13. A Bat Nursery Roost

1) Definition

A bat nursery roost means a feature that "houses" an aggregation of female bats and their young.

A nursery roost is a type of *maternity roost* (a grouping of females) but refers specifically to the period when females have given birth and are roosting with their offspring. The Wildlife Habitat Features Order differentiates nursery roosts from maternity roosts. Maternity roosts are used by pregnant females and are generally occupied from April 1 – May 30. Maternity roosts can be in tree or rock features and can be used alone or in small groups. While particularly important, maternity roosts are not included in the Wildlife Habitat Feature Order.

The Wildlife Habitat Feature criterion of 'evidence of use' is not required for bat nursery roosts because it is very difficult to identify evidence of use and confirm occupancy. High quality suitable features should be managed as bat nursery roost Wildlife Habitat Features based on the guidance provided in this chapter. If steps are taken to confirm occupancy and the results are negative, the high-quality suitable feature does not need to be managed as a Wildlife Habitat Feature.

Figure 51 shows three tree roost features. Figure 52 shows three rock crevice nursery roosts.

Figure 51. Bat nursery roosts in trees can occur in a variety of tree species. Clockwise from top: vertical crevice in a live aspen, large opening and cavity in an advanced decay class Western redcedar, and a crevice under thick bark of a live cottonwood. (Photos: Cory Olson, Province of British Columbia)

Figure 52. Bat nursery roosts in rock features can occur in a variety of formations such as cliff faces, rock outcrops, split boulders, stacked rock, and talus slopes. Top: Cliff face illustrating a roost area with multiple roost sites in rock crevices. (Photo: Mandy Kellner) Bottom left: crevices under rocks in a boulder field provide a bat roost. (Photo: Doug Burles) Bottom right: crevice under a sandstone slab used by a long-eared myotis. (Photo: Cori Lausen)

2) Importance of a Bat Nursery Roost

Bats have a small litter size and long lifespan, the opposite life history strategy for most small mammals. Most bat species give birth to just a single young (called "pup or pups") each year. Some species, such as little brown myotis, can live up to 42 years. Growth and survival of young bats depends primarily on having a safe warm roost and an abundant food source. The slow reproductive rate of bats and high overwinter mortality of pups in their first year means that bat populations are extremely sensitive to activities that would have a negative impact on reproductive success and survival. This makes the effective protection of bat nursery roosts a priority for wildlife management.

Pregnant females move to nursery roosts as they approach time to give birth. Nursery roosts are generally occupied from May 30 – September 30 but can be occupied as early as April 1. Bats

tend to give birth from late June until mid-July. The sites used by "nursery" and "maternity" colonies may or may not overlap. All sensitive period dates can vary in timing depending on regional and annual climatic conditions and/or the geographic location within the province.

Nursery roosts provide protection from the elements, such as rain, wind and excessive heat, and help to regulate the temperature of pups while the mothers are away hunting. Young bats achieve adult size by around 4-5 weeks of age, but then must learn to fly, hunt insects, and fatten enough to ensure survival through the winter hibernation period. Overwinter survival rates of young bats can be as low as 40-50%. Any factors that can accelerate or maintain optimum growth rates of young bats will improve their chances of overwinter survival.

Nursery roosts are classified as "permanent", "long-duration", or "ephemeral" based on the longevity of the feature and fidelity of bats to a site.

A **permanent roost** is one that is available for bat use over many decades and has suitable characteristics (e.g., microclimate, access) that remain stable over time. Examples of natural, permanent roosts include caves or cliffs. Permanent nursery roosts are especially important for bats, as these features may be used by the same females and their breeding female offspring year after year, sometimes for decades. Permanent roost sites are relatively uncommon on many landscapes. Narrow crevice habitats in rock formations are important for bat species that form small colonies.

A **long-duration roost** is one available for bat use for many years or even decades. An example of a long-duration roost is a slow-decaying tree species such as a hollow western redcedar (Figure 53). These trees can remain standing on the landscape for many years as they decay. Larger trees can also provide long-duration roost sites because they support larger cavities and crevice features. Narrow crevice habitats in trees (of varying decay class and diameter) are important for small bat species and bat species that form small colonies.

An **ephemeral roost** is one where the characteristics important to a bat colony (e.g., microclimate) change quickly or unpredictably. An example of an ephemeral roosts is an area under sloughing tree bark (Figure 54). In some circumstances areas of peeling bark may provide suitable bat-roosting habitat for a few seasons, but their unpredictable nature and relatively short permanency makes them an ephemeral roost.

For both rock-type and tree roosts, some species will show strong fidelity to one specific roost site while other species may show fidelity to a roost area and move between several roost sites. For example, a cliff face may provide several roost sites that a single colony will use during a season. Nursery roosts may be abandoned by bats if they experience repeated disturbance that affects the roost microclimate. Large cavities have been found capable of housing larger colonies, for the species with this life history strategy. Large colonies have been shown to have higher reproductive success because females and their young benefit from the additional warmth from huddling in a group.

Figure 53. Inside a western red cedar bat nursery roost (looking upwards). (Photo: Suzanne Beauchesne)

Figure 54. Sloughing bark provides potential nursery roost sites. (Photo: Todd Manning)

For many bat species, a nursery colony may need more than a single tree for raising pups and having alternate roost sites within an area is important. Colonies of pregnant and nursing female bats can use several roost trees in a roost area (Figure 55). The size of a roost area varies and may depend on the availability of suitable roost trees. Studies have recorded roost areas ranging from 0.3-3 ha in size. The colony may split up and roost in different trees in one area one night and return to roost in a primary roost on the next night. Depending on the bat species, a colony may use from 10-30 trees in a roost area but may have two or three "nodal" trees where the socially-linked colony forms a large group together. Movements may occur for any number of reasons.

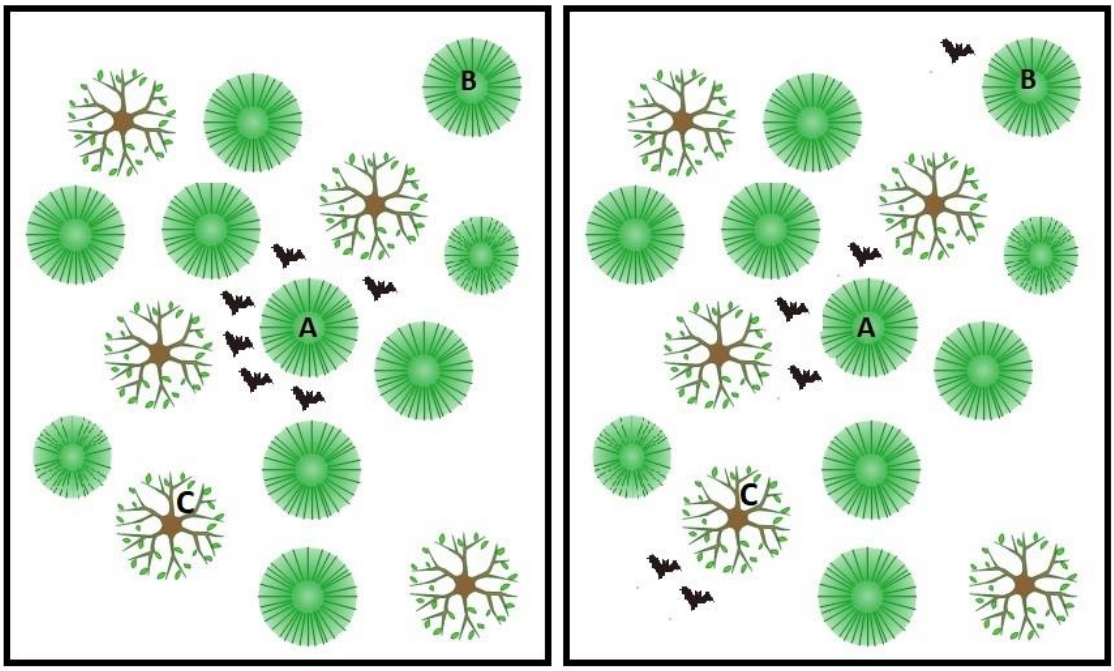

Figure 55. Nursery colonies are social groups that may roost together in a primary nodal tree (tree A) but split up and roost in separate trees on some nights (right panel, trees B & C) eventually grouping together again in a nodal tree (left panel). (Figure: Susan Holroyd)

3) What to Look For

There are fifteen different bat species in the province (Table 51). These species have many different life history characteristics and there is variation in the features of a nursery roost used by different species.

While all bats in British Columbia use forest habitat for either roosting or foraging, only four species exclusively use trees as nursery roosts. Table 52 summarizes the nursery roost types used by species. Many species use both rock crevice habitat and trees as nursery roosts, and a few use only rock crevices or cliff habitats for nursery roosts. Hoary and red bats roost as single-family units. Long-eared bats and Northern myotis likely have smaller-sized colonies at less than 25 individuals per colony. The species with the largest colony sizes are Yuma and Little Brown bats. Their colonies can be larger than 1000 individuals. Big brown bats can also have sizeable colonies when in human structures (e.g. buildings) however tree roost colonies are generally around 40 or fewer individuals. Silver-haired bats seem to have smaller colony sizes as well at 8-30 individuals. A colony can often be difficult to define as there may be a group that is socially linked but it may roost all together in one tree one night and spread in smaller groups in several trees on another night (fission-fusion roosting behaviour).

Table 51. Bat conservation status and distribution by region and biogeoclimatic zone in British Columbia.[1]

Species	Conservation Status (COSEWIC/ British Columbia)	Region							
		Cariboo	Kootenay Boundary	Northeast	Omineca	Skeena	South Coast	Thompson Okanagan	West Coast
Pallid Bat (*Antrozous pallidus*)	Threatened/ Red-listed		X					X	
Townsend's Big-eared Bat *(Corynorhinus townsendii)*	Not assessed/ Blue-listed	X	X				X	X	X
Big Brown Bat *(Eptesicus fuscus)*	Not at risk	X	X	X	X	X	X	X	X
Spotted Bat *(Euderma maculatum)*	Special Concern/ Blue-listed	X	X					X	
Silver-haired Bat *(Lasionycteris noctivagans)*	Not at risk	X	X	X	X	X	X	X	X
Eastern Red Bat *(Lasiurus borealis)*	Not assessed/ Unknown			X			X	?	
Hoary Bat *(Lasiurus cinereus)*	Not at risk	X	X	X	X		X	X	X
Californian Myotis *(Myotis californicus)*	Not at risk	X	X			X	X	X	X
Western Small-footed Myotis *(Myotis ciliolabrum)*	Not assessed/ Blue-listed	X	X					X	
Long-eared Myotis *(Myotis evotis)*	Not at risk	X	X	X	X	X	X	X	X
Little Brown Myotis *(Myotis lucifugus)*	Endangered/ Not assessed	X	X	X	X	X	X	X	X
Northern Myotis (*Myotis septentrionalis*)	Endangered/ Blue-listed	X	X	X	X	X			
Fringed Myotis (*Myotis thysanodes*)	Not assessed/ Blue-listed	X	X				?	X	?
Long-legged Myotis (*Myotis volans*)	Not at risk	X	X	X	X	X	X	X	X
Yuma Myotis (*Myotis yumanensis*)	Not at risk	X	X			X	X	X	X
Canyon Bat (*Parastrellus hesperus*)	Not assessed							?	

[1] Modified from Best Management Practices for Bats in British Columbia (2016); updated with information from the BC Species and Ecosystems Explorer (January 2019).

Table 52. Types of nursery roosts used by bats in British Columbia, typical habits and distinguishing features.

Bat Species	Nursery Roost Type	Habit	Notes
Spotted bat, Pallid Bat, Western Small-footed Myotis and Canyon Bat	Roosts in **rock features** only.	All species will fly in open habitats. Crosses large gaps easily.	Easy to identify, either visually or by echolocation call. Single acoustic detection of Canyon bat in south Okanagan. More inventory required.
Hoary bat	Roosts on **small twigs** in open foliage. Requires tall trees with open space below to "drop and fly".	Uses older, tall, mature trees with open canopy; flies in open habitats. Often chooses the tallest tree available. Open understory is essential.	Easily identifiable both visually and acoustically.
Silver-haired bat	Roosts only in **tree features**. Old-growth or mature, old-seral trees.	Forages in open habitats. Crosses large gaps easily.	Silver-haired bats are easily identifiable visually or with acoustic detectors. Northern Myotis require capture, DNA or acoustic detection for identification.
Northern Myotis		Forages along edges or in interior forest habitat. Sensitive to fragmentation.	
Big brown bat, Little Brown Myotis, Yuma Myotis, Long-legged Myotis, Fringed Myotis	Roosts in **rock and tree features**. Tree roosts generally in old-growth, mature, old-seral trees.	Forages in open habitats. Crosses large gaps easily.	Identification for all species requires capture, DNA, or acoustic detection.
California Myotis, Long-eared Myotis		Forages along edges or in interior forest habitat. Sensitive to fragmentation.	
Townsend's Big-eared Bat	Roosts in **rock and tree features**. Tree roosts generally very large cavities. Rock roosts generally shallow cave formations.	Prefers roosts with large entry points. Selects wide open locations within roosts, easy to locate and identify.	Easy to identify visually. As a "whispering bat" not easily detected by acoustic detectors.

It can be difficult to confirm bat use of a potential nursery roost. The period when bats occupy a nursery roost is relatively short, and evidence of use may or may not be obvious without specialized equipment or training. Absence of obvious current bat use does not necessarily mean that a site is not a nursery roost.

The following information will help in identification of bat nursery roosts and assessing occupancy. Table 53 summarizes what to look for when identifying bat nursery roosts. Table 54 provides guidance on methods to determine if a nursery roost is occupied. Table 55 provides information on how to select high quality suitable nursery roosts in absence of evidence of use and confirmed occupancy. Table 56 summarizes information to consider when conducting primary forest activities near a bat nursery roost.

Table 53. Bat nursery roosts: what to look for.

Description of a Bat Nursery Roost
Aspect: Preference for warm, south – southwest aspects with long periods of sun exposure. **Elevation**: Generally, below the ESSF and upper MS biogeoclimatic zones. Upper slopes in valley bottoms are common warm sites as they will be exposed to the sun for longer durations. Lower elevations can still be used, particularly if the roost sites are within 1-km of water. **Exposure**: Nursery roosts need to be dry and provide protection from the weather and wind. This can be difficult to determine, particularly when there is an emphasis on sites with high periods of solar exposure. **Temperature**: Bats select for warmer sites to promote pup development but locations with extreme temperatures (over 40°C) are often avoided. **Habitat Connectivity**: Some bat species will not cross large open spaces surrounding a roost site. Vegetative connectivity can be achieved with a narrow strip of trees or shrubs, at least 3 m in height. Locations with connectivity within 1-km of water, preferably open, still water, acceptable for drinking. Required size of water source varies by bat species depending on bat size and maneuverability. **Tree roosts:** Tree features can include hollow trees, trees with defects, stub trees, cavities, or gaps behind loose, sloughing bark. Bats using tree roosts prefer trees in older forests that meet many of the following criteria: o moderate decay (tree classes 2–5) o large diameter (> 50 cm dbh in the interior dry zones and > 70 cm dbh on the Coast and Interior Cedar–Hemlock zone). Trees with these dbh represent the largest and potentially the most effective roost trees; however, bats will use smaller dbh trees with appropriate roosting features o vertical hollow cavity accessed via a stem scar (Figure 51) o woodpecker excavations o deep stem cracks; hollows created at points where branches have broken off at the bole (Figure 53) o most bark intact but loosening (Figure 54) o any defect that results in a crevice 1-2 cm wide (or more) and 10 cm deep (or more) o bat features (cracks, cavities and crevices) must be at least 3m off the ground o prefer open vegetation conditions on the side of the tree with the roost feature **Rock roosts:** Most naturally occurring caves are suitable for overwintering but not as nursery roosts. Suitable rock features include rock crevices, cliffs, rock outcrops, boulder fields, and talus slopes in warm sites on south-facing aspects. Rock crevices used for nursery roosts usually have (Figure 52): o crevice openings are at least 1-2 centimetres wide or more o crevice depth of 15 centimetres or more o crevices may be horizontal or vertical o can be lower than 3 m off the ground but needs to be high enough to all bats to ‘drop and fly’ from the opening Bridges and buildings can also be used as nursery roosts however ***only naturally occurring bat nursery roosts are considered wildlife habitat features.***

Table 54. How to determine if a roost is occupied

Identifying an Occupied Nursery Roost Site
Nursery roosts are most often occupied by a group of bats. Evidence of use by a group or repeated use include: • large accumulations of bat feces (guano) under the roost site • dark staining on roosting surfaces from the natural oils in their fur • urine stains and/or "pissicles" (light coloured staining or hardened, light yellow icicle-shaped features made of urine) • distinct smell of bat guano and urine. Field staff can undertake basic measures to assess occupancy such as: • Inspect suspected nursery roosts cautiously by briefly shining a flashlight into the entrance and looking for individuals • Bat roosts can also be monitored at night for direct visual observations. At dusk, bats may be seen emerging from, or flying around, the entrance as they leave to forage and return • Look for bat guano. Guano is often present at the base of an entrance and the smell of ammonia from bat urine may be noticeable at recently used roosts. • Bat guano looks like mouse droppings (Figure 56) but contains chewed up bits of insect exoskeletons and wings that crush into a crumbly powder and may appear to have shiny flecks. In comparison, mouse droppings are solid and claylike. • If guano is found, collecting a sample for DNA analysis will allow verification of species If occupancy is not easily determined from these signs or methods, confirming occupation will require the services of a qualified professional biologist with specific and current experience with bats (herein referred to as a bat specialist). The methods used by bat specialists require specialized training and equipment.

Figure 56. Bat guano from two species, Big Brown Bat on the left and slightly smaller Little brown bat on the right. (Photo: Cory Olson)

Table 55. How to select high quality suitable nursery roosts for protection as Wildlife Habitat Features in absence of evidence of use.

Selecting a High-Quality Suitable Nursery Roost

• Identify whether you are in a suitable habitat area
  o South or southwesterly exposure
  o Upper slope or lower slope with access to water
  o Elevation and BEC zone
 	
• Identify tree and rock features based on suitability to support nursery roosts
• Target the biggest trees in the appropriate decay class range with defects that could be used by bats for roosting
• Focus on permanent or long-duration features
• Permanent nursery roosts in rock features and in long-duration tree roosts should receive a higher level of protection and management than ephemeral roosts (such as under peeling bark, or in trees that are known to decay quickly)
• Selection of candidate Wildlife Habitat Feature trees can be narrowed by considering
  o tree longevity
  o quality of cavities available for roosting
  o tree diameter
  o site (warm sites, sites near water, sites connected to other tree retention areas are better)
• Balance the targeted number of Wildlife Habitat Features for bats in the area with the availability of suitable bat roost trees in existing reserve zones on the landscape
• Expect high variability in the availability of suitable trees; some areas may have very few suitable trees others may have a large number that may be suitable as nursery roosts
• Not every suitable tree needs to be managed as a Wildlife Habitat Feature.
• Where there is a high number of suitable nursery roost trees, target 10 trees/ha; prioritize the best trees on site for retention

Table 56. Information to consider when conducting primary forest or range activities near a bat nursery roost.

Information to Consider

• Permanent nursery roosts should receive a higher level of protection and management than ephemeral roosts. Actively manage landscape areas with ephemeral roost habitat to maintain and recruit suitable amounts of roost habitat over time. Focus management decisions on protecting permanent nursery roosts from degradation, disturbance, or loss.
• Establish a forested retention area centred around nursery roosts.
• Where available, retain multiple trees close to one another (e.g., a wildlife tree patch) as alternative roost sites.
  o Valuable tree characteristics include: loose sloughing back, hollow vertical cavities, deep stem cracks, large diameter (Interior: > 50 cm dbh; Coast and Interior Cedar–Hemlock (ICH) biogeoclimatic zone: > 70 cm dbh).
• Avoid blasting, removing rock or talus, or constructing new roads within the retention area.
• Avoid harvesting or salvaging trees within the retention area.
• When harvesting adjacent to the retention area, retain an open, residual stand structure. Possible retention strategies:
  o Retain some large-diameter defective trees; ideally, these are trees with hollows, stem cracks, broken tops, woodpecker cavities, or loose bark, and are usually of low merchantability.
  o Retain veteran trees, especially those which extend above the main canopy.
  o Preferred roost trees on the Coast and southern Interior include western redcedar, Douglas-fir, western hemlock, and white spruce; in central and northern Interior, trembling aspen is frequently selected for roosting.
• If operating areas contain cliffs, or rock outcrops with openings or crevices (especially those which have sunny aspects), include these in a wildlife tree patch (these sites are typically inoperable); most suitable cliff or rock outcrop sites are usually at lower elevations, especially in the ICH biogeoclimatic zone.
• Minimize disturbance adjacent to known nursery roost sites during critical times, generally May–September (i.e., when young are born and reared).
• Because many nursery roost trees are either dead or decayed, they are often targeted by firewood cutters. Place a "Wildlife Tree Sign" on known and potential nursery roost trees near public roads to educate the public on their high ecological value.

4) Regional Information – Kootenay Boundary

In this section, we provide specific timing windows and guidance on disturbance buffers for the Kootenay Boundary Region. This information may vary from provincial guidance and may not be applicable outside of the Kootenay Boundary Region because of regional specificity.

Bats occur throughout the Kootenay Boundary Region, although preferred habitat types and nursery roost characteristics vary with species (Table 57). Nursery roosts occurring within a species' range are restricted by topographic features, not vegetation type. Bats are sensitive to disturbance. Table 58 provides suggested minimum buffer sizes. Additional protection or alternative measures may be needed, depending on the nature of the disturbance, existing landscape and cover, or other factors. Table 59 summarizes information to consider when conducting primary forest activities near a bat nursery roost.

Bats begin roosting and preparing for birth when they emerge from hibernation and pregnancy is initiated. There can be considerable variability in the timing of birth due to climatic conditions in

the spring. Generally, the pregnancy period is between April 1 – May 31 and the nursery period between May 31 – September 1. This creates a potential ***sensitive period of April 30 – September 1***.[2] Based on site observations, the length of this sensitive period can be refined.

Table 57. Characteristics of natural bat nursery roosts in the Kootenay Boundary Region.[3]

Species	Biogeoclimatic Zone[4]				Nursery Roost Characteristics*		
	PP	IDF	MS	ICH	Trees	Rock Crevices, Outcrops	Cliffs
Pallid Bat	X				dead/dying	No	Yes
Townsend's Big-eared Bat	X	X		X	dead/dying, live >70 cm dbh	Yes	Yes
Big Brown Bat	X	X	X	X	dead/dying	Yes	Yes
Spotted Bat	X				No	No	Yes
Silver-haired Bat	X	X	X	X	live, in tree bark	No	No
Hoary Bat	X	X	X	X	dead/dying, live	No	No
Californian Myotis	X	X	X	X	dead/dying	Yes	No
Western Small-footed Myotis	X	X			No	Yes	Yes
Long-eared Myotis	X	X	X	X	dead/dying, stump	Yes	Yes
Little Brown Bat	X	X	X	X	dead/dying	Yes	Yes
Northern Myotis				X	dead/dying	No	No
Fringed Myotis	X	X			dead/dying	Yes	No
Long-legged Myotis	X	X	X	X	dead/dying, stump	Yes	Yes
Yuma Myotis	X	X	X	X	dead/dying	Yes	No

[2] Best Management Practices for Bats in British Columbia (2016).

[3] Best Management Practices for Bats in British Columbia (2016).

[4] A Field Guide for Site Identification and Interpretation for the Nelson Forest Region (1992); PP = Ponderosa Pine; IDF = Interior Douglas-fir; MS = Montane Spruce; ICH = Interior Cedar–Hemlock; ESSF = Engelmann Spruce–Subalpine Fir.

Three different management zones are prescribed for bat nursery roosts (Figure 57).

1. The **Habitat Reserve Zone** is a zone of retention (no harvest) and is designed to protect the feature from damage (from wind, harvest-related injury or damage or disturbance from other activities such as blasting) and to retain microclimatic features of the Wildlife Habitat Feature.
2. The 100-m **Habitat Management Zone** is not a zone of retention. Disturbance recommendations are more stringent in the Habitat Management Zone than in the Disturbance Management Zone.
3. 1-km **Disturbance Management Zone** is not a zone of retention.

Recommendations are provided on the timing of specific activities that represent different levels of disturbance and on how to manage habitat within the Habitat Management Zone and Disturbance Management Zone to benefit bats. Habitat management within both these zones should be used to help retain connectivity between the Wildlife Habitat Feature and surrounding habitats for bats.

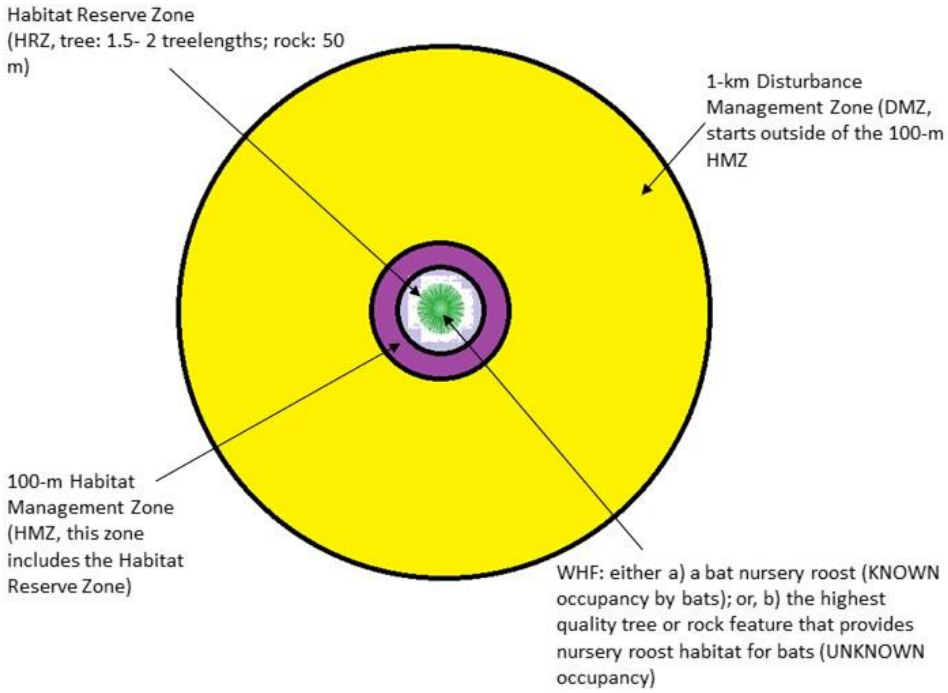

Figure 57. Habitat Reserve Zone, 100-m Habitat Management Zone and additional 1-km Disturbance Management Zone around a bat nursery roost Wildlife Habitat Feature.
(Figure: Susan Holroyd)

Table 58. Level of Disturbance allowable within each of the management zones with respect to the time of year. Outside the sensitive period is September 2 – April 29. During the sensitive period is April 30 – September 1.

<table>
<tr><th>Level of Disturbance</th><th>Time Period[1]</th><th>Habitat Reserve Zone
(tree: 1.5-2 tree lengths; rock: 50 m)</th><th>Habitat Management Zone
(100-m buffer)</th><th>Disturbance Management Zone
(additional 1-kilometre buffer)</th></tr>
<tr><td rowspan="2">Low Impact (i.e., livestock attractants, activities on foot, small groups; examples include layout, cruising, reconnaissance)</td><td>Outside</td><td colspan="2">Acceptable</td><td rowspan="2">Acceptable all-year</td></tr>
<tr><td>During</td><td colspan="2">Acceptable</td></tr>
<tr><td rowspan="2">Medium Impact
(i.e., light mechanized activities, larger groups/duration; examples include fence building, spacing, planting)</td><td>Outside</td><td>Acceptable with caution. Use extra caution adjacent to the roost. If in doubt, consult a bat specialist.</td><td>Acceptable</td><td rowspan="2">Acceptable all-year</td></tr>
<tr><td>During</td><td>May be acceptable if bats and roost will not be negatively affected by the disturbance generated. If in doubt, consult a bat specialist.</td><td>Acceptable with caution. Use extra caution immediately adjacent to the roost. If in doubt, consult a bat specialist.</td></tr>
<tr><td rowspan="2">High Impact
(i.e., mechanized activities; examples include road construction, falling and yarding, landing sites)</td><td>Outside</td><td rowspan="2">Not acceptable</td><td colspan="2">Acceptable</td></tr>
<tr><td>During</td><td colspan="2">May be acceptable if bats and roost will not be negatively affected by the disturbance generated. Consult a bat specialist.</td></tr>
<tr><td rowspan="2">Very High Impact
(i.e., blasting, helicopter logging)</td><td>Outside</td><td rowspan="2">Not acceptable</td><td>Acceptable with caution. Use extra caution adjacent to the roost. If in doubt, consult a bat specialist.</td><td>Acceptable</td></tr>
<tr><td>During</td><td>Not acceptable</td><td>May be acceptable if bats and roost will not be negatively affected by the disturbance generated. If in doubt, consult a bat specialist.</td></tr>
</table>

Table 59. Information to consider when conducting primary forest activities near a bat nursery roost.

Information to Consider

General management considerations:
• Maintain habitat connectivity on the landscape. Habitat connectivity is especially important for some of the smaller bat species.
• Connectivity can be maintained with non-merchantable timber or tall (3 m) shrub cover provided there is a contiguous line of vegetation (with gaps less than 10-20 m wide) connecting roost areas to large forest retention zones on the landscape. This is especially important if these connections afford bats routes to foraging or drinking areas.
• Designating narrow (1-3 m wide) "no-machine" zones within blocks may be an effective means of keeping habitat connectivity for small bat species. Adjacent blocks with green-up heights of 2-3 m may also function as an edge that will connect habitats.
• Not every roost requires this type of connectivity but incorporating connectivity where possible (i.e., where it can be added with little impact to harvesting objectives) will improve the habitat effectiveness for many species.
• If operating areas contain cliffs or rock outcrops with openings or crevices on solar aspects include these in a wildlife tree patch. Most suitable cliff or rock outcrop sites are usually at lower elevations, especially in the ICH biogeoclimatic zone.
• Because many nursery roost trees are either dead or decayed, they are often targeted by firewood cutters. Place a "Wildlife Tree Sign" on known and potential nursery roost trees near public roads to educate the public on their high ecological value.
 	
Habitat Reserve Zone:
• Minimize all disturbance adjacent to nursery roost sites during the sensitive period (April 30 – September 1)
• Do not blast, remove rock or talus, construct new roads, or perform harvest or salvage activities within the Habitat Reserve Zone (1.5-2 tree lengths around a tree or 50 metres around a rock feature) at any time.
 	
Habitat Management Zone:
• When harvesting within the 100-m Habitat Management Zone, retain an open, residual stand structure. Possible retention strategies include:
  o Retain some large-diameter defective trees; ideally, these are trees with hollows, stem cracks, broken tops, woodpecker cavities, or loose bark, and are usually of low merchantability.
  o Retain veteran trees, especially those which extend above the main canopy.
  o Preferred roost trees in the southern Interior include western redcedar, Douglas-fir, western hemlock, and white spruce; in central and northern Interior, trembling aspen is frequently selected for roosting and could be used across the province where these trees occur.
• Do not blast, remove rock or talus, or constructing new roads, or undertake harvest or salvage activities within the 100-m Habitat Management Zone during the sensitive period (April 30 – September 1)
• Outside of the sensitive timing window, consult a bat specialist to determine if high or very high impact activities can be conducted
 	
Disturbance Management Zone:
• Low and medium impact activities may take place within the Disturbance Management Zone throughout the year without concern.
• High and very high impact activities may take place in the Disturbance Management Zone

throughout the year, however assessment by an experienced bat biologist may be needed to ensure the activities do not compromise the effectiveness of the feature.

- Use caution in the Disturbance Management Zone to ensure that high and very high impact activities do not disrupt roosting bats with excessive noise or vibration.
    - Excessive noise includes loud (>80dB) high frequency sound (20-200kHz)
    - For blasting and jackhammer-type activities ensure sound concussion of <150 decibels, shock wave <15 p.s.i., and peak particle velocity <15 mm/second
- Ensure that activities such as blasting do not compromise the structure of the roost or that excavation activities do not compromise the roost through changes in drainage patterns.
- If very high impact activities are planned in the unoccupied period use protective methods (such as blast mats) to ensure the feature remains unchanged (see British Columbia Best Management Practices for Bats: Cave and Crevice Management for further details).

5) Additional Information

A Field Guide for Site Identification and Interpretation for the Nelson Forest Region, Land Management Handbook No. 20:
https://www.for.gov.bc.ca/hfd/pubs/docs/lmh/lmh20.htm

BC Species and Ecosystems Explorer – Species Summaries for Bats:
http://a100.gov.bc.ca/pub/eswp/search.do?method=reset

Best Management Practices for Bats in British Columbia:
http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=12460

Karst Management Handbook for British Columbia:
http://www.for.gov.bc.ca/hfp/publications/00189/Karst-Mgmt-Handbook-web.pdf

Identified Wildlife Management Strategy – Additional guidance concerning the management of any *Forest and Range Practices Act* species at risk associated with a bat hibernaculum:
http://www.env.gov.bc.ca/wld/frpa/iwms/accounts.html

Species at Risk Public Registry – Additional information for bat species:
http://www.registrelep-sararegistry.gc.ca/species/default_e.cfm