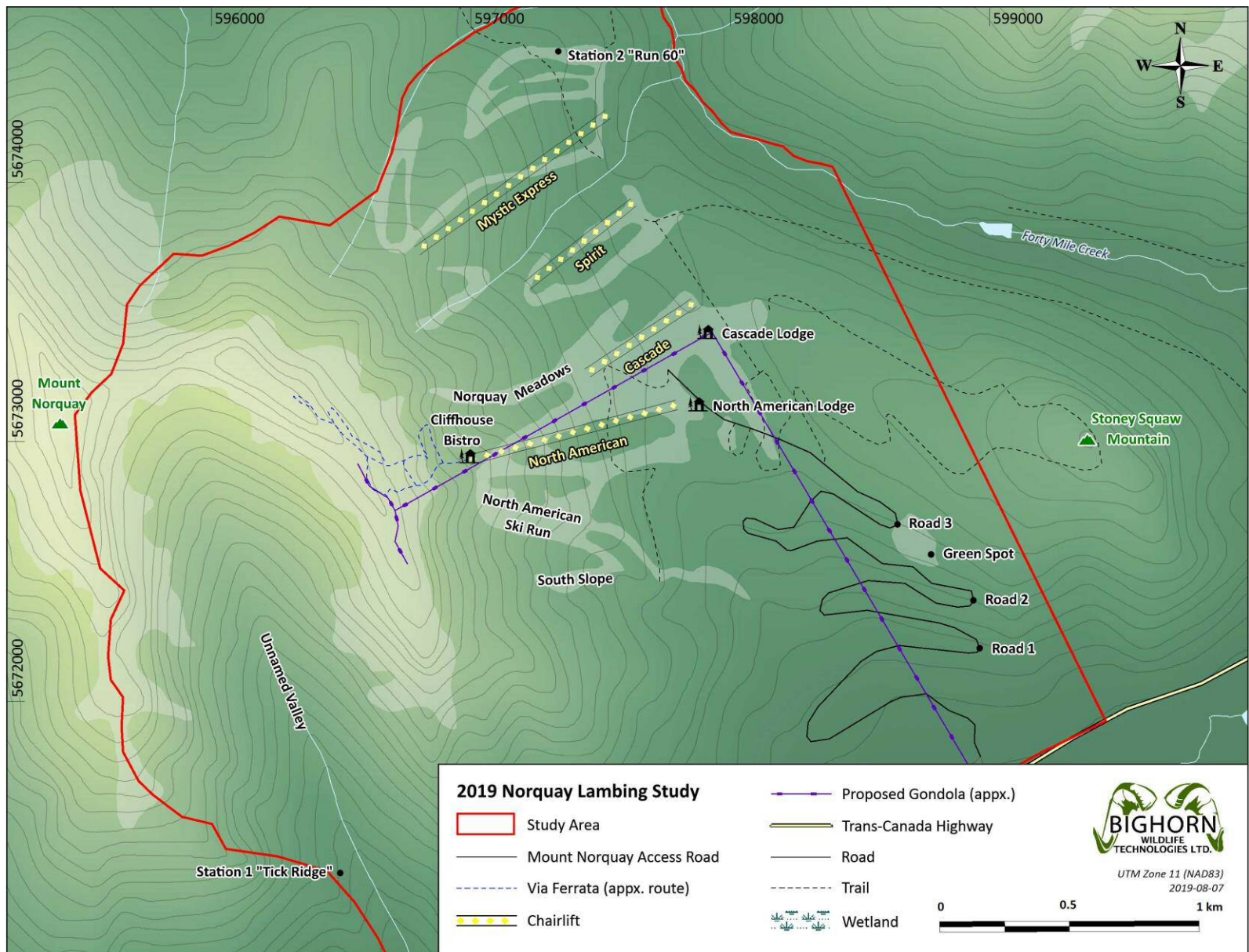


Figure 2. Location Names Used for the Norquay Lambing Study

The west slopes of Cascade Mountain were also searched using a spotting scope from the ridgeline above the Via Ferrata beginning June 4 when access became available. A summary of routes surveyed, weather and significant events affecting the survey or observed during the survey is found in Appendix I.

Surveys were initially restricted to the Norquay access road, ski hill locations and Unnamed Valley as the winter snowpack was still substantial in the higher elevations above the Cliffhouse Bistro. This prevented safe access thru the Via Ferrata to the ridgetop. The North American chairlift was also closed for maintenance between May 27 and June 2 thus preventing access to the Via Ferrata Ridgeline during this time. Bighorn sheep observations and pictures were provided by the Norquay Resort staff (John Thornton and Carter Jewett) for the period June 17 to August 3, 2019.

Binoculars and spotting scopes were used to count and classify, where possible, bighorn sheep that were observed during surveys. The centre location of each group was plotted on a large-scale air photo produced from digital imagery available from Google Earth and UTM coordinates for each location were determined after transposing air photo locations to Google Earth. Where possible, bighorn sheep were classified by sex (ewes or rams) and age (lambs, yearlings, adults). Bighorns  $\geq$  two years old were classed as adults. Rams were further categorized by horn size. Bighorn sheep was classified as:

- |                                     |                          |
|-------------------------------------|--------------------------|
| ▪ Lamb (born spring 2019)           | ▪ Ram $\frac{1}{2}$ curl |
| ▪ Yearling (male and female 1 year) | ▪ Ram $\frac{3}{4}$ curl |
| ▪ Ewe (2 years or older)            | ▪ Ram $\frac{4}{5}$ curl |
| ▪ Ram $\frac{1}{4}$ curl            | ▪ Ram full curl          |

Note that horns must reach or exceed the curl size before being identified with that size (pers. comm. Jon Jorgenson). Rams with undetermined horn size and those sheep that could not be identified by sex and age were recorded as 'unclassified ram' and 'unclassified sheep'.

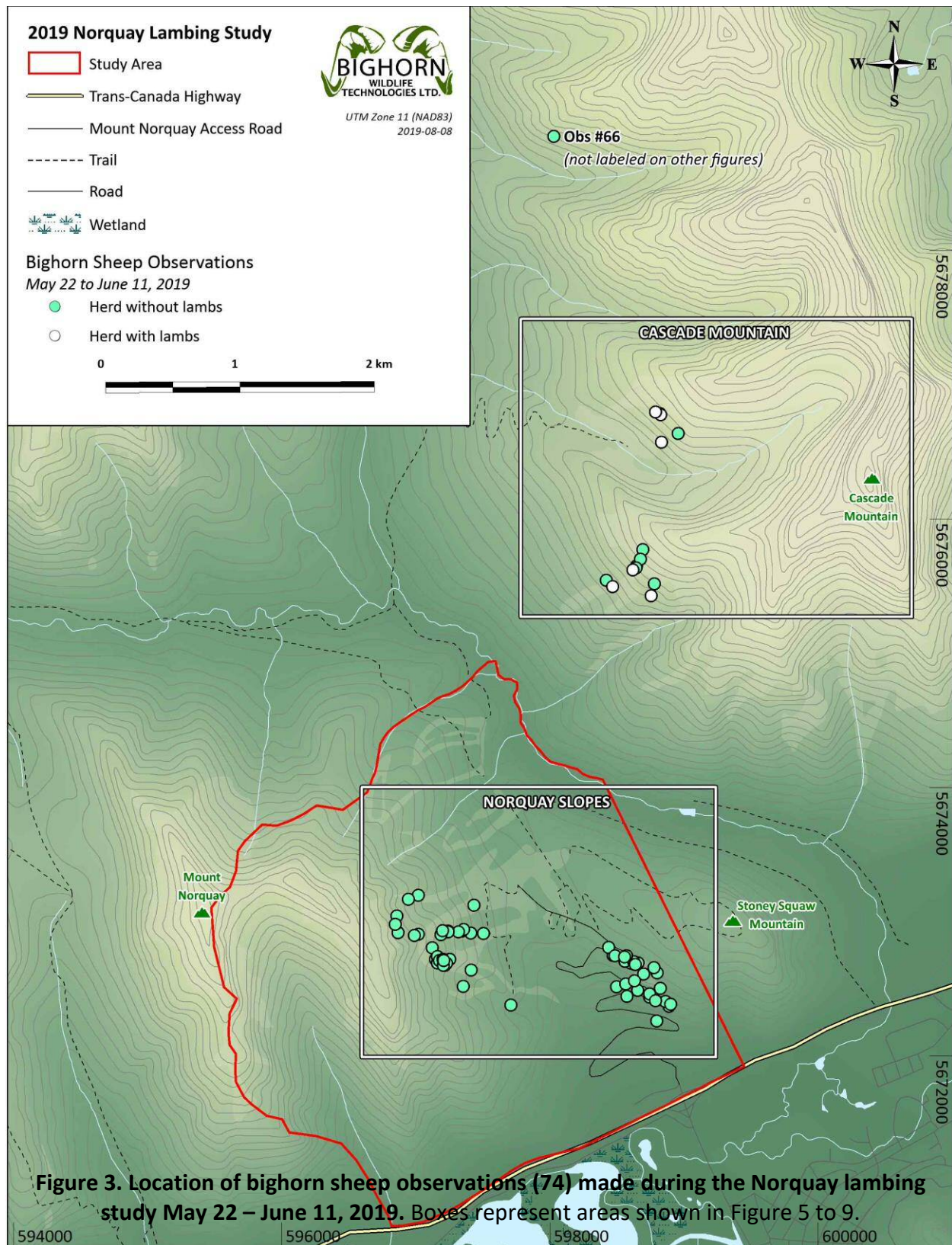
Nursery herds refer to groups of sheep composed of ewes, lambs, yearlings of either sex, and occasionally  $\frac{1}{4}$  curl rams. Ram groups included rams of all horn sizes excluding male yearlings. In a mixed herd,  $\frac{1}{4}$  curl rams were identified with the rams.

Other ungulates, carnivores, small mammals and birds observed during the survey were also identified, counted, classified where possible and the locations plotted on a large-scale map. These observations are available separately from this report.

## 4.0 RESULTS

Seventy-four groups of bighorn sheep were observed during 17 days of survey between May 22 and June 11, 2019 (Figure 3). Group size ranged from 1 to 32 individuals and most individuals were classified in 96% of the groups observed. Unclassified sheep occurred in groups that were observed at too far a distance or moved into forest cover.





**Figure 3. Location of bighorn sheep observations (74) made during the Norquay lambing study May 22 – June 11, 2019. Boxes represent areas shown in Figure 5 to 9.**



**Table 1. Bighorn Sheep observations, Norquay lambing study, May 22 - June 11, 2019.**

Coordinates: UTM Zone 11 (NAD83). "N Am" = North American. Obs numbers correspond to labels on Figures 5 to 8.

Obs	Date	Time	Ewe	Lamb	Female Yearling	Male Yearling	Yearling	Quarter Curl %	Half Curl %	Three-quarter Curl %	Four-fifths Curl %	Full curl	Unclassified Ram	Unclassified Sheep	Total	Easting	Northing	Location
1	22-May-19	9:30	6												6	597148	5672729	Lone Pine Station 8
2	22-May-19	11:52	1												1	597019	5672917	Ski slope
3	22-May-19	11:48	6					1							7	597410	5672923	Ski slope - N Am
4	24-May-19	8:45												6	6	597161	5672703	Ski slope - N Am
5	24-May-19	8:45												12	12	597253	5672730	Ski slope
6	24-May-19	10:15	4				1								5	598799	5672628	Green Spot
7	24-May-19	10:15						2	4	5	3				14	598799	5672628	Green Spot
8	24-May-19	10:45	1												1	598888	5672379	Road #2
9	26-May-19	13:30	1						1						2	597710	5672388	Rocky bluff, base of N Am ski slope
10	26-May-19	14:58							2	3	2	3			10	598698	5672618	Green spot; ram NQY-13 in group
11	26-May-19	14:58	5			1		1							7	598572	5672757	Green spot along road
12	26-May-19	16:00	17				4	3	1						25	597355	5672527	Furthest south meadow on Norquay
13	26-May-19	16:30								1					1	598863	5672416	Road 2
14	27-May-19	15:00	7				6	9	1					4	27	598576	5672454	Access road; F-NQY tag, Y-MLH, F-MRH
15	27-May-19	15:20	1		1	1									3	598636	5672689	Corner at Road 3; Y-MLH2
16	27-May-19	15:26								2					2	598557	5672747	uphill of Road 3
17	28-May-19	9:20	3			1	1	1							6	598776	5672667	Green spot
18	28-May-19	9:44	1					4	2	2		2	2		13	598824	5672512	Green spot
19	28-May-19	13:31	1		1	1									3	598566	5672544	downhill of Road 2
20	28-May-19	13:39	3												3	598485	5672755	Downhill of Road 3, F-MRH in group
21	28-May-19	13:55	1					1	4	2		3			11	598631	5672569	Green Spot
22	29-May-19	9:10	3				6	1							10	597161	5672749	Ski slope - N Am
23	29-May-19	9:30						3		4			5		12	598743	5672447	Uphill of Road 2
24	29-May-19	9:40				2	3	2	1						8	598655	5672498	Uphill of Road 2
25	29-May-19	9:45	1			1	2	1							5	598622	5672696	Road 3
26	30-May-19	9:03							1						1	598900	5672395	Road 2

Table 1. Con't

Obs	Date	Time	Ewe	Lamb	Female Yearling	Male Yearling	Yearling	Quarter Curl %	Half Curl %	Three-quarter Curl %	Four-fifths Curl %	Full curl	Unclassified Ram	Unclassified Sheep	Total	Eastings	Northing	Location
27	30-May-19	9:26											1		1	598657	5672703	Green Spot
28	30-May-19	10:00	5				7	1	1	2		1	6		23	597020	5673205	Norquay meadows
29	30-May-19	13:30							1	4		1	8		14	598743	5672470	Road 2
30	31-May-19	11:46	2					1	2	2					7	598626	5672710	Road 3 switchback
31	31-May-19	12:24	5				4	2							11	597219	5672683	Ski slope - N Am
32	2-Jun-19	9:55	4				5								9	597176	5672719	Ski slope - N Am
33	2-Jun-19	9:55	2			1	2	3	3	4		3	3		21	597346	5672940	Under N Am Chairlift (south slope)
34	2-Jun-19	10:23								2					2	598470	5672759	Road 3
35	3-Jun-19	9:44						1							1	598603	5672702	Road 3
36	3-Jun-19	10:05							2	2		2	3		9	597203	5672729	Ski slope - N Am
37	3-Jun-19	11:25	11			5	7	9							32	596946	5673177	Norquay meadows; F-MRH in group
38	3-Jun-19	12:20							2						2	596867	5672927	Scrambler's Trail
39	4-Jun-19	9:00	2				5		2	2			2		13	597230	5672699	Ski slope - N Am
40	4-Jun-19	9:20	4				2								6	597241	5672938	Under N AM Chairlift
41	4-Jun-19	10:00								1		1	1		3	596990	5672906	Cliffs above Cliffhouse Bistro
42	5-Jun-19	9:30	2				2								4	597357	5672950	Under N Am Chairlift
43	5-Jun-19	10:42	9				2	2	4	6		5	1		29	597206	5672683	Ski slope - N Am
44	5-Jun-19	14:56	1				5	2							8	598642	5675646	West side of Cascade
45	5-Jun-19	14:59	6	5											11	598832	5676582	West side of Cascade
46	5-Jun-19	15:19	4	3											7	598756	5675437	West side of Cascade
47	5-Jun-19	15:28											1		1	588957	5676647	North of Cascade
48	5-Jun-19	16:50						1	3	6		3			13	597123	5672814	Ski slope -N Am; rams NQY-09, NQY-13
49	5-Jun-19	17:18	5							3					8	598440	5672818	Access road uphill of Green Spot
50	5-Jun-19	17:30	1				3	1							5	598787	5672421	Access road
51	5-Jun-19	17:35					4								4	598796	5672269	Access road
52	6-Jun-19	9:30	1					1	1			4			7	597414	5672649	Ski slope - N Am

**Table 1. Con't**

Obs	Date	Time	Ewe	Lamb	Female Yearling	Male Yearling	Yearling	Quarter Curl %	Half Curl %	Three-quarter Curl %	Four-fifths Curl %	Full curl	Unclassified Ram	Unclassified Sheep	Total	Eastings	Northing	Location
53	6-Jun-19	9:45	8				3		1	5		1			18	597242	5672932	Under N Am Chairlift
54	6-Jun-19	11:00	2				1	1							4	598675	5675709	West side of Cascade
55	6-Jun-19	11:30	1												1	596846	5672989	Scrambler's Trail; F-MRH
56	6-Jun-19	13:15	6	5											11	598826	5676785	West side of Cascade
57	6-Jun-19	13:45	1												1	598780	5675525	West side of Cascade
58	6-Jun-19	15:10	5	4											9	598620	5675630	West side of Cascade
59	8-Jun-19	10:15						1	1	8		3			13	597208	5672720	Ski slope - N Am
60	8-Jun-19	10:40	1			1									2	598560	5672715	Green spot; ewe NQY-20
61	8-Jun-19	15:30	6	5				1							12	598467	5675506	West side of Cascade
62	9-Jun-19	10:35	1					4	3	9		2			19	597189	5672913	Ski slope below Cliffhouse
63	9-Jun-19	13:55	4				1		1						6	598422	5675554	West side of Cascade
64	9-Jun-19	13:55					4								4	598694	5675780	West side of Cascade
65	9-Jun-19	14:08	7	6											13	598789	5676806	1 slope North from Cascade
66	9-Jun-19	14:40											5		5	598030	5678860	3rd slope North from Cascade
67	10-Jun-19	10:05	1				1	3	2	6		4			17	597200	5672941	Slope under N Am chairlift (south)
68	10-Jun-19	11:40	1												1	596859	5673051	Cliffs 2 gully's north of Cliffhouse
69	10-Jun-19	11:55	3		1	1		1							6	598645	5675659	West side of Cascade
70	10-Jun-19	12:36	1			1		1							3	598820	5676793	West side of Cascade
71	11-Jun-19	13:05	6			2	3	1	1	1					14	597320	5672933	Under N Am Chairlift
72	11-Jun-19	13:28						1	3	3		2			9	597505	5672922	Under N Am Chairlift
73	11-Jun-19	13:50	1		1	1		1	1	2		1			8	597434	5673131	Under N Am Chairlift
74	11-Jun-19	14:32						1							1	598497	5672524	Uphill of road 2



## 4.1 Distribution

Bighorn sheep observations were concentrated in three areas: 1) Green Spot/Norquay access road; 2) ski runs above the North American lodge and 3) on the west slopes of Cascade Mountain (Figure 3).

### 4.1.1 Green Spot / Norquay Access Road

Over the course of the survey, the presence of bighorn sheep at the Green Spot / Norquay Access Road shifted after an incident involving wolves. On May 30, 2019, a gray wolf was observed chasing a ram down the east forest edge of the Green Spot and another wolf was photographed waiting below the roadside cliff at Road 2 where a young ram was standing, using the cliff as escape terrain (Appendix II, Photo 10 and 11). The maximum daily group size the Green Spot / Norquay Access Road before the event was 0-27 (average 13 sheep), and 0-8 (average 2 sheep) after the event. It is suspected that these sheep moved up to the Norquay Ski Slopes as seen by the change in group size on the slopes before (0-25, average 11 sheep) and after the event (11-32, average 19 sheep).

### 4.1.2 Ski Slopes between the North American and Norquay Meadows

Bighorn sheep were consistently observed on the ski slopes in the vicinity of the North American Chair throughout the observation period. Members of the nursery herd were usually located higher on the slopes closer to cliff terrain. Ram groups were commonly observed on the mid and lower slope positions of the ski runs.

### 4.1.3 Cliffs above the Cliffhouse Bistro

Five observations of bighorn sheep were made at the Cliffhouse Bistro or on the cliffs above the Bistro and in the area of the Via Ferrata between May 22 and June 11, 2019. They were:

May 22: one ewe on the ski slope immediately below the Cliffhouse (obs #2)

June 3: two ½ curl rams on the Scrambler's Trail (#38)

June 4: three rams (¾ curl, full curl, unclassified) on cliffs above the Cliffhouse (#41)

June 6: one ewe with missing right horn (MRH) on the Scrambler's Trail (#55)

June 10: one young (two-year) ewe on the Scrambler's Trail (#68)

### 4.1.4 Unnamed Valley west of the Via Ferrata ridgeline

Nine days of surveys of Unnamed Valley were conducted during the Norquay lambing study. Surveys were conducted on May 27, 29, 31 and June 4 from Station 1 and on June 4, 5, 6 and 8, 9, 10 from the Via Ferrata ridgeline at the north end of this valley. No bighorn sheep were observed along the ridgetop above the Via Ferrata or in the Unnamed valley on these days. Evidence (pellet-groups) indicated bighorn sheep travel and bed on the lower ridge in Unnamed Valley (Station 1). Bighorn sheep pellet-groups were also found on high trails below the arête at

the north end of the valley and on a prominent rock outcrop in the centre of the trail (Appendix II, Photo 6).

#### 4.1.5 Cascade Mountain West Slopes

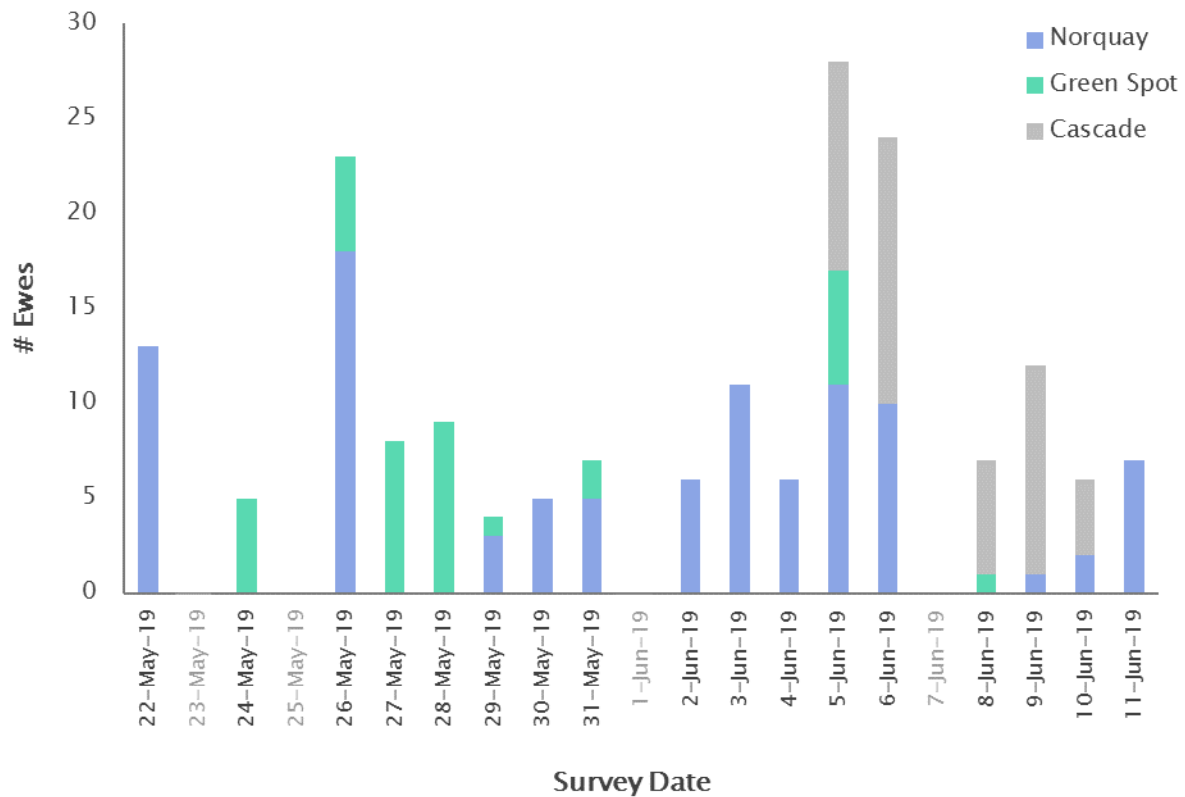
The west slopes of Cascade Mountain were surveyed using a spotting scope once access to the Via Ferrata was available. Surveys of Cascade Mountain were made daily between June 5 through 10, 2019 except on June 7 when visibility was obscured by snow. Ewes with new lambs were recorded on the west slopes of Cascade Mountain on June 5, 6, 8 and 9, 2019.

### 4.2 Bighorn Sheep Lambing

Adult ewes were observed daily (average 11, range 4-28 ewes) on Mount Norquay throughout the 17-day observation period between May 22 and June 11, 2019 (Figures 4 to 6). Daily adult ewe counts were lowest (average 7, range 4-11 ewes) in the nine-day period May 27 to June 4 (Figure 7) preceding the first observations of lambs on Cascade Mountain on June 5 (Figure 8). Two separate groups of ewes and lambs (obs #45 and 46) were observed in alpine meadows on the west side of Cascade mountain on June 5 (Appendix II, Photos 16 and 17). These lambs were at least a week old as the ewes had already joined with other ewes and their lambs. Female sheep typically withdraw from the nursery herd and seek rugged and sheltered terrain for lambing after which they remain in isolation with the lamb for 5-7 days before joining other lamb-leading females in the nursery herd. This period of isolation corresponded with the dates for reduced numbers of ewes on Mount Norquay (May 27 – June 4).

Four subsequent observations of ewes and lambs were made on Cascade Mountain during this study. On June 6, two groups were observed of six ewes with five lambs, and five ewes with four lambs. On June 8, six ewes with five lambs were observed; and seven ewes with six lambs were recorded on June 9 (Table 1). It is quite possible that some of the ewes and lambs observed on June 6, 8, and 9<sup>th</sup> were replicate observations as their locations were similar. It is unknown whether the ewes observed on Cascade Mountain had previously been part of the groups on Mount Norquay.

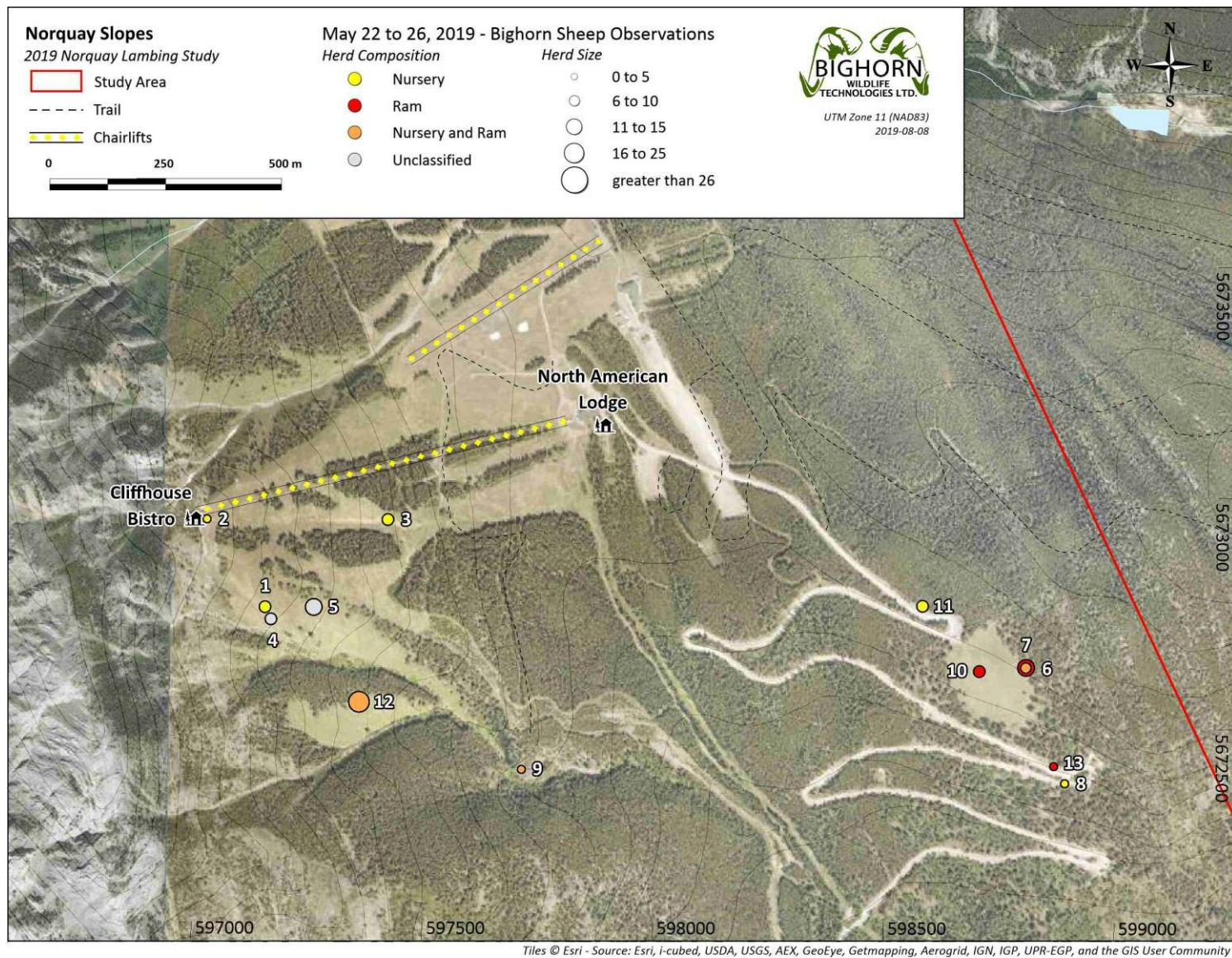
Ewes were not observed lambing within the Mount Norquay study area (Figure 3) including the cliffs above the Cliffhouse Bistro. Ewes were also not observed lambing in the area of the Via Ferrata or the ridgeline above the Via Ferrata. It is unknown where the ewes that were observed on the ski slopes of Mt. Norquay prior to lambing went to give birth.



**Figure 4. Number of adult ewes observed during the Norquay lambing study, May 22 – June 11, 2019.**

Ewes occurred in three different spatial groups, i) Norquay ski slopes to Via Ferrata ridgeline, ii) the Green Spot by the access road, and iii) Cascade Mountain's SW-facing slopes. On days showing zero sheep, no survey took place.

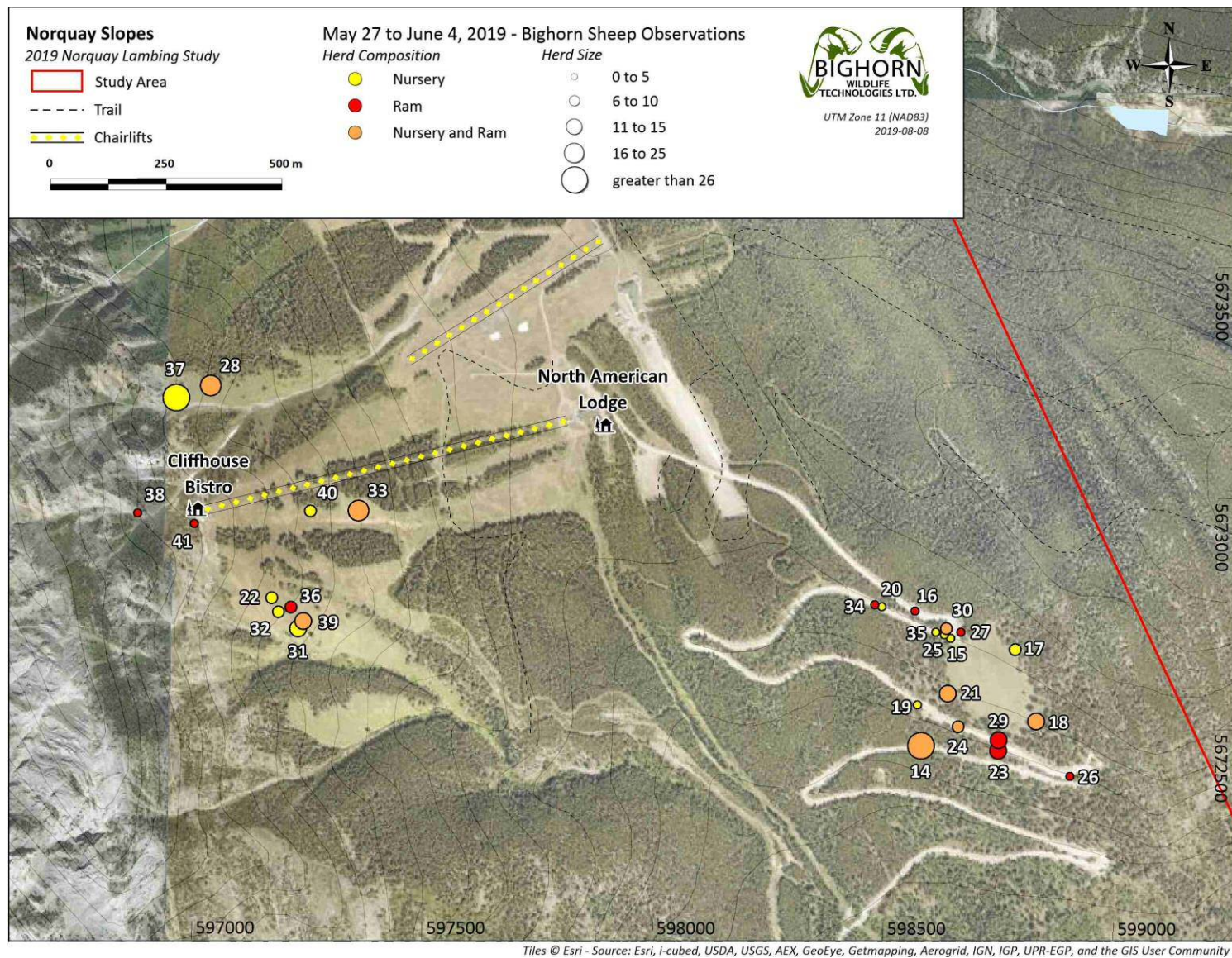




**Figure 5. Bighorn sheep observations in the Mount Norquay study area, May 22 to 26, 2019.**

Refer to Table 1 for observation details.

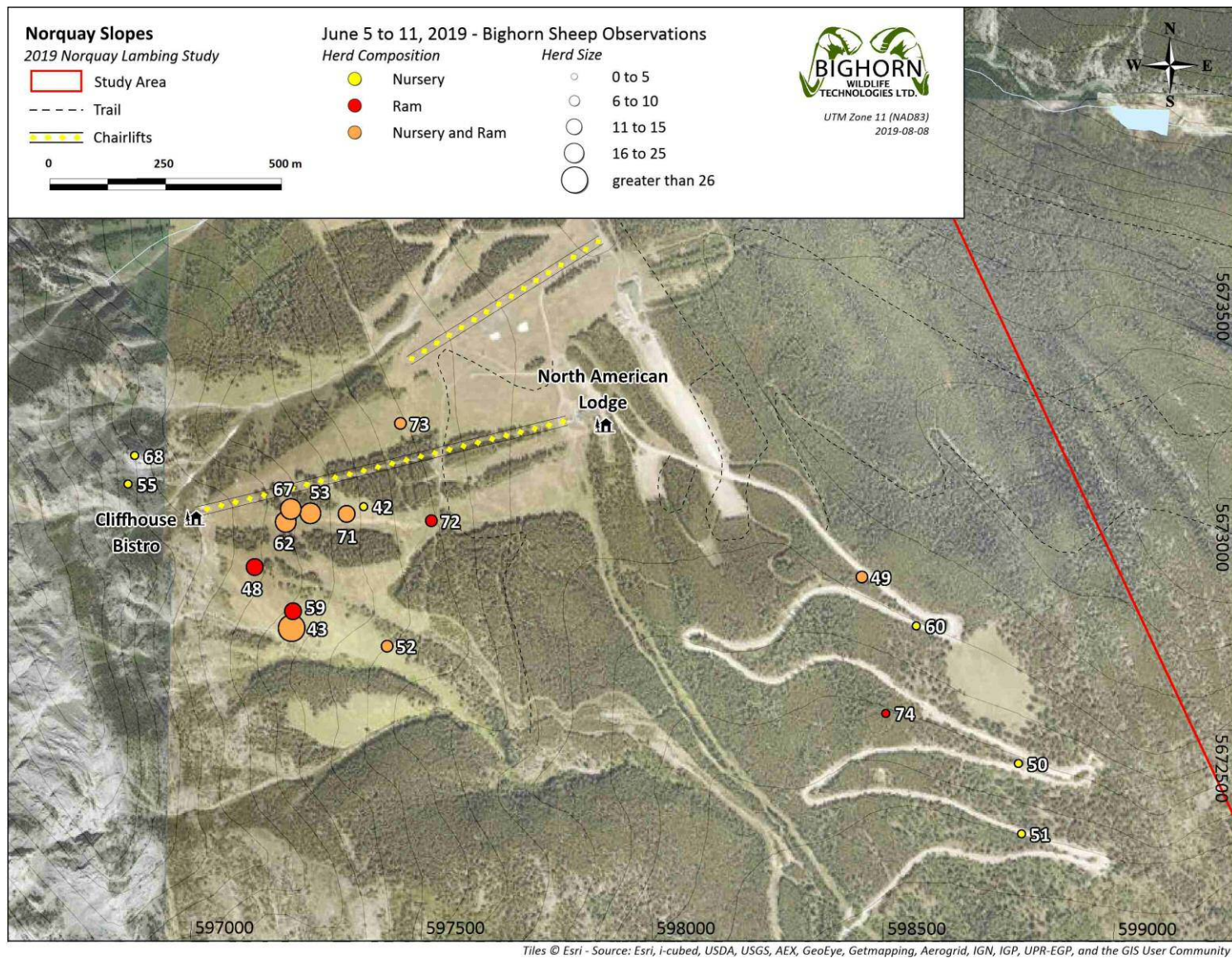




**Figure 6. Bighorn sheep observations in the Mount Norquay Study Area, May 27 to Jun 4, 2019.**

Refer to Table 1 for observation details.

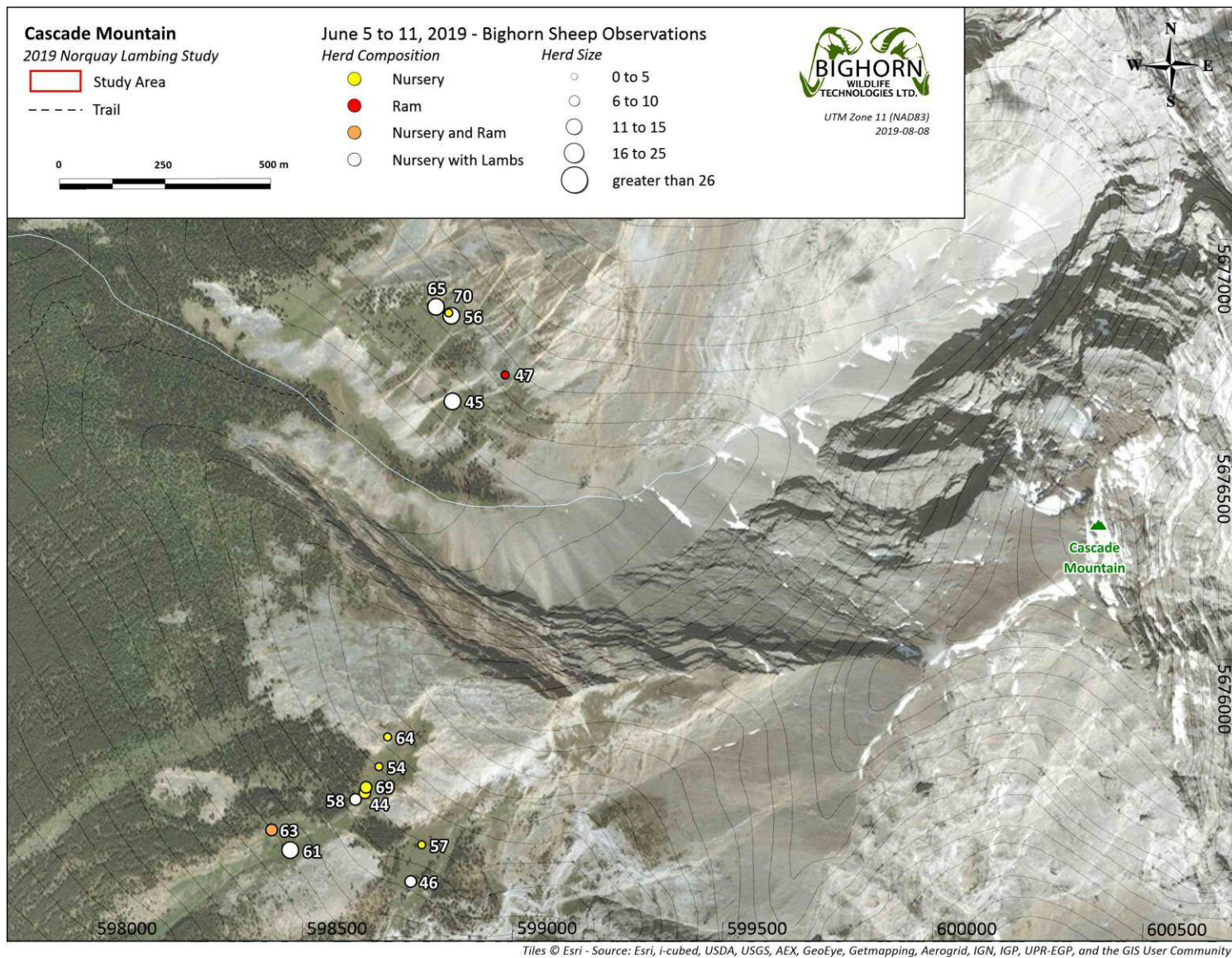




**Figure 7. Bighorn sheep observations in the Mount Norquay study area, June 5 to 11, 2019.**

Refer to Table 1 for observation details.





**Figure 8. Bighorn sheep observations on Cascade Mountain, June 5 to June 11, 2019.**

Refer to Table 1 for observation details.

### 4.3 Post Lambing

On June 17, ewes with five lambs were observed by the Norquay staff near the Cliffhouse Bistro (Appendix II, Photo 24). The group was in the area from June 14 - June 17, indicating return of the ewes with lambs from their lambing locations to occupy summer range on Mount Norquay. Subsequent observations provided by Norquay staff indicate that ewes with lambs frequent the higher elevations on Mount Norquay in the summer. In the summary below, parentheses indicate the number of sheep sighted in a group during one observation. Multiple observations on the same day at the same location may be of the same animals:

<u>At Cliff House:</u>	Ewes: July 1 (2) Ewes & Lambs: July 28 (2 ewe, 2 lamb) Lambs: July 18 (2) Rams: July 2 (1)
<u>Below Cliff House:</u>	Ewes & Lambs: June 22 (3 ewe, 1 lamb) Mixed Herd: June 24 (25)
<u>Above Waterfall:</u>	Ewes & Lambs: June 23 (4 ewe) (3 ewe, 1 lamb); June 30 (2 ewe, 2 lamb) Mixed Herd: June 30 (4 ewe, 3 lamb, 2 ram) Rams: August 3 (3)
<u>Within VF Zone:</u>	Ewes: June 27 (3 ewe on ridgetop), July 18 (1 ewe) Ewes & Lambs: June 22 (1 ewe, 1 lamb); (3 ewe, 3 lamb); June 23 (3 ewe, 1 lamb); June 24 (6 ewe, 9 lamb) (3 ewe, 3 lamb), (2 ewe, 2 lamb), (8 lamb, 7 U/C); July 10 (2 ewe, 2 lamb ridgetop); July 11 (9 ewe, 4 lamb); July 12 (1 ewe, 1 lamb (3 ewe 3 lamb); July 14 (4 ewe, 4 lamb); July 24 (3 ewe, 1 lamb); July 28 (5 ewe, 3 lamb) Mixed Herd: June 25 (1 ewe 1 ram); July 13 (1 ewe, 1 ram)
<u>Under the N Am Chairlift:</u>	Ewes: (June 26 (3 ewe) Ewes & Lambs: June 24 (3 ewe, 3 lamb) (5 ewe, 3 lamb)
<u>N Am Lodge parking lot</u>	Ewes & Lambs: July 25 (1 ewe, 1 lamb)

### 4.4 Bighorn Sheep with Ear Tags

During the study, three bighorn sheep with yellow ear tags - NQY-09 (ram), NQY-13 (ram) and NQY-20 (ewe) - were observed. These sheep were tagged as part of the Banff Bighorn Sheep Health Study (pers. comm. Bryan Macbeth, Banff National Park).

NQY-13 was seen on May 26, 2019 in the Green Spot with nine other rams (obs #10) and again on June 5, 2019 in the meadow below the Cliffhouse Bistro along with NQY-09 and eleven other rams (obs #48).

NQY-20 was observed in the Green Spot on June 8, 2019 with a male yearling (obs #60).

One untagged ewe was easily distinguishable by a missing right horn (MRH). MRH was observed with the nursery herd on May 27 (Norquay Access Road), May 28 (Access Road 3), June 3 (Norquay Meadows) and June 6, 2019 when she was observed alone walking south on the Scrambler's Trail above the Cliffhouse Bistro (obs# 14, 20, 37 and 55; Appendix II, Photo 21).

## 5.0 SUMMARY

The peak lambing period for bighorn sheep in Alberta's Rocky Mountains has been identified as the last two weeks of May, first week of June. To determine whether the Norquay Ski Resort was used for lambing, 17 surveys on four routes covering the Norquay access road, Mount Norquay ski slopes, Via Ferrata area and slopes of the Unnamed Valley west of the Via Ferrata including along the ridgeline above the Cliffhouse Bistro, were completed between May 22 and June 11.

The number of adult ewes using the Mount Norquay study area declined between May 27 to June 4, 2019. Corresponding with this time frame, ewes with new lambs were observed on Cascade Mountain's west slopes on June 5, 6, 8 and 9, 2019, however, it is not possible to know if the ewes observed on Cascade Mountain had been the same ewes using the slopes on Mt Norquay. Ewes were not observed lambing within the Mount Norquay study area.

Nursery groups of ewes with lambs were observed on Mount Norquay on June 14 by Norquay staff and through the end of June and July at higher elevations. It is unknown where these lambs were born. These ewes appear to be using the Mt Norquay ski slopes as summer range.

It is not known where the ewes that occupied Mount Norquay before lambing went for lambing. Telemetry/GPS techniques would be required to answer this question.

## 6.0 REFERENCES

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Skjonsberg, T. 1993. *Eastern Slopes wildlife study, 1984-1987*. Final Technical Report, Parks Canada, Banff National Park, Banff, AB.

## APPENDIX I. Daily Summary of Survey Routes, Weather and Significant Events

**Appendix I, Table 1. Survey route summary, Mount Norquay lambing study, May 22 - June 11, 2019.**

Date	Route
22-May-19	Access road, ski slopes
24-May-19	Access road, ski slopes
26-May-19	Access road, ski slopes, North American Chairlift
27-May-19	Access road, ski slopes, Unnamed Valley Station 1
28-May-19	Access road, ski slopes, Station 2
29-May-19	Access road, ski slopes, Unnamed Valley Station 1
30-May-19	Access road, ski slopes, Hike to Top of Spirit Chair
31-May-19	Access road, ski slopes, Unnamed Valley Station 1
2-Jun-19	Access road, ski slopes, Station 2
3-Jun-19	Access road, ski slopes North American Chairlift
4-Jun-19	Access road, ski slopes, North American Chairlift, Norquay Ridge, Unnamed Valley Station 1
5-Jun-19	Access road, ski slopes, North American Chairlift, Norquay Ridge
6-Jun-19	Access road, ski slopes, North American Chairlift, Norquay Ridge
7-Jun-19	Snowing - no observations
8-Jun-19	Access road, ski slopes, North American Chairlift, Norquay Ridge
9-Jun-19	Access road, ski slopes, North American Chairlift, Norquay Ridge
10-Jun-19	Access road, ski slopes, North American Chairlift, Norquay Ridge
11-Jun-19	Access road, ski slopes

**Appendix I, Table 2. Weather, Mount Norquay lambing study, May 22 - June 11, 19.**

Weather data provided by *Alberta Agriculture and Forestry* and *Environment and Parks*.

Date	Observed weather	Air Temp. Min. (°C)	Air Temp. Max. (°C)	Air Temp. Avg. (°C)	Precip. (mm)
22-May-19	N/A	3.4	16.2	8.9	0
24-May-19	Low clouds, heavy rain	5.2	13.2	7.9	6.9
26-May-19	Overcast	-1.5	15.6	6.6	0.2
27-May-19	Clear, sunny	-2.9	21.0	9.8	0
28-May-19	Clear, sunny	0.3	23.1	12.8	0
29-May-19	Clear, sunny	2.0	25.6	14.8	0
30-May-19	Overcast	9.3	18.5	13.8	0
31-May-19	N/A	5.2	24.1	13.7	0
2-Jun-19	Clear, sunny	5.1	25.8	17.1	0
3-Jun-19	Mostly clear, sunny	10.2	23.1	17.1	0
4-Jun-19	Clear, sunny	2.8	20.5	12.7	0
5-Jun-19	Overcast	3.9	19.1	11.6	0
6-Jun-19	Intermittent storms	5.9	15.2	9.9	1.58
7-Jun-19	Snow	0.4	7.1	3.3	19.5
8-Jun-19	N/A	0.1	12.6	6.1	0.3
9-Jun-19	Overcast	2.0	15.9	8.8	0
10-Jun-19	Mixed sun and cloud	2.9	16.6	10.6	0
11-Jun-19	N/A	6.8	20.4	13.8	0

**Appendix I, Table 3. Bighorn Sheep chronology of events - Mount Norquay lambing study.**

Date	Event
22-May-19	First day of observations for Norquay Lambing Study
26-May-19	First day of observations from the North American Chairlift
27-May-19	North American Chairlift closes for maintenance (re-opens June 3, 2019)
30-May-19	One wolf observed at the Green Spot and one observed at Road 2
30-May-19	Majority of ram observations move from the Green Spot / Norquay access road to Mount Norquay ski slopes
2-Jun-19	First day composition of nursery herd shows less ewes
3-Jun-19	North American Chairlift Reopens
3-Jun-19	Two 1/2 curl rams observed on Scrambler's Trail north of the Via Ferrata descent gully
4-Jun-19	First day of observations from ridgeline above Norquay Via Ferrata
4-Jun-19	Three rams observed walking on cliffs above Cliffhouse Bistro
5-Jun-19	First lambs of the year sighted on Cascade Mountain
6-Jun-19	One ewe observed on Scrambler's Trail
11-Jun-19	Last day of observation for Norquay Lambing Study
17-Jun-19	First day summer groups of ewe and lambs observed on Norquay ski runs below Cliffhouse Bistro
17-Jun-19	Black bear observed on ski runs above North American Lodge



## APPENDIX II. Photo record Norquay Lambing Study, 2019

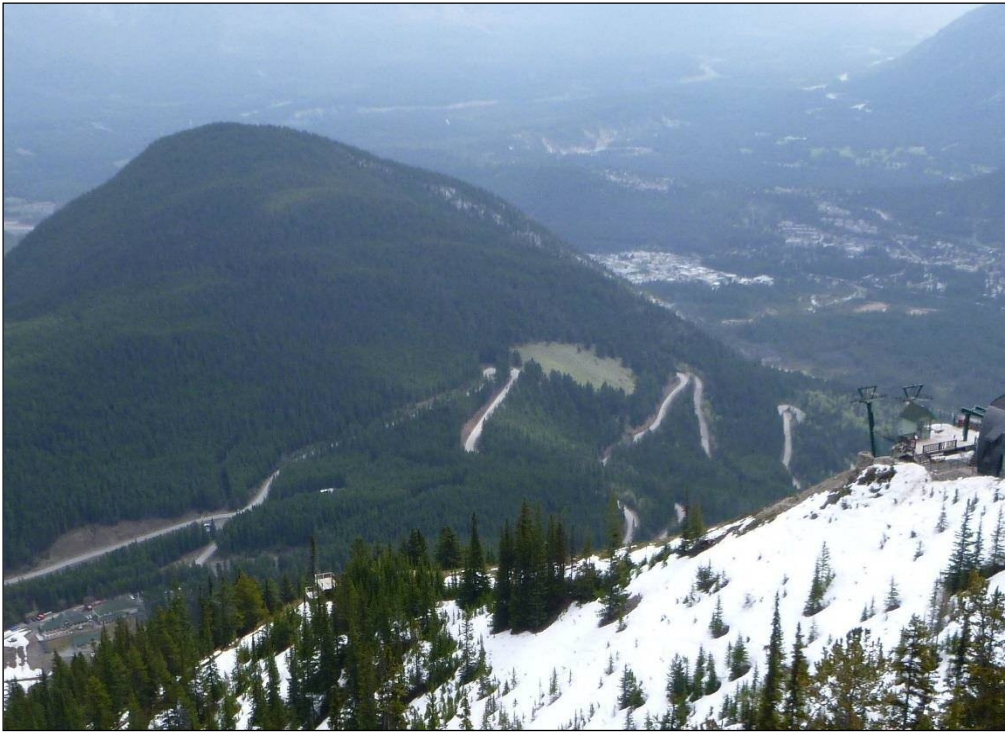


Photo 1: The Green Spot as seen from above the North American chairlift on right, May 26, 2019.

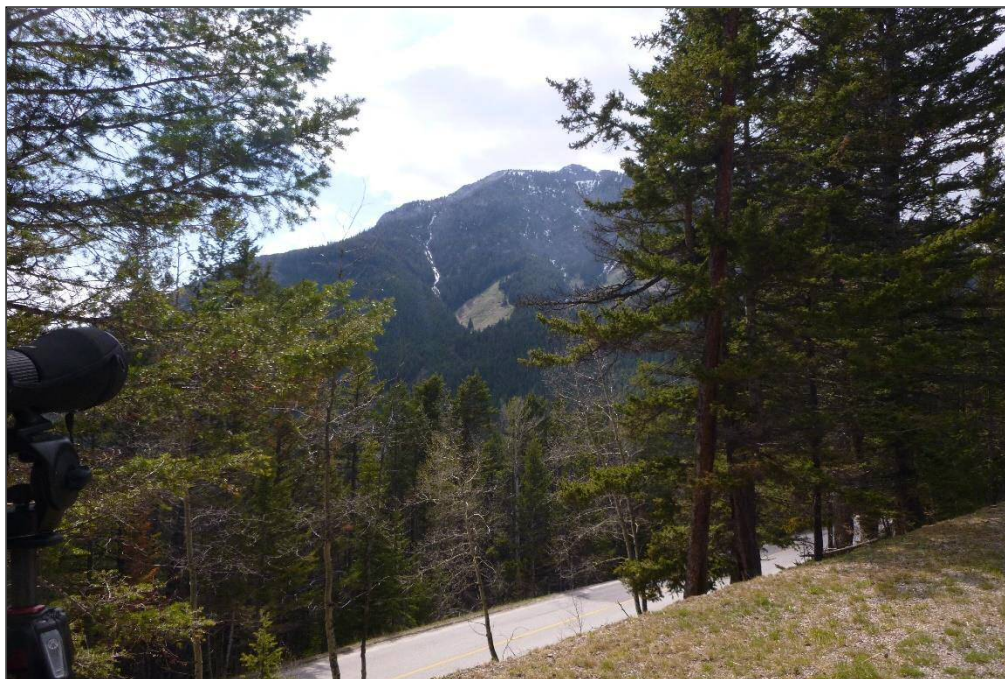


Photo 2: Norquay South Meadow observed from Norquay Access Road, May 26, 2019.

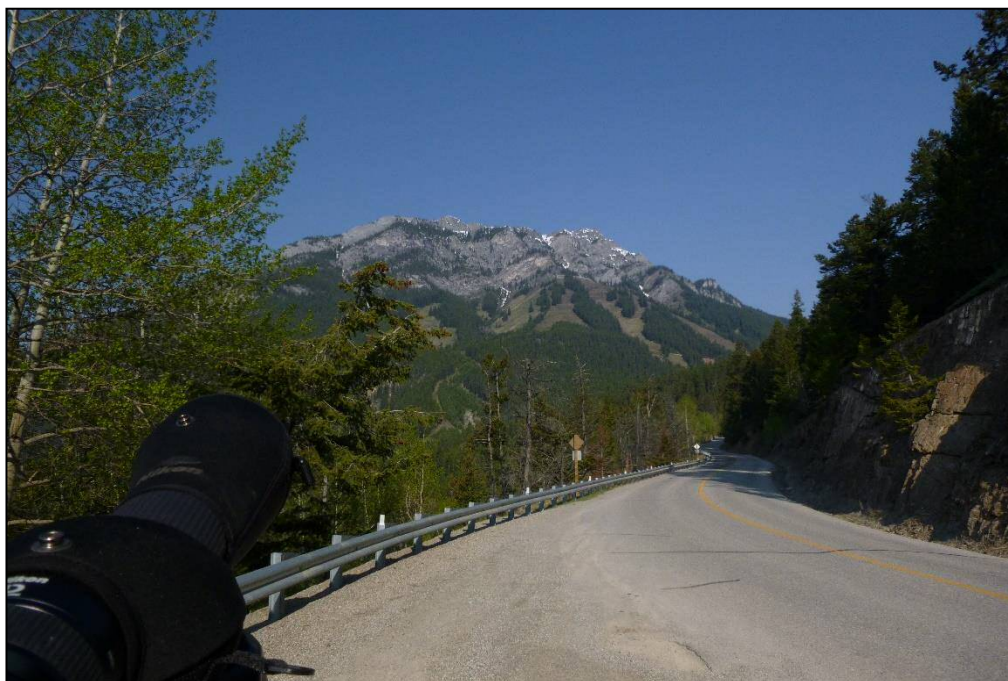


Photo 3: Mount Norquay ski runs as seen from the Norquay access road (Road 2), May 29, 2019.



Photo 4: Norquay Ski Hill as seen from the North American Lodge, May 27, 2019.





Photo 5: View of west-facing slabs in Unnamed Valley from Stop 1, May 27, 2019.



Photo 6: Rock promontory in Unnamed Valley on the west side of the Via Ferrata ridgeline, June 9, 2019.



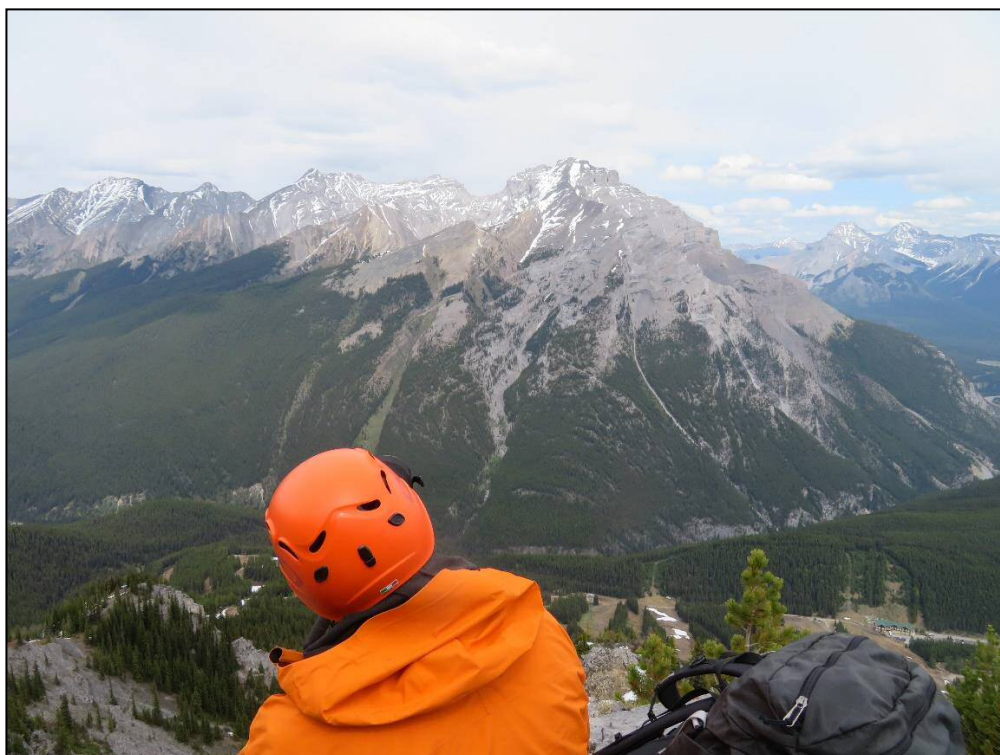


Photo 7. View of the west slopes of Cascade Mountain from the Via Ferrata ridgeline, June 5, 2019.



Photo 8. Rams on Green Spot (see #10), May 26, 2019.



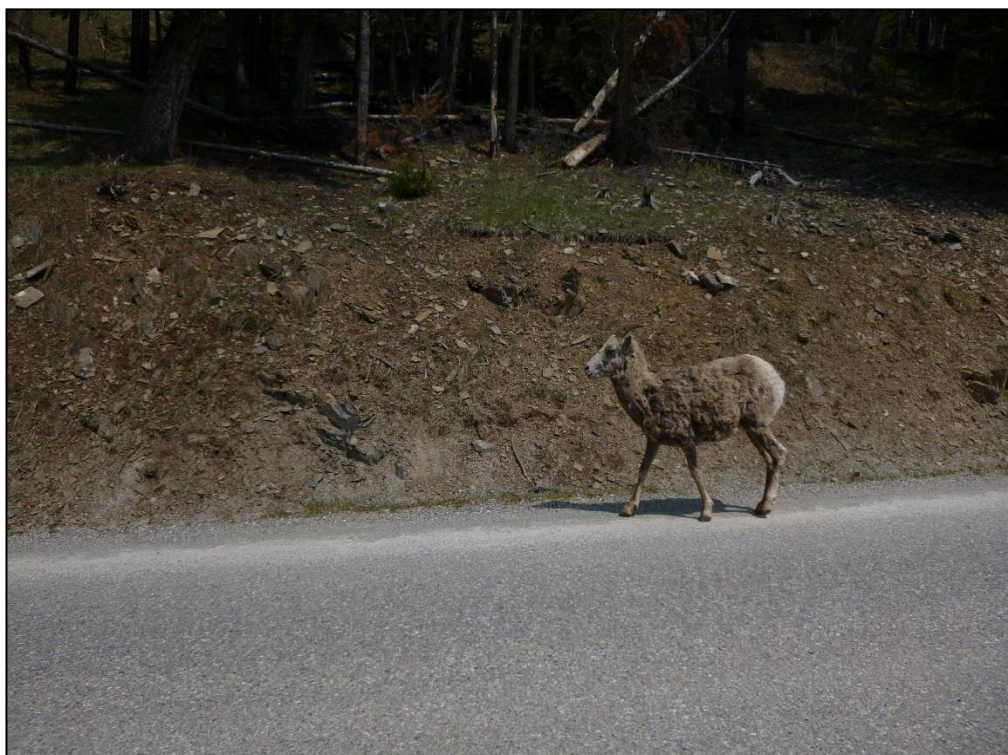


Photo 9: Bighorn Sheep (ewe - missing right horn), Norquay Access Road (see #20), May 28, 2019.



Photo 10: Bighorn sheep ram, Norquay Access Road – Road #2 (#26), May 30, 2019.





Photo 11: Grey wolf watching bighorn ram, Norquay Access Road – Road #2, May 30, 2019.

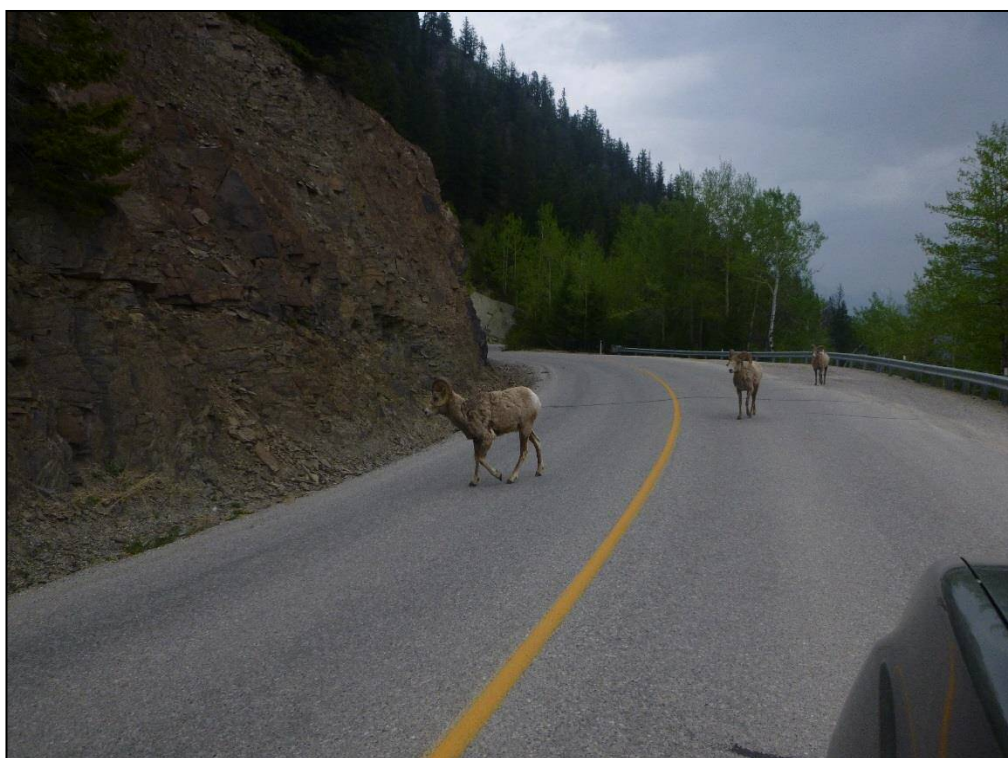


Photo 12: Bighorn Sheep (rams), Norquay Access Road, May 30, 2019.





Photo 13: Bighorn Sheep nursery herd (11 ewes, 12 yearlings, 9 - ¼ curl rams, Norquay Meadows (#37), June 3, 2019.



Photo 14: Bighorn Sheep nursery herd, Norquay Meadows, June 3, 2019.





Photo 15: Rams walking on Scrambler's Trail (#38),  
June 3, 2019.



Photo 16: Bighorn Sheep (ewe and lamb), Cascade Mountain,  
June 5, 2019.





Photo 17: Bighorn Sheep (five ewes and four lambs), Cascade Mountain (#58), June 5, 2019.



Photo 18: Bighorn Sheep (four ewes and four lambs), Cascade Mountain, June 6, 2019.

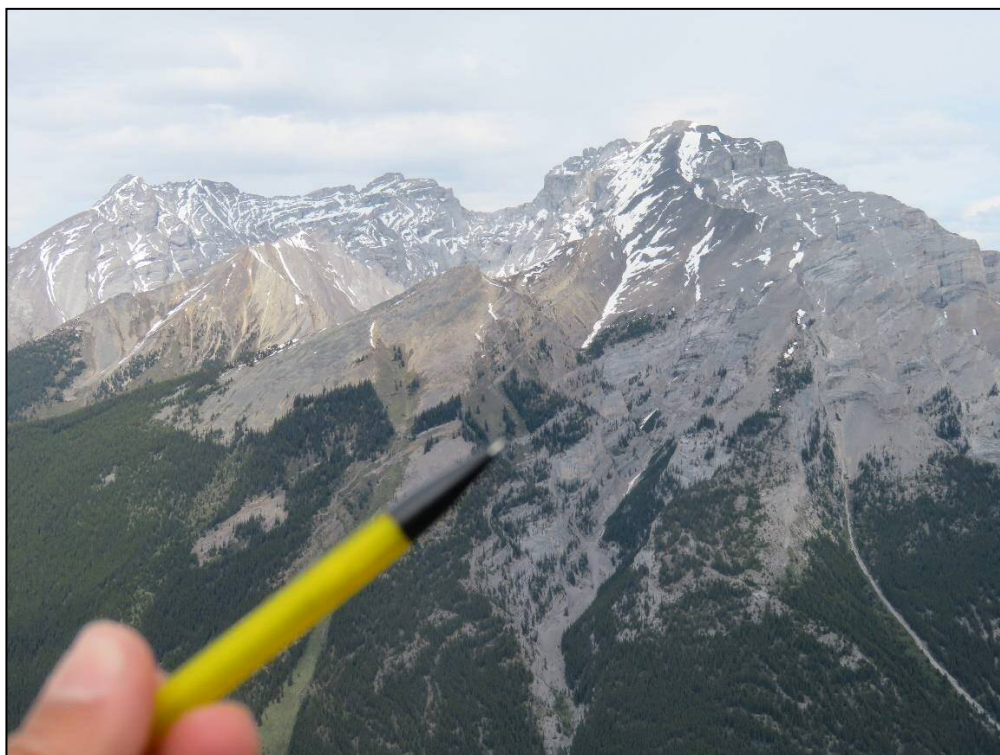


Photo 19: Location of 4 ewes & 3 lambs on Cascade Mountain (#46),  
June 5, 2019.

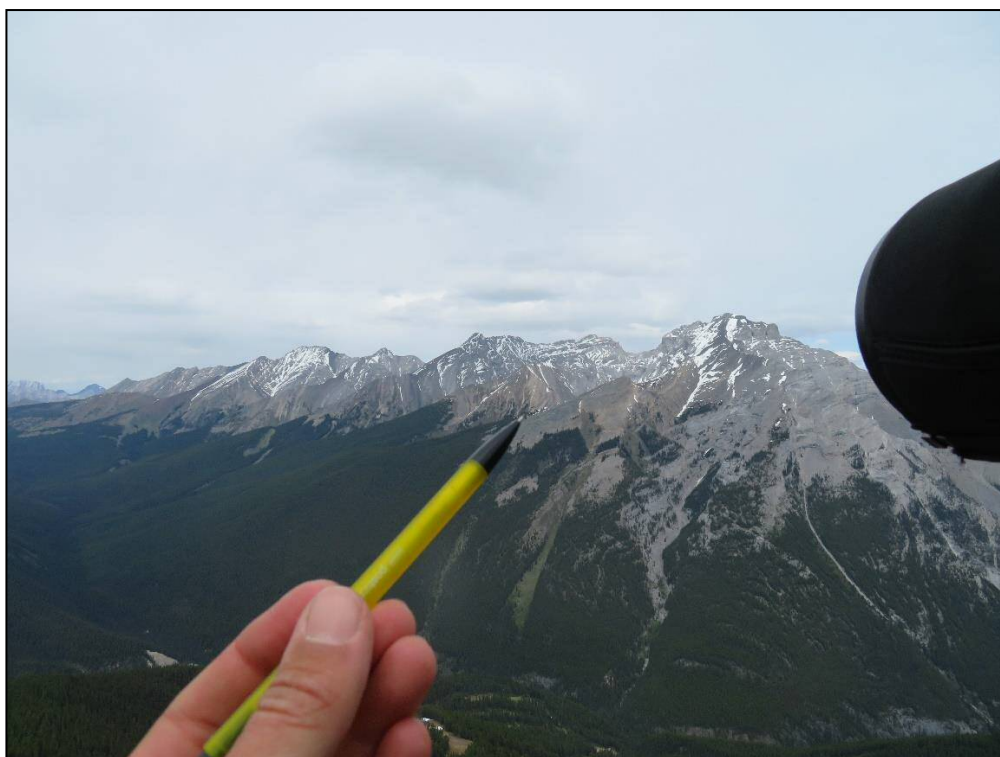


Photo 20: Location of one ram on Cascade Mountain (#47),  
June 5, 2019.





Photo 21: Bighorn Sheep ewe (missing right horn) walking south on the Scrambler's Trail above the Cliffhouse Bistro (#55), June 6, 2019.

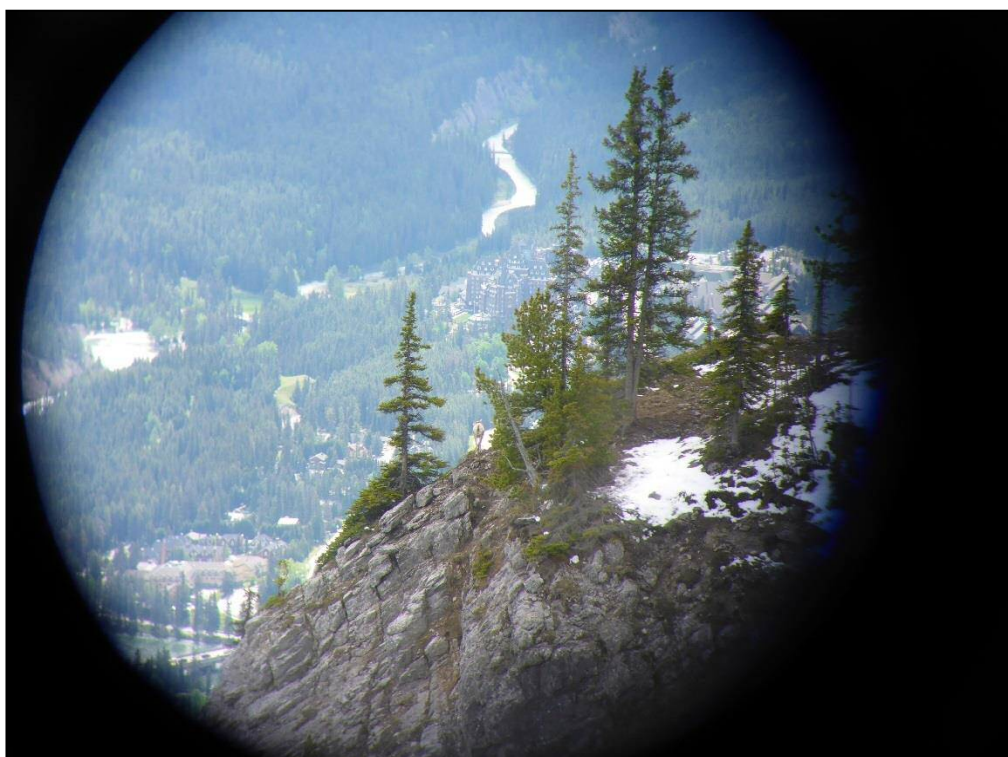


Photo 22: Bighorn Sheep ewe (2 years) on ridge above Cliffhouse Bistro (#68), June 10, 2019.





Photo 23: Bighorn Sheep (rams) under the North American Chairlift (see #67),  
June 10, 2019.



Photo 24: Ewes and lambs below the Cliffhouse Bistro,  
June 17, 2019. (Photo John Thornton).