FACTSHEET

October 2019

Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Moose in B.C.

Moose are an iconic animal in British Columbia and play a vital role in the well-being of many communities and individuals. First Nations rely on moose for social, ceremonial, and sustenance purposes. Moose also provide sustenance and recreational opportunities to resident and non-resident hunters. Hunting opportunities provide important social opportunities and economic benefits.

Ministry staff and partners are continuing to undertake surveys, research, assess moose health and work closely with First Nations and stakeholders to better inform management decisions. In 2018/19, the ministry's investments in moose projects totaled nearly $2.7 million, and over $3.3 million in moose projects were funded provincially. Projects for moose enhancement include population inventory, habitat designation, habitat enhancement and assessment of species interactions.

The ministry's moose research project started in 2013 and continues to provide important information for moose management. This fact sheet provides an update on implementing the 2015 Provincial Framework for Moose Management, and "A Strategy to Help Restore Moose Populations in British Columbia."

Highlights of the work conducted over the past year include:

- Calf survival was confirmed to be an important factor in population trends. Initial findings from this new approach suggest early calf mortality occurs during their first summer and in late winter and early spring. This mortality appears to be the main contributing factor to the population declines. The ministry is investigating multiple factors influencing the high mortality rates and will use the results to better inform management decisions and project investments.
- A new video was released on the moose research project describing the project and some of the important findings. https://youtu.be/xH_epWSjMEo

Research:

The Provincial Moose Research Project is investigating cow and calf moose survival as it relates to landscape change. In April 2019, the Provincial Moose Research Project entered its seventh year.

- Since this project began in 2012, a total of 574 individual moose (475 cows and 99 8-month old calves) have been captured, sampled and radio-collared.
- This project is currently monitoring 240 moose in five study areas. Each animal is sampled at capture using a standard protocol and then tracked by satellite via GPS-radio collars.
- The biological samples are analyzed to build a baseline dataset of comprehensive health measures. Comparisons among study areas are being summarized in a manuscript to publish this unique moose dataset.
- If a study moose dies, the collar sends a signal and crews respond as quickly as possible to collect samples and evidence to confirm the cause of mortality.
- Adult cow survival, pooled across all study areas, was above 85% in all years between 2012 and 2019, but below 85% within a couple of study areas (i.e., Entiako and Prince George South) in some years. This level of survival normally indicates a stable population. Survival rates in some study areas (i.e., Bonaparte and John Prince Research Forest) are high enough to support increasing populations.
- Of the mortalities, predation was related to about 58% and about 19% appear to be health related.
- The most recent data showed cow survival from 2018/19 at 90%.
- Winter 2018/19 was the first season that adult female moose in the Bonaparte and Prince George South study areas were measured for body fat levels at the beginning of winter using a portable ultra-sound. Results suggested confirmed subjective assessments that moose were in similar body condition in both study areas and that overall, moose were in poor to fair condition.
- Body condition is a key factor in the health of female moose and their ability to breed, maintain pregnancies, produce healthy calves (moose can produce twins) and provide adequate milk for calves to thrive. In addition, calves in poor body condition are far more susceptible to predation, accidents and other health-related causes of death. Future work will examine relationships between moose body condition, cow and calf survival and cumulative effects.
- Current research projects include the assessment of moose forage quality (effects of harvesting, season and exposure on nitrogen, digestible protein and tannin levels in preferred moose browse), habitat supply and ungulate winter range (identifying and protecting critical winter habitat), herbicide and moose forage analysis (investigating the effects of forest herbicide applications on quality of browse (as above)), quality of winter forage in fertilized and unfertilized stands, and the intensity and timing of heat stress under various forest stand types. The constituents of moose pellets are also being used to infer forage and habitat quality. These approaches to assess nutrition are hoped to assist in interpreting the causes of poor body condition of cows on moose populations.
- Year three of calf collaring continued by collaring and monitoring 39 calves in Bonaparte and Prince George South study areas. Annual survival of 8-month old calves from capture to age 1 (May 22) varied from 45% in 2017, 75% in 2018, and 76% in 2019. Causes of mortality for 29 calves was 20 by predation, 8 health-related and 1 vehicle-collision.
- The Habitat Conservation Trust Foundation supported a comprehensive 2 year cow survival analysis with UNBC, which was completed in spring 2019:

http://web.unbc.ca/~michael/Mumma_and_Gillingham_2019.pdf . Final manuscripts are currently being developed to identify potential moose management actions to improve moose populations in the province.

- For more information on the Moose Research project consult the following links:

  Provincial Moose Research Project: Research Design 2014
  Provincial Moose Research Project: Progress Report 2015
  Provincial Moose Research Project: Progress Report 2016
  Provincial Moose Research Project: Progress Report 2017
  Provincial Moose Research Project: Progress Report 2018
  Provincial Moose Research Project: Research Design 2019

- The annual Provincial Moose Winter Tick survey, initiated in 2014, is continuing. The degree of hair loss reported by the public and government staff provides a measure of the prevalence and severity of tick infestations on moose, which can have a direct impact on their survival. For more information visit:www.gov.bc.ca/wildlifehealth/mooseticksurvey

Broadening Moose Enhancement via Renewed Forestry Practices and the Cumulative Effects Framework:

- To strengthen the management of all forest values, a number of improvements were made to Forest Stewardship Plans (FSPs):
  - The Chief Forester guidance can be found at: https://www2.gov.bc.ca/assets/download/71203A4CC1BE4D4A91ACA0417F9F9185
  - The Ministry continues to develop specific planting guidance for the management of non-timber values; there is work underway to develop forestry replanting direction (stocking standards) tailored to also support moose habitat creation. This will include the options for the planting of different tree species or stock age – all of which can be used to create reforested habitat that is better for moose.

- Moose habitat is also being addressed through a number of provincial funds. Once key areas for moose management/recovery are identified projects can include moose-enhancement components such as:
  - Targeted Forest Service road deactivation and access management.
  - Changes in brushing strategies to enable growth/retention of cover/forage.
  - Planting quick-growing species along roadsides and in riparian areas.
  - Not planting wetter areas and letting them regenerate with species such as willow.
  - The Skeena Region is developing a Guide to Moose Habitat Enhancement, which is nearing completion. It provides technical guidance for all stages of enhancement projects from planning, engagement and permitting to implementation and monitoring. It was developed to support use of the *Habitat Enhancement and Protection* lever (FLNRO 2015) and address the Gorley Report recommendations to restore moose populations (Gorley 2016).

http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/Restoring-and-Enhancing-Moose-Populations-in-BC-July-8-2016.pdf

- The Skeena Region also has a Decision Support Tool that was developed to assist with identifying moose enhancement priorities in a regional context. The tool was developed to support a collaborative process using a structured decision-making framework.

- The *Cumulative Effects Framework* (CEF) has identified moose as a priority value for periodic assessment of condition and trend of habitat and populations across the province. An Interim Moose Assessment Protocol has been completed, defining standard methods for assessing moose that incorporate the cumulative effects of human activities and natural disturbances. The moose protocol and draft assessment results are undergoing review and validation in each region. Across the north the moose protocol is being reviewed or developed regionally in collaboration with First Nations as part of the *Environmental Stewardship Initiative*, ensuring local and traditional knowledge are incorporated into moose assessments.

- Starting in early 2020, moose assessments results will be reported through:

  - **CEF Moose Current Condition Reports** for each region, published in report format and through dynamic web-based tools, conveying the results for each indicator assessed, and;

  - **Integrated Monitoring and Assessment reports**, at a sub-regional scale, that provide a summary of best available monitoring and assessment information for a range of values, including moose.

- Moose Inventory:
  In 2018/19 there were 14 population surveys, 21 composition surveys, and two calf-at-heel surveys conducted in eight regions. The most recent moose population estimate for B.C. is 110,000 to 185,000. http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/2017_Provincial_Ungulate_Numbers_Sept_18_Final.pdf

  Some surveys analyzed the estimated population size and density of moose on the landscape while others were done to determine the composition of the moose population (a key indicator in determining population trends). For a regional breakdown of the most recent inventory results, see below.

Region by Region Analysis
The following is a region-specific breakdown of this year's survey work. Note that bull:cow ratio of >30 bulls per 100 cows is considered the performance measure; although in areas where moose densities are low (typically in the far north), the ratio should be 50 bulls per 100 cows. A ratio of 25 to 30 calves per 100 cows is considered suitable for stable populations, but should be higher if increasing populations are desired, since calves are counted in winter and suffer additional mortality throughout the spring and summer. Both types of ratios are used by wildlife managers as indicators of population trends.

Peace Region:

- Four surveys were conducted in the Peace Region in 2018/2019: Management Unit (MU) 7-21B/22 in the South Peace Game Management Zone (GMZ) and MU 7-33, 7-34 and 7-45 in the North Peace GMZ. Overall, the survey results suggest decreasing moose populations in 2 of the WMUs.
    - Population estimates for MU 7-21B/22 were 0.19 moose/km^2. The bull:cow ratio exceeds management targets at 39:100, and the calf:cow ratio was observed at 33:100.
    - MU 7-33 population increased by 22% since 2005, with a measured density of 1.18 (± 0.22) moose/km^2. Bull:cow ratio was observed at 29:100, and the calf:cow ratio was high at 69:100.
    - MU 7-34 moose population was estimated at 0.41 (± 0.05) moose/km^2. The bull:cow ratio was below provincial objectives at 21:100, while the calf:cow ratio was observed at 38:100. Overall, the population in 7-34 has decreased by 55% since 1997.
    - MU 7-45 population decreased by 65% since 2006 to an estimated density of 0.23 (± 0.03) moose/km^2. The bull:cow ratio meets management objectives at 32:100, while calf:cow ratio was observed at 28:100.
- Other ongoing regional initiatives include the finalization of the Peace-Liard Moose Management Plan, the continued monitoring of winter tick infestations in local moose populations, predator monitoring in the Northeast Rockies GMZ, and collaboration with forest companies to develop beneficial moose management practices and updated habitat mapping was completed.

Omineca Region:

- The Parsnip moose population (7-16, 7-23) was surveyed in 2017/18 to inform the status of liberalized moose harvest regulations to support caribou recovery efforts. The survey estimated a density of 0.48 (± 0.10) moose/km^2 showing that this population is relatively stable following a decline from 1.18 to 0.39 moose/km^2 in 2005 and 2011, respectively. Bull:cow ratio was relatively consistent with past surveys (53:100) while calf:cow ratio was slightly higher than past surveys (38:100).
- A composition flight also occurred in the Mackenzie study area (7-30) to track moose response to wolf removal for caribou recovery in neighboring management units. The bull:cow ratio was 79:100 and calf:cow ratio was 32:100. The calf ratio is lower than expected for wolf removal areas and may suggest that wolf removal immediately east of the area is not influencing moose in the Mackenzie area.
- A composition survey was flown in 7-10 and the eastern portion of 7-12 to temporally relate to calf captures to determine true recruitment. Bull:cow ratio was 27:100 and calf:cow ratio was 31:100.

Skeena Region:

- Two moose surveys were conducted in the Tweedsmuir-Entiako areas: a stratified random block (SRB) survey and a calf-at-heel survey.
    - Preliminary results indicate that moose density in the Tweedsmuir-Entiako (6-01, 6-02) areas decreased by 19% from 0.27 (± 0.05) moose/km^2 in 2013 to 0.22 (± 0.05) moose/km^2 in 2019. The bull:cow ratio of 32:100 decreased by 41% from 2013 and

remains above the provincial objective. The calf:cow ratio of 18:100 decreased by only 5% since 2013.
    - As part of the Provincial Moose Research Project, the calf-at-heel survey observed a ratio of 27:100 cows (8 calves observed with 30 collared cows) and was higher than the 2016, 2017 and 2018 Entiako calf-at-heel surveys. This result is based on a small sample size (cows that are radio-collared) and estimates late winter calf survival for Entiako study moose. The discrepancy between calf ratios from this and the SRB survey is likely due to this small sample size.
- An aerial survey to map the regional extent and severity of the poplar and willow borer infestation in willow shrubs was completed in 2018 to understand potential implications on moose forage habitat. Preliminary results found that the weevil has expanded its range since last assessed in 1999.
- A regional review of human-influenced factors that may be affecting moose is underway. The review will describe the relative importance of each factor to the Skeena moose population and link factors to available moose management levers (FLNRO 2015). This information will support priority setting and decision making related to moose enhancement and management.
- Ground verification of existing critical moose winter habitat maps continues.
- Skeena region continues to develop and implement moose-related projects collaboratively with First Nations partners through the Collaborative Stewardship Framework and Environmental Stewardship Initiative.

Cariboo Region:

- Two moose density surveys were completed by BC Provincial wildlife staff in 2018/19.
    - In Rose Lake (MU 5-02C), moose densities decreased by 27% since 2011. The bull:cow ratio was 18:100; higher than the 2018 findings, but still below the provincial objective. The calf:cow ratio was 37:100 cows.
    - In Kluskus (MU 5-13C), the estimated moose density decreased over 44% from 2006. Bull:cow ratio was 37:100 which was higher than 2017, while calf:cow ratio was 38:100, also higher than observed in 2017.
- The Tsilhqot'in Nation led two moose density surveys within their traditional territory in 2018/19 survey season, one in Mackin Creek (5-14), and a second in Gaspard Creek (5-03).
    - In Mackin Creek (5-14), the estimated moose density did not change significantly from the 2013 survey, remaining at ~0.26 (± 0.06) moose/km^2. The bull:cow ratio was 36:100, and the calf:cow ratio was 44:100; ratios of both bulls and calves were higher than those observed in 2013.
    - In Gaspard Creek (5-03), the estimated moose density was 0.23 (± 0.12) moose/km^2 and did not change significantly from the 1997 survey. The bull:cow ratio was 38:100, and the calf: cow ratio was 46:100; ratios of both bulls and calves were higher than those observed in 1997.
- The Province led composition surveys in MUs 5-02A, 5-02D, 5-12A, 5-12B, and 5-15D and observed bull:cow ratios ranging from 23 – 57:100 and calf:cow ratios ranging from 16 – 37:100.

- Overall, bull:cow ratios in the Cariboo met or exceeded provincial objectives with the exception of MU 5-15D and 5-02C.
- In Alexis Creek (MU 5-13A), a replicate block survey was conducted to better understand the impacts of the Chilcotin Plateau wildfire on the moose population in this management unit. Approximately 60% of 5-13A is within the Chilcotin Plateau wildfire perimeter and was previously surveyed in 2017 (pre-wildfire). 26 blocks were re-surveyed with total moose sightings decreasing by 15% in resurveyed blocks in 2019 (+1 years post-fire). There was an increase in total moose observed in blocks outside the burn perimeter polygon, but a decrease in moose observed within the burn perimeter polygon relative to the pre-fire SRB in 2017.
- In Big Creek (5-04), calf survival was measured by assessing radio-collared cow moose. March calf-at-heel surveys revealed a calf:cow ratio of 34:100 cows (10 calves observed from 29 collared cows).
- Density surveys in the 100 Mile (5-01), Alkali Lake (5-02A), and Anahim Lake (5-12B) areas are planned for 2019/20 to monitor the status and trends in those moose populations.

Okanagan Region:

- Two standard random block (SRB) surveys were completed in the winter of 2018/19: MU 8-12 and 8-22 which both appear to be increasing.
    - The population estimate for MU 8-12 was 496 (± 107) moose, and the estimated density of moose within the winter range of the MU was 0.30 (± 0.065) moose/km^2. The calf:cow ratio 33 (± 9):100, and the bull:cow ratio was 42 (±10):100.
    - The population estimate for MU 8-22 was 119 (± 32) moose, and the estimated density of moose within the winter range of the MU was 0.34 (± 0.09) moose/km^2. The bull:cow and calf:cow ratio were both 36 (± 15):100.

Kootenay Region:

- An aerial survey of MU 4-34 estimated a moose population of approximately 110 moose with a density of 0.22 (± .12) moose/km^2. Calf recruitment was fair, at an observed calf:cow ratio of 23:100, and bull availability approximately at management target with bull:cow ratio of 29:100.
- Surveys in MU 4-21 revealed a population estimate of 89 moose in a density of 0.21 (± .10) moose/km^2 with a calf:cow ratio of 20:100, and good bull availability at 40:100. Moose populations in this unit appear to have declined by approximately 20% over the last 5 years.
- Surveys in MU 4-24 estimated 172 moose at a density of 0.22 (± .08) moose/km^2. Survey results estimated calf:cow and bull:cow ratios at 23:100 and 25:100, respectively. This bull ratio is slightly below management objectives. Overall this population appears to have declined by 30% over the past 5 years.
- Ongoing moose population monitoring in the Lake Revelstoke area (MU 4-38 and 4-39) has shown a continued increase in moose population trend and high recruitment with 45 calves per 100 cows.

Thompson Region:

- Composition surveys were conducted in 10 MUs (3-12, 18, 19, 20, 26, 28, 29, 30, 39 and 46) with mixed results.
    - Despite reduced seasons for spike/fork bulls and reduced harvest rates in recent years, bull ratios are still generally below objective south of Kamloops and ranged from 16:100 in MUs 3-18 and 3-19 to 25:100 in 3-20.
    - Bull ratios east and north of Kamloops in MUs 3-26, 28, 29, 30B, 39 and 46 were near or above the objective and ranged from 32 – 55:100.
    - Calf ratios were also variable, ranging from 30 – 50:100 south of Kamloops to 8 – 30:100 east and north of Kamloops.

South Coast Region:

- Aerial surveys were conducted in MUs 2-6 and 2-11 in winter 2018/19 which both have a low population of moose.
    - MU 2-6 composition survey is primarily conducted along the Elaho River. Bull:cow ratios observed during this survey were 73:100 and calf:cow ratios were 33:100. MU 2-11 composition survey was conducted along the Upper Lillooet River valley. Bull:cow and calf:cow ratios observed were 33:100 and 53:100, respectively.
- A study combining GPS collaring of moose, remote cameras, and spatial mark-resight models is being developed to estimate moose abundance and distribution (spatial and temporal) in MU 2-11 to inform management decisions including potential regulation changes, enforcement actions, and response to recreational disturbance.

Fish & Wildlife Compensation Program (FWCP)

Similar to the Provincial Moose Research Project, in 2015 the FWCP's Peace Region Board began a five-year research project investigating the limiting factors affecting cow moose survival in the FWCP's Peace Region. The project is currently monitoring 80 cow moose in the Moberly (Region 7B) and West Parsnip (Region 7A) areas in the southern portion of the Williston Basin.

- Survival rates range from 83% – 100% with stable to increasing female growth rates (λ= 1.02 – 1.17).
- Calf-at-heel survey results varied by year:
    - In 2017 & 2018, twice as many calves survived until March in the West Parsnip study area (52–54:100) than in the Moberly study area (18–25:100).
    - In 2019, fewer calves survived until the end of March in the West Parsnip (20:100) than in the Moberly study area (35:100).

2019/20 is the fifth and final year of the FWCP project. In this last year, 80 collared cow moose will continue to be monitored including investigating mortalities. Multi-year analyses of factors that influence survival of cow moose within the Williston Basin will be performed as well as community and stakeholder engagement on the project's final results and recommendations. For more information on this project, including year-end reports visit: http://fwcp.ca/moose-investigations-limiting-factors/

Outreach:

- Ministry staff continues to communicate closely with First Nations and regional and provincial wildlife stakeholders on program delivery and status of the moose enhancement program and research.
- While not moose specific in all cases, the BC Wildlife Health program (WHP), in collaboration with a number of First Nations and the First Nation Health Authority (FNHA), developed a Wildlife Health Matters training workshop for First Nation communities. The full-day workshop is delivered on request. It includes discussion on general aspects of wildlife health and how to develop a community driven wildlife health assessment and monitoring program. It may also involve a practical demonstration of sampling techniques for hunters and community members. The workshops have been held at community halls, culture and hunting camps and are built around the hunted species of most interest to the community as well as any issues of concern. A series of posters and fact sheets have been developed for this program that includes photographs and descriptions of common diseases and parasites. The workshops are delivered in partnership with the WHP and FNHA-sponsored online Local Environmental Observer Network.
- In addition to significant in-house expertise, the Province also works collaboratively with universities to improve science information to guide moose management.
- The Province also commissioned a series of short films on wildlife survey methods and the results of some recent wildlife surveys. This is part of an ongoing effort to find innovative ways of sharing the information we collect with the public.
- Videos include:
    - How we count moose (https://www.youtube.com/watch?v=tMOlK2jwzN0
    - What we do with survey data https://www.youtube.com/watch?v=p8FdBM6OLUs
    - Alsek moose survey results (Skeena region): https://www.youtube.com/watch?v=6HphraH1haA
    - Peace region survey results: https://www.youtube.com/watch?v=O68o2R5mF2E
- BC Moose Tracker is an official Government of British Columbia app that allows hunters to play an important part in collecting information to inform moose management. It is in its fourth year of use and is available for download through iTunes. The app allows hunters to upload information about moose they encounter directly to a province-wide database, helping wildlife staff monitor moose populations. The BC Moose Tracker app was developed by the B.C. Government with support from the Habitat Conservation Trust Foundation and the BC Wildlife Federation.

Previous Moose Fact Sheets:

- 2018 Moose Fact Sheet: http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/2018_moose_fact_sheet.pdf
- 2017 Moose Fact Sheet: http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/2017_moose_fact_sheet.pdf
- 2014 Moose Fact Sheet: http://www.env.gov.bc.ca/fw/wildlife/management-

issues/docs/factsheet_provincial_moose_population_june2014.pdf

- 2013 Moose Fact Sheet: http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/factsheet_provincial_moose_population_april2013.pdf
- 2012 Moose Fact Sheet: http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/factsheet_provincial_moose_population_may2012.pdf

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