Project Report for Fisher Inventory in the Chilcotin Area of BC

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Executive Summary

Fishers (*Pekania pennanti*) are forest-dependent carnivores that are an important component of healthy ecosystems and can be impacted by changes to the forest landbase. Recent large-scale fires, insect infestations, and expedited salvage forest harvesting have all resulted in significant changes to the supply of forest habitat for fishers. To help assess the impacts of these changes, we conducted a DNA-based inventory for fishers in the West Chilcotin area of BC which has been impacted by fire and has a range of forest harvesting intensities.

Between December 2018 and March 2019, we monitored hair snag detectors in the 2300 km^2 study area near Puntzi Lake, BC. Hair samples were collected from 170 of the 474 sites with detectors over 4 sessions during this period. Fishers are suspected of being detected at 110 of the sites, followed by marten (*Martes americana*) at 19, squirrels (*Tamiasciurus hudsonicus*) at 9, weasel (*Mustela spp*.) at 2, one site with an unknown microtine, and 29 sites with undetermined species. Hair samples have been sent for laboratory analysis to species with fisher samples having additional analyses to determine sex and individual identity. Statistical analysis and reporting on those results will occur in the 2019-20 fiscal year using spatially explicit capture – recapture methods.

Introduction

Fishers are forest-dependent carnivores that are an important component of healthy ecosystems and can be impacted by changes to the forest landbase. Over the past 20 years, forests in the Cariboo Region have been impacted by large-scale insect infestations, fires, and salvage harvesting. Several aspects of the ecology of fishers, including their use of rare structural elements found primarily in late-successional forests, make them susceptible to changes resulting from these types of disturbances. The temporal and spatial scale of these combined disturbances has resulted in extensive areas with little forest cover.

The fisher population in British Columbia was estimated in 2004 to be between 2236 and 3715 (Lofroth 2004) based on a single study in the Williston region (8.8 fishers/1000 km^2, Weir and Corbould 2006) and the 243,542 km^2 of moderate to very high-capability habitat mapped in the province. This estimate was supported by an additional estimate from northeastern British Columbia (16.3 fishers/1000 km^2, Weir et al. 2011). However, given the above-noted disturbances to much of the landscape within the range of fishers in British Columbia since 2004, and the species profound negative response to expedited forest harvest (Weir and Corbould 2010), it is exceptionally likely that the population number has declined substantially over the past 15 years. Conducting additional inventories from other areas of the province will update and increase the precision of this estimate and confidence in its accuracy. Conducting population inventories in the Cariboo Region will also improve our understanding of the effects of habitat change, provide baseline data to assess changes in the population size over time, and inform fisher management decisions.

Project Objectives

The overall objective of this project is to evaluate the impacts of recent wildfires and other aspects of landscape change to the sustainability of the fisher population in the Chilcotin Plateau. The result of this monitoring will support management decisions and wildlife recovery planning for fisher in the province. Specific objectives of this inventory are:

1. Identify areas where fisher habitat has been significantly impacted by wildfires.
2. Estimate fisher population changes and where those changes have occurred.
3. Describe the cumulative impact from recent wildfires, historic wildfires, and recent forest harvesting.
4. Evaluate the sustainability of current fisher harvest management and make recommendations for management changes and recovery if required.

Study Area

The 2,460 km^2 area extends from Chantslar Lake on the west to Alexis Lakes in the east (Appendix 1). The southern boundary is approximately 15 km north of Highway 20 and the northern boundary extends from Nazko Lakes Park in the east to Satah Mountain in the west. This area includes the boundaries of the 2017 Plateau Fire Complex and the 2015 Puntzi Lake Fire. The area is actively trapped but fishers have been monitored in a portion of the area since the 2003 inventory (Davis 2003, Davis 2009, Davis 2017). The dominant BEC Units in the inventory area include Sub-boreal Pine Spruce dry cold subzone (SBPSxc) and Montane Spruce dry very cold variant (MSxv), with the Interior Douglas-fir dry cool 4 variant (IDFdk4) forming a small fraction of sample units of the southeast portion of the survey grid. The area was divided into 123 – 20km^2 grid cells to help distribute sampling effort. This grid cell size is slightly less than the area of a female fisher's home range in the Chilcotin (30 km^2, Davis 2009).

Methodology

Data collection

Sample units (grid cells) were sampled following RISC standards (Resources Information Standards Committee 1999) using detectors which snag and collect hair (and associated follicle tissue) from fishers. The detectors were constructed of 2 pieces of wood (2 x 19 x 60 cm) that are screwed together to form a triangular cubby, with the ends left open following the design of Foran et al. (1997). Inside the unit, a chicken wing was fastened in the center with wire and 2 - 1 x 7cm glue pads are attached at each end with screws. The sample units were fastened vertically to the bole of suitably sized tree using 4-7.5 cm long screws. A 19 x 30 cm roof was hung over the top of the cubby to prevent precipitation from degrading the glue pad and any samples present. Where low branches were present, the unit was fastened ~30 cm above the branch to facilitate fisher entry. Where a branch was not present, a ~10cm diameter run pole was attached to the tree below the trap to fulfill this function. Commercial beaver castor-based lure was applied to the chicken wings used as bait and deployed on wool strings hung near the cubby to help attract fishers to the site. Fishers attracted to the detector were forced to crawl through either the top or bottom opening to access the bait and leave hair on the glue pads when they exit (Photographs 1-3).

Sampling was conducted between December and March to reduce the likelihood of attracting bears to the bait and sites were visited every 3 weeks. Surveyors accessed the cells using snowmobile and placed detectors in locations with mature live forest where available. Surveyors were instructed to place detectors in locations likely to be used by fishers in the Chilcotin, such as spruce dominated and/or riparian stands. After 3 weeks, the detectors were removed and inspected for the presence of hair samples. Where hair was present, surveyors removed the sticky pads, covered the pads with plasticized paper, and stored the sample in numbered envelopes. Information recorded at the location includes the GPS coordinates, suspected species, quantity of hair, and date. All detectors, regardless of whether a fisher was identified, were moved to another site ≥800 m away within the same cell at least once to distribute the sampling effort. Trail cameras were also deployed at some detector sites to help understand how fishers were interacting with the hair snaggers.

All samples were stored in uniquely numbered paper envelopes which were packaged with silica gel packets to prevent damage to the specimens from moisture. The samples were sent to Wildlife Genetics International in Nelson, BC for species and individual identification. Results of the laboratory analysis can be expected in the fall of 2019.

Photograph 1. Hair detector attached to a tree with roof above and run pole beneath.

Photograph 2. Fisher hair detector set up with glue pads, bait, and lure.

Photograph 3. Fisher hair on glue pads and sample envelopes. Note the tricolored guard hairs characteristic of fisher.

Statistical Approach

The data will be analyzed using spatially explicit capture – recapture (SECR) methods (Efford et al. 2005, Royal et al. 2011) following genotyping. SECR models relate the detection history of individuals to where the individuals spend their time over the trapping period. Key to this is the idea that an individual occupies a defined area during a period of time and that its activities will be centered in that area. The detection probability for an individual is then a function of the distance between their activity center and the trap location such that detectors further from an individual's activity have a reduced detection probability (Efford et al. 2005). Spatial covariates, such as fire or salvage harvesting, can be input to replicate heterogeneity in the landscape that may affect the distribution and density of home ranges. Statistical analysis of the results will occur in 2019-2020 after the genetic analysis is completed.

Results

Sampling commenced on the 17th of December 2018 with 113 detectors set over a 5-day period. A total of 4 monitoring sessions were completed by March 13th, 2019. Table 1 shows the suspected species for the hair snagging over the 4 sessions. Fisher are suspected of being detected at approximately 23% of the sites, and several of the fishers have been verified by the trail cameras used at some locations (Photographs 1-2). American martens (*Martes americana*)

Table 1. Sampling results from 2018-19 Chilcotin Fisher Survey based on surveyor's assessment.

Row Labels	Session 1	Session 2	Session 3	Session 4	Total
Fisher	16	36	32	26	110
Unknown/indeterminate	5	4	8	12	29
Marten	4	10	3	2	19
Squirrel	5		4		9
Weasel		1	1		2
Mouse	1				1
Sprung (bait gone, no hair)			1	4	5
None detected	82	70	71	76	299
Total sites monitored	113	121	120	120	474

Photograph 1. Fisher trying to access bait from the top of a hair snagger.

Photograph 2. Fisher accessing the bait from the bottom of a hair detector.

were the second-most detected species with most being found during the second trapping session. Short white hair was detected at one detector over 2 sessions that is suspected at being from either short-tailed weasel (*Mustela erminea*) or a least weasel (*Mustela nivalis*). Overall, Session 1 had the fewest detections when all species were counted (31), Sessions 2 and 3 had the greatest number of detections (~50), with detections during the last session falling between these values (40).

Detections at some sites were affected by the loss of sticky pads. At several sites, all that remained inside the detector were the screws that held the pads in place. However, in most cases, surveyors were able to find hairs stuck to the screws or opportunistically in the wood at the edges of the trap. Our monitoring with cameras has indicated that large male fishers sometimes have difficulty fitting into the detectors and this resulted in the pads being torn out when the individual were trying to get in/out of the traps.

Discussion

A fisher inventory to assess the impacts of recent fires and salvage harvesting in the Cariboo Region was conducted in the West Chilcotin area of BC during the winter of 2018-19. Our survey team included local First Nations forestry personnel who were trained to set up and monitor the hair snag traps. The use of local personnel was valuable in their being able to identify access routes into some of the cells for the survey team. This type of collaboration also helps build local capacity to participate in wildlife monitoring programs and increases the profile of little-known species, such as fishers, for the area's residents.

Conducting a monitoring program over a large area in relatively remote conditions such as the West Chilcotin has some challenges. Low snow depths early in the project meant using ATVs instead of snowmobiles to access the trapping locations. However, higher elevations in the project area had snow that was too deep for ATVs to access and we were not able to sample some cells on the first trapping session. Snow depths improved by the start of the second session; however, keeping 6 snowmobiles in good running condition over the winter was also a challenge. Cold temperatures (-20 to -30 ^{o}C) were regularly encountered and sometimes resulted in problems keeping sleds running efficiently. Some cells had areas that were also very difficult to access by any ground-based method. We addressed some of these areas by using a helicopter for access for the 4th trapping session. Having a helicopter available for 1 day per session would likely have improved the distribution of sampling effort.

Our results show a reasonable detection rate for fishers based on the surveyor's assessment and camera data; however, it is likely that the rate of fisher detections will change once the genetic analysis has been completed. The much greater number of fisher detections compared to marten is consistent with past sampling in this area. Davis (2018) found very few martens visiting fisher den boxes set up in the project area between 2013 – 2018, and a previous DNA-based inventory also found that fishers greatly outnumbered martens in the western portion of the study area (Davis 2003). Marten have much lower foot loading than fishers and are not affected as much as fishers by a deep soft snow pack (Raine 1983). During this project, most marten detections were at higher elevations and on northern aspects where snow depths are deeper and there is less chance of a crust developing due to decreased effects of solar radiation.

Large male fishers in this survey appeared to be having difficulty accessing the bait inside the detectors and this resulted in the loss of sticky pads at several sites. When the detectors are attached to a large diameter tree, the opening size to the trap is approximately 10 cm in diameter. This opening size is sufficient for female fishers who regularly use den trees and artificial den boxes with cavity entrances of approximately 7 x 12 cm (Davis 2018). However, fishers are sexually dimorphic with male fishers being approximately twice the weight of female fishers and, generally, males are not able to access cavities with entrances the size of reproductive dens. The entrance size of the detectors can also be decreased when the traps are placed on smaller diameter trees, due to the greater curvature of the trunks on smaller trees.

To address this, we instructed the surveyors to choose trees >30 cm diameter for setting up the detectors and to insert a shim fashioned from piece of wood to create a larger opening when only small trees (e.g. <30 cm diameter) were available. Larger detectors could also be used to address this problem, but this may also make it less likely that female fishers will leave hair in the trap. We also tried to address this problem over the course of this project by angling the sticky pads to the entrance (e.g. at a 45^{0}) to decrease directional torque on the pads. Luckily, most detectors where the pads were gone had sufficient hair samples on the screws or pads that were still present to send for genetic analysis.

Lastly, approximately 30% of our grid was within the boundaries of the 2017 Plateau wildfire and our results indicate that fishers are making some use of areas with low to moderate fire intensity. The cells used generally had significant patches of green trees present in which our detectors were set. However, tracks in these grid cells showed fishers using areas, sometimes extensively, where all the trees had been killed by the last fire. Fisher use of burned stands has been documented elsewhere (Davis unpublished data, Hanson 2015). In the West Chilcotin, a female fisher who had part of her home range burned was observed making several forays into the 1-year old burn (Davis unpublished data). Hanson (2015) found that female fishers use of the 5422 ha McNally Fire in Sequoia National Park, CA, USA, was significantly higher than in adjacent unburned forest 10 years after the fire based on scat analysis. Hanson (2015) theorized that the greater spatial and vertical habitat heterogeneity provided by mixed severity burns may result in greater greater biomass in small mammal communities. Further, the vertical heterogeneity remaining in un-salvaged stands, likely provides suitable escape terrain for fisher hunting small mammals in this habitat. Despite this, moderate to severely burned forest may lack other important components of fisher habitat, such as reproductive den trees. Determining if female fishers are using burned habitats and the spatial arrangement of adjacent unburned forest required for a suitable female home range will be important outcomes of this study.

References

BC Ministry of Forests and Range and BC Ministry of Environment. 2010. Field manual for describing terrestrial ecosystems, 2nd edition. Co-Published by Research Branch B.C. Ministry of Forests and Range and Resources Inventory Branch, B.C. Ministry of Environment.

Borchers, D. and M. Efford. 2008. Spatially explicit maximum likelihood methods for capture-recapture studies. Biometrics 64: 377-385.

Burnham, K. and D. Anderson. 2002. Model selection and multimodel inference – a practical information-theoretic approach. 2nd edition. Springer-Verlag, New Yourk, Inc.

Calabrese, M. and L. Davis. 2010. Occurrence of den trees for fisher (Martes pennanti) in the Sub-boreal Pine Spruce in the Cariboo – Chilcotin. Prepared for West Fraser Mills, Williams Lake and BC Timber Sales –Cariboo Chilcotin Business Unit.

Carroll, C. and W. Zielinski. 1999. Using presence-absence data to build and test spatial habitat models for fisher in the Klamath Region, USA. Conservation Biology 13(6): 1344-1359.

Davis, L. 2003. Yun Ka Whu'ten DNA Pilot Project - 2002/2003 Summary Report. Unpublished report prepared for Yun Ka Whu'ten Holdings Ltd. FIA Project #1023014.

Davis, L. 2004. Yun Ka Whu'ten Furbearer Track Transect Project - 2003/2004 Summary Report. Unpublished report prepared for Yun Ka Whu'ten Holdings Ltd. FIA Project #4239001.

Davis, L. 2009. Denning ecology and habitat use by fisher (Martes pennant) in pine dominated ecosystems of the Chilcotin Plateau. MSc. Thesis, Simon Fraser University, Burnaby, BC, Canada.

Davis, L. and R. Weir. In prep. Density of fishers (Pekania pennanti) at the southwestern edge of the species' range in British Columbia. Manuscript.

Davis, L. 2018. Fisher (Pekania pennanti) artificial reproductive den box study. Unpublished report prepared for HCTF. CAT-16-3-345.

Efford, M., Warburton, B., Coleman, M. and R. Barker. 2005. A field test of two methods for density estimation. Wildlife Society Bulletin 33(2): 731-738.

Efford, M. 2018. Spatially explicit capture-recapture in R. Available at: https://cran.r-project.org/web/packages/secr/vignettes/secr-overview.pdf

Foran, D. S., K.C. Crooks, and S.C. Minta. 1997. DNA-based analysis of hair to identify species and individuals for population research and monitoring. Wildlife Society Bulletin 25:840-847.

Hanson, C. 2015. Use of Higher Severity Fire Areas by Female Pacific Fishers on the Kern Plateau, Sierra Nevada, California, USA. Wildlife SocietyBulletin39(3):497–502.

Hutchen, J., Volkmann, L., and K. Hodges. 2017. Experimental designs for studying small-mammal responses to fire in North American conifer forests. International Journal of Wildland Fire 26(6): 523-531.

Lofroth, E. 2004. Fisher (*Martes pennanti*) British Columbia Population Science Assessment Review. Ministry of Water, Land and Air Protection, Victoria, British Columbia, Canada. 21 pp.

Miller, C.R., P. Joyce, and L.P. Waits. 2005. A new method for estimating the size of small populations from genetic mark-recapture data. Molecular Ecology 14: 1991-2005.

Mowat, G. 2005. Study design for DNA-based mark-recapture inventories. Technical report, BC Ministry of Forests Lands and Natural Resource Operations. Available at:

https://www.researchgate.net/publication/322671046_Study_design_for_DNA-based_mark-recapture_inventories. Accessed 8 March 2018.

Raine, R.M. 1983. Winter habitat use and responses to snow cover of fisher (Martes pennanti) and marten (Martes americana) in southeastern Manitoba. Canadian Journal of Zoology, 1983, 61(1): 25-34.

R Development Core Team. (2016). R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing.

Resources Information Standards Committee. 1999. Inventory for medium-sized territorial carnivores - Coyote, Red Fox, Lynx, Bobcat, Wolverine, Fisher & Badger. Version 2. Victoria, British Columbia, Canada. Available at: www.ilmb.gov.bc.ca/risc/pubs/tebiodiv/medcarn/assets/mstc.pdf . Accessed 24 April 2013.

Royal, J. and K. Young. 2008. A hierarchical model for spatial capture-recapture data. Ecology 89:2281-2289.

Royal, J., Magoun, A., Gardner, B., Valkenburg, P., and R. Lowell. 2011. Density estimation in a wolverine population using spatial capture-recapture models. J. Wildlife Man. 75(3): 604-611.

Sauder, J. and J. Rachlow. 2014. Both forest composition and configuration influence landscape-scale habitat selection by fishers (Pekania pennanti) in mixed coniferous forests of the Northern Rocky Mountains. Forest Ecology and Management 314: 75-84.

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Weir, R. D. 2003. Status of the fisher in British Columbia. Ministry of Sustainable Resource Management, Conservation Data Centre, and Ministry of Water, Land and Air Protection, Biodiversity Branch. Report Wildlife Bulletin Number B-105. Victoria, British Columbia, Canada.

Weir, R. and F. Corbould. 2010. Factors affecting landscape occupancy by fishers in North-Central British Columbia. J. Wildl. Man. 74(3): 405-410.

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Endangered Species Research

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Trapping mortality drives the decline of an endangered mesocarnivore in British Columbia, Canada.

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ABSTRACT: Understanding the environmental, demographic, and anthropogenic factors driving the population dynamics of endangered species is critical to effective conservation. Habitat loss, fragmentation, and trapping all have been linked to the decline of the endangered Columbian fisher *Pekania pennanti* population unit in central British Columbia (BC), Canada. Although the commercial trapping season for fisher has recently been closed in BC, the animal still suffers winter mortality in traps set legally for other furbearer species, and with this source of mortality the sustainability of this highly vulnerable fisher population remains unclear. Using Program VORTEX we constructed population viability models using reproductive and survival data from radio-telemetry studies along with trapping kill rates from provincial fur harvest data.

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