

GASTROPOD SURVEYS OF THREE CREEKS 2015



Pacific sideband



Oregon forestsnail



Banana slug & Northwestern Hesperian

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The logo for the Government of Canada, featuring the word "Canada" in a serif font with a small Canadian flag icon above the letter 'a'.

Introduction:

Species Information: Oregon Forestsnail

The Oregon forestsnail (*Allogona townsendiana*) is a large terrestrial snail endemic to western North America. The slightly flattened shell of this species varies in colour from light brown to straw yellow and has a diameter of 28-35mm as an adult. The outer layer of the shell can become bleached and flake off with age. A thickened whitish apertural lip distinguishes this species from other large land snails such as the Pacific sideband snail (*Monadenia fidelis*) and Grove snail (*Cepaea nemoralis*) (Oregon Forestsnail Recovery Team, 2012).

This species occurs in the Coastal Douglas-fir (CDF) and Coastal Western Hemlock (CWH) biogeoclimatic zones occupying mixed and deciduous forest habitat. Canopy cover is typically composed of bigleaf maple (*Acer macrophyllum*), black cottonwood (*Populus trichocarpa*) and scattered western redcedar (*Thuja plicata*) (B.C. Conservation Data Centre, 2014). Occasionally, Oregon forestsnails are found using a combination of meadow and forest habitat (Edworthy et al., 2012). Soft and insulating soil is required for nesting and cover habitat (Steensma et al., 2009). Stinging nettle usually occurs alongside this species providing an important source of calcium and other minerals necessary for shell growth and also indicating the moist environment preferred by this species (OFRT, 2012). Coarse woody debris is often associated with occurrences of this species though the exact relationship is not yet understood (Steensma et al., 2009; Edworthy et al., 2012).

Oregon forestsnails are hermaphroditic but are unlikely to self-fertilize (OFRT, 2012). Mating season ranges from February to June peaking in March and April. Eggs are laid in small depressions dug into the substrate and one study calculated an average clutch size of 34 eggs. Juveniles hatch 8-9 weeks after oviposition and begin dispersing immediately. In dry conditions this species goes into aestivation to conserve moisture. During the cold winter months the Oregon forestsnail burrows into leaf litter or retreats under coarse woody debris and hibernates (Steensma et al. 2009).

A study completed on a population of Oregon forestsnails in Langley, BC shows this species to have low dispersal ability. The maximum distance moved by a snail in one day was 4.5m and home range was calculated as 18 to 404m² (Edworthy et al. 2012).

The Oregon forestsnail is considered endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and is listed under Schedule 1 as endangered by the *Species at Risk Act* (SARA). The BC conservation data center identifies this species as red-listed (BC Conservation Data Centre, 2014a). The habitat requirements of the Oregon forestsnail overlaps with the most densely populated and developed areas of British Columbia. Habitat loss and degradation due to commercial and residential development poses the most serious threat to this species. Remaining suitable habitat occurs in small isolated patches. The effects of genetically isolating populations of Oregon forestsnail are unknown at this time (OFRT, 2012).

Recreational activities such as mountain biking and hiking also threaten Oregon forestsnail habitat through soil compaction and trampling. Introduced invertebrates may threaten this species by competing for resources, such as food and shelter, and predating on Oregon forestsnails. Invasive plants can also be deleterious to Oregon forestsnail habitat by changing vegetation structure in ways that may reduce moisture retention in the forest. These invasive plants may also outcompete native vegetation important to the life cycle of this species including Stinging nettle (OFRT, 2012).

Land snails such as the Oregon forestsnail provide important ecological functions as decomposers of live and decaying plant matter (OFRT, 2012) and dispersal of seeds and fungal spores (Edworthy et al. 2012). A better understanding of this unique species will allow for more informed and effective conservation efforts.

Species Information: Pacific Sideband snail

The Pacific sideband (*Monadenia fidelis*) is a large land snail occurring along the west coast of North America. The slightly flattened shell of this species has a diameter of 22-36mm and is brown with a yellow band around the outer whorl. In some cases, this species can also be blond in colour with faint banding. The apertural lip of this species is slightly thickened but is dark brown in colour unlike that of the Oregon forestsnail. A distinguishing feature of this species is the rosy brown colour and rough texture of the animal's body (Forsyth, 2004, p.159). Pacific sideband snails are hermaphroditic and insert tiny projectiles covered in hormonal mucus prior to mating to improve sperm survival (Zevit et al. 2012).

The Pacific sideband occurs in the Coastal Douglas-fir (CDF) and Coastal Western Hemlock (CWH) biogeoclimatic zones extending as far north as the Central Coast Regional District in British Columbia. The species occurs in deciduous, coniferous or mixed forests as well as open woods and grassy areas. This snail is often found climbing trees and has been found as high as 6.7m (BCCDC, 2014; Forsyth, 2014). The Pacific sideband occurs from northwestern California to British Columbia with an unverified detection in Sitka, Alaska (Forsyth, n.d.).

The Pacific sideband is considered to be of special concern (blue-listed) by the BC Conservation Data Center. This species is not ranked by the COSEWIC or SARA. This species is threatened by habitat loss and degradation caused by residential and commercial development, agriculture and forestry (BC Conservation Data Centre, 2014b).

There are several significant gaps in our knowledge of this species. A better understanding of the habitat requirements of the Pacific sideband will help with conservation efforts and in turn prevent this species from being up-listed to threatened or endangered status.

Goals and Objectives

In 2014, a mark-recapture study was implemented on the Three Creeks property owned by the Fraser Valley Conservancy (FVC). This study is intended to increase our knowledge of the at risk gastropod species occurring on this property and to monitor these snail populations. Surveys were repeated in 2015.

Specific objectives of this project are:

- To provide data about the populations of Oregon forestsnail and Pacific sideband snail occurring on the Three Creeks property;
- To determine where on the property the endangered snail species occur and which habitats are being utilized;
- To estimate population size of the Oregon forestsnail and Pacific sideband snails as well as survival rate and longevity; and
- To identify optimal times of year for Oregon forestsnail surveys and detectability.

Study Area

This study was conducted on the Three Creeks property owned by the Fraser Valley Conservancy. This property is located on McKee Road south of the Ledgeview Golf Course in Abbotsford, BC. Access to the property is through a gate located at the east end of Ledgeview Drive. The property is located in the Coastal Western Hemlock, Dry Maritime (CWHdm) biogeoclimatic subzone within the Georgia Depression Ecoprovince of the Lower Mainland Ecoregion and the Fraser Lowland Ecosystem.

Methods

Mark-recapture

Surveys were conducted following Draft Oregon Forestsnail Mark-recapture and Monitoring study protocols (Heron and SC, 2014) as amended to suit the amount of time and funding allocated to this project.

Surveys were completed on May 29 and 30, April 2, and October 24, 2015. A total of 19 permanent survey plots are located throughout the Three Creeks property. Plots are marked with 2' rebar and flagging tape. UTM coordinates were recorded for each plot as well as aspect, slope, overstory species, slope position, time, surveyor initials, and soil comments. A category was recorded for moss cover, amount of coarse woody debris, type of light at snail level, moisture level, and disturbance.

At each location a 5m radius survey area was delineated using marking flags and/or flagging tape. An abbreviated BEC vegetation survey was completed using the Ecosystem Field Form (BCMFR & BCMOE, 2010) during the spring survey but was not repeated for the fall surveys. All vegetation located in the plots was identified and percent cover was recorded. Following the vegetation survey, a total of 20 person minutes (6 minutes and 20 seconds with three surveyors; 5 minutes with four surveyors) were spent searching the plot for all gastropod species. Surveyors sifted through leaf litter, searched under vegetation, and examined logs and tree trunks. All specimens were placed in a surveyor specific bowl for later identification in order to minimize interruption of search time.

Following the search, all gastropod species were identified and recorded. Live and dead specimens were distinguished. Oregon forestsnail and Pacific sideband snails were also measured using calipers (Canadian Tire Plastic Calipers) and given a unique number identifier. Marked snails were numbered consecutively by species using black nail polish. Live snails were returned to where they were found. Empty shells were left at the center of the plot.

Transects were walked between survey plots and any incidental sightings of Oregon forestsnails and Pacific Sidebands were identified. Incidental snails and shells were marked and measured then left where found after the GPS position of the site was recorded.

Results

Timed surveys of the Three Creeks property covered 4.7% of the 7.8 acres. In total 380 person minutes were spent searching in each of the summer and fall survey sessions (760 person minutes in 2015). Overall, 342 gastropods were identified in survey plots (158 live; 184 dead) and an additional 14 Oregon forestsnails were detected as incidental sightings. In total 28 OFS and 21 Pacific Sideband were identified.

Early Summer surveys 2015

In total 188 gastropods were identified (86 live; 102 dead). See Table 1 for a list of species and numbers identified. The average number of gastropods per plot was 10 (n=19). Eleven Oregon forestsnails (2 live, 9 dead) and nine Pacific sidebands (5 live, 4 dead) were detected. An additional 14 Oregon forestsnails were observed as incidental sightings during these surveys.

Table 1: Gastropod species identified, numbers found dead and alive, and the number of plots containing each species for summer surveys 2015.

Common Name	Scientific Name	# Alive	# Dead	Total	% plots	Avg/plot
Oregon forestsnail	<i>Allogona townsendiana</i>	2	9	11	42%	0.6
Pacific Sideband	<i>Monadenia fidelis</i>	5	4	9	37%	0.5
Lancetooth	<i>Haplotrematidae family</i>	24	79	103	100%	5.4
Chocolate Arion	<i>Arion rufus</i>	46	0	46	53%	2.4
Northwest Hesperian	<i>Vespericola columbianus</i>	6	10	16	42%	0.8
Grovesnail	<i>Cepaea nemoralis</i>	0	0	0	0%	0
Pacific bananaslug	<i>Ariolimax columbianus</i>	3	0	3	11%	0.2

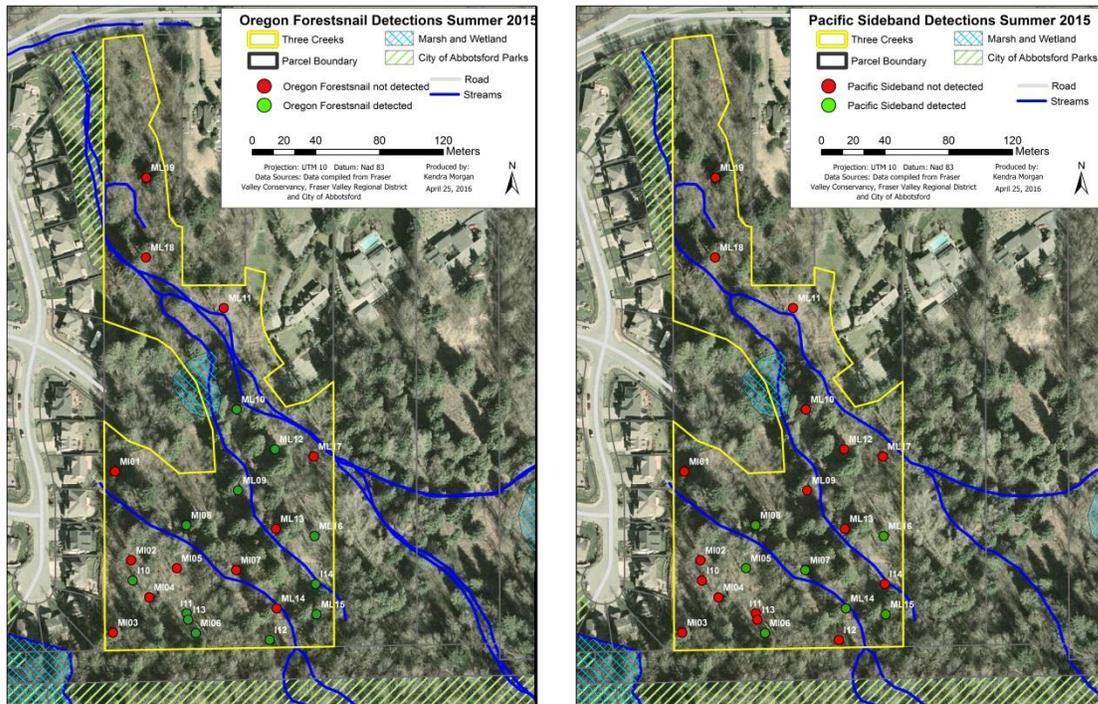
The average size of all Oregon forestsnails found, including incidental observations, was 26.3 mm while the average size for all Pacific sidebands was 31.4mm. Table 2 details the minimum, maximum and average sizes of these species.

Table 2: Average measured size of Oregon forestsnail and Pacific Sideband for alive and dead specimens in the summer, 2015

	Average Size (mm)	Standard Deviation	Minimum(mm)	Maximum (mm)
Oregon forestsnail (total)	26.3	1.6	21.9	29.6
Pacific sideband (total)	31.4	1.3	28.9	32.7

Shells of Oregon forestsnails have been found throughout the property. The 2015 summer surveys mostly detected this species in the southern half of the parcel. Pacific sideband were also concentrated in the southern half of the parcel (see Figure 2).

Figure 2: Maps showing location of Oregon Forestsnail and Pacific sideband snail detections from the summer 2015 surveys.



Fall surveys 2014

In total, 154 gastropods were identified (72 live; 82 dead) during the fall surveys. See Table 3 for a list of species and numbers identified. The average number of gastropods per plot was 8 (n=19). Three Oregon forestsnails (0 live, 3 dead) and five Pacific sidebands 1 live, 4 dead) were detected. No snails were observed as incidental sightings.

Table 3: Gastropod species identified, numbers found dead and alive, and the number of plots containing each species for fall surveys 2015.

Common Name	Scientific Name	# Alive	# Dead	Total	% plots	Avg/plot
Oregon forestsnail	<i>Allogona townsendiana</i>	0	3	3	16%	0.2
Pacific Sideband	<i>Monadenia fidelis</i>	1	4	5	21%	0.3
Lancetooth	<i>Haplotrematidae family</i>	38	65	103	94%	5.4
Chocolate Arion	<i>Arion rufus</i>	10	0	10	21%	0.5
Northwest Hesperian	<i>Vespericola columbianus</i>	14	10	24	68%	1.3
Grovesnail	<i>Cepaea nemoralis</i>	0	0	0	0%	0
Pacific bananaslug	<i>Ariolimax columbianus</i>	2	0	2	5%	0.1
Unknown	NA	7	0	7	5%	0.4

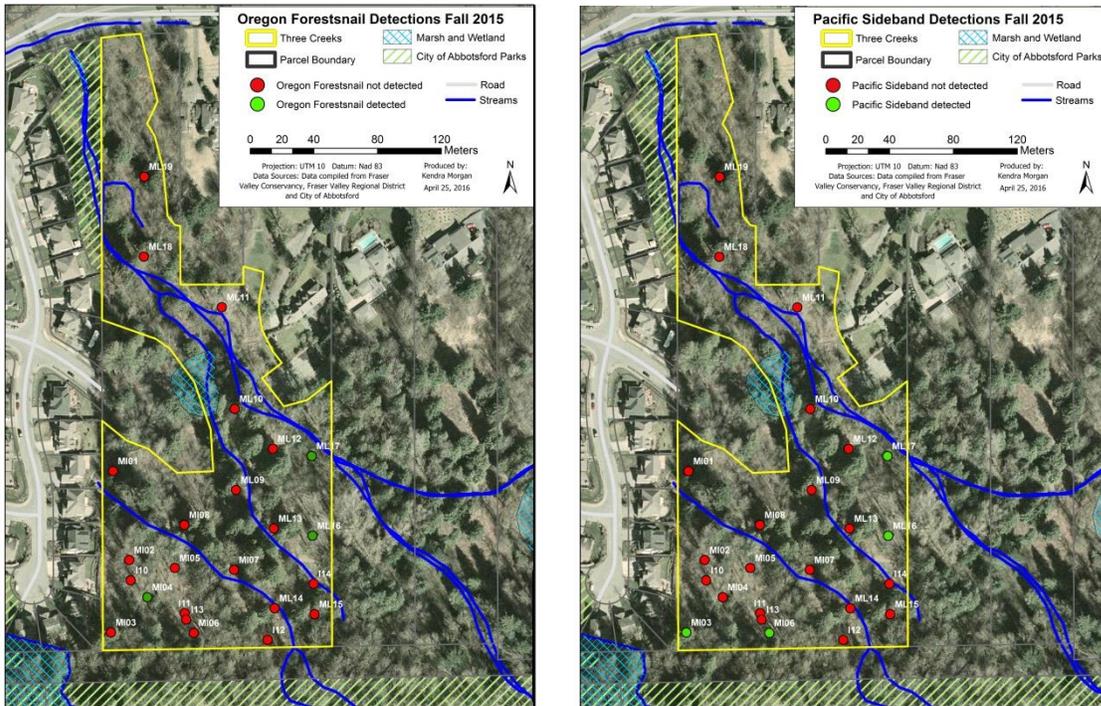
Only one new Oregon forestsnail was observed in the fall with a shell diameter of 27.5mm. The average size for all Pacific sidebands was 31.6mm. Table 4 details minimum, maximum and average sizes.

Table 4: Average measured size of Oregon forestsnail and Pacific Sideband for alive and dead specimens in the fall, 2015.

	Average Size (mm)	Standard Deviation	Minimum(mm)	Maximum (mm)
Oregon forestsnail (total)	27.5	NA	27.5	27.5
Pacific sideband (total)	31.6	0.9	30.3	32.9

Few Oregon forestsnail and Pacific sideband shells were detected in the fall survey session. This seven detections of at risk snails were all found in the southern region of the Three Creeks property (Figure 4).

Figure 4: Maps showing location of Oregon Forestsnail and Pacific Sideband detections from the fall 2015 surveys.



Discussion

The Three Creeks property was found to support a diverse group of native gastropods as well as the non-native Grovesnail and Chocolate Arion.

Both Oregon forestsnails and Pacific sideband snails were concentrated in the southern half of the Three Creeks property. This habitat is more continuous and open. The first survey was conducted relatively late this year though the weather was not overly dry. Surveys conducted earlier in the year, coinciding with more active breeding behaviours of these species, may increase survey results. The fall survey timing coincided with the start of wet weather after a dry fall season.

No live snails have been re-captured with markings. Many snail shells have been marked and found on subsequent survey sessions at the center of the plots. The marking method utilized at the beginning of this project in 2014, using metallic marker and sharpie pens, proved to be ineffective at marking shells over time. Surveyors found shells at the center of survey plots that had clearly been previously discovered but were not marked or the marking were so faded to be illegible. A change in methodology to coat the pen marks in clear nail polish was utilized for the fall surveys in 2014 and seemed to be more effective. A further change in method, to using black nail polish, was instigated in 2015. This method seems to be holding up well over time and will hopefully prove more effective in subsequent years.

Further monitoring of empty shells that were marked during this survey will help determine the longevity of these important sources of calcium (J. Heron, personal communication, June 16, 2014) in

the ecosystem. This information will help predict how long a specimen has been dead when a shell is found.

Recommendations

Continued monitoring of this population will provide a better understanding of the life cycle of these two at-risk species. Learning more about the endangered Oregon forestsnail will better enable us to protect this species in the future.

Altering the survey methodology to better encompass the at-risk gastropod populations living on this property may be required. Most of the live specimens found and marked were not found in the transect plots but were discovered incidentally when walking between transects or when working elsewhere on the property. These snails are less likely to be seen again unless they wander into one of the survey plots. Conducting wandering transects and installing permanent plots only where live specimens are found may be a more effective way to monitor the population. Many of the survey plots were located in close proximity and similar habitat to areas with large numbers of live snails but the plots themselves did not contain any live specimens.

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