FISHER (*Pekania pennanti*) ARTIFICIAL REPRODUCTIVE DEN BOX STUDY

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Prepared for:
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and Habitat Conservation Trust Foundation

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Executive Summary

Fishers (*Pekania pennanti*) are a threatened species (S2S3) in British Columbia and are a high priority for conservation efforts. Fishers are the largest obligate tree-cavity user in North America and this study seeks to determine if the species will use artificial den boxes for reproduction. Trees with characteristics of natural fisher dens are naturally rare in forested landscape and changes to the forest landbase resulting from hydro-electric development, insect infestations, forest-harvest activities, and large-scale fires are likely to have decreased the supply of these elements. This fourth year of the study continues the monitoring efforts on 53 den boxes installed during this project.

Monitoring during the reproductive season (late March – June) identified four den boxes that were used for reproduction. Three of the structures used were in the Bridge Watershed and one was in the Chilcotin. All 4 den boxes were new, bringing the total number of den boxes used to 6 over the 3 denning seasons we have monitored. An average of 2 kits were observed at the den boxes. We also collected information on fisher prey by observing one female bring several items of prey back to the den box. Modeling of habitat attributes at reproductive den box sites did not produce significant results, although den boxes in forests younger (<80 years) were never used by fisher for reproductive or other uses. Increasing the number of reproductive den boxes may help clarify which variables are important for fisher use. This will be the focus of monitoring during our last field season.

The project videos continue to provoke interest and enquiries about the project. For example, den boxes have been installed by the Toronto and Region Conservation Authority and a biologist from Alberta Environment and Parks will be constructing several structures to deploy in the Red Deer area. Other extension efforts included liaising with groups using artificial den boxes to offset habitat losses at the Site C hydro-electric, making reports and plans available on the BCFisherhabitat.ca website, and presentations to the forest industry in Prince George and Williams Lake. All extension includes information on our funding partners.

Lastly, this results of this project help the Bridge-Coastal Restoration Program achieve several of their specific objectives for the Bridge River watershed. The primary Action/Watershed Plan that this project aligns with is the ***Species Based Action Plan***. Fisher are a high priority for FWCP investment and the results of this project are helping meet Objective 1: maintain or improve the status of species or ecosystems of concern. Fisher have low reproductive output and populations in the area are benefiting from the addition of reproductive habitat. The project also provides a specific opportunity to enhance riparian areas that are degraded or sub-optimal (***Riparian and Wetlands Action Plan***) by providing a proven mitigation strategy that will supply fisher reproductive habitat for the short to mid-term until longer term measures, such as fungal inoculation, can increase the availability of cavity-bearing trees.

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Introduction

Fishers (*Pekania pennanti*) are forest-dependent carnivores in the weasel family that are an important component of healthy ecosystems. 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 to the forested landbase resulting from hydro-electric development, forest-harvest activities, and oil and gas development. As such, fishers are considered a species at risk under the Identified Wildlife Management Strategy and are blue-listed (S2S3) in British Columbia.

Fishers are a high priority for conservation efforts, as they are considered rank 2 under Goal 3 of the provincial Conservation Framework: Maintain the diversity of native species and ecosystems. Fishers are also the largest obligate tree-cavity user in North America, requiring trees that have cavities >30 cm inside diameter as reproductive dens during the rearing period (Weir and Corbould 2008). In British Columbia, reproductive dens are found in large-diameter black cottonwood, balsam poplar, trembling aspen, lodgepole pine, and Douglas-fir trees (Weir and Corbould 2008, Weir 2009, Davis 2009), which are most common in late-successional ecosystems. The development of trees that support suitable cavities for fishers is uncommon and these critical habitat elements are rare in sub-boreal landscapes (Davis and Calabrese 2010, Davis 2012).

This project provides a unique opportunity to apply the knowledge gained from research funded by the Fish and Wildlife Compensation Program and the Habitat Conservation Trust Foundation (e.g., Davis 2012, Davis and Weir 2011, Weir and Corbould 2008) to build recovery tools for fishers in areas where their habitat has been impacted. At a broad scale, the Bridge River watershed and Cariboo-Chilcotin are rated as having medium to high capability for fishers (Lofroth 2004). Habitat impacts from hydro-electric development, mountain pine beetle, large-scale fires, and salvage harvesting in these areas likely removed many of the large, cavity-bearing trees that fishers require for reproductive dens. A decrease in the supply of critical denning structures may impact on the ability of the landscape to support sustainable populations of fishers.

Previous work on fishers in these areas (Davis 2012, Davis and Calabrese 2010) has estimated that there are approximately 0.5 trees/ha with external features of reproductive dens in the remaining high value habitats. High value habitats are older stands that are becoming increasingly rare in the landscape. Further, even where present, not all den trees with external features characteristic of reproductive dens will contain a cavity large enough for fisher to use. The loss of denning opportunities may be affecting recruitment rates within the population and therefore the ability of the population to sustain itself. To potentially mitigate the impacts of development on fishers and their reproductive habitat, an increase in the supply of reproductive dens is needed. Work in the United Kingdom has found that artificial denboxes are used by pine marten (*Martes martes*) in that country (Messenger *et al.* 2006). This project will determine if a similar structure provides a denbox that fisher will use for reproductive denning.

Goals and Objectives

The objectives of this multi-year project are three-fold. Firstly, we developed a denbox design that accommodated fisher reproductive needs. Secondly, we will assess the use of the den boxes by fisher. Lastly, attributes affecting the successful use of den boxes by fisher will be analyzed. Information from this project will provide land managers with better data upon which to evaluate mitigation options to augment reproductive habitat for this species.

Study Areas

This project is composed of several study areas in the central interior of BC. The 990-km² Bridge study area lies within the Gun, Tyaughton, and Yalakom drainages to the northwest of Lillooet, BC (Appendix 1). The Cariboo-Chilcotin study area has a much wider distribution occurring between 100 Mile House and Quesnel on a north – south axis and between Horsefly and Anahim Lake on an east – west axis (Appendix 2).

Methods

Information on the den box design, installation, and thermal properties has been provided in project reports from previous years (Davis 2014, Davis 2015, Davis 2016). This report updates the monitoring outcomes for the 2016-17 field season and examines habitat factors that influence den box use by fishers.

We used a combination of motion detection cameras, a hair snagger, and observations of wildlife sign at the den boxes locations to monitor for fisher use. Twenty cameras were deployed at the structures with the cameras moved between den boxes on each visit. A wildlife permit was obtained to allow the collection of hair samples (VI13-91889). Sticky pads that were fastened to the top of the box entrance allow us to verify use at den boxes where no camera is present. Pads with hair were sent to a commercial genetics laboratory (Wildlife Genetics International for analysis of species, sex, and individual identity. The combination of video and DNA evidence allowed us to tally the number of visits to each structure. During April – June, we also examined the interior of each den box for signs of reproductive use using a GoPro camera to capture any evidence. Den boxes that were being used for reproduction had a trail cam installed to document the use.

At each location, data associated with a medium-sized territorial carnivore detection station has been collected (BC Ministry of Environment Lands and Parks 1998). This information was analyzed with the data on fisher use of the structures to identify factors influencing fisher use of the den boxes.

Results and Outcomes

The analysis of hair samples from the previous winter and reproductive denning season (2015-2016) identified 28 fisher samples, 21 red squirrel (*Tamiasciurus hudsonicus*), 8

marten (*Martes americana*), 3 flying squirrel (*Glaucomys sabrinus*), 1 black bear (*Ursus americanus*), and 1 unknown species. Of the fisher samples, 23 had sufficient markers to complete analyses of individual identity and sex. Seven new individuals were identified during that period (5 female, 2 male). These fishers were all observed at sites where fisher had previously been identified either by DNA or by trail cameras. The total number of fisher identified to individual identity using DNA is now 22 (18 female and 4 male).

The total number of den boxes with a visit verified by DNA or camera is 27 out of the 55 den boxes (12 in the Cariboo-Chilcotin and 15 in the Bridge Watershed) (Appendix 1 and 2). The Cariboo portion of the study area (east of the Fraser River) had the least number of detections, with only one den box near 100 Mile House having a confirmed fisher detection. Monitoring during the 2016 reproductive season (April – June) identified four den boxes that were being used by female fisher as reproductive dens. Occupancy times ranged between 2 – 14 days with an average of 2 kits observed (Photographs 1-4). Fisher kits at DB24 spent considerable time outside of the den boxes that was recorded on camera. A male fisher was also observed at DB20 after the female and kit had left the structure. The female at DB10 was observed bringing several prey items back to the den including flying squirrel (*Glaucomys sabrinus*) and deer mouse (Peromyscus maniculatus).

Table 1. Den boxes used for reproduction during 2016 and period of use.

Den box	Period of use	Comments
CB289	April 27 – May 11, 2016	Three kits observed inside of box.
DB10	May 30 – June 1, 2016	One kit observed inside of box.
DB24	May 21 – 25, 2016	Two kits observed entering and leaving den box with female.
DB20	Observed leaving April 3, 2016	Camera did not record an entry date; however, box was likely used as a natal den.

Only two monitoring sessions were conducted in the winter of 2016-2017 to bait the den boxes, check hair snaggers, and install trail cameras. Over the two visits we have collected 24 hair samples believed to be from fisher; however, only 2 are verified by video evidence. One is believed to be a male fisher that over a month's time chewed the opening of the den box wide enough to allow entry and access to the bait.

The site characteristics of den boxes used for reproduction are shown in Table 2. Five of 6 den boxes were in the Interior Douglas-fir biogeoclimatic zone, and one box is located in the Sub Boreal Pine Spruce zone. In general, den boxes used for reproduction are on gentle slopes (<15%), at lower mesoslope positions, and in structural stage 6 and 7 stands with moderate tree cover values. Comparisons of site characteristics at reproductive den boxes versus boxes not used for reproduction did not find any significant (α=0.05)

predictive variables (Tables 2 – 8).

Figure 1. Three fisher kits photographed inside CB289 in May 2016.

Figure 2. Single fisher kit in DB10 during late May.

Figure 3. Fisher at DB24 and two kits on May 25, 2016.

Figure 4. Female putting kit in the den box on May 21, 2015.

Table 2. Site characteristics at the six den box sites in the central interior of British Columbia used by fishers for reproduction up to 2016. Site descriptions based on Describing Ecosystems in the Field (Province of BC 1998).

Denbox	Elevation (m)	Aspect	% Slope	Biogeoclimatic zone	Mesoslope	Structural Stage	% Tree cover	% Shrub Cover	Dominant tree species
CB7	986	E	12	IDFdk4	Mid	7	30	20	Douglas-fir, lodgepole pine
DB23	996	SE	10	IDFdc	Toe	6	60	50	Douglas-fir, paper birch
CB289	1138	W	5	SBPSxc	Toe	6	25	30	Salix spp., Betugla glandulosa
DB10	1145	Flat	0	IDFdc	Toe	7	40	40	Shepherdia canadensis, Salix spp.
DB20	1149	SW	4	IDFdc	Lower	6	50	20	Shepherdia canadensis, Rosa spp.
DB24	1052	E	15	IDFdc	Lower	7	60	50	Acer glabrum, Cornus stolonifera

Table 3. Comparison of continuous site variables at fisher den boxes used for reproduction.

	Reproductive dens			Other dens		
	Mean	Count	SE	Mean	Count	SE
Shrub cover (%)	34.1	6	7.1	31.6	47	2.72
Tree cover (%)	40.1	6	6.4	37.7	47	2.10
Slope (%)	8.6	6	3.8	8.4	47	1.30
Elevation (m)	1097	6	54.5	1073	47	20.2

Table 4. Use of fisher den boxes in different aspect classes (Flat: <5% slope; North: 134 - 271°; Southwest: 135 - 270°). High use den boxes had 3 or more detections of fishers.

	Reproductive	Others	Total
Flat	2	22	24
North	2	8	10
South-west	2	17	19
Total	**6**	**47**	**53**

Table 5. Use of fisher den boxes in different biogeoclimatic zones (IDF: Interior Douglas-fir; MS: Montane Spruce; SBPS: Sub Boreal Pine Spruce). High use den boxes had 3 or more detections of fishers.

	Reproductive	Other	Total
SBS	**0**	**6**	**6**
IDF	5	24	29
MS	0	4	4
SBPS	1	13	14
Total	**30**	**12**	**53**

Table 6. Use of fisher den boxes at different mesoslope positions (Low: depression, flat, and toe; Mid: lower slope; Upper: mid, upper, and crest). High use den boxes had 3 or more detections of fishers.Table 6.

	Reproductive	Other	Total
Low	**2**	**22**	**24**
Mid	2	10	12
Up	2	15	17
Total	**6**	**47**	**53**

Table 7. Use of fisher den boxes in different structural stages (4: pole/sapling; 5: young forest; 6: mature; 7: old). High use den boxes had 3 or more detections of fishers.

S. stage	Reproductive	Other	Total
4	0	1	1
5	0	4	4
6	3	26	29
7	3	16	19
Total	**6**	**47**	**53**

Table 8. Use of fisher den boxes in different stand types (Coniferous: <20% deciduous; Mixed: ≥20% deciduous component). High use den boxes had 3 or more detections of fishers.

	Reproductive	Other	Total
Coniferous	4	29	33
Mixed	2	18	20
Total	**6**	**47**	**53**

Discussion

The fourth year of the den box study further decreased the number of monitoring visits to the structures. It is felt that time is one of the major factors in fisher finding den boxes and decreased signs and smells of human presence may increase the chances of fisher using the structures for reproductive denning. Fisher in dry areas of the province have relatively large home ranges (30 km^2 for females; Davis 2009) and finding suitable structures for denning is likely to take time. Fisher have now been detected at 50% of den boxes over the course of this study indicating that local knowledge and modeling data are important factors for identifying reproductive habitat. However, there continues to be a very low detection rate at Cariboo den boxes suggesting that other factors may be involved. Den boxes in the Cariboo were placed in areas where trappers have caught fishers in the past 10 years and where a research study in the early 1990s found fisher (Weir 1995). This same strategy has resulted in 61% of fisher den boxes being used in the other portions of the study area. To help evaluate reasons for this inconsistency, a DNA-based fisher inventory in the Cariboo Region east of the Fraser River is recommended.

DNA samples from the 2014-15 winter and reproductive season were analyzed to 15 loci at the request of the Provincial Carnivore Conservation Specialist[1] to facilitate comparisons across British Columbia. The original analysis was completed at 7 loci, and reanalysis using the additional loci did not change any of the previous assignments to individual. Five samples were identified as fisher but could not be assigned to an individual ID. These samples were from den boxes where kits had been produced, and it is likely that multiple individuals using the structure confounded the analysis. The 7 new individuals identified were not found at new den box sites (e.g. den boxes that had not been used previously). It is likely that many of these fishers are young of the previous year that are exploring their territory.

The results of monitoring during the reproductive season (April – June) are very promising with a doubling of the number of den boxes used in the previous season. All used den boxes are new and suspected to have been different females from 2015. We will verify this once hair-snag results become available. The four den boxes had a range of kits observed at the structures (1-3) which coincides with the average female output of 2.2 kits/year (Weir 2003). Observations of prey items being brought back to the kits were vetted at the yearly BC Mesocarnivore Workshop held in Gavin Lake in 2016. I presented the series of videos with prey to the biologists attending to get consensus on the likely species (flying squirrel, *Glaucomys sabrinus* and deer mouse *Peromyscus maniculatus*). Portions of the prey were taken into the den box, presumably for the kit, with some eaten on top of the structure.

The total number of den boxes used for reproduction is now at 6; however, the sample size still appears to be too small to construct any habitat model on their deployment. The

[1] Rich Weir, Provincial Carnivores of Conservation Specialist, Ecosystem Branch, Ministry of Environment.

use of new structures by fishers for reproduction in the spring of 2017 may provide additional information required to model important site characteristics. However, it is important to note that the locations chosen for the den boxes is already based on data from fisher studies across BC. Given this, use of the structures for reproduction may depend more on the supply of den trees in each fisher's home range than on site differences.

Dissemination of project information has taken place using a number of formats. Two videos on the den box project have been released on Youtube and links were provided from Facebooks "Phat Weasels" page, as well as the FWCP and HCTF websites. The videos explicitly recognize the support of both project sponsors and currently have a combined 1279 views. The project was also presented at the BC Mesocarnivore Workshop in June 2017, and at forestry – fisher workshops delivered in Prince George and 100 Mile House. Information on the project was also provided to meetings with the Tsay Keh Dene First Nations and Prince George Trappers Association in February 2017. Links to project reports and den box plans from the BCFisherhabitat.ca website, further disseminating the project results.

Interest in the project is growing in Canada and the USA. Den box designs are being used to offset habitat losses at the Site C hydro-electric project and will be installed this fall. The Toronto and Region Conservation Authority continues to monitor 3 den boxes installed at that location and a female has been observed using the structure before the upcoming 2017 reproductive season[2]. A biologist from Alberta Environment and Parks has requested den box plans and will be constructing several structures to deploy in the Red Deer area[3]. I have requested that anyone using this information reference the work on den boxes completed in BC in any extension they produce. The Prince George Trappers association has also requested and received den box plans. In all cases, the interested parties had seen the project video and sought out more information (e.g. reports and construction drawings) which all credit our funding partners.

This results of this project help the Bridge-Coastal Restoration Program achieve several of their specific objectives for the Bridge River watershed. The primary Action/Watershed Plan that this project aligns with is the ***Species Based Action Plan***. Fisher is listed as a high priority for FWCP investment and the results of this project are helping meet Objective 1: maintain or improve the status of species or ecosystems of concern. Fisher have low reproductive output and populations in the area are benefiting from the addition of reproductive habitat. This habitat will be especially important over time as timber harvesting is ongoing in the area and natural dens are likely to be impacted. Work that helps maintain viable populations of fishers will also help meet Objective 2 – maintain or improve opportunities for sustainable use. Increasing the amount of reproductive habitat will help promote sustainable populations of fishers in the watershed for the trapping and tourism industries. The project provides a specific opportunity to enhance riparian areas that are degraded or sub-optimal (***Riparian and***

[2] Adam Weir, Restoration and Infrastructure, Toronto and Region Conservation Authority.
[3] Dave Prescott, Senior Species at Risk Biologist, Alberta Environment and Parks.

Wetlands Action Plan) by providing a proven mitigation strategy that will supply fisher reproductive habitat for the short to mid-term until longer term measures, such as fungal inoculation, can increase the availability of cavity-bearing trees.

Next steps for this project include completing the last reproductive denning season monitoring in Spring 2017. All DNA samples collected will be submitted for analysis and a final analysis of den box use. In the summer/fall of 2017, we also will visit all known fisher den trees in the project area to assess the trees longevity. This information will help us forecast the need for artificial den boxes based on fall down rates of natural den trees. Extension efforts for the next year include presenting at the 2017 BC Nature AGM at Lillooet in early May 2017. This information will be compiled into a final project report by March 31, 2018.

Recommendations

This project is making progress with continued fisher detections during the winter period and the successful use of a total of 6 den boxes for reproduction. We are hopeful that monitoring during the 2017 reproductive season will identify several more structures enabling us to develop habitat models for the deployment of the structures. We will also visit all known natural fisher den trees in the project area to assess longevity. Fishers den in trees with extensive heart rot and fishers will not use the structures for reproductive denning once the trees fall. This information will allow the modeling of the supply of natural den trees and indicate the need for artificial den boxes.

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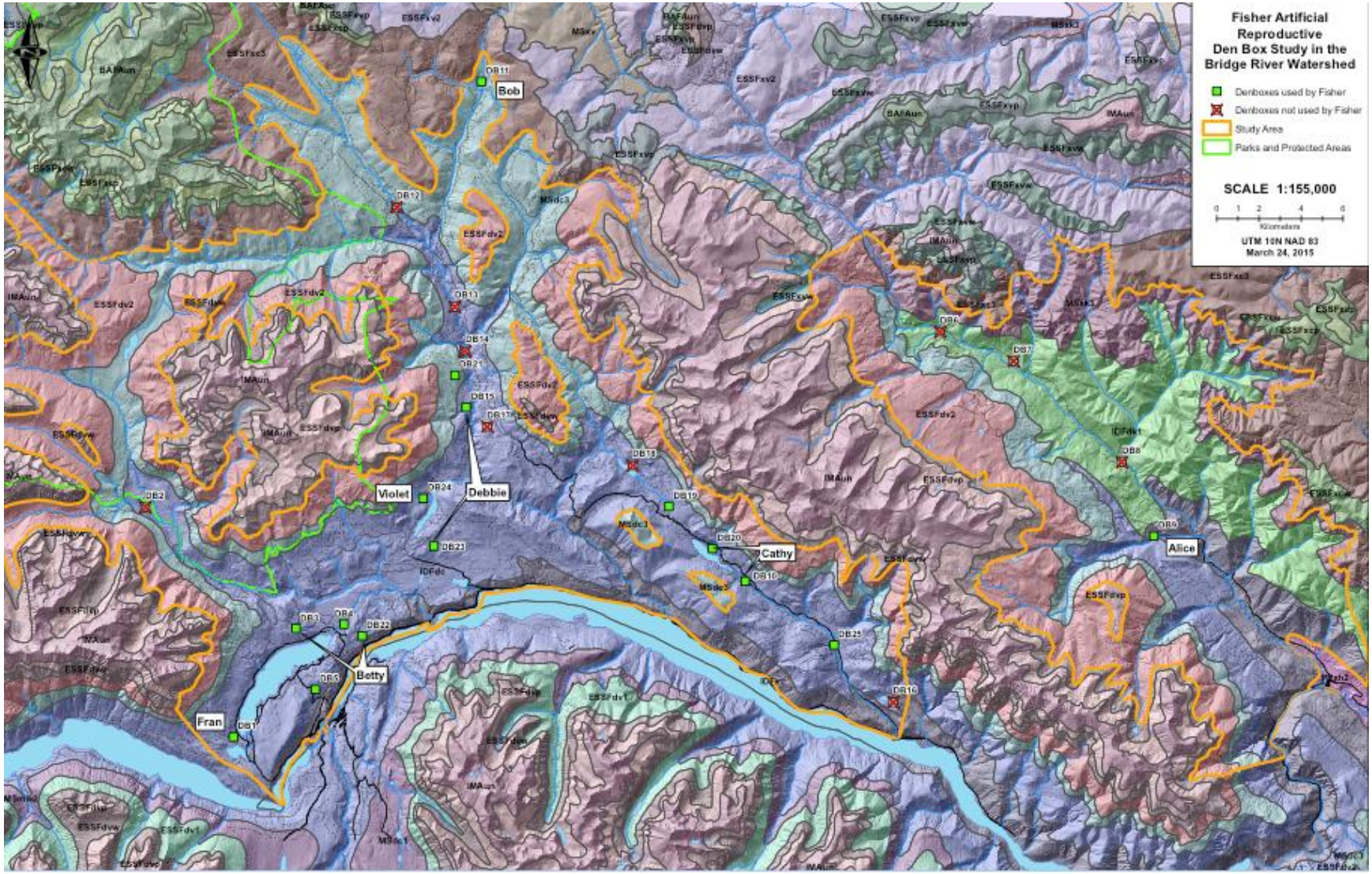
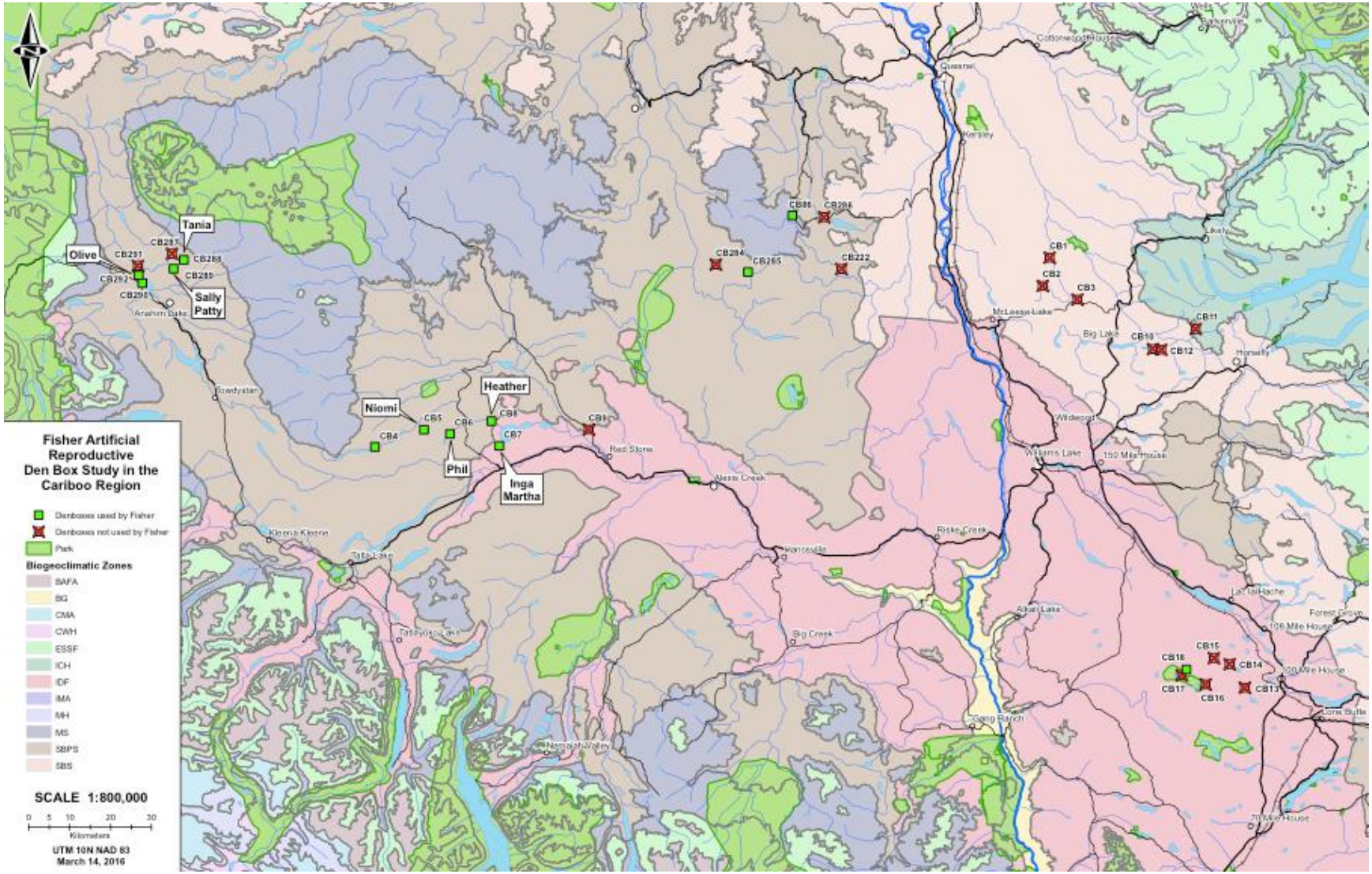
Appendix 1. 2016-17 Fisher den box locations and use in the Bridge River Watershed.



Appendix 2. 2016-17 Fisher den boxes and use in the Cariboo–Chilcotin Region



Appendix 4. Performance measures

Performance Measures – Target Outcomes -														
Project Type	Primary habitat benefit targeted of project (sq.m.)	Primary Target Species	Estuarine	In-stream Habitat – Mainstream	In-stream Habitat – Tributary	Riparian	Reservoir Shoreline Complexes	Riverine	Lowland Deciduous	Lowland Coniferous	Upland	Wetland	Other
Maintain or Restore Habitat forming process													
Artificial gravel recruitment	Area of stream habitat improved by gravel placement												
Artificial wood debris recruitment	Area of stream habitat improved by LWD placement												
Small-scale complexing in existing habitats	Area increase in functional habitat through complexing												
Prescribed burns or other upland habitat enhancement for wildlife	Functional area of habitat improved												
Habitat Development													
New habitat created	Functional area created												
Other													
New habitat elements created	56 Den Boxes installed	Fishers (*Pekania pennanti*)				X			X	X			

Appendix 5. Confirmation of FWCP Recognition

Over the course of fieldwork in the study area we often stop and discussed the project with people living and working in the area. There is local concern regarding the effects of forest harvesting that is ongoing in the area. We have also had enquiries on the availability of construction plans for denboxes. All discussions of the project were positive with people generally very interested in the work. Other examples of recognition are outlined below.

In all cases, our project funding partners are explicitly recognized in presentations and literature that I disseminate.

Community Outreach

- Information on the project was provided at separate meetings with the Tsay Keh Dene First Nations and the Prince George Trappers Association in February 2017.
- Video on the den box project was released on Youtube and links were provided from Facebooks "Phat Weasels" page, as well as the FWCP and HCTF websites in May 2016.

Communication of Results to Government, Industry, and Academia

- Information on this project was presented in June 2016 to researchers in government and the private sector at the yearly Mesocarnivore Workshop in Williams Lake, B.C.
- Information on the project was presented at forest industry workshops in Prince George and 100 Mile House in February 2017.
- Reports and den box plans were also requested by and sent to:
    - Dave Prescott, Senior Species at Risk Biologist, Alberta Environment and Parks.
- Reports and den box plans have been made available for download from the BCFisherhabitat.ca website.