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

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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 third year of the study continues the monitoring efforts on the 56 den boxes installed during this project.

The study has been successful in attracting fishers to 50% of the den boxes, with many of the structures used for resting during winter. Winter is energetically stressful for fishers and the structures provide a warm, secure location to rest. We identified 45 fisher samples using hair snaggers located at the entrance to the den boxes. Of these, individual identity was assigned to 16 fishers, 14 of which are female indicating that the den boxes are selective for this sex. Eight of the females used the structures more than once (range: 1 -8) and 4 were detected at 2 different den boxes.

Monitoring during the reproductive season (late March – June) identified two den boxes that were used for reproduction. A trail cam in the Bridge Watershed identified a female using a den box between March 25 – April 8, 2015. The fisher birthed one kit and was observed leaving the den box with the kit on April 8, 2015. The female returned with her kit and used the den box again between May 31 – June 2, 2015. In the Chilcotin, 2 kits were photographed inside a den box on April 8, 2015. A trail cam set up at the den box documented the female and both kits using the den box between June 2 – 7, 2015.

Modeling of habitat attributes at den box sites did not produce significant results, although several variables (mixed tree species forest and increased cover of vegetation) were associated with high use den boxes. Habitat differences between the two study areas may be masking some variables that are predictive. Increasing the number of detections at den boxes in each study area may help clarify which variables are important for fisher use, especially den boxes used for reproduction. Obtaining this information is likely to require extending the project out to 5 reproductive denning seasons in each study area.

Extension during this year included two community presentations, project updates on the *Phat Weasels* Facebook page and a project video on Youtube. Community presentations took place in Lillooet and Tatla Lake, BC. Links to the project video were provided to both project funding partners and currently there have been 679 views. The video has also promoted interest in the project from northern BC, Ontario, Minnesota, and California. Land managers in Ontario and Minnesota have installed den boxes using our design and will reference this project in any publications they produce. In the 2016-17 field season, we will continue monitoring of the den boxes to assess fisher use of the structures for reproductive denning and winter use.

Table of Contents

Tables

Figures

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). This report updates the monitoring outcomes for the 2015-16 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

The third year of this project had a much greater number of samples collected when compared to year 2 (74 in 2015-16 vs 40 in 2014-15). In July, we submitted 80 samples to

the genetics lab for analysis. This group of samples included those collected during the reproductive season (April – June 2015) and those collected over the previous winter (2014-15). The results found DNA from fisher, marten (*Martes americana*), flying squirrel (*Glaucomys sabrinus*), red squirrel (*Tamiasciurus hudsonicus*), wood rat (*Neotoma cinerea*), and black bear (*Ursus americanus*). Table 1 provides the frequency of each species. There were also 19 fisher verified by camera visiting a denbox where no DNA was obtained. The total number of den boxes with a visit verified by DNA or camera is 27 out of the 56 den boxes (12 in the Cariboo-Chilcotin and 15 in the Bridge Watershed) (Appendix 1 and 2). One den box in the Chilcotin was burned in a wildfire in 2015; therefore, the new total is 55 den boxes. 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 fisher detected.

Table 1. Species detected and number of detections using hair snaggers at artificial fisher den boxes between November 2014 – June 2015 in the central interior of British Columbia.

Species identified	Number of samples
Fisher (*Pekania pennanti*)	45
American marten (*Martes americana*)	9
Flying squirrel (*Glaucomys sabrinus*)	9
Red squirrel (*Tamiasciurus hudsonicus*)	4
Wood rat (*Neotoma cinerea*)	1
Black bear (*Ursus americanus*)	1
Mixed species	4

Out of the fisher samples, the laboratory identified 16 individuals (2 male and 14 female). Interestingly, this group included one female that had been detected multiple times in the previous Bridge River fisher inventory (Davis 2013). Both males were only detected once, while the number of detections of females ranged from 1-8, with several being found at 2 den boxes (Table 2, Appendix 1 and 2).

Monitoring during the reproductive season (April – June) identified two den boxes that were being used by female fisher as natal dens. In the Bridge Watershed, a den box near Taughauton Lake was occupied continuously by a female for 13 days starting on March 26, 2015. A camera at the site has video of the female making occasional short forays out of the structure during this period. The camera also recorded courtship behavior by a male fisher during this period. The male was frequently recorded in the video climbing on the tree and sitting on top of the den box. The recordings included vocalizations between the two fishers. The female left the den box carrying one kit on April 8, 2015. Fisher "Debbie" and her kit were verified using the same den box between May 31st – 2 June 2nd 2015 on video and using DNA (Photographs 1-4).

Table 2. Individual identity and sex of fishers (*Pekania pennanti*) detected at artificial den boxes using hair snaggers in the central interior of British Columbia (November 2014 – June 2015).

Individual identity	Number detections	Number den boxes
Alice (F)	1	1
Betty (F)	3	2
Cathy (F)	5	2
Debbie (F)	7	2
Bob (M)	1	1
Fran (F)	2	1
Heather (F)	1	1
Iona (F)	3	1
Martha (F)	1	1
Phil (M)	1	1
Niomi (F)	1	1
Olive (F)	1	1
Patty (F)	2	1
Sally (F)	3	2
Tania (F)	1	1
Violet (F)	8	1

Figure 1. The fisher on the tree is a male and Debbie's canine teeth can be seen as she vocalizes at him from within the den box in early April 2015.

Figure 2. Fisher "Debbie" leaving the denbox with her kit on April 8th.

Figure 3. "Debbie" pushing her now larger kit back into the denbox on May 31, 2015.

Figure 4. "Debbie" and her kit leaving the den box on June 1, 2015.

The second den box with reproduction documented is located in the Chilcotin near Puntzi Lake. On April 7, 2015, two kits were filmed inside the den box using a Gopro camera. A trail camera was set up at that time; however, it missed the female leaving with her kits. "Inga" returned June 3rd with both kits and left again on June 7, 2015 (Photographs 5-7). DNA from Inga was found at the den box in March, May, and June 2015. During the June vist, Inga and the kits made frequent forays out of the den box.

Both of the den boxes used for reproduction are located in an Interior Douglas-fir biogeoclimatic zone stand and have Douglas-fir as the dominant tree species. However, secondary tree species, structural stage. mesoslope position, and percent vegetation cover differ between the sites. The Bridge den box is in a mature structural stage stand that has deciduous species, and is situated in shallow, moist gully that has much higher forest and shrub cover than at the Chilcotin den box (Table 3). The Chilcotin den box is located on an eastern facing hillside in a mid-slope mesoslope position. The area is dominated by Douglas-fir, but there is extensive mountain pine beetle mortality in the lodgepole pine that is present.

Figure 5. Two kits photographed in Chilcotin denbox on April 8, 2015.

Figure 6. Kit climbing into Chilcotin den box near Puntzi Lake in early June 2015.

Figure 7. "Inga" pulling one of her kits out of the Chilcotin den box on June 7, 2015.

The examination of site factors associated with fisher use of den boxes focused on high-use sites (3+ detections). Given the low number of detections in the Cariboo portion of the study area (1 detection in 12 den boxes over 2 years), these structures were excluded from the analysis. Similar proportions of high use den boxes were found in both the Bridge and Chilcotin areas (7/25 high use in Bridge, 5/17 in Chilcotin).

None of the analyses was significant ($\alpha = 0.10$) in univariate tests. Shrub cover and tree cover were greater at high use den boxes ($p = .18$ and $p = .15$ respectively) (Table 4). The elevation at high use den boxes was lower than at low use den boxes ($p = .15$) in the Bridge Watershed, but was virtually the same in the Chilcotin. The analysis of most of the categorical variables suffered from low expected counts, with the exception of stand type. Mixed tree species stands were more likely to have high use den boxes ($p = 0.2$) and there is a trend of lower mesoslope positions having a greater proportion of high use den boxes ($p=0.3$). Counts of fisher detections at den boxes versus categorical variables are shown in Tables 5 – 9.

Table 3. Site characteristics at the two den box sites in the central interior of British Columbia used by fishers for reproduction in 2015. 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
Chilcotin	986	E	12	IDFdk4	Mid	7	30	20	Douglas-fir, lodgepole pine
Bridge	996	SE	10	IDFdc	Toe	6	60	50	Douglas-fir, paper birch

Table 4. Comparison of continuous site variables at fisher artificial den boxes in the Bridge and Chilcotin portions of the study area. High use den boxes had 3 or more detections of fishers.

		Bridge			Chilcotin			Bridge and Chilcotin		
	Row Labels	Mean	Count	SE	Mean	Count	SE	Mean	Count	SE
Shrub cover (%)	Low use	36.9	18	3.77	24.2	12	3.98	31.8	30	2.96
	High use	48.6	7	5.53	26.0	5	2.45	39.2	12	4.68
Tree cover (%)	Low use	41.9	18	3.50	30.8	12	3.36	37.5	30	2.66
	High use	45.7	7	5.28	43.0	5	6.63	44.6	12	3.96
Slope (%)	Low use	12.2	18	2.89	4.7	12	1.60	9.2	30	1.91
	High use	7.4	7	2.41	5.4	5	0.96	6.6	12	1.54
Elevation (m)	Low use	1091.0	18	37.92	1118.4	12	18.95	1102.0	30	23.80
	High use	986.7	7	46.83	1115.8	5	35.39	1040.5	12	35.44

Table 5. 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.

	Low use	High use	Total
Bridge	**18**	**7**	**25**
Flat	8	3	11
North	3	1	4
South-west	7	3	10
Chilcotin	**12**	**5**	**17**
Flat	7	3	10
North	3	1	4
South-west	2	1	3
Total	**30**	**12**	**42**

Table 6. 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.

	Low use	High use	Total
Bridge	**18**	**7**	**25**
IDF	15	7	22
MS	3		3
Chilcotin	**12**	**5**	**17**
IDF		1	1
MS	1		1
SBPS	11	4	15
Total	**30**	**12**	**42**

Table 7. 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.

	Low use	High use	Total
Bridge	**18**	**7**	**25**
Low	4	4	8
Mid	5	2	7
Up	9	1	10
Chilcotin	**12**	**5**	**17**
Low	8	4	12
Mid	3	0	3
Up	1	1	2
Total	**30**	**12**	**42**

Table 8. 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.

	Low use	High use	Total
Bridge	**18**	**7**	**25**
4	1		1
5	1	1	2
6	8	3	11
7	8	3	11
Chilcotin	**12**	**5**	**17**
5	1		1
6	8	3	11
7	3	2	5
Total	**30**	**12**	**42**

Table 9. 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.

	Low use	High use	Total
Bridge	**18**	**7**	**25**
Coniferous	12	3	15
Mixed	6	4	10
Chilcotin	**12**	**5**	**17**
Coniferous	7	2	9
Mixed	5	3	8
Total	**30**	**12**	**42**

Discussion

This third year of the den box study continued the trend of increasing numbers of fishers detected and den boxes used, suggesting that time is likely to be an important factor in this study. 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 den boxes were placed in areas where previous research had identified fishers, local trappers had indicated recent fisher use, and in locations that modeling of fisher reproductive habitat indicated was high value[1]. 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 has been 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 studied 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.

The extremely high proportion of females identified by DNA using den boxes indicates that the structures are selective for females. The entrance dimensions of the boxes is based on natural reproductive dens and females are extremely selective for a restricted range of hole sizes (Weir et al. 2012). This is thought to help prevent larger male fishers from entering the den and harming the kits . Both sexes use cavities for resting, but females are reported to use cavities more often and to use cavities that are smaller and more secure than those used by males (Zellinski et al. 2004; Kilpatrick and Rego 1994).

[1] Fisher Habitat and Forest Management Web Module. Management Table – Dry Forest. Available at: http://fisher.forrex.org/management-table-dry-forest

The male fisher observed in the Bridge Watershed courting the reproductive female frequently attempted to stick his head into the den box; however, his skull appeared too large to access the structure and he was not observed entering.

Reproduction in fisher involves delayed implantation, where females breed within 7-10 days after giving birth, but the egg does not implant until the following February. Other species also have delayed implantation; however, fishers have the longest delay period. This project documented the courtship of a female by a male over 7 days that included the male repeatedly climbing on the den tree and den box. Likewise, the female made short forays outside the den box during this period. Numerous instances of vocalization between the fishers were also recorded during this time.

At this point, the sample size for den boxes used for reproduction is still too small to construct any habitat model on their use. The reuse of both structures by females and kits suggests that the den boxes provided more than an emergency structure to give birth to their young. The reuse of the den boxes also indicates the structures met their needs for both a natal and maternal den. Expanded use of additional structures by fishers for reproduction 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 differences in the location of these structures.

The analysis of high-use den box sites did not produce significant results and this may also be due to the placing of the structures in locations that are already predicted to be reproductive habitat. Some of the general trends observed such as greater use of mixed tree species stands and greater vegetation cover, are in general predictive for fisher habitat across the species range and are included in modeling for fisher reproductive habitat. In addition, pooling of results from both study areas may make observing a difference difficult. The Chilcotin and Bridge areas have some key differences in topography among other things. Terrain in the Bridge watershed involves deep valleys and generally steep slopes up to alpine areas. In contrast, the Chilcotin is largely plateau with smaller changes in elevation except near the southern and western edges. Given this, finding differences in site characteristics between high use and low use den boxes is likely to require a much larger number detections.

Dissemination of project information has taken place using a number of formats. A 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 2015. The video explicitly recognizes the support of both project sponsors and currently has 679 views. The project was also presented at community meetings in the T'it'q'et center in Lillooet that was attended by 27 community members and at a community forest meeting in Tatla Lake. The Tatla Lake Community forest will be installing several den boxes in 2016.

Interest in the project is growing in Canada and the USA. Den box designs have been requested by parties in the north-east of BC for deployment in areas impacted by gas/oil

exploration. The Toronto and Region Conservation Authority has installed 3 den boxes in areas inhabited by fisher in Ontario. Hubbard County in Minnesota, USA has installed den boxes to address habitat losses in that area. Finally, P&G gas has also expressed an interest in using den boxes as a conservation tool in California. 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. I have requested that they reference the work on den boxes completed in BC in any extension they produce.

Next steps for this project include submitting DNA samples collected this winter for analysis, continued monitoring for fisher use of the denboxes, and extension of the project to user groups. Monitoring for fisher use of denboxes during the reproductive denning season will commence in early April with monthly visits through June. In November, denboxes will be visited again for repairs and baiting. Monitoring over the winter of 2016-17 will be at a lower intensity (2 site visits). Fisher use of the structures may be influenced by disturbance at the den box; therefore, we intend to operate at a reduced intensity prior to the reproductive season to determine if this will help increase fisher use of the den boxes. Finally, extension efforts for the next year include presenting at the 2017 BC Nature AGM at Lillooet in early May 2016.

Recommendations

This project is making progress with continued increases in fisher detections during the winter period and the successful use of two den boxes for reproduction documented in 2015. We were not able to identify any site variables that influenced fisher use of the structures; however, continuing the project through 5 reproductive seasons would increase the amount of detections and allow us to examine site use factors within each of the study areas. Further, the most relevant information is likely to come from those den boxes actually used for reproduction and increasing this number will take time. I have also made a recommendation to MoE to conduct an inventory on fisher abundance in the Cariboo portion of the project. Understanding why the number of detections from this portion of the study area are so low will be important in assessing this project outcomes.

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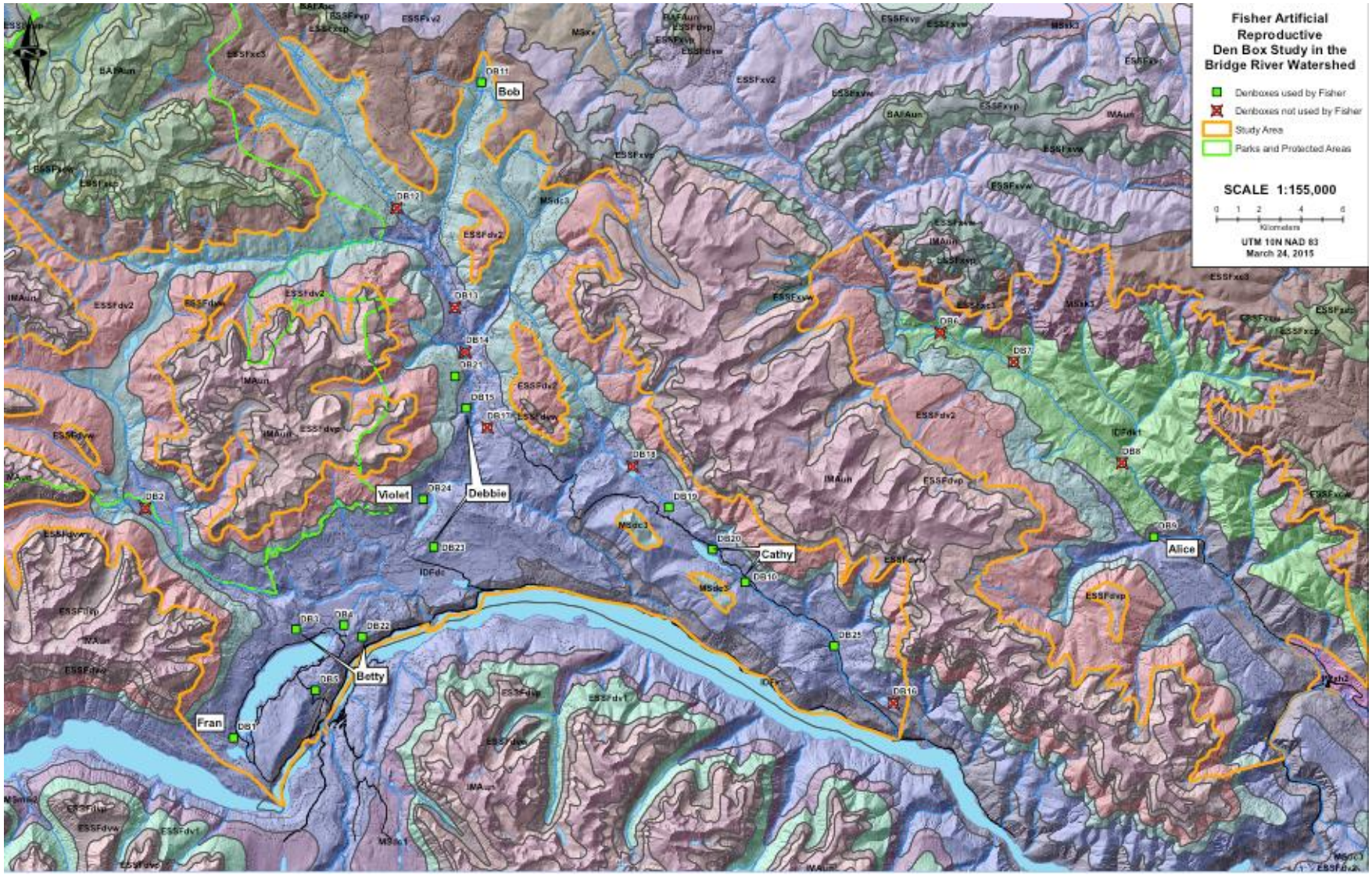
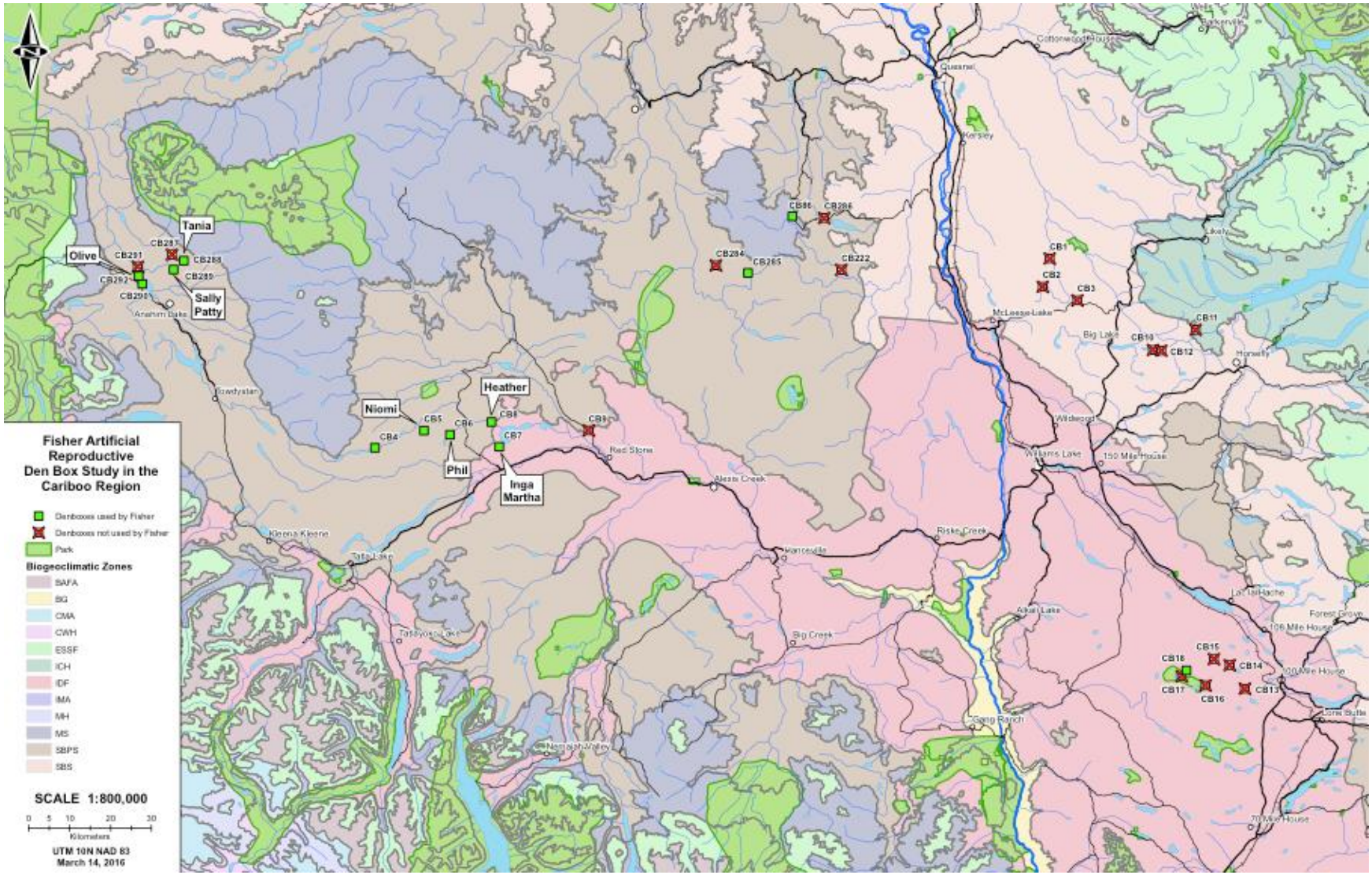
Appendix 1. 2015-16 Fisher den box locations and use in the Bridge River Watershed.



Appendix 2. 2015-16 Fisher den boxes and use in the Cariboo–Chilcotin Region



Note:

Technical drawings for fisher den boxes are appended below. Before building and deploying artificial den boxes into the field, the reader is asked to consider the following.

Artificial den boxes can be a useful tool to augment fisher reproductive potential where the supply of natural reproductive dens has been determined to be a limiting resource. Dens can be scarce for a number of reasons including anthropogenic effects (e.g., forest development, reservoir impoundment) or natural effects (e.g., large-scale wildfire, mountain pine beetle kill). Den boxes, however, should not be used to mitigate the effects of anthropogenic effects where impacts on natural denning habitats and den structures can be avoided. Furthermore, den boxes should only be considered a temporary conservation tool to provide short-term reproductive habitat elements in den-limited landscapes while managing for the development of natural den structures over the mid- to long-term.

Thank you.

FISHER DEN BOX DRAWINGS

PREPARED FOR:

DAVIS EVIRONMENTAL

PREPARED ON:

24/20/2015

PREPARED BY:

MICHAEL BRINONI, AScT

HABITAT CONSERVATION TRUST FOUNDATION

FISH AND WILDLIFE COMPENSATION PROGRAM

The FWCP is a partnership of:

BC hydro FOR GENERATIONS · British Columbia · Canada · Fisheries and Oceans Canada · Pêches et Océans Canada

Sheet Number	Sheet Name
1	COVER
2	PLAN
3	PHOTO DESCRIPTION

SCALE: 12" = 1'-0" FIELD CREW: SHEET NUMBER:

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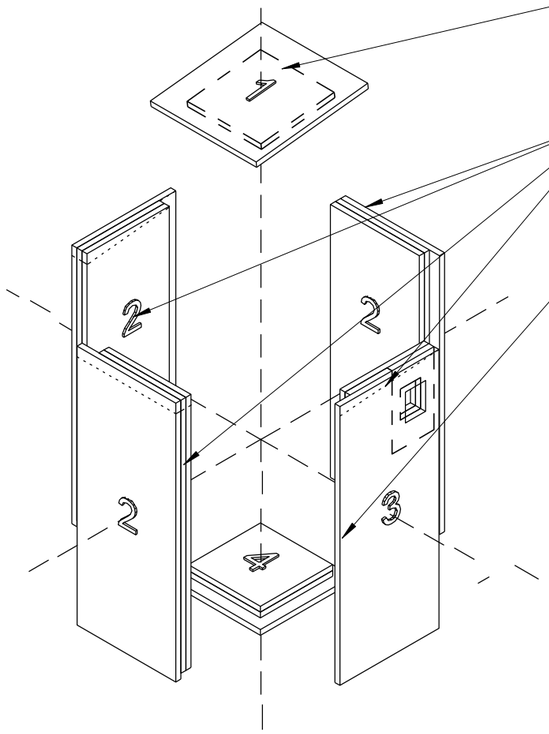
STAMP

PROJECT: FISHER DEN BOXES

SHEET: COVER

DESIGNED BY: LD	DATE: 24/02/2015
DRAWN BY: MB	REVISION NUMBER:
CHECKED: LD	REVISION DATE:
SITE SURVEY: N/A	JOB #: p506

1



PANEL 1:
- 2 LAYERS 3/4" PLYWOOD

FASTEN LAYERS TOGETHERWITH 1 1/4" SCREWS @ 6" O.C SPACING
MIN. 2 1/4" EDGE DISTANCE, OVERHANG ON LOW SIDE

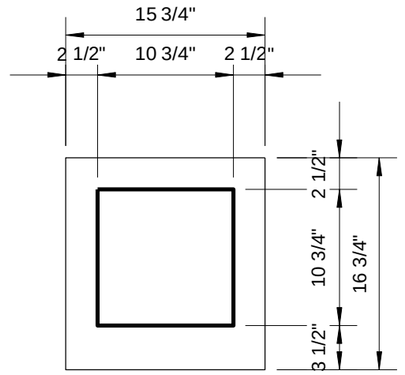
PANEL 2 THROUGH4:
- 1 LAYER 3/4" PLYWOOD
- 1 LAYER 3/4" EXPANDED STYROFOAM INSULATION
- 1 LAYER 3/4" PLYWOOD

LAMINATE THROUGH ALL LAYERSWITH 2" SCREWS @ 6 " O.C.SPACING
MIN. 1" EDGE DISTANCE

FASTEN ALL PERPENDICULAR EDGES WITH #8 X 2" ZINC COATED SCREWS @ 4" O.C, STAGGERED (SEE DETAIL 02)

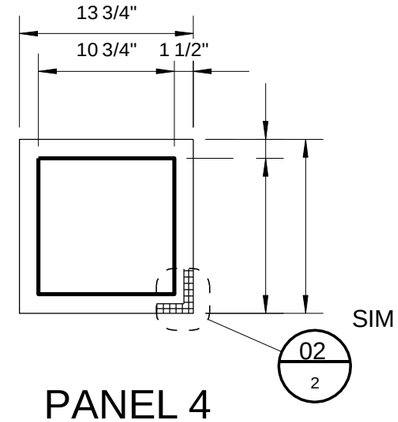
MATERIAL TAKE-OFF:
- 2 SHEETS OF 3/4" CSP PLYWOOD
- 1 4'X8' SHEET OF 3/4" EPS STYROFOAM
- 130 PCS. #8 X 2 " ZINC COATED SCREWS
- 25 PCS. #8 X 1 1/4" ZINC COATED SCREWS

EXPLODED VIEW



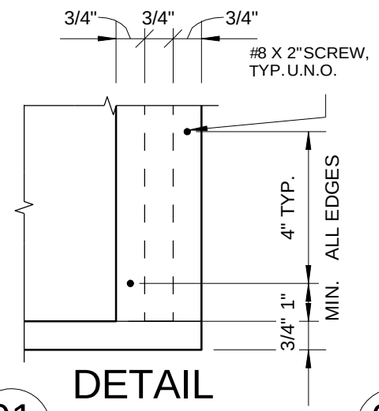
PANEL 1

1" = 1'-0"



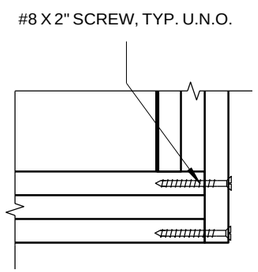
PANEL 4

1" = 1'-0"



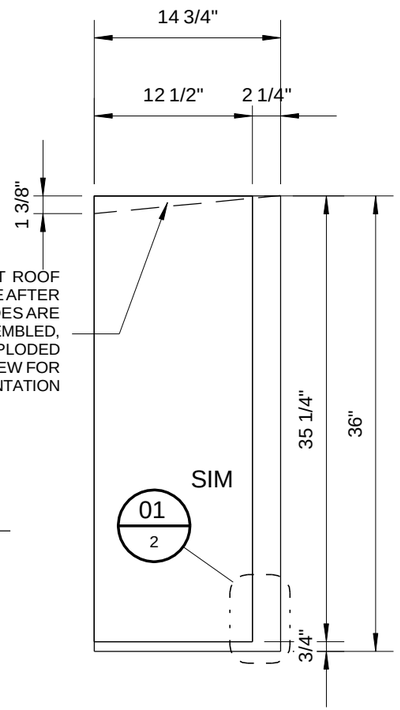
DETAIL 01

3" = 1'-0"



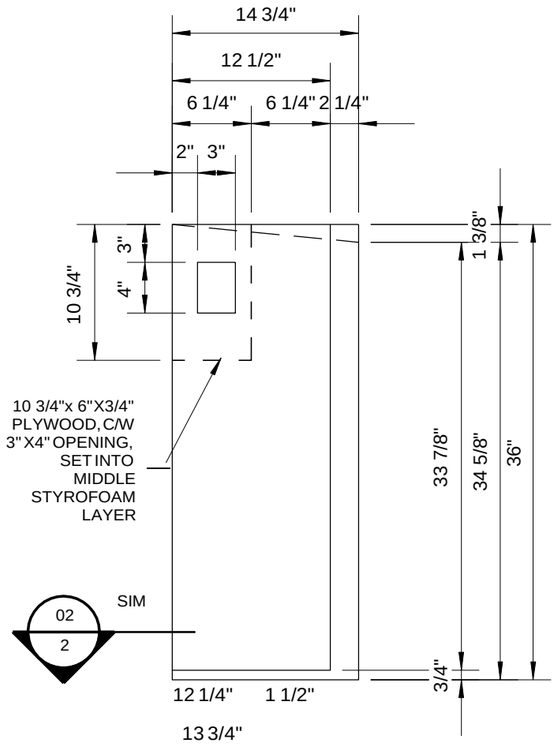
DETAIL 02

3" = 1'-0"



PANEL 2, TYP.

1" = 1'-0"



PANEL 3

1" = 1'-0"

Construction notes: Use exterior grade screws on all panels

1. Assemble the 4 side panels (panels 2 & 3) with foam cores. A 6" x 10 ¾ plywood core section is required where the door hole will be cut. Keep screws at least 2" from the top and bottom of the panels.

2. Use carpenters glue and 2" screws to fasten the four sides of the box together.

3. The top of the box is cut at approximately 5 degree slope to shed water. One way to do this is to measure down ¼" at the high side and 1 5/8" on the low side (e.g. away from the door). Draw a line through these marks and cut the sides with a circular saw. Then angle the saw blade at 5 degrees and cut across the front and back to meet the side cuts.

4. Assemble the bottom (#4) panel which is designed to sit inside the side panels. Fasten with 2" screws.

5. Cut the entrance hole. Use a ¾ wood bit to make each corner of the door hole (3x4") and finish with a jig saw.

6. Make top panel (#1) which can be fastened in place with 2 – 2" screws.

7. Put approximately 6" of insulation in bottom. We have used wood shavings, but dry rotten wood from local trees is also likely to be good and may smell more natural.

8. We have used a dark colored water based stain to help preserve the box.

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PROJECT: FISHER DEN BOXES

SHEET: PLAN

SCALE: As indicated	FIELD CREW:
DESIGNED BY: Designer	DATE: 10/19/12
DRAWN BY: MB	REVISION NUMBER: 1
CHECKED: LD	REVISION DATE: 15 NOV
SITE SURVEY: N/A	JOB #: p506

SHEET NUMBER: 2

Preparing panels

Cutting the door opening

Assembling the box panels

Finished den box

Erecting denbox notes:

Cutting the sloped top of the box

Stained den box with battens

Erecting denbox notes:

1. Find a location that fisher frequent. Den trees in BC are often found along streams and wetlands, but are usually back from an opening so that the female can approach using cover.

2. Hang the box on a relatively large diameter (e.g. larger diameter than the box if available) healthy tree, located on relatively flat ground, at approximately 8-12 feet high.

3. Screw 3-15" long 1½ x 1½" battens onto the back of the box at the top and bottom using 3 – 2 ½" #10 screws. Note that while the photo shows 2 horizontal battens, this is a weak point when the box is hanging. A third batten in the middle of the box provides the needed strength.

4. Screw 2-36" long 1½ x 1½" batons vertically onto the 15" batons using 4 – 4" #10 screws. The battens should be screwed to the side of the box closest to where the door is located. Space the vertical batons to allow the horizontal battens to just touch the tree and prevent the box from rocking on the tree.

5. Fasten a chain and pulley firmly to the tree at a point above where the box will hang. Thread a rope though the pulley and tie it securely to the batons on the back of the box. Pull to the correct height.

6. Fasten the box to the tree with 3 wraps of plastic coated wire (clothesline) and clamps. Once it is fastened, pull down on the box to jam it against the tree. If the box still rocks, use a branch for a shim between the box and the tree.

7. Ideally, a branch will be located on the tree near the door to help the fisher access the box. Where this is not available, we have screwed a branch between the box and tree.

8. We have hung scent strings under the box to speed up the time it takes for fisher to find it. Providing a piece of bait inside also seems to improve the chances of a fisher entering the box. These actions should be taken until a fisher is using the box, then discontinue to avoid disturbing the animals.

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STAMP

PROJECT: FISHER DEN BOXES

SHEET: PHOTO DESCRIPTION

SCALE:	FIELD CREW:
DESIGNED BY: Designer	DATE: 05/02/13
DRAWN BY: MB	REVISION NUMBER: 1
CHECKED: Checker	REVISION DATE: 15 NOV
SITE SURVEY: N/A	JOB #: p506

SHEET NUMBER: 3

Addendum 1 to FISHER DENBOX DRAWINGS 31 March 2018

Background: squirrel damage has enlarged the entrances of some den boxes. Female fishers are very selective for the entrance dimensions to reproductive dens, presumably to exclude larger predators, including male fishers. In 2017, we had one instance of infanticide where a male fisher was able to chew open the entrance sufficiently to gain entry and kill the two kits inside. We believe that squirrel chewing damage on the plywood at the entrance facilitated the male's entry (see photograph A) . Approximately 21% of den boxes showed significant chewing damage at the entrance after 4 years of deployment. To address this, we have designed a solid wood door jamb and molding that fits into the entrance and can be changed easily if it is damaged (Photograph B).

Photograph A: example of squirrel chewing damage.

Photograph B: replaceable door jamb and molding.

Project funding provided by:

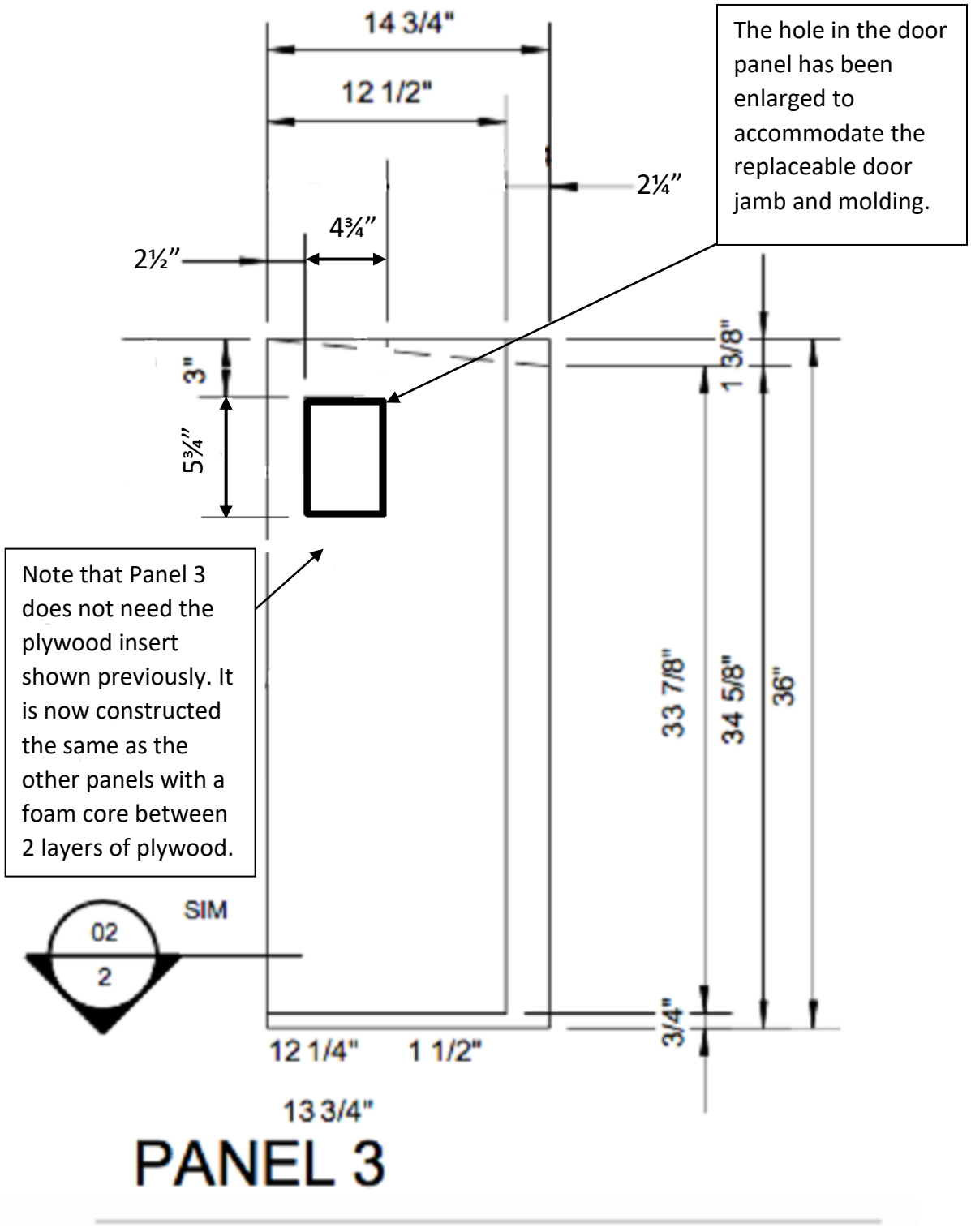
FWCP Fish & Wildlife COMPENSATION PROGRAM

HABITAT CONSERVATION TRUST FOUNDATION

FESBC

Forest Enhancement Society of British Columbia

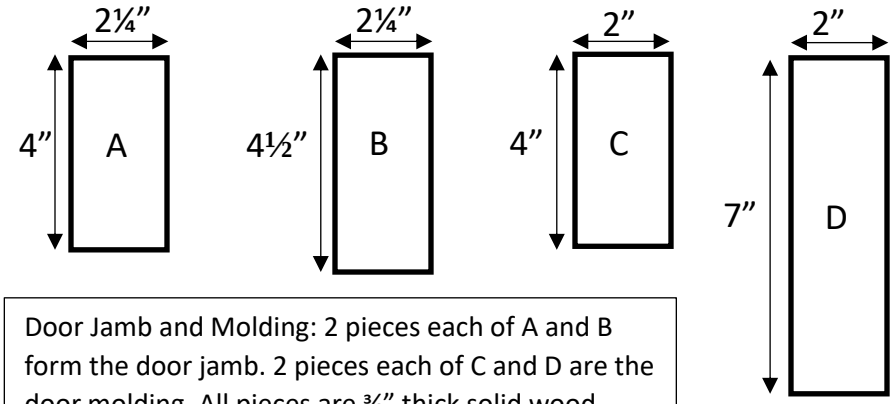
Addendum 1 to Fisher Denbox Drawings 31 March 2018



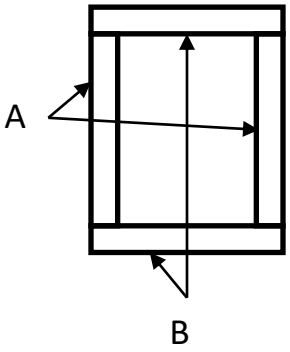
The hole in the door panel has been enlarged to accommodate the replaceable door jamb and molding.

Note that Panel 3 does not need the plywood insert shown previously. It is now constructed the same as the other panels with a foam core between 2 layers of plywood.

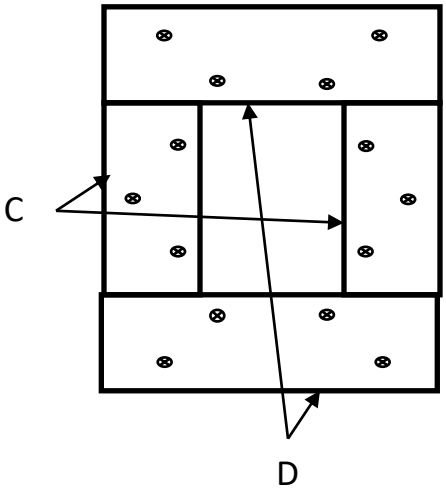
Addendum 1 to Fisher Denbox Drawings 31 March 2018



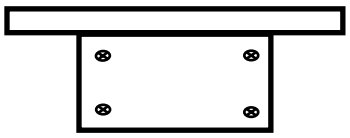
Door Jamb and Molding: 2 pieces each of A and B form the door jamb. 2 pieces each of C and D are the door molding. All pieces are ¾” thick solid wood. Pieces can be cut from 1 x 4” wood.



Jamb End View



Molding Face View with screw locations ⊗



Jamb and door molding End View with screw locations ⊗

Assembly instructions

- Pre-drill all holes with ⅛” bit and counter sink with ¼” bit.
- Assemble jamb using 8 – 2” construction grade screws.
- Add door moulding using 2” screws. Inner 8 holes are for attaching moulding.
- Outer 6 holes are for attaching jamb and moulding to the den box.