Understanding Moose Management and Hunting Pressure in British Columbia

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Directed Studies

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## 1. Introduction

### Moose are a significant wildlife species for British Columbia due to its abundant population in the province. However, the decline in moose populations across certain regions of British Columbia, Canada, since the mid-2000s, raises substantial concerns, particularly with a licensed harvest plummeting by over half from 1987 to 2014 (Kuzyk et al. 2020). Studies revealed a linear decline in the average age of harvested bulls over the years, with a similar trend observed for cows during the study period. This underscores the critical need for continuous monitoring of the age structure within moose populations. Remarkably, a study identified hunting as the second most significant factor influencing moose mortality out of the 49 documented cases (Kuzyk et al. 2016). The most recent ongoing studies delve into various hypotheses to comprehend the factors contributing to moose population declines in British Columbia. Covering aspects related to adult female survival, landscape changes, nutrition, health, thermal stress, and predation (Anderson et al. 2023).

Despite these comprehensive studies (Anderson et al. 2022), none have specifically targeted moose populations in Upper British Columbia including in the Taku River Tlingit territory. The First Nations has raised concern over a recent decline in the moose populations that isn’t reflected in the provincial counts. They are worried that the size of the wildlife management unit in their region is not giving a fair representation of what hunting pressure the moose are under, and that hunting pressure may be much larger than what their moose populations can sustain.

## 1.2 Objectives

This study will aim to investigate the potential misrepresentation of hunting pressure on moose populations in British Columbia, particularly in the Atlin region. It will explore whether accessibility to the land may be causing an underestimation of hunting pressure and how this is related to factors of Wildlife Management Unit (WMU) size and latitude.

Firstly, it will investigative factors related to hunting pressure. Examining how the latitude and distribution of accessible areas within wildlife management units impact hunting pressure of moose. Secondly, it will examine the correlation between kills per total area and kills per accessible area across different regions in British Columbia, to understand how hunting activities are distributed relative to the availability of legally accessible land. Thirdly, it will see how the difference between kills per accessible area and kills per total area varies across different WMUs. This allows to see if the moose harvest rate in the WMU's accessible areas is higher than the moose harvest rate for the entire WMU. If the results show that its high, regulations need to be changed. Finally, to establish if the problem of underestimating hunting pressure is a northern issue, a graph of latitude and the difference in hunting kills per area will be created. Through this analysis, the research intends to provide insights that can inform more targeted and effective moose management approaches in the region.

## 4. Methods

This study employed a combination of data analysis and spatial mapping techniques to address its objectives. Firstly, under the BC government website, there is a section for “Hunting Data” that was used to compile data on moose harvest. This dataset encompassed Harvest data from Big Game Harvest Statistics spanning from 1976 to the present. It contains useful data like wildlife management units, region, and feature area.

iMapBC was used to add provincial layers and order data for Digital Road atlas (Digital Road atlas – lines), a River (Freshwater Atlas Rivers) and Lake atlas (Freshwater Atlas Lakes). Then, in ArcGIS software was subsequently employed to delineate WMU boundaries and quantify the accessibility of each area within these units. This process involved spatially mapping WMU, water bodies, and road distributions throughout British Columbia, thereby enabling the calculation of accessible areas within each WMU.

This was accomplished by developing a model that examines the relationship between Kills per Accessible Area and latitude. Initially, the accessible area data (AccessibleArea.csv) was extracted from GIS, with the "Area" column representing this information. Subsequently, the model was added data on road networks across British Columbia (RoadDistance.csv) to calculate the total length of roads within each Wildlife Management Unit (WMU). Additionally, information on rivers and lakes (obtained from the Freshwater Atlas Rivers and Freshwater Atlas Lakes datasets) was incorporated. To assess accessibility, a 5km buffer was applied around these features, ensuring that factors that impact hunting were included. Following this, the model merged the datasets, enabling the calculation of the accessible area for hunters within 5 km of each variable within every WMU.

The calculation involved a process involving opening the attribute table of the merged data and utilizing the field calculator function to compute the area. The resulting table shows the geographic accessibility and its relationship with hunting activity.

For statistical analyses, R Studio served as the platform for graph creation using various datasets sourced from the BC government website. These datasets included the harvest data (harvest.csv), WMU information (wmu.csv), latitude data (extracted from ycoord stored in wmu\_centroids.csv), and accessibility data obtained from ArcGIS as mentioned above. Subsequently, regression analyses were employed to assess the significance of these relationships. This analytical approach allowed to see the hunting pressure across latitudes and WMU sizes within British Columbia, offering insights into wildlife management within the region.

## 2. Results

The analysis conducted on data from the years 2018 to 2021 (Figure1), portrays a discernible pattern suggesting heightened hunting pressure. It is depicted by total kills per accessible area, with increasing latitude in British Columbia. The regression analysis conducted to explore the relationship between latitude (ycoord) and total kills per accessible area demonstrated a statistically significant association (β = 6.938e-10, t = 4.952, p < 0.001). This finding suggests that as one moves northwards in the province, there is an observable increase in hunting activity relative to the accessible hunting area.

A screenshot of a graph

Description automatically generated

**Figure1.** Scatter plot of the total kills per accessible area plotted against latitude across British Columbia, with emphasis on the Atlin area near the Taku River Tlingit territory. The four plots from years 2018 to 2021 depict variations in hunting pressure across different regions in BC.

Nonetheless, to comprehensively understand if there is a noticeable issue, Figure 2 helps to confirm that there is a strong positive correlation between kills per total area and kills per accessible area. The Graph shows a clear upward trend, with points clustering around a line that slopes upwards, meaning that regions with higher hunting intensity in terms of total area also tend to have higher hunting intensity in the accessible areas.

**Figure 2:** Correlation between Kills per Total Area and Kills per Accessible Area. Illustrates the correlation between kills per total area (square meter) and kills per accessible area (square meter) for different regions in British Columbia. Each plot represents data from a specific hunting year, with the color distinguishing between the Atlin region and other regions in BC.

Lastly, to help emphasize how moose management is being misrepresented Figure 3 illustrates the difference between kills per accessible area and kills per total area varies across different WMUs. Showing clearly that the Atlin region shows that moose harvest rate in the WMU's accessible areas has a way higher peak than the moose harvest rate for other parts of the region. Figure 4 is a high-increasing quadratic model that emphasizes that hunting pressure as a northern concern.

**Figure 3:** Relationship Between Difference in Kills/Area Measures and WMU Total Area in years 2018 to 2021. This plot depicts the relationship between the difference in kills per accessible area and kills per total area against Wildlife Management Unit (WMU) in British Columbia. Points are color-coded to distinguish between the Atlin region and other regions in BC.

A graph with red and black dots

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**Figure 4.** Relationship Between Latitude and the Difference in Hunting Kills per Area in British Columbia. The graph reveals an upward trend in the difference between kills per accessible area and kills per total area as latitude increases, particularly evident in northern regions like Atlin having a larger discrepancy.

## 3. Discussion and Recommendations

A larger positive difference (~0.025) indicates that the moose harvest rate in the accessible areas of the WMU may be considerably higher than the estimated moose harvest rate for the whole WMU. Considering the findings from this study regarding high hunting pressure of moose in Northern British Columbia, several recommendations are proposed for consideration by First Nations communities involved in wildlife management and conservation. According to the results, Hunting pressure as you go up in latitude shown in the graphs is clearly high. Atlin exhibits significantly higher hunting pressure compared to other regions in British Columbia, indicating that if the moose population in the area is declining, there is a compelling need to reduce the annual moose harvest quota. This adjustment is warranted due to the elevated hunting pressure experienced within Atlin's Wildlife Management Unit (WMU), ensuring the preservation and sustainable management of the moose population in the region. Figure 3. confirms there is a positive value in this difference suggests that the kills per accessible area are higher than the kills per the total area. This implies that the accessible areas see more concentrated hunting activity compared to the broader region.

In conclusion, advocating for sustainable harvest practices that prioritize the long-term health and stability of moose populations is crucial. Establishing new quotas is needed for the Atlin region is needed, follow up studies like looking on assessments of moose population trends and ecological capacity should be looked at to see the actual moose population and how much is really changing in the region. Along with supporting ongoing monitoring and research efforts in the North to assess changes in moose populations and hunting pressure over time is essential. By implementing these recommendations, First Nations communities can conserve moose populations while preserving cultural practices and traditions associated with sustainable hunting.

## 5. Literature citated

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