Stone's sheep seasonal range and habitat use in the Russel, Swannel and Tatlatui ranges, northern BC: 2021/22 Progress Report

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Acknowledgements

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Abstract

Stone's sheep are an iconic northern wildlife species with significant socioeconomic, cultural, and ecological value, but in parts of their range, critical knowledge gaps compromise effective conservation and management. Sheep range in British Columbia's Region 7A Omineca is poorly known and constitutes the south-central portion of global Stone's sheep range. This project aims to define herd boundaries and habitat selection in the Tatlatui, Swannel, and Russel ranges (Wildlife Management Units 7-38, 7-39, 7-40, 6-18) to better monitor and evaluate population trends, harvest pressure, and habitat enhancement options.

The project began in 2021/22 with collar purchase and planning, although discussions had been on-going since 2020 among government biologists, First Nations, stakeholders, and contractors. We deployed 13 satellite GPS collars on ewes in the study area in February 2022 and conducted a June lamb-at-heel survey. Lamb recruitment was 34 lambs per 100 ewe-like sheep based on all sheep observed, or 33 lambs per 100 ewes based on lamb-at-heel status of collared ewes.

Introduction

Background

Knowledge gaps for thinhorn sheep are extensive: disease, seasonal range suitability/capability, impact of land use activities (including industrial development and fire suppression), predation dynamics, and cumulative effects (Demarchi et al 2004, Gordon et al. 2008). The importance of addressing these key knowledge gaps has been recognized by stakeholders, First Nations, and biologists. Stone's sheep occur in small pockets in Wildlife Management Units (WMUs) 7-38, 7-39, 7-40, and 6-18 in the Tatlatui, Swannel, and Russel ranges. The most recent survey in the Russel Range was in 2020 and suggested an apparent 50% decline since the previous survey in 1993 (Anderson 2020, Corbould 2001). The 1993 survey had a higher abundance than expected based on the previous 1985 survey, and it is not clear whether 1993 represented an anomalously high estimate or a decline. Nothing is known about the movements, habitat use, seasonal ranges, survival, recruitment, or health of this population, making it difficult to even hypothesize reasons for the apparent decline. This project addresses key knowledge gaps to inform Stone's sheep management by defining herd ranges and habitat selection to monitor population trends, assess harvest rates, and evaluate habitat enhancement options.

We will be working closely with First Nations and stakeholders throughout all stages of the project – Kwadacha First Nation, Tsay Keh Dene Nation, BC Parks, BC Ministry of Forests, and Wild Sheep Society of BC are all collaborators on this project. We plan to deploy 20-30 satellite GPS collars on Stone's sheep in the Tatlatui, Sustut, Swannel, and Russel ranges in WMUs 7-38, 7-39, 7-40, and 6-18. The emphasis will be on collaring ewes because of the importance of adult females to population dynamics, and because monitoring collared ewes also gives us recruitment information. However, we also plan to collar a smaller sample of young rams to gain a better understanding of sex-specific movements and seasonal habitat use. Collars are programmed to collect locations every 4 hours (6 per day) with an 8-hour mortality signal to assess cause-specific mortality. We will monitor survival (Kaplan-Meier survival estimator) and lamb recruitment over the course of the study. We are anticipating 3-year collar deployment and data collection 2022-2025.

Health samples will be collected during capture and mortality investigations following established protocols and coordinated by the BC Wildlife Health Team. Although there is no known current contact with domestic sheep or goats, baseline monitoring would be important in assessing risk factors for population health. This will help inform WSF's Conservation Vision 2025 Goal 5b: Develop strategies to address wild sheep challenges – fund and encourage collaborative disease research by wild and domestic sheep interests.

Seasonal habitat selection will be assessed at the landscape scale and the home range scale. Home ranges of all collared sheep will be assessed along with incidental observations and local knowledge to update herd range boundaries. At the coarse scale, we will examine where sheep home ranges occur within the study area, compared to the available landscape. This will provide an indication of the most important limiting factors for Stone's sheep in this interior snowbelt at the southern edge of their range. At the finer scale, we will assess areas within individual home ranges that sheep use and select. This will

provide us with information at a scale more relevant to management and to assessing habitat enhancement options. This will help inform WSF's Conservation Vision 2025 Goal 1e: Enhance wild sheep habitat – promote and enable active management on private and public land.

We plan to expand the project in 2022-23 to use the collar data as a basis for an assessment of Stone's sheep nutrition and range condition, which will also draw on collars currently deployed on the Dunlevy and Schooler herds, southeast of the study area along the Peace Arm of the Williston Reservoir. Collar types and schedules, mortality investigations, and assessments of survival and recruitment follow the same protocols for Peace Arm and Finlay-Russell sheep, allowing us to compare several herds that likely experience different limiting factors. This will allow us to make stronger inferences on management actions to address limiting factors to enhance sheep populations. The project overall is well-aligned with WSF's objective to promote scientific wildlife management.

Project Objectives

1. Define herd boundaries for low-density Stone's sheep populations in a largely unmonitored area in the southern part of their range to better inform population trend monitoring, harvest monitoring, and disease transmission risk.
2. Determine seasonal habitat use of Stone's sheep in a largely unmonitored area in the southern part of their range to better inform habitat enhancement options.
3. Continue to expand health monitoring of thinhorn sheep in BC using consistent protocols and coordinating with BC Wildlife Heath Team.
4. Assess nutritional status and range condition for sheep in the Finlay-Russel to inform enhancement options (to be initiated in 2023)

Methods

Study Area

We defined the study area as sheep range in WMUs 7-38, 7-39, 7-40, and 6-18 in the Tatlatui, Swannel, and Russel ranges (Figure **1**). Most sheep are in the eastern part of the study area, but study objectives also include monitoring lower density populations to the west. The study area is at the northern end of the Omineca Range, extending to the Cormier Range in the Cassiar Mountains at Prairie Mountain and falling under the Cassiar Mountains (CAR) and Northern Omineca Mountains (NOM) Ecosections in the Northern Boreal Mountains Ecoprovince (Meidinger and Pojar 1991). Valley bottoms are generally in the dry cool Boreal White and Black Spruce biogeoclimatic (BEC) zone (BWBSdk) with subalpine areas dominated by moist very cold Engelmann Spruce-Subalpine Fir (ESSFmv1) and moist cool Spruce-Willow-Birch (SWBmk1) BEC zones (Meidinger and Pojar 1991). The Alpine Tundra (AT) zone is present above tree line, which is at 1500-1600 m ASL, with most mountain peaks ranging between 1800-2200 m.

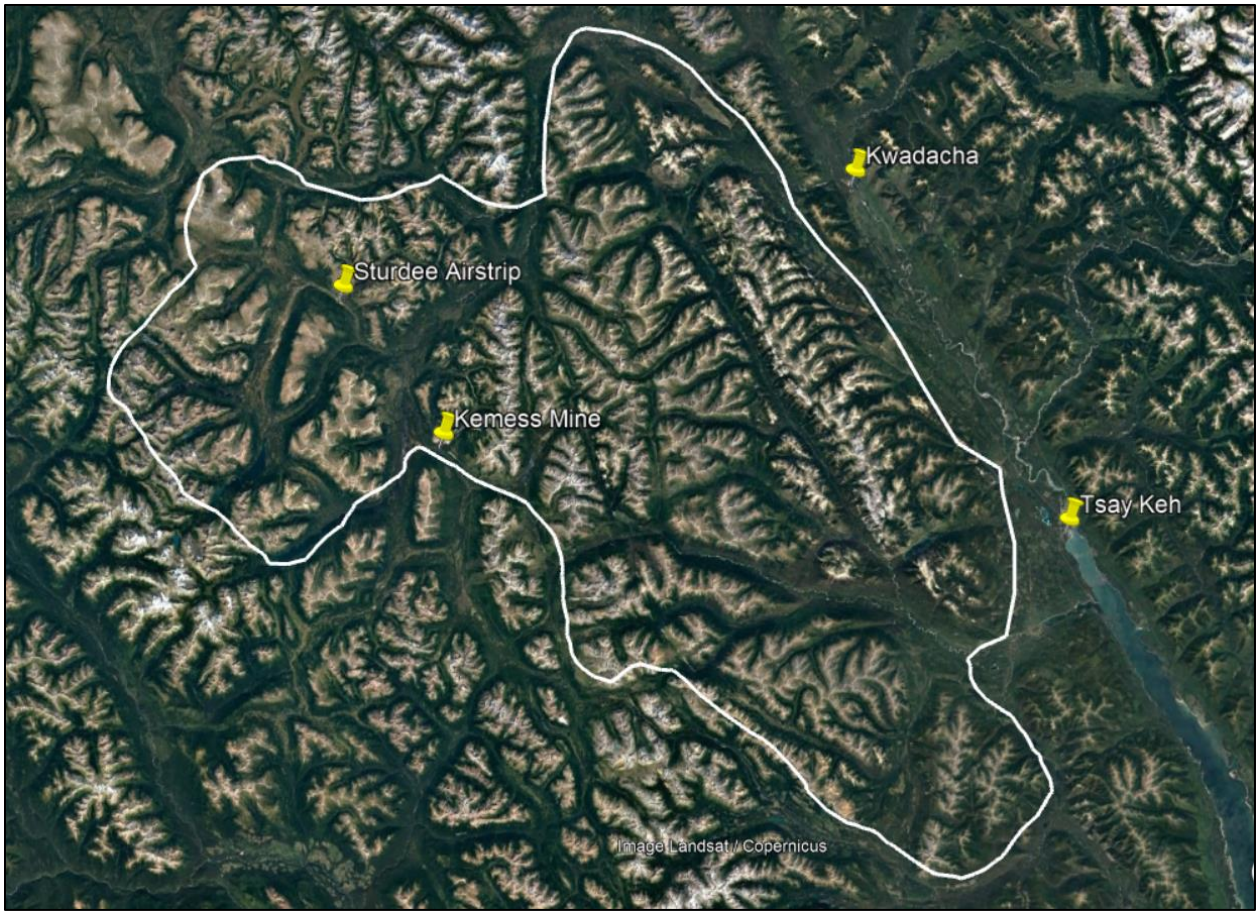

Figure 1. Approximate study area for the Finlay-Russel Stone's sheep project.

Collar Deployment and Sample Collection

We conducted sheep captures, collaring and health sampling in mid-Feburary using experienced crews following Resource Inventory Standards Committee (RISC) protocols. Capture activities were conducted using aerial net gunning on high elevation winter ranges. The provincial wildlife veterinarian, Dr. Caeley Thacker, a highly experienced thinhorn sheep specialist, was to ensure proper sample collection and handling. When we were able, a crew flew the intended capture locations in both ranges prior to capture activities during a March survey, to increase efficiency during captures. A fixed-wing aircraft (Cessna 210) was used to check areas of unknown sheep occupancy and locate groups in low density areas to increase capture efficiency.

Aerial net gun capture activities were conducted using a AS350 (A-Star) B2 helicopter (Krausman et al. 1985), with right-hand sliding door and a crew consisting of an experienced mountain helicopter capture pilot, a certified and experienced net gunner and two handling crew members/navigators. Current and historic late winter range use data were used to determine suitable areas for capture (Watts and Child 1986, Anderson 2020). Once the capture crew arrived in the area, any unmarked adult sheep were identified in the bands and a target animal was chosen. The safety of each capture event, for both the crew and sheep, was fully assessed by the crew prior to proceeding. If the sheep were in an unsafe position, or conditions were not right (slope, hazing distance, snow depth, slope, wind) the capture attempt was aborted.

Once captured, sheep were restrained with hobbles, blindfolded and their rectal temperature was taken. Processing was completed as quickly and quietly as possible to reduce stress; it included marking and sampling the animals and collection of the following data: sex, age (estimated from horn annuli), body condition, hair loss, body morphometrics, evidence of previous lactation, incisor condition and wear.

Sampling followed the official protocol of the BC Wildlife Health branch, using standard sampling kits and equipment, as well as the provincial sheep capture form. The primary samples included blood, hair, skin biopsies, nasal swab, ear swab and fecal pellets. Each animal was scored for body condition by palpating the loin muscle and spine and each animal also underwent a rump fat ultrasound.. Any abnormalities such as parasites or discharge were also sampled if noted. Teeth and horns were photographed to help estimate age class based on horn annuli and tooth eruption and wear. Once collected, biological samples were sent to the provincial wildlife health lab in Nanaimo. They were then forwarded for analysis of various parameters, including pregnancy status, serology, serum trace mineral levels and parasites.

Each sheep was marked with a unique ear tag number combination and GPS collar. The ear tags will allow observers to identify individual sheep on surveys when more than one collared animal is in the same group. Sheep received one of two types of Vectronic GPS/VHF transmitting collars: model Vertex Lite Iridium Collar or model Survey-2D Iridium Collar; Vectronic aerospace GmbH, Germany. These collars use Iridium satellites that allow for two-way communication and the ability to change location or "fix" rates used for data collection. Both collars are programmed to obtain a fix four times/day (every six hours) to provide an adequate monitoring period.

Lamb-at-heel survey

Lamb surveys will be conducted three times a year: 1) late June/July – lamb production, 1) November/December – summer/fall survival and 3) March – over winter survival/recruitment. During each survey, collared ewes are located using a combination of telemetry and the most recent GPS locations received from the collar.

Each aerial survey crew consisted of an experienced navigator and two previously trained or experienced observers. Surveys were conducted in a Bell 206B Jet Ranger with bubble windows, consistent with aerial wildlife survey standards[1]. The navigator used a GPS enabled tablet using either Gaia GPS or Avenza Maps applications to allow for real-time recording of the locations of the helicopter. The most recent locations of all collared sheep were downloaded onto the tablet the morning of the survey, and used to navigate to the approximate location of each collared sheep. Once in the general vicinity of the sheep, aerial telemetry was used to further navigate to the exact location of each collared sheep. When a telemetry signal was detected, the navigator guided the aircraft to the vicinity of the collar signal. Once a collared sheep was located, photos were taken of the animal/group and the following information was recorded: observation time, date, presence or absence of a lamb(s), group size, group composition, study area, general location, general weather conditions, animal identification, species, habitat type and any other comments (e.g. hair loss, abnormal horn growth, predators nearby etc.). Where possible all sheep were classified using the classification diagram (Figure 2) developed by Geist (1971) for bighorn sheep.

[1] See standards and methods for aerial inventory at www.for.gov.bc.ca/htc/risc/pubs/tebiodiv/ungulatesv2/unga_ml20final.pdf

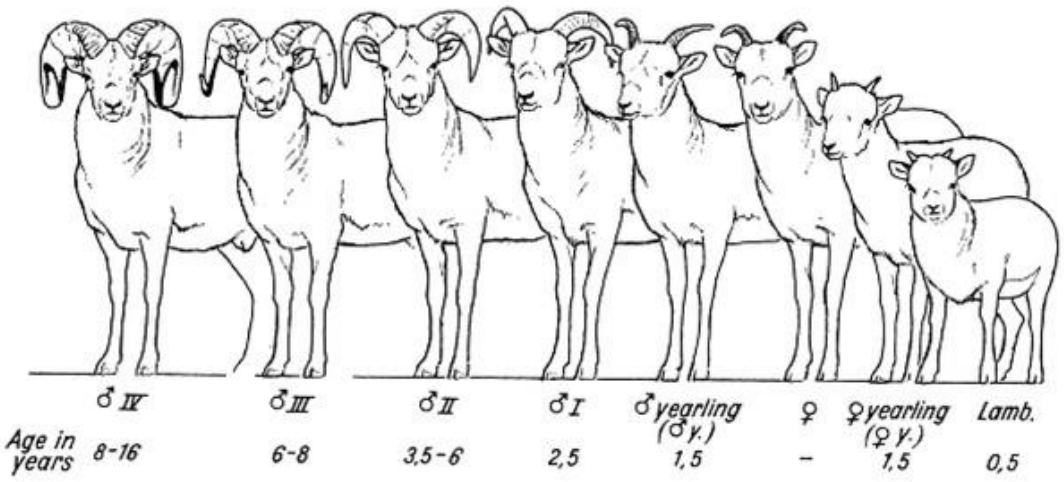

Figure 2. Classification diagram for bighorn sheep from Geist (1971).

Results

Collar deployment

We flew 7 hours in the fixed wing aircraft (Cessna 210) to check areas of unknown sheep occupancy to focus capture efforts. The spotter plane was especially helpful for areas far from fuel and in such a large landscape to prioritize areas for capture and is recommended for captures next year as well. Capture conditions were good (around -20°C, winds variable, clear or high overcast, near complete snow cover) and we had no major injuries or mortalities. We flew 20.1 hours in the capture helicopter, capturing, collaring and sampling 13 sheep.

Six of the captured ewes had no lamb-at-heel, one had a lamb, and it was uncertain whether lambs in the group with the other captured sheep were theirs or not. The youngest ewe was 2.5 years old and the oldest was 12.5 years old. Ultrasonography of rump fat revealed very little fat (0-5 mm), which is expected for thinhorn sheep in late winter, and body condition scores were between 1-2.5. The ewes were all of similar size: 153 ± SE 7 cm body length, 102 ± SE 5 cm chest girth, 39 ± SE 1 cm neck girth.

Figure 3. Stone's sheep ewe in escape terrain on a cliff near rolling ridgeline – she remained in the cliff and did not get a collar (photo – Caeley Thacker).

Figure 4. Left: Morgan Anderson and Fraser MacDonald collaring an ewe near Kemess Mine. Right: Caeley Thacker uses a portable ultrasound to assess rump fat depth on a captured ewe. Photos – Rob Altoft.

Figure 5. Photos of horn shape and morphology help identify individual ewes (left) as well as providing information on age by counting annuli (middle). The oldest captured ewe was 12.5 yrs old (right). Photos – Morgan Anderson.

Blood and serum were collected from each sheep for health testing, but diagnostic labs have been backlogged and samples have not been analyzed. The exception is the swabs taken to test for *Mycoplasma ovipneumoniae*, all of which came back negative. Fecal pellets, tissue (ear biopsy punch from ear tag), and hair samples have been archived for future work.

Lamb-at-heel survey

We conducted a lamb-at-heel survey in 8.3 hours (including ferry from Fort St. John) in a Bell 206 Jet Ranger (RISC 2002). We counted 136 sheep, including 32 lambs (34 lambs per 100 ewe-like sheep). We took high resolution photos of large groups to attempt a more detailed sex/age classification, and generally yearlings were noticeably smaller. Class I rams may still have been confused with ewes from the photos based on angle and focus, but if our sex/age estimates are reliable, it would suggest 21 yearlings per 100 ewes and 41 lambs per 100 ewes. Class 1 rams are likely still included in the 'ewe' group though, as we did not identify any Class I rams on the survey. Based on the lamb-at-heel status of the collared ewes (4 with lambs, 1 uncertain, 8 without lambs) we estimate 33 lambs per 100 ewes.

Lamb ratios in June were somewhat lower than observed later in the year in 2018-19 (46 lambs per 100 ewe-like sheep in September) and 2019-20 (37 lambs per 100 ewe-like sheep in March), although similar to the July 1985 survey (Watts and Child 1986, Klaczek and Anderson 2019, Anderson 2020).

Figure 6. Checking collared ewes for lamb-at-heel status. Ear tags help identify individuals when more than one collared sheep is present in a group (top left sheep in top photo has a yellow tag in right ear; middle sheep in bottom photo has a purple ear tag in left ear).

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Appendix 1 - Funding

Note that while this signifies a final report for the purposes of the 2021/22 grant year for the Grant in Aid, this is the first year of a multi-year project. Habitat Conservation Trust Fund support was obtained for 2022/23 as a multi-year project (reapplying for the next 4 years) and we will be applying for Peace-Williston Fish and Wildlife Compensation Program funding for 2023/24 to support the multi-year objectives as well. We are also planning for a Masters student starting Fall 2023 with University of British Columbia – Okanagan. Unfortunately, the project was not discussed as part of the WWSBC request for 2022/23 GIA support, so it is not included in the 2022/23 application.

Partner funds received:

Habitat Conservation Trust Foundation $5,000 in 2021/22; $46,580 in 2022/23

BC Ministry of Forests Land-based Investment Strategy $50,000 in 2021/22; $20,000 in 2022/23

Wild Sheep Society of BC contributed 20 collars and the first year of data fees (~$34.6K value)

In-kind contributions of staff time not quantified – Kwadacha Wildlife Guardians and BC Ministry of Forests wildlife biologist.

Use of WSF funds:

Expense	Subtotal (CDN)	GST (CDN)	Total (CDN)
Heli time $3267.50/hr for 3 hrs	$ 9,802.50	$ 490.13	$ 10,292.63
Tsay Keh observer	$ 300.00		$ 300.00
Accommodation at Kwadacha	$ 4,725.00	$ 236.25	$ 4,961.25
FW scouting, 8 hrs $650/hr	$ 5,485.20	$ 274.26	$ 5,759.46
*June lamb survey heli time**	$ 14,942.67	$ 747.13	$ 15,689.80
Total Spent	$ 35,255.37		**$ 37,003.14**
Total Available	$ 24,000 USD		

*Excess cost not covered under GIA was billed to HCTF funding