SURVEYS FOR BLUE-GREY TAILDROPPER AND OTHER GASTROPODS AT RISK ON SOUTHERN VANCOUVER ISLAND, AUTUMN 2013

Chase Woods, Nov 2013. Photo by K. Ovaska

Prepared for

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We thank all the landowners and managers who participated in the study. Your efforts are much appreciated.

EXECUTIVE SUMMARY

The Blue-grey Taildropper (*Prophysaon coeruleum*) is an endangered forest slug that in Canada occurs only on southern Vancouver Island. The slugs face numerous threats from human activities throughout their range, which overlaps almost entirely with populated areas. This project is part of Habitat Acquisition Trust's (HAT) stewardship program aimed towards conservation of species at risk and their habitats, primarily within the Capital Regional District. In 2013, we continued efforts from previous years to clarify the distribution and habitat use of the Blue-grey Taildropper and to engage landowners and managers in stewardship activities.

To survey for gastropods, we set up artificial cover-objects (ACOs), constructed of corrugated cardboard, in Capital Regional District (CRD) regional parks and municipal and private lands. The sites surveyed included four CRD regional parks (Elk-Beaver Lake, Matheson Lake, Mt. Work, and Thetis Lake), a municipal property in Saanich (Haliburton Farm), and a Camosun College property in Metchosin. Landowners surveyed an additional eight residential properties with ACOs. In total, there were 439 ACOs at 25 localities distributed in suitable habitats within the CRD. The ACOs were checked multiple times for gastropods in September – November 2013, a period when the Blue-grey Taildropper is most readily detected. Additionally, we searched natural cover on the forest floor at two localities, Chase Woods on Mt. Tzouhalem near Duncan and Matheson Lake Regional Park in Metchosin in November 2013.

During artificial cover-object surveys, HAT biologists detected a total of 1649 individual gastropods, representing 28 species. The species included three native and seven introduced species of slugs, and 16 native and two introduced species of snails. The Blue-grey Taildropper was not found. On the residential properties, landowners who checked cover-objects similarly reported no Blue-grey Taildroppers.

During searches of natural cover on the forest floor, the Blue-grey Taildropper was found at two sites, Chase Woods and Matheson Lake. On 9 November 2013, during a nature walk at Nature Conservancy's property at Chase Woods, two adult Blue-grey Taildroppers were found. This record is of particular interest, as it extends the known distribution of the species northward by a straight-line distance of 25 km from the CRD along the east coast of Vancouver Island. On 18 November, at Matheson Lake Regional Park, an aggregation of nine adult Blue-grey Taildroppers were found at a known site for this species but not in other areas of the park searched.

The Chase Woods locality was in a moist second-growth Bigleaf Maple stand, whereas the Matheson Lake locality was in a mainly coniferous older forest stand. Both sites were very moist and had an abundance of coarse woody debris. The species has been previously found in similar habitats, as well as in Garry Oak – Arbutus habitats. Common features are the availability of moist refuges and possibly a proximity to a food source, such as an abundance of fungi, as was observed at the Matheson Lake site during the search in November 2013.

The project provided opportunities for landowners and managers to participate in the surveys and appreciate the role of terrestrial gastropods as components of the region's biodiversity. Landowners were provided with outreach materials and cardboard cover-objects, and follow-up support in the form of project updates and help with identification upon request. Efforts by landowners greatly increased survey coverage, but unfortunately no Blue-grey Taildroppers were found on the residential properties in 2012 or 2013. A "slug walk" during Nature Conservancy's volunteer event at Chase Woods proved highly productive and raised the participants' awareness of terrestrial gastropods and species at risk.

Recommendations for further work in 2014 include the following:

- Develop a habitat suitability model to direct survey efforts.
- In collaboration with CRD Regional Parks undertake habitat restoration, including removal of invasive plants and reducing unauthorized trails, at sites where this is deemed beneficial such as Thetis Lake and Mt. Work Regional Parks.
- Continue surveys within CRD Regional Parks and Trails System and other areas within the CRD in an effort to better delineate the distribution of this species and to confirm its persistence at known sites.
- Expand search effort to suitable habitats north of the CRD towards Cowichan Valley.
- Include searches of both artificial cover-objects and natural cover into survey plans.
- Continue working with municipalities and private landowners, targeting areas near known occurrences and other areas with suitable habitat.

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1.0 INTRODUCTION

The Blue-grey Taildropper (*Prophysaon coeruleum*) is a small forest slug that is listed as endangered in Canada (COSEWIC 2006). There are only a small number of Canadian records of the species, all of which are from southern Vancouver Island. Prior to this project, the species was known only from the Capital Regional District (CRD). The Blue-grey Taildropper is one of four species of taildroppers, native slugs of the genus *Prophysaon*, which occur on Vancouver Island. The slugs are named after their ability to detach the end of their tail in response to an attack by a predator.

Here we present the results for fieldwork conducted in 2013, representing the final year of a 3-year project funded by Environment Canada's Habitat Stewardship Program. This project is part of Habitat Acquisition Trust's (HAT) stewardship program, continuing previous efforts aimed towards conservation of species at risk and their habitats. HAT has conducted surveys and community outreach with the Blue-grey Taildropper as a focal species since 2010 (Ovaska and Sopuck 2010, 2012, 2013). This year's project builds on these studies and on surveys conducted previously in the CRD Regional Parks and Trails System on behalf of CRD Parks (Ovaska and Sopuck 2006, 2007, 2008, 2009).

The goal for 2013 was to continue clarifying the distribution and habitat use of the Blue-grey Taildropper and to engage landowners and managers in stewardship activities. An extended drought occurred in the area in 2012, lasting from mid-summer well into autumn, and probably contributed to the lack of observations of Blue-grey Taildroppers in that year, even after the return of moist conditions (Ovaska and Sopuck 2013). Therefore, an additional objective for 2013 was to examine persistence of populations at known sites.

2.0 OBJECTIVES

The objectives for 2013 were to:

- Survey suitable habitats for the Blue-grey Taildropper on southern Vancouver Island in an effort to better delineate the distribution of this species and to confirm its persistence at known sites.
- Work with private landowners and install artificial cover-objects on properties with potentially suitable habitat for the species, targeting areas near known occurrences.
- Describe habitats and threats at sites where the Blue-grey Taildropper is found, and provide management recommendations.
- Document other species of terrestrial gastropods found during surveys for the Blue-grey Taildropper.

3.0 STUDY SITE AND METHODS

3.1 Study sites

The study sites were located in CRD Regional parks, other protected areas under conservation covenants, an organic farm, and several residential properties in the vicinity of known sites or within potentially suitable habitat (Figure 1). With the exception of one site (Chase Woods on Mt. Tzouhalem, Cowichan), the sites were within CRD on the southern tip of Vancouver Island. In the CRD Regional Park system, we selected four parks for surveys: Elk-Beaver Lake, Matheson Lake, Mt. Work, and Thetis Lake. Within these relatively large parks, we surveyed portions that had received little or no survey effort in an attempt to better delineate the area of occupancy by the Blue-grey Taildropper. The species has been previously found in all the above parks except at Elk-Beaver Lake Regional Park, and we resurveyed these exact sites to confirm its continued persistence (see Appendix 1 for coordinates of survey sites within parks).

Haliburton Organic Farm is a 4 ha property owned by the municipality of Saanich and operated by the Haliburton Community Organic Farm Society. The Urban Biodiversity Enhancement Project provided an opportunity to include surveys for the Blue-grey Taildropper and other rare gastropods at the site, which contains a patch of mixed-wood forest adjacent to an enhanced wetland and meadows.

In Metchosin, a 63.5 ha property owned by Camosun College and under a conservation covenant with Nature Conservancy Canada, was surveyed for gastropods. The property was logged in the 1940s, but the forest is regenerating. The site contains several wetland and upland forest habitats (Durand 2004), three of which (moist mixed-wood riparian forest and two mainly coniferous upland forest types) were surveyed as part of this project. North of the CRD, at Chase Woods on Mt. Tzouhalem, another Nature Conservancy conservation covenant area was surveyed with volunteer help.

On residential properties, we selected sites where landowners either showed interest in participating in the surveys or allowed access to larger tracts of land, preferably in the vicinity of known sites. Suitable survey sites were selected after ground inspection.

Figure 1. Location of study sites surveyed for terrestrial gastropods on southern Vancouver Island in 2013.

3.2 Sampling with artificial cover-objects

As in previous years, we used artificial cover-objects (ACOs) constructed of corrugated cardboard to survey for gastropods (Hawkins *et al*. 1998, Ovaska and Sopuck 2001, 2008). In 2013, we deployed a total of 439 ACOs at 15 sites (25 plots) (Table 1). The cover-objects consisted of layered 30 cm x 30 cm sheets of cardboard, placed flush with the ground, imitating pieces of fallen bark. This method is effective in detecting the Blue-grey Taildropper and other gastropods and allows for repeated surveys of the same site with minimal habitat disturbance.

In CRD Parks and two other sites (Camosun College property in Metchosin; Haliburton Farm), the ACOs were placed along 100 m-long transects at sampling stations that were 10 m apart. At one of three sites in Thetis Lake Regional Park, the cover-objects were placed within a 30 x 30 m grid with stations 5 m apart. This grid was established in 2012 at the site where the Blue-grey Taildropper had been previously found to obtain information on population density. Each transect station had two ACOs, within 1 m of each other, while each grid station at Thetis Lake and transect stations at Haliburton Farm had one ACO per station. On the residential properties surveyed, the ACOs were set in sites deemed most suitable, depending on available habitat, size of the property, and ease of access.

We set up and checked the ACOs in CRD regional parks and two other sites (Camosun College property and Haliburton Farm). The set-up was from 30 August – 9 September 2013, and ACOs were checked for gastropods 3 – 4 times from 1 October to 19 November 2013 (Table 2). There was an additional check of the old ACOs from 2012 on the grid at Thetis Lake during their replacement on 31 August. There were a total of 1245 ACO flips at these sites.

On the residential properties, landowners set up the cover-objects in early September either independently or with help from HAT biologists and checked them multiple times from October to November.

The surveys in 2013 were carried out in the autumn because past experience indicated that Blue-grey Taildroppers are detected most readily at this time (Ovaska and Sopuck 2008, 2009, 2011, 2012). Conditions during the ACO checks in autumn 2013 were mild and moist, suitable for gastropod activity. During checks by HAT biologists, ambient temperatures ranged from 5 – 14°C (average = 9.4°C; 30 August check of Thetis Lake grid excluded).

Table 1. Summary of search effort using artificial cover-objects (ACOs) to survey terrestrial gastropods in autumn 2013.

A. CRD Regional Parks & municipal & private properties with ACOs checked by HAT biologists:

Site Name	Transect of plot	No. of transects or plots*	# stations**	# ACOs^	# surveys	# of ACO flips
Elk-Beaver Lake Regional Park	T1, T2	2	20	40	3	120
Matheson Lake Regional Park	T1, T2	2	20	40	3	120
Mt. Work Regional Park	T1, T2	2	20	40	4	160
Thetis Lake Regional Park	T1, T2	2	20	40	4	160
Thetis Lake Regional Park	Grid	1	20	49	5	245
Haliburton Farm (Saanich)	T1, T2	2	20	20	4	80
Metchosin (Camosun property)	P1, P4, P5 (T1, T2 within each)	6	60	120	3	360
Sub-total:		17	180	349	26	1245

B. Residential properties with ACOs checked by landowners:

Site Name	Transect of plot	No. of transects or plots*	# sampling stations	# ACOs*	# surveys
Highlands (Site 1)	1	1	10	10	Several
Highlands (Site 2)	1	1	10	10	Several
Langford (Site 1l)	1	1	10	10	Several
Mill Hill (Site 1)	1	1	10	10	Several
Prospect Lake (Site 1)	1	1	10	10	Several
West Saanich (Site 1)	1	1	10	20	Several
West Saanich (Site 2)	1	1	10	10	Several
West Saanich (Site 3)	1	1	10	10	Several
Sub-total:		8	80	90	
Grand total (A +B):		25	260	439	

*ACO-Artificial (cardboard) cover-object

Table 2. Dates and sites of artificial cover-object surveys by HAT biologists in 2013.

Site Name	# transects or plots*	Check 1	Check 2	Check 3	Check 4	Check 5
Elk-Beaver Lake Regional Park	T1, T2	5-Oct-13	28-Oct-13	8-Nov-13		
Matheson Lake Regional Park	T1, T2	10-Oct-13	4-Nov-13	18-Nov-13		
Mt. Work Regional Park (Durrance Lake)	T1, T2	4-Oct-13	18-Oct-13	5-Nov-13	15-Nov-13	
Thetis Lake Regional Park	T1, T2	1-Oct-13	25-Oct-13	2-Nov-13	19-Nov-13	
Thetis Lake Regional Park	Grid	31-Aug-13	1-Oct-13	26-Oct-13	5-Nov-13	14-Nov-13
Haliburton Farm (Saanich)	T1, T2	5-Oct-13	14-Oct-13	23-Oct-13	14-Nov-13	
Metchosin (Camosun College property)	T1-T6	26-Sep-13	6-Oct-13	4-Nov-13		

3.3 Surveys of natural cover objects

Artificial cover-object surveys were supplemented by searches of natural cover on the forest floor at two sites, Chase Woods and Matheson Lake Regional Park (Table 3). The searches consisted of visual examination of downed logs, sloughed-off bark, handfuls of leaf litter, and other microhabitats for the presence of gastropods. The natural cover-objects were carefully replaced and no logs were taken apart to avoid damage to the habitat. Intensive searches were carried out within habitats deemed suitable for the Blue-grey Taildropper, or in the case of one site at Matheson Lake, where the species had been found previously.

Table 3. Dates and sites of searches of natural cover on the forest floor for gastropods in 2013.

Site Name	Date	Start time	End time	Search time (person-hours)	# of persons	Air temp. (C°)	Notes
Chase Woods, Mt Tzouhalem	9-Nov-13	10:30	14:00	10+	10+	8	Slug walk with volunteers; spot searches along trail and intense searches for ca. 30 min at 3 moist habitats by varying number of people with varying experience.
Matheson Lake Regional Park	18-Nov-13	14:20	14:40	0.7	2	9	Bigleaf maple stand near artificial cover-object transect
Matheson Lake Regional Park	18-Nov-13	15:00	15:20	0.7	2	9	Douglas-fir-Arbutus stand where Blue-grey Taildropper had been found in previous years

3.4 Identification and data recording

We identified and recorded all gastropods found during the study. Nomenclature follows Forsyth (2004). Identification was done in the field using external characteristics, and all animals were released after examination. Photos of Blue-grey Taildroppers were taken

as vouchers. We also recorded the dominant overstorey and understorey vegetation where the species was found and noted any habitat disturbance or potential threats to the site.

The data were entered into Microsoft® Excel 2007 spreadsheets. Raw data are submitted together with this report as an Excel file.

4.0 RESULTS

4.1 Artificial cover-object surveys

A total of 1649 individual gastropods, representing 28 species, were found during artificial cover-object surveys at the sites surveyed by HAT biologists (Table 4). The species included three native and seven introduced species of slugs, and 16 native and two introduced species of snails. Of the native species, two large snails, the Northwest Hesperian, a herbivore/fungivore, and the Robust Lancetooth, a carnivore, were found at all sites, and several small snails such as the Blue Glass and Tightcoil snails were also widespread and relatively abundant. The Pacific Sideband (Blue-listed in BC) was found at one site (Thetis Lake grid); artificial cover-objects are not an optimal method for locating this semi-arboreal species.

Relatively few native slugs were found during the surveys. The Pacific Banana Slug was widespread but found in low numbers. Two other native slugs found during the surveys were the Reticulate Taildropper at the Thetis Lake grid and the Meadow Slug, also at the Thetis Lake grid, and at Haliburton Farm. The Blue-grey Taildropper was not found during the artificial cover-object surveys (but see Section 4.2).

Several introduced species of gastropods were found during the surveys (Table 4). Introduced species were numerous and abundant at Haliburton Farm, as expected based on the proximity of the survey sites to cultivated areas (Figure 2). The small Chrysalis Snail was particularly abundant at this site. Introduced gastropods were also relatively abundant at the Thetis Lake grid but not on the transects, which were located in a different part of the park. The abundance of native versus introduced slugs and snails, as reflected in the ACO samples, is shown in Figure 2.

On residential properties, landowners who checked cover-objects reported no Blue-grey Taildroppers, and slugs identified by us (in the field or from photographs) were all of introduced species.

Table 4. Terrestrial gastropod species and numbers found during artificial cover-object searches by HAT biologists in 2013.

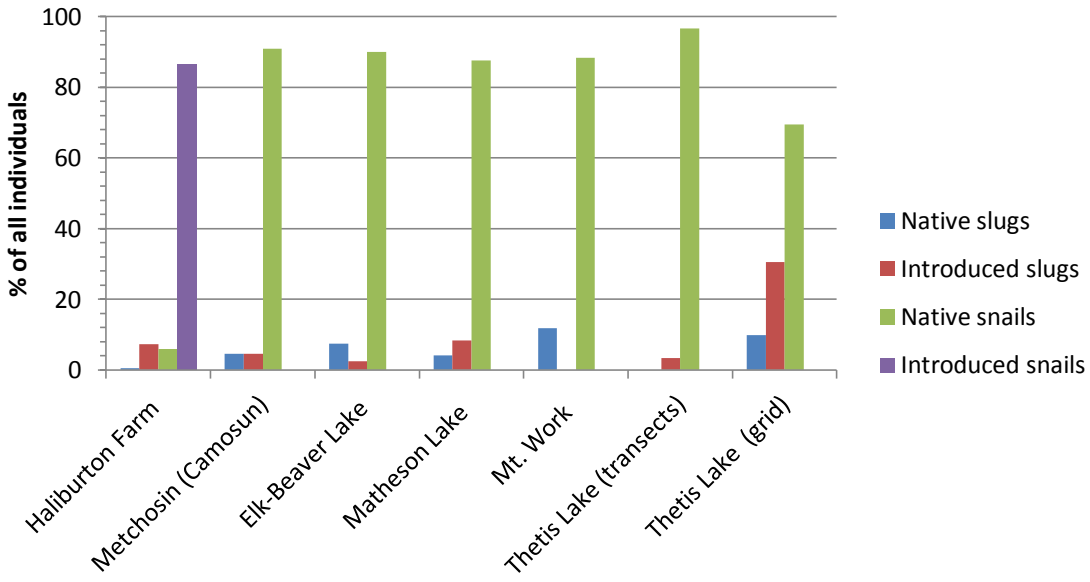
Numbers in cells denote total number of individuals found by site unless otherwise noted.
*after species name denotes introduced species
n = # of cardboard cover-objects (ACOs), set along transects or, in the case of Thetis Lake, in a grid.

SPECIES	Haliburton Farm (T1, T2; n=20)	Metchosin (Camosun) (T1-T6; n=120)	Elk-Beaver Lake (T1, T2; n=40)	Matheson Lake (T1, T2; n=40)	Mt. Work (T1, T2; n=40)	Thetis Lake (T1, T2; n=40)	Thetis Lake (GRID, n=49)	# of animals	% of all animals	% of all sites
Slugs:										
Pacific Banana-slug, *Ariolimax columbianus*	0	13	3	3	2	0	0	21	1.3	57.1
Brown-banded Arion, *Arion circumscriptus**	51	0	0	0	0	0	0	51	3.1	14.3
Hedgehog Arion, *Arion intermedius**	1	0	0	0	0	0	14	15	0.9	28.6
Chocolate Arion, *Arion rufus**	0	10	0	3	0	0	0	13	0.8	28.6
Dusky Arion, *Arion subfuscus**	1	0	0	0	0	0	0	1	0.1	14.3
Arion species* (unidentified juveniles)	4	2	0	0	0	0	0	6	0.4	28.6
Meadow Slug, *Deroceras laeve*	5	0	0	0	0	0	6	11	0.7	28.6
Longneck Fieldslug, *Deroceras panormitanum**	1	0	0	0	0	0	5	6	0.4	28.6
Grey Fieldslug, *Deroceras reticulatum**	19	0	0	0	0	0	18	37	2.2	28.6
Giant Gardenslug, *Limax maximus**	2	1	1	3	0	1	0	8	0.5	71.4

SPECIES	Haliburton Farm (T1, T2; n=20)	Metchosin (Camosun) (T1-T6; n=120)	Elk-Beaver Lake (T1, T2; n=40)	Matheson Lake (T1, T2; n=40)	Mt. Work (T1, T2; n=40)	Thetis Lake (T1, T2; n=40)	Thetis Lake (GRID, n=49)	# of animals	% of all animals	% of all sites
Reticulate Taildropper, *Prophysaon andersonii*	0	0	0	0	0	0	6	6	0.4	14.3
Snails:										
Beaded Lancetooth, *Ancotrema sportella*	0	0	0	0	0	0	1	1	0.1	14.3
Toothless Column, *Columella edentula*	2	2	0	1	0	0	0	5	0.3	42.9
Glossy Pillar, *Cochlicopa lubrica*	52	0	0	1	0	0	0	53	3.2	28.6
Pygmy Oregonian, *Cryptomastix germana*	0	17	1	4	2	0	9	33	2.0	71.4
Brown Hive, *Euconulus fulvus*	2	5	0	0	0	4	0	11	0.7	42.9
Robust Lancetooth, *Haplotrema vancouverense*	2	6	3	1	3	1	4	20	1.2	100.0
Chrysalis Snail, *Lauria cylindracea**	861	0	0	0	0	0	0	861	52.2	14.3
Pacific Sideband, *Monadenia fidelis*	0	0	0	0	0	0	1	1	0.1	14.3
Blue Glass, *Nesovitrea binneyana*	0	53	6	5	1	3	0	68	4.1	71.4
Glass Snails, *Oxychilus* species*	66	0	0	0	0	0	0	66	4.0	14.3
Pinhead Spot, *Paralaoma servilis*	0	0	0	0	0	0	8	8	0.5	14.3
Western Broadwhorl, *Planigyra clappi*	0	1	0	2	0	0	1	4	0.2	42.9

SPECIES	Haliburton Farm (T1, T2; n=20)	Metchosin (Camosun) (T1-T6; n=120)	Elk-Beaver Lake (T1, T2; n=40)	Matheson Lake (T1, T2; n=40)	Mt. Work (T1, T2; n=40)	Thetis Lake (T1, T2; n=40)	Thetis Lake (GRID, n=49)	# of animals	% of all animals	% of all sites
Tightcoil snails, *Pristiloma* sp. (*P. stearnsii* and/or *P. lansingii*)	0	125	11	33	0	5	3	177	10.7	71.4
Conical Spot, *Punctum randolphii*	1	0	0	7	5	2	4	19	1.2	71.4
Northwest Striate, *Striatura pugetensis*	0	3	0	0	0	0	0	3	0.2	14.3
Vertigo species	0	10	0	1	1	1	1	14	0.8	71.4
Northwest Hesperian, *Vespericola columbianus*	4	30	13	8	3	9	51	118	7.2	100.0
Quick Gloss, *Zonitoides arboreus*	0	5	2	0	0	4	1	12	0.7	57.1

Figure 2. Proportional abundance of native and introduced slugs and snails (all species combined) by site in artificial cover-object surveys in 2013.



4.2 Searches of natural cover

During a nature walk at Chase Woods, Mt. Tzouhalem, visual surveys of the forest floor by volunteers and led by Kristiina Ovaska resulted in the detection of four species of slugs and six species of snails (Table 5). The focus was on slugs and large snails, and many more small snails almost certainly exist at the site. The survey was conducted very late in the season, on 9 November, corresponding to an optimal period for detecting the Blue-grey Taildropper but not necessarily other gastropods. In addition to the ubiquitous Pacific Banana Slug and the introduced Chocolate Arion, two species of taildroppers were found: Blue-grey Taildropper and Yellow-bordered Taildropper. Two adult Blue-grey Taildroppers were found within approximately 5 m from each other in a moist Bigleaf Maple-dominated stand (Figure 3; see Table 6 for habitat description). The slugs were within a mossy, decaying stump and within deep leaf litter under Sword Ferns at the base of a large Bigleaf Maple tree, respectively.

Encouraged by the success of finding the Blue-grey Taildropper at Chase Woods, we supplemented artificial cover-object surveys with searches of natural cover on the forest floor at Matheson Lake Regional Park on 18 November. Three species of slugs, including the Blue-grey Taildropper, and one species of snail, the Pacific Sideband were found (Table 5). The Blue-grey Taildroppers were approximately 15-20 m from a site with a previous observation of the species during the Metchosin Bioblitz in late April 2011. We were surprised to find a total of nine adults during a brief search of this site. The slugs were under separate pieces of bark or small logs within a 15 m radius area (Figure 4). The site was in an older coniferous forest stand with little understorey but much coarse woody debris and an abundance of *Russula* sp. mushrooms (see Table 6 for habitat description). We did not find the species during a similar search of natural

cover in the vicinity of an artificial cover-object transect (T2) in the park during the same day. Onset of freezing conditions within days of this search prevented further searches of natural cover at other sites.

Table 5. Terrestrial gastropod species and numbers found during searches of natural cover in 2013.

Numbers in cells denote total number of individuals found by site unless otherwise noted.
*after species name denotes introduced species

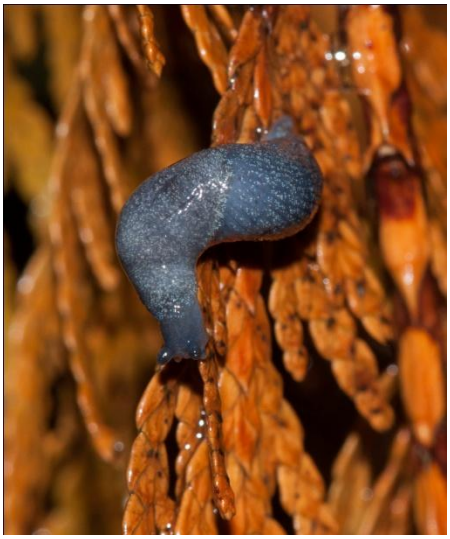
SPECIES	Chase Woods	Matheson Lake Regional Park
Slugs:		
Pacific Banana-slug, *Ariolimax columbianus*	2	1
Chocolate Arion, *Arion rufus**	1	1
Yellow-bordered Taildropper, *Prophysaon foliolatum*	1	0
Blue-grey Taildropper, *Prophysaon coeruleum*	2	9
Snails:		
Beaded Lancetooth, *Ancotrema sportella*	1	0
Robust Lancetooth, *Haplotrema vancouverense*	5	0
Pacific Sideband, *Monadenia fidelis*	2	1
Blue Glass, *Nesovitrea binneyana*	1	0
Northwest Hesperian, *Vespericola columbianus*	6	0
Quick Gloss, *Zonitoides arboreus*	1	0

Table 6. Blue-grey Taildropper records from Vancouver Island, autumn 2013.

Date	# found	Site name	Observer	Habitat description	Stand age (approx)	Dominant tree species (% canopy closure)	Shrubs (% coverage)	Ferns (% coverage)	CWD (%)
09-Nov-13	2	Chase Woods, Mt Tzouhalem	Malcolm Taylor & K. Ovaska	Moist Bigleaf Maple stand with Sword Fern & Oregon Grape understorey; deep leaf litter	80	Bigleaf Maple (30%)	Oregon Grape, Trailing Blackberry (40%)	Sword Fern, Bracken (15%)	10
18-Nov-13	9	Matheson Lake Regional Park	K. Ovaska & Lennart Sopuck	Older coniferous forest on gently sloping terrain with sparse understorey; numerous mushrooms & pieces of wood/bark	150	Douglas-fir, Western Redcedar, Western Hemlock (70%)	Salal, Oregon Grape (10%)	None	20

Figure 3. Blue-grey Taildropper and its habitat at Chase Woods, Mt. Tzouhalem, 9 November 2013.

Figure 4. Blue-grey Taildropper and its habitat in Matheson Lake Regional Park, Metchosin, 18 November 2013.



5.0 DISCUSSION

5.1 Blue-grey Taildropper

Distribution and population persistence:

Surveys in autumn 2013 resulted in the finding of the Blue-grey Taildropper at two sites, Chase Woods near Duncan and Matheson Lake Regional Park. The Chase Woods record is of particular interest, as it extends the known distribution of the species northward from the CRD along the east coast of Vancouver Island (see Figure 5 for a summary of all BC localities for the species). In a straight-line distance, this site is 25 km north from the nearest previously known site (Durrance Lake on Saanich Peninsula). Chase Woods is located on the west slope and near the base of Mt. Tzouhalem, which is largely forested. The intervening habitat along the east coast of Vancouver Island is heavily fragmented by agricultural and residential developments, but a few larger patches of forest remain, such as in the Malahat and Bamberton areas. There are also larger patches of forest to the north of Maple Bay and to the east across the Strait of Georgia on the west side of Saltspring Island. Suitable habitats within these forested areas should be searched for the slugs.

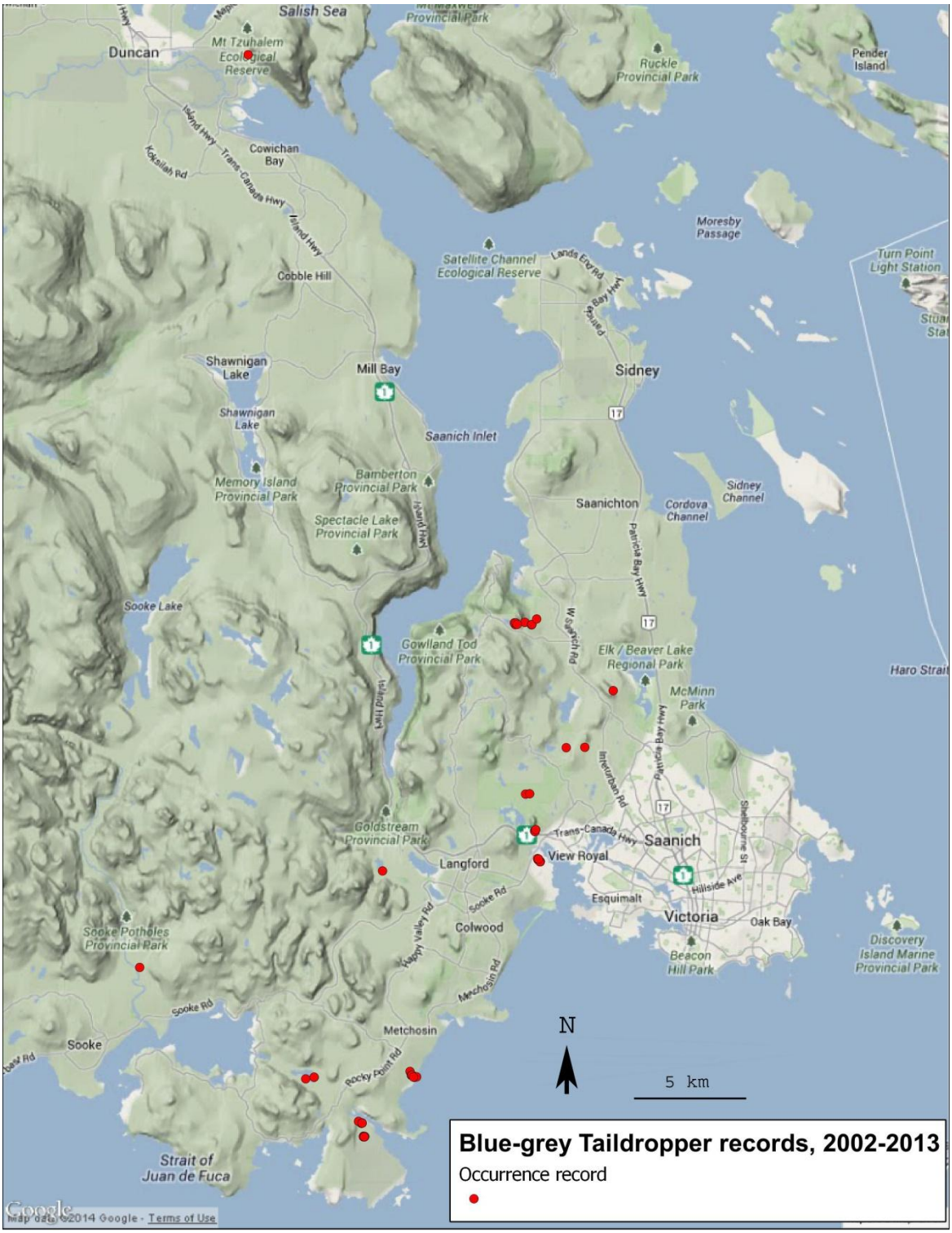
The Blue-grey Taildropper could potentially also occur farther inland in the Cobble Hill and Shawnigan areas, but its westward distribution on the island is probably limited by high elevation terrain. All known localities of the species are at low elevations (<200 m asl), which support forest types with a deciduous component of Bigleaf Maple, Arbutus or Garry Oak. Extensive search efforts for gastropods on forestry lands and in parks on the west coast and northern Vancouver Island have failed to locate the species (COSEWIC 2006). Habitat modelling, such as done for the Dromedary Jumping-slug, *Hemphillia dromedarius* (Parks Canada Agency 2012), would be desirable to help focus survey efforts to suitable habitats north of the CRD.

In autumn 2012, no Blue-grey Taildroppers were found at any of the survey sites within the CRD, including those sites with previous observations (Ovaska and Sopuck 2013). The lack of observations was attributed to a prolonged drought that lasted from mid-July to mid-October that year, raising concerns about the long-term impacts of the drought on population persistence. In 2013, observations of the species at a previously known site in Matheson Lake Regional Park confirm its survival there. However, we failed to find the slugs at two other sites with previous observations (Mt. Work: Durrance Lake and Thetis Lake), the exact localities of which were searched intensively in 2013.

Both observations of the Blue-grey Taildropper in 2013 were in late autumn (9 and 18 November), supporting the notion that the slugs are most easily detected very late in the season. The observation at Matheson Lake occurred just days before the first heavy frost, which effectively curtailed further searches and ended the field season. At the Matheson Lake site, we found a relatively large number (9) of Blue-grey Taildroppers within a short (40 person-minute) search, all within metres of each other. It is unknown whether the slugs aggregate late in the season for mating, egg-laying, or hibernation, or whether they are attracted by an abundant food source or other resources. Numerous

mushrooms were present at this site. It is possible that the slugs were attracted to this food source and moved there from adjacent areas.

Figure 5. Summary of Blue-grey Taildropper localities from British Columbia.



Habitat associations:

The Blue-grey Taildropper has been found in a variety of forest habitats, ranging from Garry Oak – Arbutus woodlands to Bigleaf Maple stands to Western Redcedar – Douglas-fir stands. Common features are the availability of moist refuges, provided by coarse woody debris, abundant forest litter or a thick moss layer. Proximity to a food source, such as an abundance of suitable fungi, may also be a factor.

The Chase Woods locality was in a moist second-growth Bigleaf Maple stand, whereas the Matheson Lake locality was in a mainly coniferous older forest stand. The species has been previously found in similar habitats (Bigleaf Maple habitat at Rocky Point; older mainly coniferous forest at Heals' Rifle Range). Both sites were very moist and had an abundance of coarse woody debris.

Effectiveness of survey methods:

At both Chase Woods and Matheson Lake, the Blue-grey Taildropper was found during searches of natural cover rather than during artificial cover-object searches, raising questions about the effectiveness of the latter method. However, two lines of evidence suggest that ACOs, such as used in this study, are effective for the species. First, the species has been found previously during ACO searches at several sites within the CRD, including multiple slugs found on ACO grids on DND properties similar to the one used at Thetis Lake in 2012 and 2013 (Ovaska and Sopuck 2009b). Second, numerous other species of terrestrial gastropods were found as a result of this method in 2013 and in previous years. Furthermore, searches of natural cover at another site at Matheson Lake, which was also sampled with ACOs, resulted in no slugs on the same day when the Blue-grey Taildropper was found. Both the timing and location of the natural cover searches were probably simply fortuitous. Nevertheless, searches of natural cover can be advantageous as they allow searchers to move around and search microhabitats deemed best. We recommend that careful and strategic natural cover searches be incorporated into Blue-grey Taildropper surveys in the future, particularly late in the season when the slugs are most readily found. Careful inspections of mushrooms and adjacent natural cover objects may be a particularly effective method during moist periods in spring and autumn.

5.2 Other species at risk

In addition to the Blue-grey Taildropper, one other gastropod species at risk was found during the surveys. The Pacific Sideband was found at three sites: Thetis Lake ACO grid, Matheson Lake, and Chase Woods. This large snail is widely distributed at low elevations on southern Vancouver Island, particularly in mixed-wood stands with Bigleaf Maple, where it can be locally abundant.

5.3 Volunteer involvement

The project provided opportunities for landowners and managers to participate in the surveys and appreciate the role of terrestrial gastropods as components of the region's biodiversity. Landowners interested in participating in the surveys were identified

through HAT's habitat stewardship and landowner contact program. Several landowners who participated in the program previously chose to continue this year. Artificial cover-objects provided by HAT allowed landowners to conduct independent surveys on their lands. Outreach materials, including the Blue-grey Taildropper Identification Guide (HAT 2011) and Habitat Monitoring Guide (HAT 2013), were provided. HAT provided follow-up support through email updates, identifying gastropods from photographs sent to us, and site visits upon request. Efforts by landowners and CRD Parks volunteers greatly increased survey coverage, but unfortunately no Blue-grey Taildroppers were found on the residential properties. It is hoped that landowners and volunteers will continue helping with surveys in the future.

A "slug walk" during Nature Conservancy's volunteer event at Chase Woods proved highly productive. Not only was the Blue-grey Taildropper found in a new area, but the surveys also raised the participants' awareness of terrestrial gastropods and species at risk. The participants included local naturalists, members of the public, and children from Cowichan Valley Young Naturalists. One of the two Blue-grey Taildroppers was found by a 7-year old participant. Including such volunteer events is recommended for surveys of new areas in the future.

6.0 THREATS AND RECOMMENDED MITIGATION

As previously identified (COSEWIC 2006, Ovaska and Sopuck 2012), the main threats to Blue-grey Taildropper populations on southern Vancouver Island are the loss and degradation of habitat due to urbanization, agriculture, logging, heavy recreational use, and the spread of invasive plants and animals. Populations of Blue-grey Taildroppers within this largely modified landscape are becoming increasingly fragmented, which increases the probability of local extinctions. Severe weather associated with climate change, including prolonged droughts, increased temperatures and flooding, are additional stressors that may adversely affect Blue-grey Taildropper populations over the longer term. These impacts could be mitigated by maintaining a network of suitably-connected protected areas and other suitable habitat within the range of the species on southern Vancouver Island.

Blue-grey Taildropper populations in protected areas, including regional and municipal parks, community watersheds and other conservation lands, are not necessarily safe from habitat degradation. Excessive trail networks, off-trail mountain bike and ATV use, invasive plants and animals, and forest encroachment into Arbutus and Garry Oak ecosystems all threaten Blue-grey Taildropper habitat. Additional trail signage, decommissioning of unofficial trails, invasive plant control, and habitat restoration of trampled areas can be used to mitigate these threats.

At Thetis Lake Regional Park, we carried out intensive surveys with a grid of cardboard cover-objects at a site where the Blue-grey Taildropper has been found in previous years. Habitat at this site is threatened by introduced Laurel-leaved Daphne (*Daphne laurealis*), which appears to be spreading (Figure 6). Numerous unofficial trails are also present in the vicinity of the site, and introduced slugs are prevalent. Removal of

Daphne is recommended but should be carried out carefully with minimal disturbance to the soils and avoiding compaction of the forest floor by trampling. At this site, we also observed several large piles of woody debris, created as a result of fire prevention activities over the last several years. This activity disturbs the forest floor and reduces the overall availability of coarse woody debris used as refuges by the slugs with possible detrimental effects on the population.

Figure 6. Deterioration of Blue-grey Taildropper habitat due to invasive plants and unofficial mountain bike trails in CRD regional parks.

Laurel-leaved Daphne invading Blue-grey Taildropper habitat at Thetis Lake Regional Park.

New unofficial mountain bike trail through a site where a Blue-grey Taildropper was found in 2008 in Mt. Work Regional Park (Durrance Lake).

Unofficial trail widening in Blue-grey Taildropper habitat in Mt. Work Regional Park (Durrance Lake).

At Mt. Work Regional Park, severe habitat degradation as a result of mountain bike use was observed at a Blue-grey-taildropper site immediately to the east of Durrance Lake (Figure 6). In June 2008, one juvenile slug was found at this site in an area of dense Ocean Spray shrubs and a thick layer of moss. In August 2013, during set up of cover-objects, we noticed that a new mountain bike trail looping into the main trail had been created directly through this site. Shrub and moss cover was completely lost within a 1 – 2 m wide strip through the site. The damage affects slugs directly by removing habitat within the strip and indirectly by reducing moisture-retention and facilitating encroachment by invasive alien plants in a wider zone of habitat adjacent to the strip. We recommend that the new trail should be closed using temporary fencing and the site restored by planting native shrubs and herbs.

At Matheson Lake Regional Park, we noticed a network of unofficial trails in the vicinity of the site where an aggregation of Blue-grey Taildroppers were found this autumn. Such activities affect slugs by the compaction of soil, removal of mushrooms, trampling of vegetation, and disturbance to coarse woody debris. Unnecessary trails should be closed and restored, and official trails managed so that the area of disturbance is minimized. Signs requesting hikers to stay on the path and not disturb mushrooms may also help to reduce impacts.

7.0 RECOMMENDATIONS FOR 2014

Recommendations include the following:

- Develop a habitat suitability model to direct survey efforts.
- In collaboration with CRD Regional Parks undertake habitat restoration, including removal of invasive plants and reducing unauthorized trails, at sites where this is deemed beneficial such as Thetis Lake and Mt. Work Regional Parks.
- Continue surveys within CRD Regional Parks and Trails System and other areas within the CRD in an effort to better delineate the distribution of this species and to confirm its persistence at known sites.
- Expand search effort to suitable habitats north of the CRD towards Cowichan Valley.
- Include searches of both artificial cover-objects and natural cover into survey plans.
- Continue working with municipalities and private landowners, targeting areas near known occurrences and other areas with suitable habitat.

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APPENDICES

Appendix 1. Detailed locations of study sites in CRD Regional Parks in 2013.

Site name	Transect ID	UTM Easting (start)	UTM Northing (start)	UTM Easting (end)	UTM Northing (end)	ACO set-up date	No. stations	No. ACOs
Elk/Beaver Regional Park	T1	470385	5373826	470354	5373909	30-Aug-2013	10	20
Elk/Beaver Regional Park	T2	470250	5373933	470253	5373849	30-Aug-2013	10	20
Matheson Lake Regional Park	T1	456011	5356643	456062	5356574	2-Sep-2013	10	20
Matheson Lake Regional Park	T2	456058	5356916	455975	5356952	2-Sep-2013	10	20
Mt. Work Regional Park: Durrance Lake	T1	464964	5377242	465030	5377291	30-Aug-2013	10	20
Mt. Work Regional Park: Durrance Lake	T2	465128	5377287	465080	5377232	5-Sep-2013	10	20
Thetis Lake Regional Park	T1	466103	5368558	466057	5368630	31-Aug-2013	10	20
Thetis Lake Regional Park	T2	465711	5369456	465786	5369458	31-Aug-2013	10	20
Thetis Lake	GRID	465835	5367939	465852	5367962	31-Aug-2013	49	49

*Transects consisted of 10 or 5 sampling stations, 10 m apart and each with cardboard cover-objects.
Grid consisted of a 30 m x 30 m grid with 1 cardboard cover-object every 5 m.