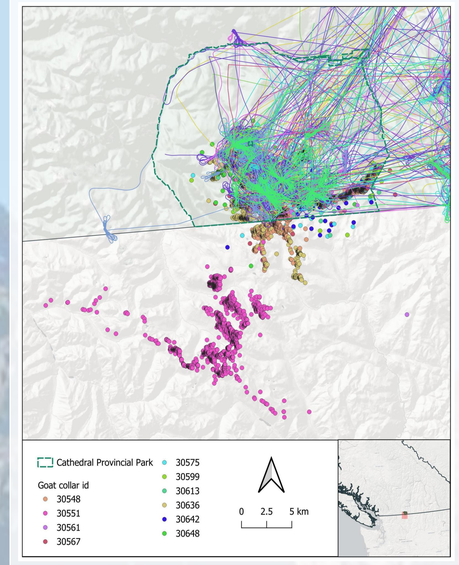
University of British Columbia, Okanagan, Department of Biology

Examining the Response of Mountain Goats in Cathedral Provincial Park to Helicopter Traffic During the COVID-19 Pandemic

A. Chhen[1,2], R. Gill[1,2], K. Stafford[3], M. J. Noonan[1,2]

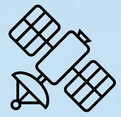
Background

While protected areas are important for species conservation, many are operating under severe human pressure, which risks compromising their conservation value. Over half of the world's mountain goats (*Oreamnos americanus*) reside in British Columbia and are provincially listed as vulnerable to extinction (S3; Mountain Goat Management Team 2010). In the southern interior in particular, mountain goats have been experiencing steady declines with little to no evidence of recovery (Mountain Goat Management Team 2010). Studying the impacts of human activity in protected areas is challenging, however, as we often lack controls or baselines against which observations can be compared. Here we leveraged the COVID-19 pandemic (termed the 'anthropause', Rutz et al. 2020) to assess the impacts of helicopter flight training in and around Cathedral Provincial Park, in southern British Columbia, on mountain goat movement behaviour.



10 Mountain Goats

48,930 GPS location data



194 helicopter flight paths

Methods

Our primary aim was to explore how movement and habitat use patterns differed between years of normal helicopter activity (2019 and 2021) compared to 2020. Using a COVID-19 induced Before-after-control-impact (BACI) design, we used continuous-time stochastic processes to estimate home-range sizes and movement patterns during and after the anthropause period (April 1 to June 8, 2020). Home-range size and diffusion were modeled as a function of year while controlling for individual differences in behaviour using generalized linear mixed models with a gamma distribution for comparing years.

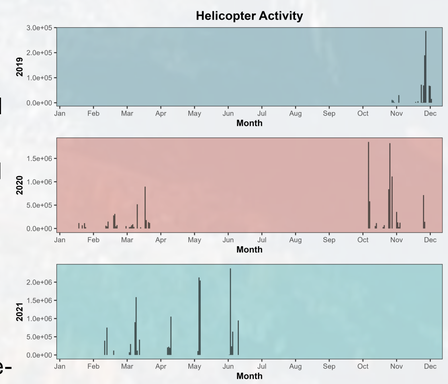


Figure 1: Helicopter GPS location data in and around Cathedral Park for each year.

Results

We found no evidence that the lack of helicopter traffic during the anthropause altered mountain goat home-range sizes as compared the following year ($p = 0.51$; $\beta = -0.11$; CI: -0.44, 0.22). The average home-range sizes were 81.6 km^2 in 2020 and 159.1 km^2 in 2021.

We found evidence that helicopter traffic during the anthropause altered mountain goat diffusion rates as compared to the following year ($p < 0.05$; $\beta = 0.42$; CI: 0.40, 0.46). The average diffusion rates were 0.7 km^2/day in 2020 and 0.5 km^2/day in 2021.

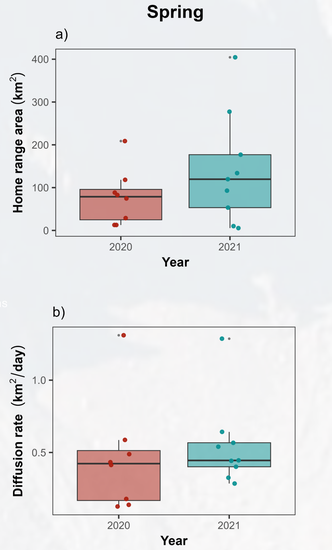


Figure 2: Mountain goat home-ranges (a) and diffusion rates (b) in and around Cathedral Park for the Spring season (April 1 to June 8) for 2020 and 2021.

We found that home-ranges differed between 2019 and 2021 ($p < 0.05$; $\beta = 0.40$; CI: 0.40, 0.40) but not in 2020 ($p = 0.33$; $\beta = 0.05$; CI: -0.60, 0.68) during the summer season (June 9 to Sept 30) when no helicopter activity was present across all years. The average home-range sizes were 49.4 km^2 in 2019, 48.7 km^2 in 2020 and 86.8 km^2 in 2021.

We found evidence that diffusion rates differed across all years (2020: $p < 0.05$; $\beta = 0.26$; CI: 0.26, 0.26; 2021: $p < 0. 05$; $\beta = 0.15$; CI: 0.15, 0.15). The average diffusion rates were 1.0 km^2/day in 2019, 1.3 km^2/day in 2020 and 1.1 km^2/day in 2021.

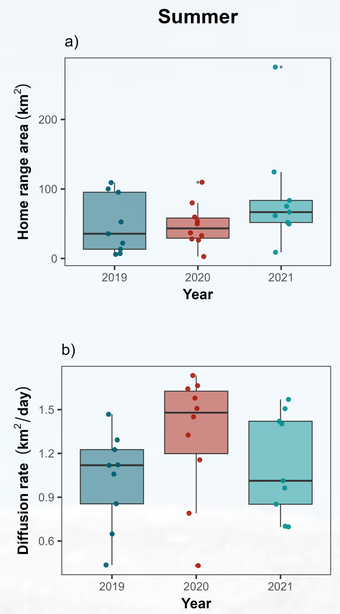


Figure 3: Mountain goat home-ranges (a) and diffusion rates (b) in and around Cathedral Park for the Summer season (June 9 to September) for all years.

Conclusion

Home range size and diffusion rates differed significantly between years, but with no clear link to the anthropause. These findings suggest one of three possibilities:

i) there is some baseline threshold amount of helicopter traffic that goats respond to in a set way;

ii) mountain goats in Cathedral Park respond to helicopter traffic at a finer temporal scale than we assessed here; or

iii) mountain goats are not responding to helicopter traffic or have become habituated.

Our results suggest more study is needed to determine if helicopters are impacting mountain goat space use. Modifying helicopter use of the park to disentangle these effects at a finer scale could contribute to future management actions.

PHOTO:BC PARKS

1 THE UNIVERSITY OF BRITISH COLUMBIA
Okanagan Campus

2 Quantitative Ecology Lab
UBC Okanagan

3 BC Parks

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Mountain Goat Management Team. 2010. Management Plan for the Mountain Goat (*Oreamnos americanus*) in British Columbia. Page 87. Ministry of Environment, Victoria, BC.
Rutz, C., M.-C. Loretto, A. E. Bates, S. C. Davidson, C. M. Duarte, W. Jetz, M. Johnson, A. Kato, R. Kays, T. Mueller, R. B. Primack, Y. Ropert-Coudert, M. A. Tucker, M. Wikelski, and F. Cagnacci. 2020. COVID-19 lockdown allows researchers to quantify the effects of human activity on wildlife. Nature Ecology & Evolution 4:1156–1159.