Habitat Assessment of the Pacific Sideband (*Monadenia fidelis*) In the Lower Fraser Valley British Columbia

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Executive Summary

The Pacific sideband (*Monadenia fidelis*) is the largest land snail known to occur in British Columbia. Although blue-listed in British Columbia for apparent scarcity and threats to its habitat, the snail is widespread throughout the western United States. This report attempts to define the habitat requirement of the Pacific sideband in the lower Fraser Valley; specifically the Abbotsford area and to a lesser degree adjacent municipalities. Data was collected in conjunction with a variety of mapping projects from January 2005 to August 2007. Additional data continues to be collected and may be used to refine this report in the future.

Data from 159 sample plots were analyzed to determine a variety of ecological and physical site features of preferred snail habitat. Analysis included physical conditions such as slope, elevation, and substrate, as well as ecological descriptions of dominant vegetation and associations of trees, shrubs, and herbs. In general the results of this study indicate that Pacific sideband is most commonly associated with relatively undisturbed deciduous and mixed forested areas. However, its habitat requirements appeared to be highly variable and we continue to find it in unexpected locations.

Acknowledgements

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1.0 Introduction

The Pacific sideband (*Monadenia fidelis*) is a relatively common occurrence throughout the wet lower elevation forests of coastal BC. However, anthropogenic activity (development into natural areas) is continually reducing the amount of available habitat throughout its range. This report is an attempt to describe the preferred habitat characteristics of the Pacific sideband in the lower Fraser Valley. The habitat descriptions provided herein may not be synonymous with other geographic areas.

The ecology, life history and distribution of the Pacific sideband have been poorly studied. While the Pacific sideband is blue listed and relatively uncommon in BC, it is considered to be a secure species globally. The snail is known to be distributed in BC, Alaska, Washington, Oregon and California. In BC the species is restricted to west of the Coast and Cascade Mountains and a coastal species in the previously mentioned states. (NatureServe, 2007 & Forysth, 2004)

Despite a substantial literature search, the only pertinent Pacific sideband description was found in the *Land Snails of British Columbia* (Forsyth, 2004). Forsyth describes the Pacific sideband's morphological characteristics as:

> *Shell 22-36 mm wide, heliciform, usually chestnut brown with a narrow, pale yellow band at the periphery, a narrow, dark brown band above this, and a dark brown base. Whorls 5 ¼ 6 ¾, the last whorl descending before the aperture. Aperture whitish inside with darker pigment showing through. Apertural lip is slightly thickened, and pale brown or purplish brown. Umbilicus small. Animal rosy brown, with grayish spaces between the tubercles; behind the head are some sparse, black reticulations. Mantle has a bold rust-coloured band. Sole of the foot is pale grey.*
>
> *There is considerable variation in the colour and banding of this species. The yellow band, for example, varies in width, and in some populations, it may even extend below the periphery and onto the underside of the shell. Some individuals may be pale yellow without substantially darker banding. The introduced snail, Cepaea nemoralis, is smaller and lacks an umbilicus in adults.*
>
> *Monadenia fidelis lives in deciduous, coniferous or mixed forests but also in open woods and grassy areas. It has even been found under low mats of stunted Garry Oak on a small, rocky inlet in the Gulf Islands. M. fidelis is most often encountered in late spring when adult males are crawling on the ground in the open or climbing the trunks of shrubs or trees – snails have been observed in trees as high as 6.7 metres above ground.*

This research project initially attempts to determine the macrohabitat requirements of the snail and, following subsequent analysis of the data, endeavors to determine what site factors should be considered when assessing areas for potential habitat, impacts to habitat, and conservation of habitat. It is anticipated that this information will be used by interested parties to assess development sites and other areas to identify critical habitat and to develop measures to protect the species and its habitat.

2.0 Methodology

Data was collected during Sensitive Habitat Inventory Mapping (SHIM) projects for the City of Abbotsford and the Fraser Valley Regional District. Additional data was collected from incidental sightings during other studies and activities.

All data was collected digitally using a Trimble Pathfinder XR Pro GPS with real-time differential correction (1 to 5 metre accuracy). This method allowed for the efficient collection of data that included spatial references of all sample plots. Two different data sets were created as more ecological and site information was desired as the project progressed. The complete data set (n=159) included the collection of:

- Species
- Number of individuals observed (living or shells)
- General comments (site descriptions, abnormal observations, etc.)

The second data set (n=77) was significantly expanded in order to collect information in a more consistent manner and to collect additional information. Data collection involved the use of pre-defined drop down menus and open fields where text and numeric data was entered. Data fields included (descriptions of drop-down menu options in parentheses):

- Date
- Species
- Number Observed
- Live/Dead (live, dead, shell)
- Slope
- Aspect
- Substrate (CWD, leaf litter, mud, talus, etc.)
- LFH Depth (< 5cm, 5 to 10cm, >10cm)
- Coarse Woody Debris Count (0, <5, 5-10, or >10)
- Forest Type (conifer, broadleaf, shrubs, etc.)
- Forest Age (shrub, sapling, young, mature, etc.)
- Qualifier (natural, disturbed, urban residential, etc.)
- General Site Comments
- Canopy Cover (<5%, 5-33%, 34-66%, 67-100%)
- Tree Species
- Shrub Cover (<5%, 5-33%, 34-66%, 67-100%)
- Shrub Species
- Herb Cover (<5%, 5-33%, 34-66%, 67-100%)
- Herb Species
- Moss and Lichen Cover (<5%, 5-33%, 34-66%, 67-100%)

For the purposes of the study, the following definitions of Forest Type from the SHIM protocol (Mason & Knight, 2001) were used:

- "Coniferous forest - This area has a natural tree crown cover of 20% or more of the total polygon area, and at least 80% of the trees are conifers.

- Broadleaf forest - This area has a natural tree crown cover of 20% or more of the total polygon area, and at least 65% of the trees are broadleaf.

- Mixed forest - This area has a natural tree crown cover of 20% or more of the total polygon area, but of the total trees no more then 80% can be conifer and no more then 65% can be broadleaf.

- Shrubs - The area has less than 10% tree crown cover and natural shrubs constitute 20% or more of the ground cover. Shrubs are defined as multi-stemmed woody perennial plants, both evergreen and deciduous.

- Herbs/grasses - The area has less than 20% tree cover, less than 20 % shrub cover, and 20% or more natural herbaceous cover. Herbs for this classification are defined as grass-like vascular plants, including ferns and forbs, without a woody stem. Some dwarf woody plants may be included in this category."

Data was collected from plots centered on live snails or snail shells. The plots did not have fixed areas; rather they were based on visual areas of homogenous forest type, disturbance, vegetation species, etc. As the habitat patch size of the species is not well known, it was thought that a fixed plot size may not accurately describe the actual habitat of the species. Therefore, the variable plots size was considered to be a more appropriate assessment of the habitat being used by the snail at the time of the survey.

In each plot the number of live snails and shells were counted. This data was not considered to be accurate counts of the total number of snails in the plot. Counting was typically undertaken by one crew member while the other entered data and fixed a GPS location. Counting stopped when the data was collected, regardless of how much of the plot was surveyed.

3.0 Results

Field surveys were conducted from January 2006 to August 2007. In total, 159 plots were surveyed in a variety of locations. The majority of the plots were located on McKee Peak, lower Sumas Mountain and Vedder Mountain within the City of Abbotsford. Additional plots were located in the City of Abbotsford, Little Mountain (Chilliwack) and the lower Ryder Creek watershed in the Chilliwack River Valley. Due to the sensitivity of the species and the large number of plots that were located on private property, the specific locations will not be made public. As the survey methodology was not standardized and did not use fixed plots, statistical analysis of the results has been kept to a minimum.

3.1 Number Observed

From the 159 plots a total of 154 live snails and 49 shells were observed. Counts of live snails per plots ranged from 0 to 5 while shell counts per plot ranged from 0 to 3. As previously mentioned, these counts are not considered to be an accurate representation of the number of individuals or shells per plot. Large numbers of live or dead snails were not found within a given plot, but within larger areas or similar habitat types several dozen or more were often observed. This result is consistent with our general field observations working throughout the Fraser Valley. Furthermore, the majority of observations of multiple live snails occurred during known breeding times.

3.2 Vegetation

Data on the vascular vegetation present at each site were collected. Tree and shrub species were well inventoried, but herbaceous species were limited to common occurrences and do not represent the true diversity of species. Moss and lichens were not inventoried. Due to the length of the field survey, the following results were influenced by seasonal changes which affected the number and type of herbaceous species recorded.

3.2.1 Forest Cover

The forest cover of 77 plots was estimated (Table 1). Broadleaf forest and mixed forests accounted for 61.0% and 25.9% of the plots while coniferous forests were only found in 9.1% of the plots. A variety of other forest cover types comprised the remainder of the plots.

Table 1. Forest Cover

Forest Cover	# Plots	Percent
Shrubs	2	2.6
Mixed Forest	20	25.9
Wetland	0	0.0
Broadleaf Forest	47	61.0
Exposed Soil	0	0.0
Herbs/Grass	1	1.3
Coniferous Forest	7	9.1
TOTAL	**77**	

3.2.2 Stand Age

The estimated forest stand age was recorded for 77 plots. Young forests accounted for 79.2% of the plots while mature forests accounted for 14.3%. Tall shrubs and saplings were found in 3.9% and 2.6% respectively.

This data is likely skewed towards younger stands as the majority of the plots were located within, or in close proximity too, urban areas where mature stands are uncommon.

3.2.3 Trees

74 of the detailed plots were dominated by trees. The assessment determined that 52.0% of the plots of a canopy cover of 34-66%, 33.0% had a cover of 67-100%, while the remainder had covers of less than 33%.

In order to determine which tree species were most commonly associated with the Pacific sideband, analysis of the collected data was completed. Results of the analysis indicated that big leaf maple (*Acer macrophyllum*) was found in 76.7% of the plots along with red alder (*Alnus rubra*) at 60.0%, and western red cedar (*Thuja plicata*) at 30.0%. Other common species that occurred in 20% or less of the forested plots included Douglas-fir (*Pseudotsuga menziesii*), paper birch (*Betula papyrifera*), and western hemlock (*Tsuga heterophylla*).

3.2.4 Shrubs

All of the detailed plots contained one or more shrubs species. Percent cover for the plots varied considerably with 38.1% having a cover of 67-100%, 33.3% had a cover of 5-33%, while 14.3% of the plots had either 34-66% or less than 5% cover.

In order to determine which shrub species were most commonly associated with the sideband, analysis of the collected data was completed. Results of the analysis indicated that the most common shrubs associated with the sideband was vine maple (*Acer circinatum*) at 52.4%, salmonberry (*Rubus spectabilis*) at 47.6%, beaked hazelnut (*Corylus cornuta*) at 33.3%, and thimbleberry (*Rubus parviflorus*) at 28.6%. Other associated species (occurred in 4.8% to 14.3% of the plots) included red elderberry (*Sambucus racemosa* ssp. *Pubens*), Devil's club (*Oplopanax horridus*), Indian plum (*Oemleria cerasiformis*), snowberry (*Symphoricarpos albus*), red huckleberry (*Vaccinium parvifolium*), hardhack (*Spiraea douglasii*), and ninebark (*Physocarpus capitatus*).

3.2.5 Herbs

All of the detailed plots contained at least one herbaceous species. Percent cover for the plots fond that 47.6% of the plots had a percent cover of 67-100%, 33.0% had a cover of 5-33%, and 19.0% had a cover of 34-67%.

In order to determine which herbs species were most commonly associated with the sideband, analysis of the collected data was completed. Results of the analysis indicated that the most common shrubs associated with the sideband was sword fern (*Polystichum munitum)* at 81.0%, stinging nettle (*Urtica dioica*) at 23.8%, bracken (*Pteridium aquilinum*) at 19.0% and Pacific bleeding heart (*Dicentra formosa*) at 14.3%. Other common species that occurred in 10% or less of the plots include fringecup (*Tellima grandiflora*), bedstraw (*Galium spp.*), maiden-hair fern (*Adiantum aleuticum*), and piggyback plant (*Tolmiea menziesii*).

3.2.6 Moss

The percent cover of mosses was estimated for the detailed plots. Individual species were not identified. The assessment indicated that 33.3% of the plots had 5-33% cover, 28.6% had <5%, 19% had 34-66% and 19.0% had no moss cover.

3.3 Disturbance

77 of the sample plots were assessed for disturbance. The assessment found that 20% of the plots were considered to be in disturbed areas. This was a qualitative measurement based on the general appearance of the site. A plot was considered to be disturbed if any significant disturbance had occurred within the last 20 years. Few if any sites were located in areas that have not been historically disturbed by human use due to their proximity to urban areas.

Disturbances varied throughout the study areas. Types of disturbance observed ranged from past/current logging, agricultural, urban/residential encroachment, trails, roads, and natural events such as slides and slumps. The most common disturbance types noted were trails and urban/residential encroachment.

3.4 Slope

The slope of 77 plots was measured. Slope ranged from 1° to 52° with an average slope of 19°. These data may be skewed as the vast majority of areas where mapping occurred were on the mountainous slopes in Abbotsford. However, few snails were located in lowland areas despite several months spent mapping in suitable areas; therefore steeper slopes may be a factor in preferred habitat.

3.5 Aspect

The majority of occurrences were found on north and western aspects. However, a significant number of snails also occurred on all other aspects. The data are skewed towards the north and west due to the amount of time and number of plots located on these aspects.

3.6 Elevation

The elevation of the lowest and highest plots was determined from digital topographical maps. The lowest elevation was 20 metres a.s.l. at the base of Sumas Mountain in the City of Abbotsford. The highest elevation was 400 metres a.s.l. on Vedder Mountain in the City of Abbotsford. Although the elevation of all data points were not statistically analyzed, a visual inspection of the mapped occurrences indicates that no particular elevation within in that range had a concentration of species.

3.7 Substrate

Snails were observed on a variety of substrates. Substrate ranged from various types and thicknesses of leaf litter, exposed mineral soil, organic soils, large woody debris, and interspersed amongst colluvial boulders. The most common substrate observed was leaf litter, accounting for 82% of the plots (Table 2).

Table 2. Substrate

Type	# Plots	Percent
Leaf litter	63	82.0
Soil	5	6.5
Colluvium	4	5.0
LWD	5	6.5
TOTAL	**77**	

Although it was not a recorded attribute, general observations indicated that snails typically occurred in fairly shallow leaf litter and were not often found in thick, fresh litter. There did not appear to be any strong indication that the amount or decay class of large woody debris was a factor in habitat preference.

4.0 Discussion

The results of this survey indicate that the Pacific sideband inhabits a wide variety of habitats. The data indicates that the snail shows a strong preference for forested habitat, but also occurs in non-forested areas. As the majority of the areas surveyed were forested ecosystems, it may be somewhat misleading to suggest that they are preferable habitat. It can be inferred however that the snail is not found in wetlands and wetter ecosystems in general.

The snail appears to prefer deciduous and mixed forest stands with uncommon occurrences in conifer dominated stands. Most occurrences were found within young forest stands, however these data are likely skewed by the urban and near urban locations that were primarily surveyed.

Snails were most commonly associated with red alder, big-leaf maple and western red cedar with crown closures of greater than 33% and often over 67%. Vine maple, salmonberry, beaked hazelnut and thimbleberry were the most common shrubs. Snails occurred in all recorded percent cover of shrubs with no strong preference for a given cover class with the exception of having more than 5% cover.

Herbaceous cover was dominated by sword fern, with lesser occurrences in stinging nettle, bracken and Pacific bleeding heart. As with shrubs, the only preference in terms of herbaceous cover was that it was greater than 5% cover.

While moss species were not identified in this study, sidebands were shown to have an affinity to sparse to absent moss layers with no plots recording greater than 67% cover.

No obvious preferences were found for slope, aspect or elevation. As well, there was little confidence placed in these values due to the relative number of plots and time spent in specific areas (i.e. north and western steep slopes).

Sidebands were found on a variety of substrates including leaf litter, soil, colluviums and large woody debris. The data suggested that the species had an affinity towards sites that were dominated by leaf litter which corresponds well with the association with deciduous and mixed.

Disturbance was an interesting variable. As the amount of habitat required for a snail is not known, it is quite difficult to determine how well used the area in which it was found was. It would be easy to say that since 20% of the plots were considered to be disturbed that the species is relatively tolerant of habitat disturbance. However, this statement can not be confirmed or rejected until additional studies are conducted to determine what the patch size of daily and annual habitat is and how habitat is used. Just because a snail was observed in a disturbed area once does not imply, to our knowledge, that the area is providing the preferred habitat requirements.

5.0 Conclusion and Recommendations

This study attempted to describe the most common habitat in which the Pacific sideband occurs. Based on the large sample size and distribution of sample plots, the results should be reasonably accurate within the study area, but likely do not fully describe habitat found in other parts of its range. As well, sample sites were skewed towards relatively intact forests and did not fully capture other potential habitat features commonly found in the lower Fraser Valley, specifically urban lowland areas.

The data could be significantly improved by the creation of permanent fixed sample plots of standard sizes and the development of a standardized survey method. However, in order to determine these criteria, additional knowledge on the life cycle and microhabitat requirements of the snail is required. This study is conducive to future repetition as all the sample plots were accurately mapped. When the biology of the snail is better understood, it is recommended that a survey is conducted in a manner in which comprehensive statistical analysis can be performed.

General conclusions from this study indicate that undeveloped forested areas in the lower Fraser Valley are important habitat for this listed species. While occurrences were noted in urban and disturbed conditions, the snail appears to have a preference for natural areas. Therefore, as development of natural areas continues it is important that substantial areas are left in a natural state to provide critical habitat. With additional information on the patch size and general ecology of this species critical habitat can be better refined and planed for accordingly.

It is important that, given the lack of detailed knowledge of Pacific sideband and other species at risk habitat requirements, land-use authorities should implement environment assessment protocol that focuses on the generation of more detailed data. Subsequently, this information should be distributed to government databases such as the British Columbia Conservation Data Centre, the Committee on the Status of Endangered

Wildlife in Canada and the Species at Risk registry. It is anticipated that through this process the scientific body will be able to establish appropriate recommendations to successfully manage and maintain the Pacific sideband as well as other species at risk.

It is also very important that assessment specialists do not discount or solely rely on existing scientific literature when scoping study areas for the potential presence of Pacific sideband or other species at risk. It is apparent that due to natural variation, geographic location and isolation, and species adaptability (e.g., adapting to an urbanized area), more than a single habitat type may be suitable.

6.0 References

Forsyth, R.G. 2004. Land snails of British Columbia. University of British Columbia Press. Vancouver, BC. 176pp.

Mason, B., and R. Knight. 2001. Sensitive Habitat Inventory and Mapping. Community Mapping Network, Vancouver, British Columbia. 315pp + viii. M. Johannes, Editor.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: October 16, 2007).

Appendix A: Photo Plates

Figure 1 shows a snail shell from the top, Abbotsford.

Figure 2 shows a snail shell from the bottom, Abbotsford.

Figure 3 shows an abnormally coloured live snail on Sumas Mountain, Abbotsford.

Figure 3 shows a live snail on the dirt of a well used trail on Little Mountain, Chilliwack.

Figure 4 shows an example of the well used trail from Figure 3.

Figure 5 shows an example of a snail climbing a young red alder on Sumas Mountain, Abbotsford.