

# Living Lab Program for Climate Change and Conservation - Final Report



## Planning for Resilient Mountain Goat Populations Using Indigenous Knowledge and Science

### Research findings

Findings from this project indicate that:

- Mountain goat density in Kitasoo/Xai'xais (KXx) Territory and the Fiordland Conservancy is low when compared to other coastal and interior population density estimates. Based on a literature review of studies and reports of mountain goat density, goat density in KXx Territory falls below the mean for interior and coastal population estimates. Similarly, the number of goats observed per hour of flight time was very low compared to other studies and reports of similar aerial surveys. Raw data and specifics of the results will be shared with the province through formal data share agreements at the Coastal First Nations - FLNRORD Wildlife Engagement table.
- Mountain kid/adult ratios are approximately twice as high in KXx Territory and the Fiordland Conservancy compared to other mountain goat populations.
- Despite low density, mountain goats occur across the mountainous areas of KXx territory and the Fiordland Conservancy.
- Knowledge Holders from KXx indicate that the direction of population change for mountain goats in KXx Territory has consistently declined since the 1980's, with the sharpest decreases observed by the majority of respondents between 2000 and 2010.
- Knowledge Holders from KXx also indicate that the frequency of mountain goat sightings has declined, with the sharpest decrease in observations per unit of time beginning in 2000 to the present.
- Provincial harvest records indicate that hunter success rates (a proxy for population abundance) across the entire coastal range of mountain goats has declined since 1976, with the greatest declines beginning in 2000. This decline was not found when data were pooled for wildlife management regions 1, 2, 5, and 6 (encompassing the majority of mountain goat harvest data) nor was it observed for interior populations of mountain goats.
- The development of occupancy models for coastal mountain goats at fine spatial scales was inhibited by the low numbers of goats observed. Subsequent surveys in future years may improve model performance as would sampling at larger spatial scales provided that study objectives and conclusions recognize and account for the change in spatial scale.

## Methods summary

- Mountain goat density was determined from 17 aerial surveys of KXx Territory and the Fiordland Conservancy in 2 successive sampling rounds during August 2019 across 500km<sup>2</sup> of goat summer habitat >1000m in elevation.
- Raw density was calculated as the mean number of goats observed within a sampling round divided by the survey area. A very conservative sightability correction factor of 0.3 was applied to account for missed detections of goats consistent with other aerial survey techniques used in British Columbia, Alberta, Alaska, and Washington State.
- Reports and studies of previously estimated mountain goat density and observations per hour were compiled from ISI Web of Science, the BC Species Inventory Web Explorer, Alaska and Washington Department of Fish and Game, and through direct inquiries to provincial mountain goat specialists in British Columbia and Alaska.
- Semi-structured interviews were conducted with 17 participants from KXx with significant experience (10 – 40 years) working and living in KXx Territories.
- Mountain goat harvest data was compiled for 1976 – 2017 from the Compulsory Inspection Database and the Guide Declaration Database. Calculations of catch-per-unit-effort were performed using mean and median measures of hunter success (number of kills per hunter or 100 hunter days).
- Occupancy models were developed using program RPresence with R ver. 3.6.1.

## Key outcomes for BC Parks

- Coastal mountain goat populations, including those in KXx Territory and the Fiordland Conservancy, have likely declined over the past 20 years based on results from multiple data sources.
- High juvenile/adult ratios are characteristic of populations that have recently declined. The late age of sexual maturity in mountain goats (~4 years old) coupled with potentially long inter-birth intervals while nannies raise kids and high mortality rates in kid goats may result in a slow recovery for mountain goats.
- Coastal mountain goats are likely to experience reductions in viable summer habitat as temperatures rise. In KXx Territory, the maximum altitude of mountains is approximately 2000m which may result in altitudinal shifts to cooler high elevation habitat an unviable adaptive strategy.

## Relevance to BC Parks management

BC Parks should recognize that populations of coastal mountain goats, including those in KXx Territory and the Fiordland Conservancy, have likely declined over the past 20 years. Populations of goats that are in decline, or have recently undergone decline, are likely to be characterized by high kid/adult ratios which means that they are sensitive to disturbance from humans. Recreational and industrial activity should be limited in areas inhabited by recovering populations. In particular, park visitors should remain at a safe distance from mountain goats, especially nannies with kids. The US National Park Service recommends people stay >50 yards away from mountain goats. In addition, mountain goats are known to be sensitive to disturbance from helicopters and low flying drones (see Goldstein et al. 2005, Wildlife Society Bulletin). These activities are common for recreational, commercial, and industrial practices along the coast, but should be limited in areas where mountain goats occur, especially nursery groups with a high

density of nannies and kids. In particular, the mountains on the north and south side of Kynoch Inlet have particularly high densities of kids.

BC Parks should also recognize that the coastal ecotype of mountain goats has a different suite of threats than the interior ecotype. Low elevation mountain ranges that characterize coastal goat habitat have less high elevation thermal refugia by which goats may cope with climate change. Additionally, mining and logging activities may more easily encroach on coastal mountain goat winter and summer habitat compared to interior populations. Our results also show that coarse analyses of mountain goat data that combine coastal and interior goats may mask declines of certain populations. Management should occur at spatial scales relevant to the ecology of the species of interest. Within-species differences (e.g. coastal vs. interior mountain goats) can create the potential to overlook negative outcomes.

Management should also occur in a manner relevant to the values of people living near parks. Mountain goats have and continue to hold cultural importance for KXx and management that considers goats within KXx Territory to be a sub-unit of a larger management area overlooks the value placed on wildlife by the people that live and interact with these animals regularly. Distinguishing between coastal and interior populations of goats is an important step towards recognizing the importance of goats within KXx Territory.

## Project's challenges/opportunities

1. List a challenge or opportunity (e.g., lesson learned) here.

Occupancy modelling of mountain goats is challenging in large part due to the remote areas in which they inhabit as well as the low numbers of goats that may be observed in coastal areas. Future studies of coastal mountain goats should expect to encounter very few goats and should consider sampling at larger scales to improve the estimation of statistical parameters of interest.

2. List a challenge or opportunity here.

Mountain goat studies will be well-served by incorporating multiple data sources into their analyses. The challenges associated with mountain goat research coupled with the low number of previous studies on the coast can prove difficult for researchers and managers to draw sound conclusions using a singular dataset. Including Local Knowledge in particular is an effective way to identify both rapid changes in wildlife as well as changes over time. Declining observations of mountain goats by KXx served as the impetus for this project which, when coupled with additional interview data, revealed long-term changes in coastal goat abundance over time.

## Links

<https://engage.gov.bc.ca/bcparksblog/2019/10/17/mountain-goats-alpine-sentinels-of-climate-change/?fbclid=IwAR2Cr1CJp38JgZuPW0RBFIBifoUCTC9LpvIPjVL5rhRL2OiyEBquoIBLSFo>

<http://www.web.uvic.ca/~darimont/2019/10/searching-for-sentinels-at-the-top-of-the-world/>

## Contact info

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## Checklist

- Have you submitted a blog for BC Parks' website? If not, a blog summarizing your project in no more than 400-600 words is due no later than 30 days after the end of the term of your agreement.
- Have you added any relevant Living Lab project data or reports to the BC Data warehouse and/or EcoCat? Please contact Jen Grant or Stephen Ban for assistance.
- As the fiscal year comes to a close, we will need an invoice from you for the final instalment of your Living Lab transfer agreement. Please provide an invoice that gives the university address, the Transfer Payment number (as per your agreement) and a one-line description of what the project is about. Tell us that it is the final payment and indicate the amount due (you may need to send this via your financial arm). The invoice should follow or accompany the completion of this final report template of which both are due on or before March 22<sup>nd</sup>, 2020. **If we do not receive an invoice from you by this date, we will not be able to issue your final payment.**