# Creation of Black Bear Dens in the Campbell River Watershed

Prepared by:

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# Introduction & Background

American black bears (*Ursus americanus*) require suitable winter den sites to provide security and cover to successfully survive the critical winter denning period. Female bears may utilize dens for up to 6 months (Davis 1996) and have additional energy costs associated with gestation, whelping, and nursing of cubs during this period (Lentz et al. 1983). Dens are reused intermittently over decades, if not longer, and are often used by successive bears (Davis et al. 2012). On Vancouver Island, winter dens used by black bears have only been found in or beneath large diameter (mean = 143 cm) trees or wooden structures derived from trees (i.e., logs, root boles and stumps; Davis 1996; Figure 1). It is likely that black bears do not use structures other than wooden ones in coastal British Columbia (BC) because of the cool and wet climate during the denning period, unlike other parts of North America where they may dig dens in the soil (Beecham et al. 1983) or den in nests on the ground (Martorello and Pelton 2003).

**Figure 1. A typical coastal black bear den in a yellow-cedar tree (photo by D. Wellwood).**

Current and historic land management activities in coastal forests have affected the supply of these critical element-level features. Most prominently, forest harvesting has removed many large trees that are needed to form den structures. Furthermore, the new crop of trees is not allowed to grow to sufficient size for replacement dens to develop in future forest rotations. Additionally, flooding of forested land for hydro-electric development removed trees from the potential den supply because reservoirs are in valley bottoms where forests are most productive and thus often where the largest trees grow. Despite the knowledge that these habitat features are critical to the over-winter survival of black bears, the BC government has not provided any regulatory protection for these critical structures. A reduction in the supply of suitable den sites may impact bear populations through predation on denned bears (Davis and Harestad 1996) and loss of condition of bears utilizing unsuitable dens. The net effect of this reduction in supply is that suitable den sites may become a factor that limits black bear populations.

## Goals and Objectives

The goal of this project is to enhance the supply of dens for black bears by installing artificial structures (e.g., culverts or molded dens) in areas dominated by second growth forests that may lack suitable natural den structures. A secondary objective is to mitigate losses of denning opportunities in the Campbell River Watershed by creating potential dens in existing old growth trees or large legacy stumps. We will evaluate the efficacy of artificial den structures for black bears by monitoring the structures for use by bears over time.

# Study Area

The project takes place in the Campbell River watershed (Figure 2), west of the town of Campbell River and north of the Strathcona Dam. The Campbell system, including the upper sub-basins of the Heber, Salmon and Quinsam Rivers, straddles the Vancouver Island mountain range. Elevations range from sea level in the Campbell and Salmon River estuaries to rugged peaks with small areas of permanent snowpack over 2200 m. The watershed receives considerable precipitation from October to March with mixtures of snow and heavy rain.

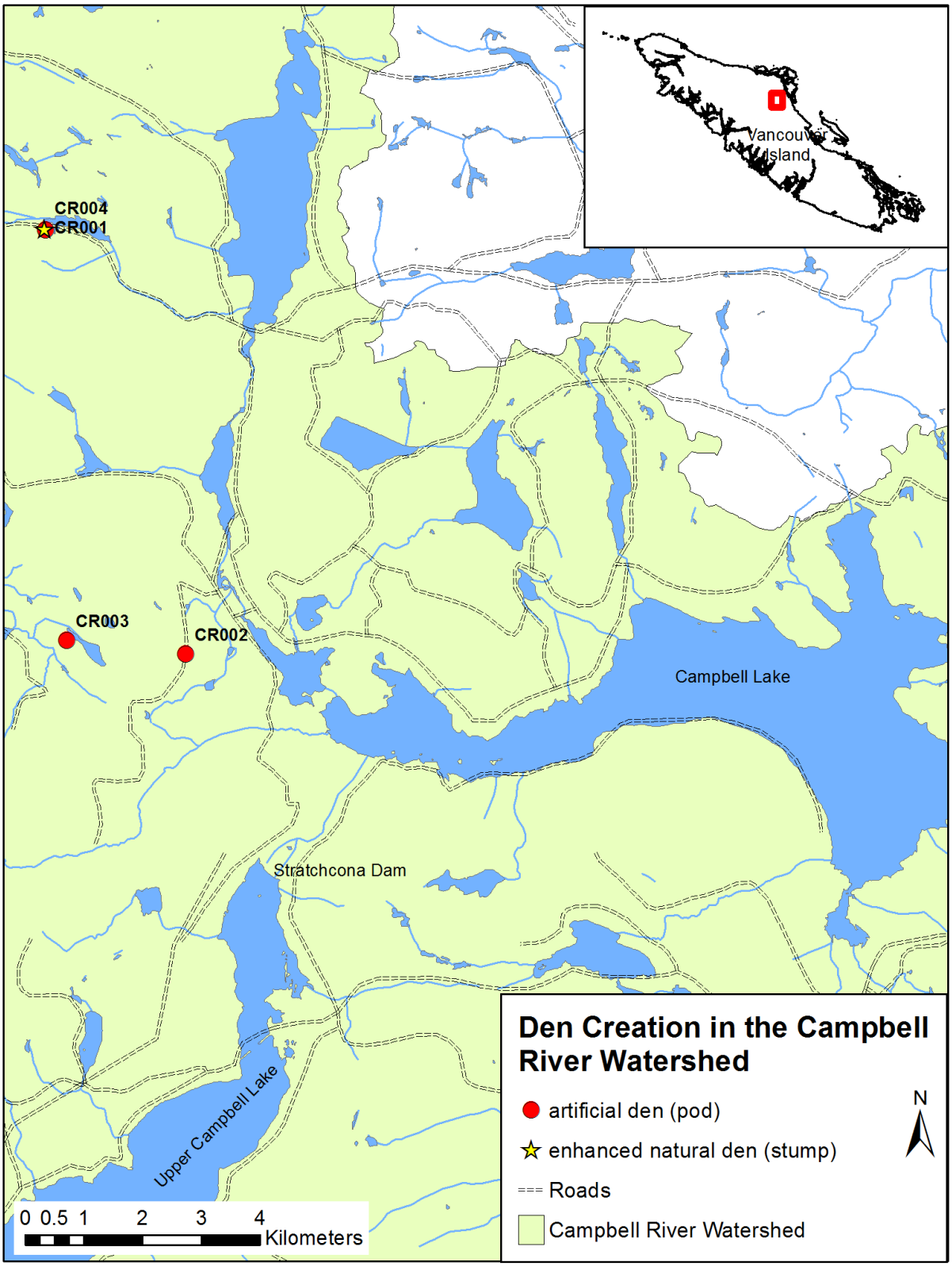


**Figure 2. Study area location (west of Campbell River, BC).**

The average precipitation in November is 420 mm, but may reach 800 mm (Fish and Wildlife Compensation Program 2011).

The study area lies within the Georgian Depression Ecoprovince (Demarchi 1996) and Coastal Western Hemlock very dry maritime (CWHxm2) biogeoclimatic subzone (Green and Klinka 1994). Land ownership in the watershed is a mixture of Crown land and privately owned timberlands (mostly owned by TimberWest Forest Corp.).

The study area was chosen due to the habitat loss associated with hydro-electric development and large amount of second growth forest created by a forest fire in 1938 (the "Sayward Burn") that burned for almost 30 days and consumed approximately 35,000 hectares of forests (BC Ministry of Forests 1997). Due to the size of the burn and ongoing forest harvesting, few old growth structures suitable for use as dens by black bears remain in this landscape. In addition to loss of habitat, black bears in the Campbell River watershed have reduced access to a critical fall food supply because salmonids in the watershed have been heavily impacted by the creation of dams and hydroelectric facilities (Fish and Wildlife Compensation Program 2011).

# Methods

In highly modified landscapes, several options exist to create new denning opportunities for bears on a small element-level scale. First, entirely new denning structures that meet the need for thermal and security cover could be engineered and distributed on the landscape for adoption by bears as winter dens. Use of artificial structures for dens by black bears has been documented in the past; dry road culverts have been used (Wyoming, Barnes and Bray 1966; Minnesota, Noyce and Dirks 2012). However, to our knowledge, no one has attempted to intentionally create artificial dens for black bears. Second, existing natural structures not currently suitable for denning could be enhanced to create new winter dens. We applied both techniques using an adaptive management approach to mitigate the reduction in den supply resulting from past hydroelectric and forest harvesting starting in Jordan River watershed in 2014 (Davis 2015) and in both the Campbell River and Jordan River watersheds in 2015.

Our project is intended as an interim method of addressing shortages of dens at a very fine spatial scale (i.e., element scale) and does not address the larger landscape-scale issue of den supply. Enhanced natural structures and artificial den structures may provide a stop-gap supply of dens that could bridge the period between current and historic forest management (i.e., little or no voluntary retention of suitable structures) and future element, stand and landscape management that takes den supply into account.

## ACTIVITY 1: ARTIFICIAL DEN STRUCTURES

### Den Design and Manufacturing

In 2014 we installed artificial bear denning structures made out of plastic culverts in the Jordan River watershed and hired an industrial designer (Codetta Product Design Inc.) to develop options for materials, construction methods, den designs and costs (Davis 2015). Dimensions for the new den design were based on dens excavated by bears in other areas of North America (Davis 2015) because we assume that these dimensions better reflect the cavity size that bears would choose (since they dig the excavations) than those of den cavities in trees (where bears have little influence on the internal chamber size). We designed the shape of the den so that the entrance did not lead straight into the bedding chamber which is how natural dens tend to be configured. This configuration likely increases the safety of dens and reduces the possibility of wind and rain entering the den. In May 2015 the resulting den design was sent to 5 biologists specializing in black bears for comment; the artificial den design was reviewed by Dave Lindsay (TimberWest Forest Corp.), Lana Ciarniello (independent wildlife researcher, bear specialist), Grant MacHutchon (independent wildlife researcher, bear specialist), John Beecham (retired bear researcher, Idaho), and Richard Beausoleil (bear specialist, Washington Dept. of Fish and Wildlife). The design was subsequently modified to be a top-only design (Figure 3) after feedback from all 5 suggested

they thought that would be preferable. This design was then sent to various potential manufacturers to get cost estimates.

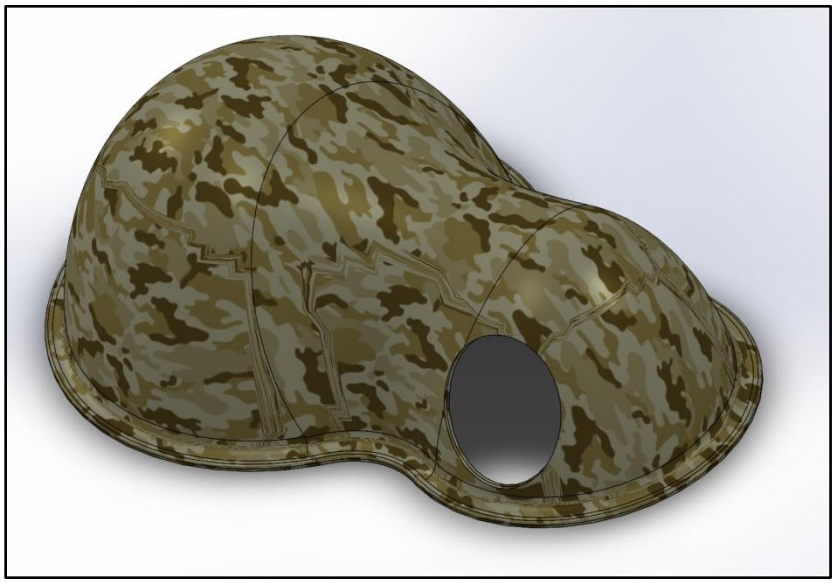

**Figure 3. Artificial den structure design.**

Once comments were received from the reviewers we sought a manufacturer for the den pods. Multiple designs and materials were considered. We considered using insulation for the den structure, but this increased costs considerably. We considered 3 options for construction:

1. Creation of the dens from fibreglass. The use of fibreglass would have allowed more design flexibility as production started but master plug and mold costs were estimated at $12,000 plus each den would cost an additional $2200 ($3100 each with insulation; CIF composites Inc., Saanichton, BC).
2. Creation of the dens from culverts with a modified design from 2014 was estimated to cost $1779.70 each (Armtec, Nanaimo, BC). The modified design would still have been a round culvert (i.e., with a bottom) which did not achieve the design changes suggested by the 5 reviewers.
3. Creation of the dens from vacuum-molded polyurethane. The tooling costs were estimated at $6300 plus each den would cost an additional $672.50 (Method Innovation Partners Ltd., www.methodinnovates.com).

The final decision was to make artificial dens of polyurethane. The polyurethane material is very strong (7 mm thick) and a reinforcement ring was added around the den entrance that provides greater protection to the bears and allowed a den hood (not shown in Figure 3, see Appendix I for photos of installed dens) to be bolted over the entrance. The den design changed somewhat so that we could use rectangular sheets of polyurethane that were available without special order from the manufacturer. Unfortunately the supplier of camouflage-coloured polyurethane stopped producing it once we ordered the dens so the polyurethane used was black in colour instead of camouflage. This new design and light weight (~13.5 kg) created an artificial den that was easy to carry by 2 people which allowed for installation further into the bush from roads versus the ~90 kg culverts installed in 2014 that required 4 people to move them. The mold will be retained by Method for 1-2 years so that anyone can order den pods.

## Choice of Installation Sites

Based on detailed descriptions of the habitat type being sought for artificial den placement, BC Timber Sales (BCTS) staff scouted forest stands to look for suitable sites. On 20 July 2015 potential sites were visited by H. Davis and 3 sites were chosen for installation of den pods the following day. All 3 den pods were placed within

mature closed canopy second growth forests with little understory and were situated out of sight from roads. Installation sites were all within forest stands that will not be harvested in the future.

### Den Installation/Creation

Once sites were selected the ground was prepared by removing vegetation and rocks and levelling the site. A depression for the bed was formed under the den chamber and lined with vegetation (e.g., ferns or moss) to mimic a typical bed used by coastal black bears. Dens were anchored to the ground using 5 cable anchors (ShelterLogic's Easy Hook® Anchors; www.shelterlogic.ca, Figure 4). The anchor was pounded vertically into the ground using a rod placed into the anchor, pulling upward on the anchor cable rotates the anchor into a perpendicular locked position underground that is very difficult to dislodge (often necessitating digging right down to the anchor to remove it if needed). Holes through which the anchor cables passed were drilled on site in the lip of the den so that they would match the anchor locations. Anchor cables were passed upwards through the hole, wrapped back around and through the hole again and secured using a cable clamp. We also attempted to use ShelterLogic's ShelterAugers Earth Anchors, but soil depths were too thin for them to be anchored far enough into the ground to be effective. They edge of the dens were then covered with soil and debris. A sign and flagging tape were used to mark the site. Den pods were installed in 1.5-2 hours if soil conditions were suitable.

**Figure 4. Cable anchor on pounding rod before installation.**

We tried to encourage bears to investigate the dens sites in 2 ways. Trapping lure (anise oil, pulverized beaver castor, commercial fisher lure, skunk oil and glycerin) that attracts Mustelids (weasels) was placed around the site to create interest by bears without providing a food reward. Additionally, we had some success with bears climbing into artificial dens that we had put bear hair into in the Jordan River watershed, because of this we put a small handful of bear hair into the 3 den pods and stump den in October 2015.

### ACTIVITY 2: ENHANCEMENT OF NATURAL STRUCTURES

In the Jordan River watershed we attempted to locate natural structures suitable for enhancement (i.e., stumps or trees with a hollow centre; Davis 2015). Although this was not a key goal of this project, BCTS was requested to look for suitable natural structures when scouting installation sites for artificial den structures. Two stumps and one hollow tree were found with some potential for enhancement. One western redcedar (*Thuja plicata*) stump was selected for enhancement (the other was too close to a road), the hollow centre was cleared out, the entrance was enlarged and the top levelled with a chainsaw before capping it with a shaped piece of ¾" plywood secured with lag bolts. The enhanced stump is about 20 m from a den pod-giving us a paired design to look at selection by bears (if either is used as a winter den it indicates that the bear had preference for one type over the other).

Additionally, one redcedar tree left within a 15 year old clearcut was investigated for its suitability for enhancement. An entrance was created by pulling away loose pieces of bark either side of the existing internal cavity and the rotted insides were pulled out. It is likely that the tree is as-of-yet too small to be used as a den

but it may develop into a suitable den tree. We placed a "wildlife tree" sign on the tree and we will monitor it in future because it is quite close to 2 structures that are being monitored.

### Monitoring

We deployed 3 motion-sensitive cameras (Bushnell Trophy Cam model 119678C) at artificial dens to monitor wildlife activity. Cameras were configured to record one 15-second video clip with a 1 second delay before triggering a new video. A camera on loan (Reconyx) was also set up at the enhanced stump den structure that was configured to take 5 still photographs when triggered.

## Results and Outcomes

We achieved our objectives in 2015 by creating potential black bear dens in 3 artificial structures in July and 1 enhanced natural structure in October (see Appendix I for details and photos of each). The forests within the burn area appeared to have very limited natural den supply; large trees are rare and there are very few large, structurally sound stumps. Candidate stumps for modification were barely large enough (140-150 cm diameter) to house dens and had fairly advanced decay.

### Monitoring

We revisited the 3 den pods and newly enhanced stump den on 21 October 2015 to download cameras and search for sign of visitation by bears. Dens were monitored for a total of 281 camera days (Table 1), during which only 3 visits by 2 different bears to den pod CR001 were documented. There were frequent visits by squirrels (*Tamiasciurus hudsonicus*), black-tailed deer (*Odocoileus hemionus*), one visit by a Pacific marten (*Martes caurina*) and one by a large cougar (*Puma concolor*). Photos of "unknown cause" can be triggered by intense sun, or animals walking close by the cameras without getting caught on camera.

**Table 1. Results of photo-monitoring artificial and enhanced natural den structures in the Campbell River Watershed in 2015.**

| | | | | # of photo sequences | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Den # | Start date | End date | Number of camera days | Total sequences | Bears | Deer | Marten | Squirrel | Other | Unknown cause |
| CR001 | 21/07/2015 | 21/10/2015 | 92 | 6 | 3 | | | | | 3 |
| CR002 | 21/07/2015 | 21/10/2015 | 92 | 30 | | 6 | | 7 | 1 | 13 |
| CR003 | 21/07/2015 | 21/10/2015 | 92 | 19 | | | 1 | 11 | | 7 |
| CR004 | 16/10/2015 | 21/10/2015 | 5 | 0 | | | | | | |
| | | Total | 281 | 55 | 3 | 6 | 1 | 18 | 1 | 23 |

There were fewer detections of bears at den structures in the Campbell River watershed than in the Jordan River watershed (Davis 2015). Dens in the Campbell watershed are in an area of human recreation and many roads that could cause disturbance and increase hunting pressure on bear populations whereas the structures in the Jordan watershed are mostly in gated areas with limited human access.

### Community Engagement and Communications

Our project has successfully increased awareness by the forest industry and public of the need for voluntary retention of bear den structures and the possibilities for den creation in coastal BC. By working in cooperation with BC Timber Sales, planning and operational foresters now better understand the denning needs of black bears and will hopefully be inspired to retain existing bear dens and plan for retaining and creating future denning habitat through forest planning.

A scientific poster about the Jordan River and Campbell River den creation projects was presented (Appendix II) at the Western Black Bear Workshop (12-14 May 2015, Canmore, Alberta). I discussed the artificial den design with multiple bear researchers at the workshop.

A presentation about the Jordan River and Campbell River den creation projects was given to the Victoria Natural History Society on 13 October 2015. The presentation was advertised in the newsletter, through email reminders and on Twitter. Forty-three people, including other wildlife biologists, attended to hear about the project and watch videos of bears investigating den structures. We were able to take a den pod for people to inspect, many people climbed in and out to test the dimensions!

**Tuesday, October 13**
NATURAL HISTORY NIGHT
***Black Bear denning habitat: can we create new dens?***
Coastal Black Bear require dens to survive through the winter and reproduce. Dens are generally in or under old growth structures: large hollow trees and stumps, logs and root wads. What happens when forest harvesting removes these structures? Can we create dens in natural structures and will bears use artificial structures? Come see what researcher **Helen Davis** has been doing in the Jordan River to test these ideas! Meet at 7:30 p.m. in room 159 of the Fraser Building, University of Victoria. Free! Everyone is welcome. Bring a friend.

## Future Work

We hope to continue to monitor artificial and enhanced natural den structures in 2016 and beyond by checking the remote-sensing cameras that are at each structure. We will do a comprehensive press release in May 2016 after dens have been checked to determine whether any of the structures have been used over the winter. Videos of bears investigating dens in 2015 have been posted on YouTube and we anticipate having more videos after the winter denning season to do a well-rounded multi-media release. We have interest from both TV (Shaw) and radio (CBC) in doing stories that will allow us to showcase the work we have done as well crediting the funding agencies that have supported the work.

## Acknowledgements

I thank BC Timber Sales for financial support but also for great staff participation and enthusiasm! Staff put a large effort into the project, they found sites for installation of artificial dens and a couple of opportunities for enhanced natural dens, helped with artificial den installation and undertook the creation of an enhanced natural den in a stump.

I thank the Weiwaikum First Nation for support and for finding me an enthusiastic and capable assistant (Cory Cliffe) for den installations.

I thank the Fish and Wildlife Compensation Program for their financial support and for support of the project in the Jordan River that initiated this work in the Campbell River watershed.

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# Appendix I. Den catalogue

### *Structure #CR001: artificial den (den pod)*

Type: polyurethane molded den pod
Entrance: 35 cm (h) x 30 cm (w)
Chamber: 75 cm (h) x 110 cm (w) x 110 cm (l)
Tunnel: 50 cm (h) x 65 cm (w) x 70 (l)
Habitat: second growth forest (burn), CWHxm2
Notes: Bedding and bear hair added. Motion sensitive camera installed. Investigated 3 times by bears (at least 2 different bears).

**Figure 5. Biologist Helen Davis in bed of a flipped up den pod held by Cory Cliffe.**

**Figure 6. A black bear investigates den pod CR001.**

### *Structure #CR002: artificial den (den pod)*

Type: polyurethane molded den pod
Entrance: 35 cm (h) x 30 cm (w)
Chamber: 75 cm (h) x 110 cm (w) x 110 cm (l)
Tunnel: 50 cm (h) x 65 cm (w) x 70 (l)
Habitat: second growth forest (burn), CWHxm2
Notes: Bedding and bear hair added. Motion sensitive camera installed. No bears detected as of 21 October 2015.

**Figure 7. Rob Martin (BCTS) and Cory Cliffe after installing den pod CR002.**

**Figure 8. A cougar investigates den pod CR002.**

## *Structure #CR003 artificial den (den pod)*

**Figure 9. Den pod CR003 with wildlife sign and camera on tree on left (lock showing on tree).**

Type: polyurethane molded den pod
Entrance: 35 cm (h) x 30 cm (w)
Chamber: 75 cm (h) x 110 cm (w) x 110 cm (l)
Tunnel: 50 cm (h) x 65 cm (w) x 70 (l)
Habitat: second growth forest (burn), CWHxm2
Notes: Bedding and bear hair added. Motion sensitive camera installed. No bears detected as of 21 October 2015.

### *Structure #CR004: Enhanced natural structure (stump)*

**Figure 10. Rob Martin (BCTS) in stump CR004 before enhancement.**

**Figure 11. Stump after levelling before installation of plywood.**

Diameter: 140 cm
Species: western redcedar
Entrance: 34 cm (h) x 27 cm (w)
Habitat: second growth forest (burn), CWHxm2
Modifications: entrance slightly enlarged, stump levelled, top capped with ¾" plywood. A 1-2" lip of plywood was left where it hung over so ensure the rain stayed off the stump. The plywood was held in place with 6 lag bolts (4", 6", 8") with washers and a couple of 10" spikes. One soft side/crack of the stump was filled in with slabs and shavings. A thick layer of moss was added for bedding.
Notes: Motion-sensitive camera (on loan from COS) installed. Stump is about 20 m from CR001.

**Figure 12. Laura Chessor (BCTS) at enhanced stump CR004, October 2015.**

# Appendix II. Extension and Communications

Scientific poster presented at Western Black Bear Workshop (Canmore, Alberta) 12-14 May 2015.

## Creation of Den Structures for Black Bears in Coastal BC


Helen Davis

Artemis Wildlife Consultants, Victoria, BC, Canada


### Issue

American black bears (*Ursus americanus*) require suitable winter den sites to provide security and cover to successfully survive the critical winter denning period. Dens are reused intermittently over decades, if not longer, and may be used by successive bears (Davis et al. 2012). On Vancouver Island, winter dens used by black bears have been found in or beneath large diameter (mean = 143 cm) trees or wooden structures derived from trees (i.e., logs, root boles and stumps; Davis 1996). It is likely that black bears do not use structures other than wooden ones in coastal BC because of the cool and wet climate during the denning period.

A classic natural den in a yellow-cedar tree in the Nimpkish Valley. Originally used by a radio-collared bear in 1993, still being used today in a clearcut.

Current and historic land management activities in coastal forests have affected the supply of these critical element-level features. Most prominently, forest harvesting and hydro-electric development has removed many large trees that are needed to form these den structures. Loss of land from hydro-electric development is permanent. Furthermore, these large structures are not replaced during forest rotations because the new crops of trees are not allowed to grow to sufficient size for replacement dens to develop. Further negative impacts to the den supply come from harvesting of second growth, which may damage the few residual structures remaining from old growth harvesting. Despite the knowledge that these habitat features are critical to the over-winter survival of black bears, no regulatory protection is in place for these critical structures in British Columbia.

### Project Objectives

1) mitigate losses of denning opportunities by creating potential den cavities in natural and artificial structures,
2) evaluate the efficacy of den structures created,
3) increase awareness by forest companies for the need for retention of den structures in coastal BC, especially during second growth harvesting, and,
4) increase awareness by government policy makers of the need for regulation to protect these critical forest elements.

### Study Area


The study areas are the Jordan River Watershed on southwestern Vancouver Island and Campbell River Watershed on northeastern Vancouver Island, British Columbia. Both watersheds receive high amounts of precipitation from October to March with mixtures of snow and heavy rain. Snow cover can be non-existent or sporadic in winter. The watersheds have experienced extensive industrial development since the late 1800s: forest harvesting, mining and flooding for hydro-electricity has occurred. Industrial development continues today with the ongoing harvest of second-growth forests, mining, and hydro-electric power generation.

### Methods

Enhancement of Natural Structures

We identified stands with the greatest likelihood of containing potential dens based upon structural attributes with a query of spatial vegetation data. We conducted ground-searches in the identified stands for large western redcedar or yellow-cedar trees or large, high-cut stumps that had internal heart rot but no entrance to the centre. These were enhanced by creating suitably sized openings into the centre with a chainsaw and removing decayed wood when necessary. Entrance sizes were based on those found in natural den trees on northern Vancouver Island (Davis 1996) and by structural limitations of the tree or stump being enhanced. We sealed tops of stumps that had a hollow centre with a plywood "roof" and capped a log to create an internal tube of about 5 m long.

Enhanced dens structures created during 2014 in the Jordan River watershed, British Columbia. Top left: a capped stump; top right: a capped log, bottom left: slightly hollow cedar tree before modification, bottom right: after cutting an entrance into tree and pulling out internal duff (created by assistant Michael "Bear" Charlie).

Artificial Den Structures

In 2014, we created 3 artificial den structures out of large plastic culverts. The size and shape of these dens closely resemble natural dens in hollow logs. Culverts were made of double-walled plastic with a smooth inner wall and a corrugated outer wall, with a ¾" thick plastic plate welded to each end of the pipe and secured with 4 lag bolts for extra strength. Based upon entrances of dens utilized by adult females in the Nimpkish Valley (Davis 1996), an oval entrance was cut into one of the end plates. We attempted to have an entrance size that was accessible to adult females while excluding adult males to reduce the possibility of predatory attacks by other carnivores and male bears (Davis and Harestad 1996). Final net weight of the artificial dens was approximately 90 kg. Culverts were situated in forested stands.


Monitoring Artificial and Enhanced Natural Structures

Motion-activated cameras were placed at four created structures (3 culverts, 1 enhanced stump) in July 2014 to monitor investigations of the dens by bears through spring 2015. Because the thermal properties of the artificial dens is unknown relative to those of natural structures, we deployed temperature data loggers at 5 potential dens (one natural hollow tree, one enhanced hollow tree, and three culverts) in the watershed. At each potential den, we paired one data logger inside the structure with one affixed in a nearby tree, which allowed us to compare the temperature within the cavity to the ambient temperature outside the cavity. Data loggers collected temperature readings 4 times per day between 1 November 2014 and 29 April 2015.

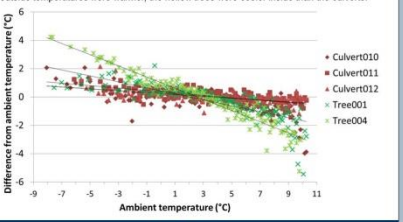
### Results

In 2014, we created potential black bear dens in 7 natural structures (3 in hollow trees, 3 in stumps, 1 in a log) and 3 in artificial structures constructed from plastic culverts. None of the dens were used over the 2014-2015 winter. We anticipated that it could take several years for bears to adopt the structures. The structures have the potential to be used for releasing orphan cubs into the wild.

Monitoring Artificial and Enhanced Natural Structures

Motion-sensitive cameras provided invaluable information about the artificial dens and the animals that investigated them. Only one culvert had obvious sign (i.e., hair) of being investigated by bears; without camera monitoring we would not know that bears have found the structures but so far have chosen not to use them. We photographed 3 different bears and one family group visiting one of the dens shortly after installation and 6 separate visits by bears (≥3 individuals) at another. Bears investigated the dens (i.e., sniffing the culverts and looking inside), but no bears were photographed climbing inside. The cameras were also provided interesting environmental data (e.g., no snow in the study area over the 2014-2015 winter). We also photographed visits by birds, red squirrels, Pacific marten, cougars, and deer.

Temperature data loggers measured the temperature inside and outside 5 structures four times/day. None of the monitored structures were occupied by animals during the monitoring period. Analysis of this data shows that, without bears present, hollow trees moderated the high and low temperatures more than culverts (see chart below). That is, when outside temperatures were colder, the hollow trees were warmer inside than the culverts, and when outside temperatures were warmer, the hollow trees were cooler inside than the culverts.




### Next Steps

In 2015 we will enhance more hollow trees and stumps as well as build and install artificial dens of a new design (see below) that will include a layer of insulation. We are installing 6 of these in the Jordan River Watershed as well as 3 in the Campbell River Watershed. Structures will be monitored over the next 5+ years. We hope to have a total of ≥12 artificial structures by winter 2015 that can be monitored over time to assess adoption of the structures by coastal black bears.

### Please Help!!!!

WHICH DESIGN DO YOU PREFER AND WHY? PLEASE LEAVE COMMENTS!

Den pod with top and bottom (left and middle), or top only (right)?

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