

Land Snail Biodiversity Assessment for the Selkirk Mountains Park Region in Southeastern British Columbia.

Final Report prepared for the: Valhalla Wilderness Society

Jeff Nekola¹, Brian Coles², and Michal Horsak³

¹University of New Mexico, Albuquerque, USA; jnekola@unm.edu

²National Museum of Wales, Bangor, Wales, UK; pristiloma@hotmail.com

³Masaryk University, Brno, Czech Republic; horsak@sci.muni.cz

Introduction:

In an effort to help the Valhalla Wilderness Society document the land snail biodiversity from areas within and adjacent to the proposed Selkirk Mountain Caribou Park, an international team of three researchers (Brian Coles, Natural History Museum of Wales; Michal Horsak, Masaryk University, Brno, Czech Republic; Jeff Nekola, University of New Mexico) spent a total of 19 person-days in the region. This survey work represents the first thorough land snail survey in SE British Columbia across all habitats and elevations.

Methods:

Sample Sites

A total of 29 sites were surveyed for their land snail biodiversity, ranging from Revelstoke, the Incomappleux Valley and Duncan Valley in the north to the south end of Slocan Lake, the east shore of Kootenay Lake at Crawford Bay, and the Canal Flats area on the south shore of Columbia Lake. Almost half (13 total) were located within the proposed Selkirk Mountain Caribou Park boundaries: Incomappleux 1, Boyd Creek, Healy Creek Pass, Healy Creek Pass Fen; Healy Creek 1, Healy Creek 2, Healy Creek 3, Incomappleux 2, Battle Brook Seep, Coot Lake, Hall Creek, Duncan Lake 1, BB Creek Confluence, and Duncan Lake 2. These sites cover the total range of major habitat types present in the region, and include mixed coniferous/deciduous forest, cedar and cedar/hemlock forest, subalpine spruce forest, talus slopes, bedrock outcrops, riparian forest, alder thickets and seeps, sedge meadows, and tundra. The latitude-longitude position of each pole location was determined using a Garmin 12XL hand-held GPS unit.

Field Protocols

Land snail assemblages from each site were documented from August 27-September 3, 2011 quasi-independently by the three investigators using two different search strategies: Nekola and Coles through eye-hand collection for larger shells and litter sampling for smaller taxa, and Horsak primarily through eye-hand collection for shells across the body size spectrum. Approximately an hour was spent at each site. Eye-hand searching followed normal malacological protocols, and emphasized known favored microsites such as coarse woody debris, stones, rock outcrops, and tree bases. Soil litter collections followed protocols of Nekola & Coles (2010), and emphasized microsites known to support high micro-snail densities (e.g., Emberton et al. 1996). Approximately 500 ml of litter was collected per subsample. Across all three investigators, generally ten times as many individuals were captured as species, which is advocated by Cameron & Pokryszko (2005) for accurate land snail community documentation.

Laboratory Procedures

As outlined by Nekola & Coles (2010), dried litter samples were passed through a standard sieve series and hand picked against a neutral-brown background. All shells and shell fragments were removed. All shells were assigned to species (or subspecies) using the authors' reference collections, with the total numbers of shells per species per site being recorded. The number of unassignable immature individuals and fragmentary shells was recorded. Nomenclature is based principally on Hubricht (1985) with updates by Turgeon et al. (1998), Nekola (2004) and Nekola & Coles (2010).

Results

Overview of Fauna

A total of 10,598 individuals were encountered from the 29 sample sites. Of these, 1617 were immature or fragmentary and could not be assigned to a species. Of the remaining 8981, 39 species from 18 families were documented (Table 1). Adult individuals ranged in size from the >60 mm long *Arion ater* and >20 mm diameter *Allogona ptychophora* to the ~1 mm diameter *Punctum randolphi*. The most frequently encountered species were: *Euconulus fulvus* (25 sites), *Punctum randolphi* (21), *Discus cronkhitei* (21), *Microphysula ingersolli* (21), *Nesovitrea binneyana* (20), *Striatura pugetensis* (19), *Columella simplex* (18), *Zonitoides arboreus* (15), *Vertigo coloradensis* (12), *Planogyra clappi* (10), and *Vertigo concinnula* (10). The most abundant species were: *Punctum randolphi* (1796 individuals), *Planogyra clappi* (1313), *Striatura pugetensis* (1277), *Euconulus fulvus* (718), *Nesovitrea binneyana* (427), *Discus cronkhitei* (416), *Microphysula ingersolli* (359), *Punctum californicum* (331), *Vertigo coloradensis* (199), *Columella simplex* (178), and *Vertigo concinnula* (178).

Biogeography

The fauna consists primarily of species with four biogeographic affinities.

- 1.** Cosmopolitan species that are found across the North American taiga and often across the rest of the continent as well. The taiga zone has been termed the 'Northern Province' by molluscan biogeographers (Pilsbry 1948). Thirteen of the encountered species possess this general range: *Cochlicopa lubrica*, *Columella simplex*, *Deroceras* spp., *Discus cronkhitei*, *Euconulus alderi*, *Euconulus fulvus*, *Nesovitrea binneyana*, *Nesovitrea electrina*, *Vertigo arthuri*, *Vertigo ovata*, *Vertigo ultimathule* / *ronnebyensis* / AK2, *Zonitoides arboreus*, and *Zoogenetes harpa*.
- 2.** The Rocky Mountain Province. Species of this group generally range throughout the western cordillera from the desert southwest north sometimes as far as Alaska. The eight species representing this type of range pattern are: *Microphysula ingersolli*, *Oxyloma nuttallianum*, *Punctum californicum*, *Punctum conspectum*, *Vertigo coloradensis*, *Vertigo concinnula*, *Vertigo idahoensis*, and *Vitrina alaskana*.
- 3.** The Washingtonian Province. This small biogeographic division ranges across the Columbia Basin in central Washington across central and northern Idaho to the continental divide in Montana, and north into southeastern BC. The eight species which fit best into this group include: *Allogona ptychophora*, *Anguispira kochi*, *Cryptomastix mullani*, *Hemphillia camelus*, *Oreohelix strigosa strigosa*, *Pristiloma chersinella*, *Radiodiscus abietum*, and *Vertigo modesta sculptilis*. This group is of particular interest because its members appear to represent relicts of the time in which mixed conifer/deciduous forest covered the entire northern hemisphere. As a result, a number of these species have close relatives in the forests of the central and southern Appalachians. The northern limit of this Province appears to be defined by the northern end of Slocan Lake and the Retallack

area east of New Denver. Five of these species are listed as being of conservation importance in the Province by the BC Ministry of the Environment.

4. The Oregonian Province. This region is largely coincident with the Pacific Rainforest communities found from the northern California coast to the Kenai Peninsula in Alaska. Six of the encountered species are largely confined to this province: *Planogyra clappi*, *Pristiloma arcticum*, *Prophysaon andersoni*, *Punctum randolphi*, *Striatura pugetensis*, and *Vertigo columbiana*. The populations found during this survey in general represent the first time these species have been seen in BC east of the coastal ranges.

Last, four Eurasian exotic species were encountered: *Arion ater*, *Arion intermedius*, *Arion silvaticus*, and *Vallonia pulchella*. These were limited to low-elevation, anthropogenically disturbed sites and do not represent at this time a danger to the native biodiversity.

Species of Conservation Importance

Eight of the encountered species are currently listed of conservation importance by the British Columbia Ministry of Environment (<http://www.env.gov.bc.ca/atrisk/toolintro.html>). One is on the "Red List": *Vertigo idahoensis* (= *V. elatior*), which was considered extirpated from the Province, having not been seen since 1906. Seven additional species are "Blue Listed": *Anguispira kochi*, *Cryptomastix mullani*, *Hemphillia camelus*, *Oreohelix strigosa strigosa*, *Pristiloma arcticum*, *Pristiloma chersinella*, and *Vertigo arthuri*. Four additional species must be mentioned because they represent new records for BC: *Radiodiscus abietum*, *Vertigo concinnula*, *Vertigo modesta sculptilis*, and *Vertigo ultimathule / ronneybyensis / AK2*. Of these, *Vertigo concinnula* is likely common in SE BC, and has simply been taxonomically confused with *V. modesta modesta*, and is not likely of conservation interest. Also, *Vertigo ultimathule / ronneybyensis / AK2* was noted based on the occurrence of a single shell which may simply represent an aberrant individual of a typical species in the region. Until/unless more individuals are found and a population confirmed, this taxon should not be listed. However, both *Radiodiscus abietum* and *V. modesta sculptilis* are almost certainly confined in BC to this general region which represents their northern range limits. As such, they should be considered for future Blue listing by the Environment Ministry.

Six of these species (*Hemphillia camelus*, *Pristiloma arcticum*, *Pristiloma chersinella*, *Vertigo arthuri*, *Vertigo modesta sculptilis* and *Vertigo idahoensis*) were found from sites lying within the proposed boundary of the Selkirk Mountains Caribou Park. The remaining four (*Anguispira kochi*, *Cryptomastix mullani*, *Oreohelix strigosa strigosa*, and *Radiodiscus abietum*) were limited to low elevation sites south of the proposed park boundary.

Sites of Conservation Importance

Thirteen sites (45% of total) harbored at least 11 species, with four sites exceeding 12 species: Slocan Wayside (13 species), Slocan Lake North (14), Incomappleux 1 (17), and the Slocan River (21). The maximum richness reported from coastal BC forests by Cameron (1986) was 17, with 50% of his sites harboring at least 11 species. The Selkirk Mountain Park region sites thus compare well in terms of total richness with sites from the Pacific Coast.

Twenty-one sites harbored at least one of the ten species of conservation importance (eight red/blue list species of the Environment Ministry plus *Radiodiscus abietum* and *Vertigo modesta sculptilis*). Thirteen sites harbored only one of these species, while another five harbored two. Crawford Bay and New Denver East each harbored three species, while the Slocan Wayside harbored four.

SPECIES ACCOUNTS

Following are descriptions for all encountered species. Species names generally follow Turgeon (1996) with updates by Nekola (2004), Nekola & Coles (2010) and additional information provided in 'Taxonomic Notes.' Family assignments are based on Bouchet & Rocroi (2005). The parenthetical numbers following each of the sites of occurrence represent the total number of individuals encountered across all three researchers. Habitat notes refer to BC sites only. North American biogeography is based primarily on Pilsbry (1948), with BC distribution information being distilled from Forsyth (2004). Conservation status data was accessed via the BC Species Explorer of the Environment Ministry (<http://a100.gov.bc.ca/pub/eswp/search.do?method=reset>), accessed on March 30 and 31, 2012.

Family: Agriolimacidae

Deroceras spp. / slug plates

Sites: Slocan Lake North (1); Slocan River (3)

Habitat: Riparian forest near the shore of Slocan Lake

Biogeography: *Deroceras leave* is found throughout North America

Taxonomic notes: Live individuals were not recorded, and these records are based on the presence of calcified internal 'shell plates' in soil samples. As slugs in the family Arionidae lack such plates, their presence indicates that individuals from either the Agriolimacidae or Limacidae are present. Most likely they originated from either the native *Deroceras leave* or from an exotic such as *Deroceras reticulatum*.

Family: Arionidae

Arion ater (Linnaeus, 1758) [syn. *Arion rufus* of Forsyth 2004]

Site: Slocan Lake North (2)

Habitat: Disturbed lakeshore forest

Biogeography: Exotic to North America

Taxonomic notes: We follow Kerney & Cameron (1979) as considering this a variable species group, and do not split the subspecies into separate species-level taxa.

Arion intermedius (Normand, 1852)

Site: Slocan River (1)

Habitat: Disturbed riparian forest and roadside

Biogeography: Exotic to North America

Arion silvaticus Lohmander, 1937

Site: Slocan River (1)

Habitat: Disturbed riparian forest and roadside

Biogeography: Exotic to North America

Prophysaon andersoni (J.G. Cooper, 1872)

Sites: Crawford Bay (1); Revelstoke (2); Slocan Lake North (2); Slocan River (2)

Habitat: Low-elevation, mesic woodlands

Biogeography: Largely an Oregonian Province endemic, ranging from the Pacific coast of central California to southern Alaska, with an isolated set of populations in northern Idaho. Previously

known in BC only from west of the coastal ranges with inland sites being limited to the central and east-central parts of the Province. These records represent the first reported from the southeast.

Family: Binnevidae

Hemphillia camelus Pilsbry & Vanatta, 1897

Conservation Status: Blue

Site: Healy Creek Pass 2 (1)

Habitat: Moist leaf litter under scrub willow

Biogeography: Washingtonian Province endemic. Restricted in British Columbia to the southeast

Conservation notes: Only seven previously documented occurrences from the Columbia Basin region in southeastern BC. Its habitat is vulnerable to logging and forest development.

Family: Charopidae

Radiodiscus abietum H.B. Baker, 1930

Sites: Crawford Bay (7); New Denver East (5); Retallack Grove (19); Slovan River (11); Slovan Wayside (9)

Habitat: Low elevation mesic forested talus slopes or riparian forest from New Denver and south.

Biogeography: Washingtonian Province endemic. Previously known only from central/northern Idaho and northeastern Oregon. The occurrences listed here are the first documented reports from BC and Canada.

Family: Cochlicopidae

Cochlicopa lubrica (Müller, 1774)

Sites: Revelstoke (1); Slovan River (2)

Habitat: Disturbed low-elevation riparian forest

Biogeography: Difficult to assess because of taxonomic issues (see below). True *C. lubrica* likely occurs as a Eurasian exotic across the mid-latitudes in North America. The putative native taxon that has been confused with *C. lubrica* appears to range across the Northern and Rocky Mountain Provinces. *C. lubrica* is reported to occur throughout BC.

Taxonomic notes: We follow Hubricht (1985), Turgeon et al (1995), and Forsyth (2004) in listing the northern North American members of this genus as *C. lubrica*. However, it seems likely that *C. lubrica* is not Holarctic but is native only to central and western Eurasia. North American populations of this species are almost certainly escaped exotics and are generally restricted to anthropogenically disturbed habitats. However, what has passed as '*C. lubrica*' in northern and western North American taiga upon critical examination has too narrow of a shell for true *C. lubrica* while being too tall for the Eurasian *C. lubricella*. It thus seems likely that '*C. lubrica*' in North America may represent a mixture of both exotic and native populations, with the native populations representing an undescribed new species most closely allied to the eastern *C. morseana*. DNA sequence data from across the North American range of '*C. lubrica*' will be required to test this hypothesis and sort out the current taxonomic morass. The SE British Columbia material most resembles the putative native populations, even though they were found in disturbed sites.

Family: Discidae

Anguispira kochi (Pfeiffer, 1821)

Conservation Status: Blue

Sites: Crawford Bay (7); Slocan Wayside (68)

Habitat: Low elevation forested talus slopes

Biogeography: Highly disjunct North American distribution, being found in the deciduous forests of the east and then again in the Washingtonian Province. Restricted in BC to the SE from along the Kootenay River, Kootenay Lake, and southern portion of the Columbia River drainage.

Taxonomic notes: The western populations have been segregated as subsp. *occidentalis*, although this form shows complete conchological overlap with the eastern populations (Pilsbry 1948). We have thus chosen to not taxonomically segregate this material until definitive genetic proof exists.

Conservation notes: Thirteen occurrences have been previously reported from Syringa Creek (Lower Arrow Lake), Kootenay Lake, Nelson, S of Gray Bay (Hwy 3A), Six Mile Lakes and Schroeder Creek (N of Kaslo). It appears vulnerable to habitat loss and fragmentation from development and forestry.

Discus cronkhitei (Newcomb, 1864) [syn. *D. whitneyi*]

Sites: BB Creek Confluence (27); Bear Lake Road (1); Camborne Canyon (15); Canal Flats (1); Coot Lake (1); Crawford Bay (5); Duncan Lake 1 (59); Duncan Lake 2 (21); Hall Creek (34); Healy Creek 3 (1); Incomappleux 1 (17); Incomappleux 2 (51); John Fenger Trail (7); New Denver East (52); Retallack Grove (13); Ruby Silver Grove (11); Slocan Lake North (17); Slocan Wayside (56); Summit Lake (2); Upper Arrow Lake (11); Zincton West (14).

Habitat: Middle-low elevation forests

Biogeography: Occurs throughout the Northern Province and south to the Mexican border in New Mexico, Arizona, and California. It is reported as common throughout much of BC, but is rare on the coast.

Taxonomic Notes: We use here the epithet '*cronkhitei*' for this species because '*whitneyi*' went unused for over a century before being resurrected in the 1990s. ICZN Article 23.9.2 provides appropriate rationale for suppressing the senior synonym in such instances.

Family: Euconulidae

Euconulus alderi (Gray, 1840) [syn. *Euconulus praticola* of Forsyth 2004]

Site: Incomappleux 1 (37)

Habitat: Open sedge meadow

Biogeography: We have seen this species across the Northern Province from Labrador to northern Alaska, and south to Ohio, Iowa, and New Mexico. It is sporadic and little known in BC.

Taxonomic notes: We use the epithet '*alderi*' for this species based on Kerney & Cameron (1979). We do not follow CLECOM nomenclature (Faulkner et al. 2001) which splits this entity into two species: *E. alderi* and *E. praticola*. The validity of the latter taxon has yet to be assessed based on replicatable, hard biological data. As has been pointed out by Davis (2004) and Cameron et al. (2006), the CLECOM project is highly controversial, even in Europe. As a result, it seems far more prudent to use the older and more well-established name.

Euconulus fulvus (Müller, 1774)

Sites: BB Creek Confluence (55); Bear Lake Road (1); Boyd Creek (18); Camborne Canyon (17); Canal Flats (2); Coot Lake (4); Crawford Bay (20); Duncan Lake 1 (69); Duncan Lake 2 (104); Hall Creek (29); Healy Creek 1 (27); Healy Creek 2 (11); Healy Creek 3 (9); Incomappleux 1 (134); Incomappleux 2 (47); John Fenger Trail (18); New Denver East (8); Retallack Grove (22);

Ruby Silver Grove (61); Slocan Lake North (9); Slocan River (2); Slocan Wayside (19); Summit Lake (8); Upper Arrow Lake (2); Zincton West (22)

Habitats: A wide variety of wooded sites across the elevation spectrum

Biogeography: A holarctic species found in North America across the Northern Province south to the Ohio and Missouri Rivers and in the mountains to southern New Mexico, Arizona, and California. It is common throughout BC.

Taxonomic notes: While many of our collected shells appear to fall within the concept of *Euconulus fulvus alaskensis*, we have not distinguished this subspecies because it appears to intergrade completely with *E. fulvus fulvus* across much of western North America. These forms do to appear to be distinguishable in Alaska, however.

Family: Gastrodontidae

Striatura pugetensis (Dall, 1895)

Sites: Boyd Creek (91); Camborne Canyon (28); Coot Lake (7); Crawford Bay (36); Duncan Lake 1 (150); Duncan Lake 2 (1); Hall Creek (111); Incomappleux 1 (168); Incomappleux 2 (120); John Fenger Trail (150); New Denver East (30); Retallack Grove (33); Ruby Silver Grove (177); Slocan Lake North (16); Slocan River (5); Slocan Wayside (123); Summit Lake (2); Upper Arrow Lake (28); Zincton West (1)

Habitats: A variety of low-elevation forest sites

Biogeography: Ranges from BC south along the coast ranges to Baja California and Guadalupe Island, inland to the mountains of western Montana with a disjunct station in south-central Utah. In BC it is primarily known from west of the Coast Range and from the East Thompson River valley in the east-central. It was previously poorly known (or unknown) from the southeast.

Zonitoides arboreus (Say, 1816)

Sites: BB Creek Confluence (5); Boyd Creek (9); Coot Lake (2); Crawford Bay (6); Duncan Lake 1 (6); Duncan Lake 2 (33); Incomappleux 1 (8); Incomappleux 2 (26); John Fenger Trail (4); Retallack Grove (6); Ruby Silver Grove (3); Slocan Lake North (4); Slocan River (8); Slocan Wayside (16); Zincton West (1)

Habitats: A variety of low-elevation forest sites where it favors coarse woody debris.

Biogeography: Found across all of North America. While it occurs throughout BC, it is more common east of the coastal ranges.

Family: Oreohelicidae

Oreohelix strigosa strigosa Gould, 1848

Conservation Status: **Blue**

Sites: Bear Lake Road (1); New Denver East (16); Slocan Lake North (8); Slocan Wayside (5); Zincton West (61)

Habitat: Rocky, often dry low elevation forests

Biogeography: This subspecies is a Washingtonian Province endemic. In BC it appears restricted to the Columbia River basin, where it has been reported as far north as Donald Station.

Taxonomic notes: We report this entity simply as the typical subspecies for *Oreohelix strigosa*. However, it appears to differ from Idaho/Oregon/Washington material because of its much smaller size, more depressed spire, and much more pronounced keel. However, Pilsbry (1948) documents a wide range of conchological variability in this subspecies which is implied to overlap with the collected British Columbia material. For instance, Pilsbry lumped *O. strigosa canadica* Berry,

1922 from Donald Station with subsp. *strigosa*. In spite of this, we also note that many of the collected shells (especially those from the most xeric sites such as at Zincton West) also appear similar with *O. amariradix* Pilsbry, 1934 of the Bitter Root Mountains in Montana in possessing a small diameter, depressed spire, and keeled margin. However, *O. amariradix* lacks the spiral striation prominent in all the BC shells. A careful examination of the soft-body anatomy and DNA sequence data from the BC populations and potential congeners would appear in order to determine their proper taxonomic placement.

Conservation notes: Fifteen occurrences were previously known from southeastern BC. Major threats are believed to include habitat loss and fragmentation from development, forestry and livestock grazing.

Family: Oxychilidae

Nesovitrea binneyana (E.S. Morse, 1864)

Sites: BB Creek Confluence (4); Bear Lake Road (1); Boyd Creek (6); Camborne Canyon (22); Coot Lake (6); Crawford Bay (47); Duncan Lake 1 (14); Duncan Lake 2 (6); Hall Creek (20); Incomappleux 1 (79); Incomappleux 2 (53); John Fenger Trail (26); New Denver East (12); Retallack Grove (26); Ruby Silver Grove (12); Slovan Lake North (36); Slovan River (8); Slovan Wayside (40); Upper Arrow Lake (7); Zincton West (2)

Habitat: A wide variety of middle and low-elevation forest types

Biogeography: Occurs throughout the Northern Province from Newfoundland to Alaska, and south along the Rockies to New Mexico. It is widespread throughout BC.

Nesovitrea electrina (Gould, 1841)

Sites: Battle Brook Seep (1); Boyd Creek (4); Canal Flats (1); Incomappleux 1 (42); Summit Lake (2)

Habitat: Open low-elevation wetlands and stream-sides

Biogeography: Occurs throughout the Northern Province south to the Ohio and Missouri Rivers and in the Rockies to New Mexico. It occurs throughout BC.

Family: Polygyridae

Allogona ptychophora (A.D. Brown, 1870)

Sites: Bear Lake Road (32), Slovan Lake North (4), Slovan River (2)

Habitat: Low elevation mesic, rocky forests and avalanche chute scrub

Biogeography: Washingtonian Province endemic. In BC it is common throughout the south Kootenay, Columbia and Elk River drainages at least as far north as Revelstoke

Cryptomastix mullani (Bland and J.G. Cooper, 1861)

Conservation Status: **Blue**

Sites: Crawford Bay (4); New Denver East (4); Slovan Lake North (56); Slovan Wayside (18)

Habitat: Low-elevation rocky forests

Biogeography: Washingtonian Province endemic. Limited in BC to the southeast.

Conservation notes: Previously reported from only eleven sites from Revelstoke and southeast.

Family: Pristilomatidae

Pristiloma arcticum (Lehnert, 1884)

Conservation status: **Blue**

Site: Incomappleux 2 (1)

Habitat: Low elevation old-growth cedar grove

Biogeography: Primarily an Oregonian Province species ranging from Oregon north to Anchorage, Alaska. In BC only a few collections are known from the Skeena and Cascade mountains in the west.

Taxonomic Notes: The lone collected shell was unfortunately sub-mature. However, the lack of umbilicus, upper surface shell sculpture and shell color points to this being *P. arcticum*. Conclusive verification of the existence of this species in the Incomappleux valley should be prioritized.

Conservation notes: Only a very few prior stations have been reported in BC, all from the west. No known populations are known from protected sites.

Pristiloma chersinella (Dall, 1886)

Conservation status: **Blue**

Sites: Healy Creek 1 (197), Healy Creek 2 (1), Healy Creek Pass 1 (110)

Habitat: High-elevation shrubland, seepage slopes and forest

Biogeography: Occurs in high-elevation sites in the Washingtonian Province and in the Sierra Nevada of California. Limited in BC to mountains from the far-southeast to central-north.

Conservation notes: Previously reported from only two sites; Driftwood Creek in the Babine Mountains and from the Rocky Mountains near Fernie and south. Threats include clearcut logging practices in subalpine forest.

Family: Punctidae

Punctum californicum Pilsbry, 1898

Sites: BB Creek Confluence (1); Boyd Creek (12); Healy Creek 1 (36); Healy Creek 2 (134); Healy Creek 3 (2); Healy Creek Pass 1 (146)

Habitats: Primarily high elevation woodland and scrub, it also ranges downslope into low-elevation riparian forests influenced by cold air drainage.

Biogeography: Known from Fairbanks, Alaska to the high elevations of the Sierra Nevada in California. Although not previously reported from BC, the Province certainly lies well within its known range. Reports of *P. californicum* from montane forests in the desert SW are based on what appears to be a different, likely undescribed species.

Taxonomic notes: Pilsbry (1948) indicates that this taxon is separable from *P. randolphi* only by its larger size, and suggests that these two taxa may be conspecific. While we have noted both to co-occur with no intermediates in some coastal Alaskan sites, this was not the case in SE BC. Within the study region we noted a continuous range of shell sizes from small, low-elevation *P. randolphi* to large, high-elevation *P. californicum*. Both small and large shells were observed from some low-elevation riparian forests with all possible intergradations in shell size being noted. While these data argue that only a single species may be present, with shell size expressing strong clinal variation with temperature, the treatments by Pilsbry (1948), Turgeon et al. (1996) and our personal experiences in both Alaska and California suggest that it may be prudent to provisionally maintain these as separate until their DNA sequences can be assessed.

Punctum conspectum (Reeve, 1852) [syn. *Paralaoma servilis* of Forsyth 2004]

Site: Incomappleux 1 (70)

Habitat: Alder thicket at wetland margin

Biogeography: Found throughout the western cordillera of North America from the Mexican border to coastal Alaska. Sporadic and seasonally common in BC.

Taxonomic notes: This species has a convoluted taxonomic history, having been variously called *Pleuropunctum micropleuros*, *Punctum conspectum*, *Punctum pusillum*, *Toltecia pusilla*, *Vallonia patens* or *Paralaoma caputspinulae*. The placement of this entity into these various genera has been solely based on comparative conchology. Because shells and internal anatomy in the Punctidae are very simple, there are few hard diagnostic features upon which these various claims can be assessed. Since the genus *Paralaoma* is endemic to Australasia, the use of this genus name for the North American entity casts this taxon as an exotic. However, the ecological data do not support this contention, with western North American populations often occurring in undisturbed native habitats with no other anthropophilic species. Until DNA sequence data for this taxon and supposed congeners across the globe are compared, it seems unwise to call this the same species as one that was described from New Zealand. Thus, we retain the earliest name with a North American type to represent this taxon until appropriate taxonomic revisionary work is accomplished.

Punctum randolphi (Dall, 1895)

Sites: Battle Brook Seep (2); BB Creek Confluence (42); Boyd Creek (70); Camborne Canyon (42); Coot Lake (31); Crawford Bay (9); Duncan Lake 1 (315); Duncan Lake 2 (3); Hall Creek (109); Incomappleux 1 (325); Incomappleux 2 (78); John Fenger Trail (159); New Denver East (78); Retallack Grove (80); Ruby Silver Grove (299); Slocan Lake North (1); Slocan River (48); Slocan Wayside (21); Summit Lake (15); Upper Arrow Lake (60); Zincton West (9)

Habitats: While most abundant in cedar groves, this species occurs across a wide range of low-elevation wooded sites.

Biogeography: Oregonian Province species ranging along the Pacific Coast from southern California to Alaska. Widespread and common along the BC coast, sporadic in the central interior, but common again in the Rockies and other mountain systems of the interior wet belt.

Taxonomic notes: see *Punctum californicum*, above.

Family: Succineidae

Oxyloma nuttallianum (I. Lea, 1841)

Sites: Incomappleux 1 (15); Summit Lake (1)

Habitat: Open, wet sedge meadows

Biogeography: Ranges from Baja California to Alaska and Manitoba. No specific BC distributional data has been reported

Taxonomic notes: Dissections indicate that all collected succineads from the study region represent an *Oxyloma*. While the western Eurasian succinead fauna can be rather easily defined based both upon shells and soft-body anatomy, the North American fauna represents a confusing mess. There is much overlap in shell features between the genera, with anatomical dissections being required to accurately place individuals to a genus. In addition, genitalic features are highly plastic, with individuals from the same population having been found to pass through multiple putative ‘species’ during the course of a growing season. As a result, it is unclear what should constitute a ‘species’ within this family within the North American fauna. Resolution of this issue will require a continental-wide survey of DNA sequence data from across the named species.

Because of this high level of uncertainty, use of the epithet ‘*nuttallianum*’ simply represents a placeholder until the larger taxonomic and evolutionary issues in the group can be assessed.

Family: Thysanophoridae

Microphysula ingersolli (Bland, 1875)

Sites: BB Creek Confluence (3); Boyd Creek (23); Coot Lake (1); Crawford Bay (6); Duncan Lake 1 (17); Duncan Lake 2 (9); Hall Creek (12); Healy Creek 1 (4); Healy Creek 2 (31); Healy Creek 3 (5); Healy Creek Pass 1 (45); Incomappleux 1 (1); Incomappleux 2 (3); John Fenger Trail (3); New Denver East (70); Retallack Grove (16); Ruby Silver Grove (15); Slocan Lake North (47); Slocan River (16); Slocan Wayside (14); Zincton West (18)

Habitats: Found in a wide variety of forest and shrubland habitats from low elevation cedar groves to willow scrub in alpine tundra. Population sizes are greatest in rocky sites.

Biogeography: Ranges in mountainous terrain from northern Mexico north to BC. In the Province it is common in the SE, but has been found north to Pine Pass in the Hart Range.

Taxonomic notes: While high elevation populations possessed shells with a deeper suture and somewhat more rugose shell (characters typically associated with *Microphysula cookei*) than lower elevation populations, they were still more similar to *M. ingersolli* material we have collected from Utah and Nevada than *M. cookei* from Alaska. For this reason, we are terming all material collected in this current study as *M. ingersolli*.

Family: Valloniidae

Planogyra clappi (Pilsbry, 1898)

Sites: Boyd Creek (94); Camborne Canyon (1); Incomappleux 1 (389); Incomappleux 2 (5); John Fenger Trail (384); Retallack Grove (233); Ruby Silver Grove (185); Slocan River (1); Summit Lake (20); Upper Arrow Lake (1)

Habitat: Found in low elevation mesic forests dominated by *Thuja plicata* and adjacent wetland fringes. Oddly, some old-growth cedar stands, such as the one on the northern end of Duncan Lake, lack populations.

Biogeography: This species was previously considered an Oregonian Province endemic, possessing a range essentially coincident with that of *Thuja plicata*. In BC it was previously unknown west of the coastal ranges.

Ecological Note: In a remarkable example of ecological conservatism, the sibling eastern North American species *Planogyra asteriscus* is essentially limited to *Thuja occidentalis* forests in regions with maritime climates, such as the Maritime Provinces, Maine, and shoreline areas along the Great Lakes.

Vallonia pulchella (Müller, 1774)

Site: Slocan River (56)

Habitat: Disturbed wooded road bank

Biogeography: While listed as a native North American species by Hubricht (1985), this species appears most common throughout the continent in anthropogenically disturbed habitats.

Additionally, no pre-European fossil material is known. It seems likely that genetic analyses will ultimately determine that this species is exotic to the continent. Considered exotic to BC by Forsyth (2004).

Zoogenetes harpa (Say, 1824)

Sites: BB Creek Confluence (12); Camborne Canyon (5); Duncan Lake 2 (1); Hall Creek (11); Incomappleux 2 (2); Summit Lake (1); Upper Arrow Lake (1)

Habitat: Confined to low-elevation riparian forest and shrublands

Biogeography: Holarctic, ranging across the Northern Province in North America from Newfoundland to Alaska. In western North America it extends south in mountains to southern Colorado. In BC it is sporadic in the north and in the Rockies.

Family: Vertiginidae

Columella simplex (Gould, 1840) [syn. *Columella edentula* of Forsyth 2004]

Sites: Battle Brook Seep (3); BB Creek Confluence (9); Boyd Creek (12); Coot Lake (1); Crawford Bay (18); Duncan Lake 1 (2); Hall Creek (9); Healy Creek 3 (1); Incomappleux 1 (60); Incomappleux 2 (5); John Fenger Trail (2); Retallack Grove (19); Ruby Silver Grove (11); Slovan Lake North (12); Slovan River (2); Slovan Wayside (4); Summit Lake (3); Upper Arrow Lake (5)

Habitats: Occurs in a wide variety of low-mid elevation habitats.

Biogeography: As currently assigned, *C. simplex* ranges across the middle and upper latitudes of North America from South Carolina and southern Alabama to New Mexico and Arizona, north to central Quebec and Alaska. In BC it is widespread throughout much of the Province.

Taxonomic notes: We do not use *C. edentula* as the name for this species as we have seen no compelling data to suggest that our taxon is conspecific with this western European entity. As indicated in Nekola & Coles (2010), *C. simplex* almost certainly represents a species-complex. This is also true within the study region, with two potential species-level entities existing under this name: One form has a smaller and more striate shell and may be the same as the *C. simplex* ‘large morph’ reported by Nekola & Coles (2010). This entity ranges from the montane forests of the southwestern USA east on carbonate cliffs to the New England states. The other form has a larger shell with reduced sculpture and a less deep suture. We have also seen this form in coastal rainforest sites south of Anchorage, Alaska. This entity is limited in the region to low-elevation cedar forests.

Vertigo arthuri von Martens, 1882 [syn. *V. gouldii basidens* of Pilsbry 1948 and *V. gouldii* of Forsyth 2004]

Conservation status: **Blue** for *V. arthuri*; **Yellow** for “*V. gouldii*”

Sites: BB Creek Confluence (1); Duncan Lake 1 (6); Duncan Lake 2 (4); Incomappleux 1 (21)

Habitats: Favors low elevation riparian habitats ranging from seepage banks to poplar and cedar forests.

Biogeography: This species and its various named forms (i.e., *paradoxa*, *hubrichti*, *basidens*, *brierensis*) range across the Northern Province from Newfoundland and the Maritimes west through the Great Lakes region and central Manitoba to the Alaskan Interior and south along the mountains to northern New Mexico. In BC the range of this species is made difficult to assess because of taxonomic issues in Forsyth (2004; see below). While BC *V. arthuri* sites are confined to the Peace River District and central interior, his “*V. gouldii*” is reported from the Rocky Mountains and adjacent ranges.

Taxonomic notes: As shown by Nekola et al. (2009) and Nekola & Coles (2010), based on both conchological and DNA sequence data *V. gouldii* is limited to eastern North America. The various forms of “*V. gouldii*” previously reported from the west actually represent a variety of other species, with *Vertigo gouldii basidens* simply being a junior synonym of *V. arthuri*. It is typical for all possible intermediate morphologies between the ‘*arthuri*’ and ‘*basidens*’ forms to be present within any given population.

Vertigo coloradensis (Cockerell, 1891) [syn. *Vertigo cristata* of Forsyth 2004]

Sites: BB Creek Confluence (1); Boyd Creek (2); Camborne Canyon (11); Coot Lake (3); Duncan Lake 1 (16); Duncan Lake 2 (63); Hall Creek (11); Incomappleux 2 (31); John Fenger Trail (3); New Denver East (52); Ruby Silver Grove (5); Slocan River (1)

Habitats: While found across a variety of low-elevation forest sites, in the region it is most abundant on talus slopes and rock outcrops.

Biogeography: This species is restricted to the western cordillera where it ranges from southern Arizona north into the Alaskan arctic. The eastern terminus of the range is not known, but based upon material collected in Manitoba it seems likely to extend east in taiga to Hudson's Bay. In BC it is generally distributed across the northern part of the Province and in the Rocky Mountains.

Taxonomic notes: As shown by Nekola et al. (2009), *V. coloradensis* is very genetically distinct from the eastern *V. cristata*, and should be considered a separate species.

Vertigo columbiana (Pilsbry & Vanatta, 1900)

Sites: Camborne Canyon (7); Duncan Lake 1 (69); Slocan River (186)

Habitats: Low-elevation rocky woods, cliffs, and cedar groves.

Biogeography: Generally restricted to the Oregonian Province, occurring from western Oregon to coastal forests at Anchorage, Alaska. It also occurs inland in adjacent northern Idaho. In BC it is reported as widespread and common west of the coastal ranges. Not previously reported from the SE.

Vertigo concinnula Cockerell, 1897 [syn *Vertigo modesta* in part of Forsyth 2004?]

Sites: BB Creek Confluence (3); Boyd Creek (16); Camborne Canyon (2); Duncan Lake 1 (6); Hall Creek (10); Incomappleux 1 (2); New Denver East (39); Retallack Grove (53); Ruby Silver Grove (32); Zinton West (15)

Habitat: Low-elevation mesic rocky forest and cedar groves

Biogeography: This is essentially a Rocky Mountain Province endemic ranging from the montane forests of New Mexico and Arizona north to southern BC, Alberta, and the Black Hills of South Dakota. Not listed as occurring in BC by Forsyth (2004), though reported by Pilsbry (1948) from adjacent Idaho.

Taxonomic Notes: Although lumped by Bequaert & Miller (1973) with *V. modesta* based upon no empirical data, genetic analysis supports species-level status for this taxon (Nekola et al. 2009). Much of what has been identified previously as "*V. modesta*" from the central Rockies in both the USA and Canada likely represents *V. concinnula*. Given the information presented in Forsyth (2004) we assume that this publication also has conflated these two entities, and that it is present in previously collected material from the Province.

Vertigo idahoensis Pilsbry, 1934 [syn. *Vertigo elatior* of Forsyth 2004]

Conservation Status: **Red**

Sites: Canal Flats (34); Incomappleux 1 (180); Slocan River (19); Summit Lake (16)

Habitat: Open and often relatively acidic sedge meadows

Biogeography: If valid (see below) *V. idahoensis* is restricted to the Rocky Mountains and Washingtonian Provinces where it ranges from the mountains of New Mexico north to southern BC. *Vertigo elatior* ranges across the Northern Province from Newfoundland and the northeastern USA to the Yukon. In BC, "*V. elatior*" has only been previously reported from Field near the Alberta border.

Taxonomic Notes: Previously collected material of this species from BC has been identified as “*V. elatior*.” However, BC material appears to more resemble *V. idahoensis*, whose type locality is only a few hundred km south of the Provincial border in west-central Idaho. Pilsbry (1948) compares *V. idahoensis* with the northeastern maritime *V. ventricosa*, which both differ from *V. elatior* by their greater width/height ratio and less calcified apertural margin. *V. idahoensis* is distinguished from *V. ventricosa* by its deeper suture and more pronounced depression over the palatal lamellae. In eastern North America *V. ventricosa* and *V. elatior* may be difficult to distinguish, with intermediate shells being not uncommon in some regions. It seems as though a similar situation may exist in the west between *V. idahoensis* and *V. elatior*. True *V. elatior* is known from just across the Provincial border in Alberta, with Lake Louise (formerly Lake Laggan) being the type locality for *V. gouldii lagannensis*, a junior synonym of *V. elatior*. DNA sequence analysis from across the range of *V. elatior*, *V. idahoensis*, and *V. ventricosa* will be required to determine the species-level validity of these forms.

Conservation Notes: No matter the epithet used, this species has been considered extirpated from BC, with the only previous sighting having been made in 1906. This fact has led the BC Ministry of Environment to conclude that it is “unlikely to occur throughout southeast BC.” However, this conclusion is based on a poor understanding of its species biology, with Forsyth (2004) stating that it is likely a woodland resident. Because it is actually limited to open, sedge/rush dominated wetlands, this habitat misdiagnosis has apparently led to drastic underreporting of its occurrences in southeastern BC. We had little trouble locating it on all four of the likely habitats visited during the week of field survey work. As a result, we feel that this entity will eventually be found in most open sedge-meadow communities within the southeast.

Vertigo modesta sculptilis Pilsbry, 1934

Sites: Battle Brook Seep (2); Coot Lake (2); Healy Creek 1 (54); Healy Creek 2 (11); Healy Creek 3 (3); Slovan River (13)

Habitat: Forested or shrubby wetlands across the elevation gradient. Farther south in the Rockies it also occurs in sedge meadows and seeps.

Biogeography: *Vertigo modesta* is currently recognized as being distributed throughout the Holarctic. The subsp. *sculptilis* is largely restricted to the Washingtonian and northern Rocky Mountains Provinces, and is known from Colorado, Utah, Nevada, Oregon, and Montana. In BC, *Vertigo modesta* is reported as being widespread and common, particularly in the northern mountains. The subsp. *sculptilis* has not previously been listed from the Province or Country.

Taxonomic Notes: A number of races of *V. modesta* have been reported from North America. While some appear spurious, *V. m. sculptilis* seems to have some validity, possessing reduced apertural lamellae development, a domed apex, and pronounced striation on the initial whorls, while being restricted to relatively high-elevation wetlands in the central Rockies.

Vertigo ovata Say, 1822

Sites: Canal Flats (31); Incomappleux 1 (1); Slovan River (1)

Habitat: Open, wet sedge meadows

Biogeography: Found over much of the continent, ranging from central America and the Caribbean north to central Quebec, Manitoba, and the Alaskan interior. In BC this species is locally common in suitable habitats throughout the Province.

Vertigo AK 2 / *ronnebyensis* (Westerlund 1871) / *ultimathule* von Proschwitz, 2007 ?

Site: Ruby Silver Grove (1)

Habitat: low-elevation cedar grove

Biogeography: Shells like this have been found throughout the Alaskan interior and north, and also occur in the tundra at Churchill, Manitoba. Similar material also occurs in Scandinavia and the Altai mountains of central Asia. This entity has not previously been reported from BC, and would represent the most southern populations known from North America.

Taxonomic Notes: Because this entity is reported within the study region from only a single shell, it is perhaps likely that it simply represents an aberrant individual of one of the other *Vertigo* species in the region, in particular *V. coloradensis* or *V. concinnula*. However, if verified, it is unclear exactly to what name this population should be assigned. Southern Siberian material identified as *V. ronneyensis* are genetically very similar to what Nekola et al. (2009) terms *Vertigo* AK2 from the Alaskan interior. These shells also appear conchologically close to the recently described Scandinavian *V. ultimathule*. Until *V. ronneyensis* and *V. ultimathule* from Scandinavia have been genetically compared with North American/Siberian material, proper placement of this form will not be possible.

Family: Vitrinidae

Vitrina alaskana Beck, 1837 [syn. *Vitrina pellucida* of Forsyth 2004]

Sites: Bear Lake Road (2); Camborne Canyon (1); Healy Creek 1 (17); Healy Creek Pass 1 (37); Healy Creek Pass 2 (2); Slocan Wayside (4)

Habitat: Generally favors open / shrubby sites, becoming more frequent with increasing elevation.

Biogeography: In North America the genus *Vitrina* is found throughout the Northern Province, with *V. limpida* ranging south into deciduous forest and grasslands of the northeastern and midwestern USA, and *V. alaskana* ranging south into montane forests of New Mexico, Arizona and southern California. In BC, this species is found throughout the Province.

Taxonomic notes: While *V. alaskana* has been claimed to be a synonym of *V. pellucida* (Roth & Sadeghian 2003) no empirical data was used to verify these conclusions. Strangely, *V. limpida* from the east was not considered in this revision, even though it appears conchologically identical. Because of the limited range of shell and anatomical variation within the genus, it is not clear that any macroscopic comparison of features would be able to distinguish distinct sibling species. Until DNA sequence data from across the range of all three species is analyzed, it seems most prudent to consider the western North American populations separate not only from the eastern, but from Eurasian as well. Thus, we retain use of *V. alaskana* to demarcate these western populations.

SITE INFORMATION

Following are all collated data from all collected sites listed in sampling order. In these lists, the numbers reported after each species represent: [] = number of individuals collected by Coles;() = number of individuals collected by Horsak; and numbers without parentheses = individuals collected by Nekola. The total number of recorded individuals from a site represents not only all identified shells from Coles, Horsak, and Nekola, but also all unidentifiable immature or fragmentary shells collected by Nekola. BC Environment Ministry species status is indicated by font color, with **red** representing **Red Listed** species and **blue** representing **Blue Listed** species.

August 27, 2011

Revelstoke: 51° 0' 18" N., 118° 13' 18" W.

Bottomland woods at parking site

Species Richness: 2; Listed Species: 0; Total Individuals: 3

<i>Cochlicopa lubrica</i>	[1]	<i>Prophysaon andersonii</i>	[2]
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Upper Arrow Lake: 50° 26' 42" N., 117° 53' 28" W.

Deep leaf litter in mixed woodland above upper flood level of stream

Species Richness: 8; Listed Species: 0; Total Individuals: 115

<i>Columella simplex</i>	[5]	<i>Planogyra clappi</i>	[1]
<i>Discus cronkhitei</i>	[11]	<i>Punctum randolphi</i>	[60]
<i>Euconulus fulvus</i>	[2]	<i>Striatura pugetensis</i>	[28]
<i>Nesovitrea binneyana</i>	[7]	<i>Zoogenetes harpa</i>	[1]

Summit Lake: 50° 8' 50" N., 117° 36' 29" W.

Bracken, sedge and herb edge to ditch

Species Richness: 10; Listed Species: 1; Total Individuals: 70

<i>Columella simplex</i>	[3]	<i>Planogyra clappi</i>	[20]
<i>Discus cronkhitei</i>	[2]	<i>Punctum randolphi</i>	[15]
<i>Euconulus fulvus</i>	[8]	<i>Striatura pugetensis</i>	[2]
<i>Nesovitrea electrina</i>	[2]	<i>Vertigo idahoensis</i>	[16]
<i>Oxyloma nuttalianum</i>	[1]	<i>Zoogenetes harpa</i>	[1]

August 28, 2011

Slocan River: 49° 45' 15" N., 117° 28' 36" W.

Riverside sedge meadow, cedar forest, and roadside

Species Richness: 21; Listed Species: 1; Total Individuals 528

<i>Allogona ptychophora</i>	(2)	<i>Punctum randolphi</i>	[11]	(1)	26
* <i>Arion sylvaticus</i>	(1)	<i>Radiodiscus abietum</i>	[2]	(6)	3
* <i>Arion intermedius</i>	(1)	<i>Striatura pugetensis</i>		(2)	3
<i>Cochlicopa lubrica</i>	(2)	* <i>Vallonia pulchella</i>	[16]	(7)	33
<i>Columella simplex</i>	(2)	<i>Vertigo coloradensis</i>			1
<i>Deroceras</i> spp.	(1)	2 <i>Vertigo columbiana</i>	[100]	(29)	57
<i>Euconulus fulvus</i>		2 <i>Vertigo idahoensis</i>	[15]		4
<i>Microphysula ingersolli</i>	[5] (7)	4 <i>Vertigo modesta sculptilis</i>	[6]	(1)	6
<i>Nesovitrea binneyana</i>	(2)	6 <i>Vertigo ovata</i>			1
<i>Planogyra clappi</i>		1 <i>Zonitoides arboreus</i>		(5)	3
<i>Prophysaon andersonii</i>	(2)				

Retallack Grove: 50° 2' 33" N., 117° 9' 18" W.

Old growth riparian cedar forest

Species Richness: 11; Listed Species: 0; Total Individuals: 590

<i>Columella simplex</i>	[3]	(5)	11	<i>Microphysula ingersolli</i>			16
<i>Discus cronkhitei</i>	[2]	(2)	9	<i>Nesovitrea binneyana</i>	[5]	(4)	17
<i>Euconulus fulvus</i>	[5]	(2)	15	<i>Planogyra clappi</i>	[42]	(4)	187
<i>Punctum randolphi</i>	[13]	(5)	62	<i>Vertigo concinnula</i>	[13]	(19)	21
<i>Radiodiscus abietum</i>		(3)	16	<i>Zonitoides arboreus</i>			6
<i>Striatura pugetensis</i>	[7]	(3)	23				

Bear Lake Road: 50° 2' 38" N., 117° 11' 23" W.

Avalanche corridor shrubland

Species Richness: 6; Listed Species: 1; Total Individuals: 38

<i>Allogona ptychophora</i>	(9)	23	<i>Euconulus fulvus</i>	(1)
<i>Discus cronkhitei</i>	(1)		<i>Nesovitrea binneyana</i>	(1)
<i>Vitrina alaskana</i>	(2)		<i>Oreohelix strigosa strigosa</i>	(1)

Zincton West: 50° 1' 55" N., 117° 13' 17" W.

Open, xeric bedrock talus

Species Richness: 9; Listed Species: 1; Total Individuals: 162

<i>Discus cronkhitei</i>	(9)	5	<i>Punctum randolphi</i>	[7]	2	
<i>Euconulus fulvus</i>	[2]	(7)	13	<i>Striatura pugetensis</i>	[1]	
<i>Microphysula ingersolli</i>	[2]	(6)	10	<i>Vertigo concinnula</i>	[7]	8
<i>Nesovitrea binneyana</i>	(2)		<i>Zonitoides arboreus</i>		(1)	
<i>Oreohelix strigosa strigosa</i>	(13)	48				

August 29, 2011

Camborne Canyon: 50° 46' 49" N., 117° 40' 6" W.

Wooded, mossy cliff

Species Richness: 11; Listed Species: 0; Total Individuals: 162

<i>Discus cronkhitei</i>	(1)	14	<i>Vertigo coloradensis</i>	(3)	8
<i>Euconulus fulvus</i>	(1)	16	<i>Vertigo columbiana</i>		7
<i>Nesovitrea binneyana</i>	(4)	18	<i>Vertigo concinnula</i>	(1)	1
<i>Planogyra clappi</i>		1	<i>Vitrina alaskana</i>	(1)	
<i>Punctum randolphi</i>	(2)	40	<i>Zoogenetes harpa</i>		5
<i>Striatura pugetensis</i>	(5)	23			

Ruby Silver Grove: 50° 51' 58" N., 117° 36' 35" W.

Old growth cedar forest

Species Richness: 12; Listed Species: 0; Total Individuals: 862

<i>Columella simplex</i>		11	<i>Punctum randolphi</i>	[110]	189
<i>Discus cronkhitei</i>		11	<i>Striatura pugetensis</i>	[60]	117
<i>Euconulus fulvus</i>	[16]	45	<i>Vertigo</i> AK 2		1
<i>Microphysula ingersolli</i>		15	<i>Vertigo coloradensis</i>	[1]	4
<i>Nesovitrea binneyana</i>	[7]	5	<i>Vertigo concinnula</i>	[20]	12
<i>Planogyra clappi</i>	[33]	152	<i>Zonitoides arboreus</i>		3

Incomappleux 1: 50° 55' 21" N., 117° 34' 43" W.

Open sedge meadow, alder thicket and trailside seep

Species Richness: 17; Listed Species: 2; Total Individuals: 1767

<i>Columella simplex</i>	[28]	(3)	29	<i>Punctum conspectum</i>	[70]	
<i>Discus cronkhitei</i>	[9]	(3)	5	<i>Punctum randolphi</i>	[116]	(5) 204
<i>Euconulus alderi</i>		(9)	28	<i>Striatura pugetensis</i>	[39]	(2) 127
<i>Euconulus fulvus</i>	[48]	(8)	78	<i>Vertigo arthuri</i>	[7]	14
<i>Microphysula ingersolli</i>			1	<i>Vertigo concinnula</i>	[2]	
<i>Nesovitrea binneyana</i>	[27]		52	<i>Vertigo idahoensis</i>	[80]	(38) 62
<i>Nesovitrea electrina</i>		(19)	23	<i>Vertigo ovata</i>		(1)
<i>Oxyloma nuttalianum</i>		(7)	8	<i>Zonitoides arboreus</i>	[1]	(4)
<i>Planogyra clappi</i>	[108]	(68)	213	3		

Boyd Creek: 50° 54' 1" N., 117° 34' 27" W.

Hillside and streamside cedar/hemlock forest

Species Richness: 12; Listed Species: 0; Total Individuals: 371

<i>Columella simplex</i>			12	<i>Punctum californicum</i>		12
<i>Euconulus fulvus</i>		(3)	15	<i>Punctum randolphi</i>		(4) 66
<i>Microphysula ingersolli</i>			23	<i>Striatura pugetensis</i>		(5) 86
<i>Nesovitrea binneyana</i>		(1)	5	<i>Vertigo coloradensis</i>		(1) 1
<i>Nesovitrea electrina</i>			4	<i>Vertigo concinnula</i>		(13) 3
<i>Planogyra clappi</i>		(44)	50	<i>Zonitoides arboreus</i>		(1) 8

August 30, 2011

Healy Creek Pass 1: 50° 38' 49" N., 117° 11' 28" W.,

Scrub willow on tundra flat

Species Richness: 4; Listed Species: 1; Total Individuals: 338

<i>Microphysula ingersolli</i>	[6]	(19)	20	<i>Punctum californicum</i>	[50]	(17) 79
<i>Pristiloma chersinella</i>	[31]	(22)	57	<i>Vitrina alaskana</i>	[7]	(7) 3

Healy Creek Pass 2: 50° 39' 13" N., 117° 11' 30" W.

Seepage fen

Species Richness: 2; Listed Species: 1; Total Individuals: 3

<i>Vitrina alaskana</i>		(2)		<i>Hemphillia camelus</i>		(1)
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Healy Creek 1: 50° 38' 12" N., 117° 11' 30" W.

Hillside alder seep

Species Richness: 6; Listed Species: 1; Total Individuals: 353

<i>Euconulus fulvus</i>	[3]	(10)	14	<i>Punctum californicum</i>	[6]	(2)	28
<i>Microphysula ingersolli</i>		(1)	3	<i>Vertigo modesta sculptilis</i>	[25]	(21)	8
<i>Pristiloma chersinella</i>	[40]	(21)	136	<i>Vitrina alaskana</i>	[1]	(2)	14

Healy Creek 2: 50° 37' 57" N., 117° 11' 41" W.

Upland spruce forest

Species Richness: 5; Listed Species: 1; Total Individuals: 196

<i>Euconulus fulvus</i>	(2)	9	<i>Punctum californicum</i>	(4)	130
<i>Microphysula ingersolli</i>	(19)	12	<i>Vertigo modesta sculptilis</i>	(7)	4
<i>Pristiloma chersinella</i>	(1)				

Healy Creek 3: 50° 36' 31" N., 117° 12' 17" W.

Hillside alder seep

Species Richness: 6; Listed Species: 0; Total Individuals: 21

<i>Columella simplex</i>	(1)	<i>Microphysula ingersolli</i>	(5)
<i>Discus cronkhitei</i>	(1)	<i>Punctum californicum</i>	(2)
<i>Euconulus fulvus</i>	(9)	<i>Vertigo modesta sculptilis</i>	(3)

John Fenger Trail: 50° 25' 54" N., 117° 9' 3" W.

Old growth cedar grove

Species Richness: 10; Listed Species: 0; Total Individuals: 761

<i>Columella simplex</i>	2	<i>Planogyra clappi</i>	(17)	367	
<i>Discus cronkhitei</i>	(2)	5	<i>Punctum randolphi</i>	(2)	157
<i>Euconulus fulvus</i>	(2)	16	<i>Striatura pugetensis</i>	150	
<i>Microphysula ingersolli</i>		3	<i>Vertigo coloradensis</i>	(3)	
<i>Nesovitrea binneyana</i>	(1)	25	<i>Zonitoides arboreus</i>	4	

August 31, 2011

Canal Flats, Columbia Lake: 50° 9' 50" N., 115° 50' 42" W.

Sedge/rush meadow with willows and scrub at edge of lake

Species Richness: 5; Listed Species: 1; Total Individuals: 69

<i>Discus cronkhitei</i>	[1]	<i>Vertigo idahoensis</i>	[34]
<i>Euconulus fulvus</i>	[2]	<i>Vertigo ovata</i>	[31]
<i>Nesovitrea electrina</i>	[1]		

Slocan Lake North: 50° 5' 21" N., 117° 27' 48" W.

Maple-birch forest on rocky slope

Species Richness: 14; Listed Species: 2; Total Individuals: 214

<i>Allogona ptychophora</i>	(2)	2	<i>Microphysula ingersolli</i>	(25)	22
* <i>Arion ater</i>	(2)		<i>Nesovitrea binneyana</i>	(5)	31
<i>Columella simplex</i>	(3)	9	<i>Oreohelix strigosa strigosa</i>	(5)	3
<i>Cryptomastix mullani</i>	(26)	30	<i>Prophysaon andersonii</i>	(1)	
<i>Deroceras</i> spp.		1	<i>Punctum randolphi</i>		1
<i>Discus cronkhitei</i>	(7)	10	<i>Striatura pugetensis</i>	(1)	15
<i>Euconulus fulvus</i>	(4)	5	<i>Zonitoides arboreus</i>	(3)	1

Slocan Wayside: 49° 46' 39" N., 117° 28' 1" W.

Douglas fir, cherry, birch fringe of open talus slope

Species Richness: 13; Listed Species: 3; Total Individuals: 400

<i>Anguispira kochii</i>	(29)	39	<i>Oreohelix strigosa strigosa</i>	(3)	2
<i>Columella simplex</i>	(3)	1	<i>Punctum randolphi</i>		21
<i>Cryptomastix mullani</i>	(7)	11	<i>Radiodiscus abietum</i>	(4)	5
<i>Discus cronkhitei</i>	(6)	50	<i>Striatura pugetensis</i>	(5)	118
<i>Euconulus fulvus</i>	(2)	17	<i>Vitrina alaskana</i>	(2)	2
<i>Microphysula ingersolli</i>	(7)	7	<i>Zonitoides arboreus</i>	(6)	10
<i>Nesovitrea binneyana</i>	(7)	33			

New Denver East: 49° 59' 47" N., 117° 20' 43" W.

Wooded talus slope. Lower section mossy with maple, birch, *Ribes*; top open and dry.

Species Richness: 11; Listed Species: 2; Total Individuals: 592

<i>Cryptomastix mullani</i>		4	<i>Punctum randolphi</i>		78
<i>Discus cronkhitei</i>		52	<i>Radiodiscus abietum</i>		5
<i>Euconulus fulvus</i>		8	<i>Striatura pugetensis</i>		30
<i>Microphysula ingersolli</i>		70	<i>Vertigo coloradensis</i>		52
<i>Nesovitrea binneyana</i>		12	<i>Vertigo concinnula</i>		39
<i>Oreohelix strigosa strigosa</i>		16			

September 1, 2011

Incomappleux 2: 50° 59' 16" N., 117° 35' 9" W.

Virgin old growth cedar/hemlock forest

Species Richness: 12; Listed Species: 1; Total Individuals: 428

<i>Columella simplex</i>		5	<i>Pristiloma arcticum</i>		1
<i>Discus cronkhitei</i>	(3)	48	<i>Punctum randolphi</i>	(6)	72
<i>Euconulus fulvus</i>	(8)	39	<i>Striatura pugetensis</i>	(16)	104
<i>Microphysula ingersolli</i>	(2)	1	<i>Vertigo coloradensis</i>	(28)	3
<i>Nesovitrea binneyana</i>	(4)	49	<i>Zonitoides arboreus</i>	(11)	15
<i>Planogyra clappi</i>	(4)	1	<i>Zoogenetes harpa</i>		2

Battle Brook Seep: 50° 59' 54" N., 117° 35' 0" W.

Open, acidic seep

Species Richness: 4; Listed Species: 0; Total Individuals: 8

<i>Columella simplex</i>	3	<i>Punctum randolphi</i>	2
<i>Nesovitrea electrina</i>	1	<i>Vertigo modesta sculptilis</i>	2

September 2, 2011

Coot Lake: 50° 40' 50" N., 117° 5' 10" W.

Sedge-dominated lakeshore in hemlock/cedar forest

Species Richness: 10; Listed Species: 0; Total Individuals: 61

<i>Columella simplex</i>	(1)	<i>Punctum randolphi</i>	(1)	30
<i>Discus cronkhitei</i>	(1)	<i>Striatura pugetensis</i>	(1)	6
<i>Euconulus fulvus</i>	(2)	2 <i>Vertigo coloradensis</i>	(2)	1
<i>Microphysula ingersolli</i>	(1)	<i>Vertigo modesta sculptilis</i>	(2)	
<i>Nesovitrea binneyana</i>	(1)	5 <i>Zonitoides arboreus</i>		2

Hall Creek: 50° 41' 2" N., 117° 5' 20" W.

Mossy cliff and gravel seepage bank along road with *Equisetum*

Species Richness: 10; Listed Species: 0; Total Individuals: 367

<i>Columella simplex</i>	(3)	6 <i>Punctum randolphi</i>	(45)	64
<i>Discus cronkhitei</i>	(8)	26 <i>Striatura pugetensis</i>	(25)	86
<i>Euconulus fulvus</i>	(6)	23 <i>Vertigo coloradensis</i>	(5)	6
<i>Microphysula ingersolli</i>	(3)	9 <i>Vertigo concinnula</i>	(5)	5
<i>Nesovitrea binneyana</i>	(2)	18 <i>Zoogenetes harpa</i>	(5)	6

Duncan Lake 1: 50° 37' 19" N., 117° 3' 4" W.

Rich, old growth lowland cedar forest

Species Richness: 12; Listed Species: 1; Total Individuals: 908

<i>Columella simplex</i>		2 <i>Striatura pugetensis</i>		150
<i>Discus cronkhitei</i>	(2)	57 <i>Vertigo arthuri</i>		6
<i>Euconulus fulvus</i>	(1)	68 <i>Vertigo coloradensis</i>	(7)	9
<i>Microphysula ingersolli</i>		17 <i>Vertigo columbiana</i>		69
<i>Nesovitrea binneyana</i>		14 <i>Vertigo concinnula</i>		6
<i>Punctum randolphi</i>		315 <i>Zonitoides arboreus</i>	(1)	5

BB Creek Confluence: 50° 38' 22" N., 117° 3' 1" W.

Riparian poplar/spruce forest

Species Richness: 12; Listed Species: 1; Total Individuals: 173

<i>Columella simplex</i>		9 <i>Punctum randolphi</i>		42
<i>Discus cronkhitei</i>		27 <i>Vertigo arthuri</i>		1
<i>Euconulus fulvus</i>		55 <i>Vertigo coloradensis</i>		1
<i>Microphysula ingersolli</i>		3 <i>Vertigo concinnula</i>		3
<i>Nesovitrea binneyana</i>		4 <i>Zonitoides arboreus</i>		5
<i>Punctum californicum</i>		1 <i>Zoogenetes harpa</i>		12

Duncan Lake 2: 50° 37' 40" N., 117° 2' 8" W.

Birch/poplar forest on lower fringe of open massive talus slope

Species Richness: 10; Listed Species: 1; Total Individuals: 373

<i>Discus cronkhitei</i>	21	<i>Striatura pugetensis</i>	1
<i>Euconulus fulvus</i>	104	<i>Vertigo arthuri</i>	4
<i>Microphysula ingersolli</i>	9	<i>Vertigo coloradensis</i>	63
<i>Nesovitrea binneyana</i>	6	<i>Zonitoides arboreus</i>	33
<i>Punctum randolphi</i>	3	<i>Zoogenetes harpa</i>	1

September 3, 2011

Crawford Bay: 49° 38' 43" N., 116° 47' 47" W.

Fir/maple/birch forest on mossy massive talus slope

Species Richness: 12; Listed Species: 2; Total Individuals: 171

<i>Anguispira kochii</i>	(2)	5	<i>Nesovitrea binneyana</i>	(4)	43
<i>Columella simplex</i>	(5)	13	<i>Prophysaon andersonii</i>	(2)	
<i>Cryptomastix mullani</i>		4	<i>Punctum randolphi</i>	(7)	2
<i>Discus cronkhitei</i>		5	<i>Radiodiscus abietum</i>		7
<i>Euconulus fulvus</i>	(11)	9	<i>Striatura pugetensis</i>	(21)	15
<i>Microphysula ingersolli</i>		6	<i>Zonitoides arboreus</i>	(3)	3

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Table 1: Summary Statistics for encountered land snail species.

Taxon	Sites	Individuals	Status
<i>Allogona ptychophora</i> (A.D. Brown, 1870)	3	38	
<i>Anguispira kochi</i> (Pfeiffer, 1821)	2	75	Blue
* <i>Arion ater</i> (Linnaeus, 1758)	1	2	
* <i>Arion intermedius</i> (Normand, 1852)	1	1	
* <i>Arion silvaticus</i> Lohmander, 1937	1	1	
<i>Cochlicopa lubrica</i> (Müller, 1774)	2	3	
<i>Columella simplex</i> (Gould, 1840)	18	178	
<i>Cryptomastix mullani</i> (Bland and J.G. Cooper, 1861)	4	82	Blue
<i>Deroceras</i> spp. / slug plates	2	4	
<i>Discus cronkhitei</i> (Newcomb, 1864)	21	416	
<i>Euconulus alderi</i> (Gray, 1840)	1	37	
<i>Euconulus fulvus</i> (Müller, 1774)	25	718	
<i>Hemphillia camelus</i> Pilsbry & Vanatta, 1897	1	1	Blue
<i>Microphysula ingersolli</i> (Bland, 1875)	21	359	
<i>Nesovitrea binneyana</i> (E.S. Morse, 1864)	20	427	
<i>Nesovitrea electrina</i> (Gould, 1841)	5	50	
<i>Oreohelix strigosa strigosa</i> Gould, 1848	5	91	Blue
<i>Oxyloma nuttallianum</i> (I. Lea, 1841)	2	16	
<i>Planogyra clappi</i> (Pilsbry, 1898)	10	1313	New to SE BC
<i>Pristiloma arcticum</i> (Lehnert, 1884)	1	1	Blue
<i>Pristiloma chersinella</i> (Dall, 1886)	3	308	Blue
<i>Prophysaon andersoni</i> (J.G. Cooper, 1872)	4	7	New to SE BC
<i>Punctum californicum</i> Pilsbry, 1898	6	331	New to BC
<i>Punctum conspectum</i> (Reeve, 1852)	1	70	
<i>Punctum randolphi</i> (Dall, 1895)	21	1796	
<i>Radiodiscus abietum</i> H.B. Baker, 1930	5	51	New to BC/CA
<i>Striatura pugetensis</i> (Dall, 1895)	19	1277	
* <i>Vallonia pulchella</i> (Müller, 1774)	1	56	
<i>Vertigo arthuri</i> von Martens, 1882	4	32	Blue
<i>Vertigo coloradensis</i> (Cockerell, 1891)	12	199	
<i>Vertigo columbiana</i> (Pilsbry & Vanatta, 1900)	3	262	New to SE BC
<i>Vertigo concinnula</i> Cockerell, 1897	10	178	New to BC/CA
<i>Vertigo idahoensis</i> Pilsbry, 1934	4	249	Red
<i>Vertigo modesta sculptilis</i> Pilsbry, 1934	6	85	New to BC/CA
<i>Vertigo ovata</i> Say, 1822	3	33	
<i>Vertigo</i> AK 2 / <i>ronnebyensis</i> / <i>ultimathule</i>	1	1	New to BC
<i>Vitrina alaskana</i> Beck, 1837	6	63	
<i>Zonitoides arboreus</i> (Say, 1816)	15	137	
<i>Zoogenetes harpa</i> (Say, 1824)	7	33	