

Land Snail Ecology and Biogeography of Eastern Maine



Vertigo bollesiana
Collins Siding

Vertigo nylanderi
Baileyville

Vertigo paradoxa
Caribou

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Table of Contents:

Introduction	1
Methods	
Study Region	2
Study Sites	2
Field Methods	3
Laboratory Procedures	4
Data Summary and Statistical Analysis	4
Results and Discussion	
Regional Faunistic Overview	5
Diversity Patterns	8
Habitat Associations	9
Community Composition Gradients	22
Annotated Checklist and Description of Fauna	27
Species Not Encountered During this Survey	72
Conservation Recommendations	73
Conclusions and Recommendations	74
Literature Cited	75
Appendix I: Taxonomic Key for Maine Land Snails	78
Appendix II: Sample Site Data and Species Lists	86

Introduction

The land snail fauna of Maine has long been the subject of academic research, extending back to C.T. Jackson's 1837 list of species from the *First Report of the Geology of the State of Maine* and J.W. Mighels' 1843 "*Catalogue of the marine, fluvial and terrestrial shells of the state of Maine and adjacent ocean*". Expansions on these were continued throughout the 1800 by a number of North America's most eminent malacologists, including Amos Binney, William Binney, A.A. Gould, Edward Morse, G.W. Tryon and H.S. Pilsbry (Martin 2000). Of these, Morse was perhaps the most prolific as he discovered fully seven new species in the state (*Nesovitrea binneyana*, *Planogyra asteriscus*, *Striatura ferrea*, *Striatura milium*, *Vertigo bollesiana*, and *Vertigo ventricosa*). In the early 20th Century, Olaf Nylander of Caribou also made extensive collections of the molluscs in Aroostook County, discovering two additional new taxa (*Vertigo nylanderi* and *Vertigo paradoxa*). Thus, unlike many regions in North America (Hubricht 1985), Maine apparently boasts a well-known land snail fauna.

During four brief collecting trips to Maine from 2002-2004, Dr. Brian Coles (now of the Welsh National Museum) and I encountered 55 taxa and 18,743 individuals from 46 sites scattered across York, Oxford, Cumberland, Piscataquis, Penobscot, Hancock and Aroostook counties. These observations included new county occurrence records (based on Hubricht 1985) for 31 taxa, added eight taxa to the state fauna (*Euconulus alderi*, *Punctum* n.sp., *Vertigo cristata*, *Vertigo malleata*, *Vertigo morsei*, *Vertigo perryi* and *Vertigo ronneybyensis*), including the discovery of a species new to science (*Vertigo malleata* from the Saco Heath in York County; Coles & Nekola 2007). This work documented new populations for a number of species of particular conservation importance, including *Vertigo cristata* (not known to occur in the U.S. until 1996; Nekola 2001), *Vertigo nylanderi* (not seen alive from 1949-1997; Nekola & Massart 2001), *Vertigo paradoxa* (including the first observation of this species from the proximity of its type locality since the early 1900s), *Vertigo morsei* (perhaps the rarest fen-obligate land snail in North America; Nekola 2004), *Vertigo perryi* (not seen extant since the early 1900s and previously believed restricted to the Cape Cod region; Hubricht 1985), and *Vertigo ronneybyensis* (previously believed restricted to northwestern Europe; Kerney & Cameron 1979). These discoveries clearly indicate that even with over a century and a half of investigations the biodiversity of the Maine land snail fauna remained inadequately compiled.

Spurred by these findings, Jonathan Mays of the Reptile, Amphibian, & Invertebrate Group, Maine Department of Inland Fisheries & Wildlife, desired for a more thorough survey of land snail diversity patterns be conducted through the Aroostook Hills and Lowlands Inventory, a 10-year survey of rare and endangered wildlife, plants, and natural communities coordinated by the MDIFW and Maine Natural Areas Program.

The following report summarizes findings from a land snail survey of all important natural communities found within this and adjacent biophysical regions. The large spatial and ecological extent of this analysis permits not only documentation of the distribution and abundance of individual species in the regional fauna, but also the potential ecological patterns and processes that influence their distribution and abundance. This study represents the most extensive such survey of its kind made so far conducted in northeastern North America.

Methods

Study Region: The focus for this work was centered on the combined one million hectare area of the Aroostook Hills and Aroostook Lowlands biophysical regions, which span parts of Aroostook, Penobscot, and Piscataquis counties in northeastern Maine. To allow for a more thorough regional analysis, sites were also surveyed in the St John Uplands, Central Foothills, Maine-New Brunswick Lowlands, Eastern Interior, Central Maine Embayment and East Coastal regions. The eastern Maine landscape is of particular interest as it is not only underlain by calcium-rich metasedimentary substrates which often correlate with high land snail abundance and richness (Nekola 1999), but it also represents a climatic gradient ranging from maritime conditions near the shore to more continental conditions farther inland.

Study Sites: A total of 101 sites were analyzed (Figure 1). Sixty-seven were collected across the entire extent of the Aroostook Hills and Aroostook Lowlands biophysical regions, while the remaining 34 were located in adjoining biophysical regions. Seventy sites were sampled from September 4-17, 2007, while the remaining 31 sites represent collections made during earlier reconnaissance in the area during 2002-2004. Sites were selected if they represented typical examples of their respective habitat, and included some sites which had been subjected to various levels of anthropogenic disturbance.

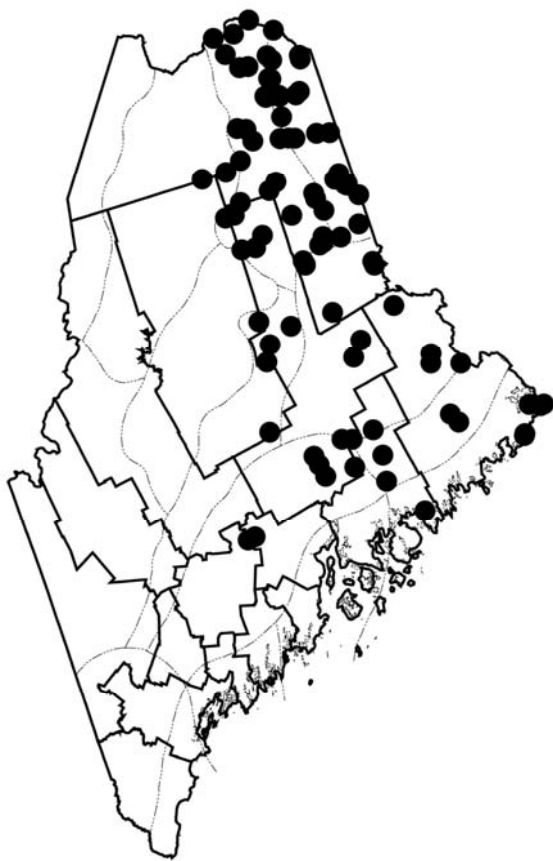


Figure 1: Location of the 101 land snail sample sites

Collections were made from 13 different habitat types. These habitats can be broadly grouped into four categories: **bedrock outcrops, upland forests, lowland forests** and **lowland openings**.

Two types of **bedrock outcrop habitats** were surveyed. Metasedimentary outcrops (8 sites) occur in sites where low-grade metamorphosed calcareous mudstones, shales, and limestone have been exposed through erosional downcutting along stream corridors. All surveyed sites were limited to the Aroostook Lowlands region. Outcrops invariably possessed a canopy of *Thuja occidentalis*, and occasionally included groundwater seepage. Igneous and Metamorphic outcrops (5 sites) occurred where various extrusive or high-grade metamorphic rocks were exposed along stream courses, hillsides, and monadnoks. Canopy trees included not only *Thuja occidentalis*, but also *Tsuga canadensis* and Oaks.

Four types of **upland forests** were sampled. These habitats primarily differed in their canopy species, usually as a result of different soils, drainage, and slope/aspect relationships. Sugar Maple forest (5 sites) typically occurred on hard, clay-rich or rocky soils, and had thin leaf litter layers. White Spruce forests (7 sites) occurred in slightly more mesic sites

on more base-poor soils. Along the Atlantic Coast white spruce becomes an important component of the canopy along with Red and Sugar Maple in most upland situations. Aspen forests (4 sites) generally represent early to mid-successional stands in dry-mesic upland settings. The bulk of these sites will likely develop into Sugar Maple forests over time. Rocky forests (3 sites) represent typical Sugar Maple - Red Maple - White Spruce stands which have developed on boulder fields or talus slopes. Quite often these sites possess thin leaf litter accumulations due to rapid erosional rates due to the unstable ground surface in conjunction with steep relief.

Six types of **lowland forests** were surveyed. Tamarack swamp forests (5 sites) were dominated by tamarack, but also often harbored significant numbers of Ash, Northern White Cedar, Red Maple and Balsam Fir. Surficial soil chemistry varied from acidic (where *Sphagnum* moss was abundant) to more neutral (where *Sphagnum* was largely absent); litter collection was generally limited to the latter microsites. White Cedar - Ash swamp forests (41 sites) were found throughout the survey region. While the canopy was dominated by these two species, significant numbers of tamarack, red maple, balsam fir, willow, and alder were generally also present. Sites ranged from wet to mesic and from highly acidic (with *Sphagnum* dominating the ground layer) to moderately basic (with a diverse bryophyte/herb groundlayer lacking *Sphagnum*). Deep accumulations of leaf litter were often observed, and sites often had cool soils. Red Maple - Black Spruce swamp forests (4 sites) has the lowest base-status of any of the surveyed wooded wetland sites, and consistently possessed a groundlayer carpet of *Sphagnum* moss. The shrub layer of these sites included alder and winterberry. Lastly, shrub-carr habitats (2 sites) were dominated by low-growing thickets of alder, willow, and dogwood, and supported a dense sedge-grass groundlayer.

Lastly, three types of **lowland openings** habitats were surveyed. Sedge meadows (9 sites) occur on moist sites with mineral soils along stream courses or roadside verges, and become more common to the south. Coarse, tussock-forming sedges dominate the groundlayer, with scattered clumps of willows, dogwood, and alder also being commonly present. Fens (3 sites) are peatland areas with saturated, base-rich soils found at sites of ground water discharge (Nekola 1994). Sites lacked *Sphagnum* but supported large populations of brown mosses such as *Campylium* and *Drepanocladus*, and were dominated by various species of *Carex* and the tussock-forming *Scirpus caespitosus*. Acid bogs (5 sites) represent base-poor peatlands (including both ombrotrophic bogs and poor fens) which are dominated by *Sphagnum* and various small shrubs in the Myricaceae and Ericaceae, such as Leatherleaf, Bog Rosemary, Sheep Laurel, Rhodora, Blueberry, and Myrtle. Deep leaf litter accumulations are often present under these thickets.

Field Methods: The latitude and longitude of each site was determined using a hand-held GPS. Terrestrial gastropod faunas were documented from a representative 100-1000 m² area within each site by hand collection of larger taxa and litter sampling for smaller taxa. Litter sampling was used as the primary method of collection because it provides the most complete assessment of site faunas (Oggier *et al.* 1998, Cameron & Pokryszko 2005). As suggested by Emberton *et al.* (1996), collections were made at places of high micro-mollusc density such as loosely compacted leaf litter lying on top of highly compacted damp soil or humus. This loose litter was removed by hand and aggressively sieved in the field using a shallow sieve of 2 mm mesh nesting loosely inside a sieve of 0.6 mm mesh. The procedure consisted of throwing handfuls of litter onto the coarser mesh accompanied by vigorous shaking, tapping, or other agitation. The process was continued for 15-60 minutes during which time 50-500 ml of fine material (0.6-2.0 mm) was collected.

Laboratory Procedures: Samples were slowly and completely dried at room temperature and then passed through a standard sieve series -- ASTM E 3/8" (9.5 mm), #10 (2.0 mm), #20 (0.85), and ASTM E #30 sieve (0.6 mm mesh) -- with fractions being hand picked against a neutral background. All shells, shell fragments, and slug plates were removed, and all identifiable material from each site was assigned to species using the author's reference collection. The total numbers of shells per species per site were recorded, as were the number of unassignable immature individuals. Nomenclature generally follows that of Hubricht (1985), with updates and corrections by Nekola (2004).

Data Summary and Statistical Analysis:

1. Faunistic description of habitats and habitat affinities of species. The total number of occurrences, occurrence frequency, total number of individuals, and average number of individuals per site were calculated for the entire dataset, for each of the 13 habitat types, and for the 9 ordination regions (see below). Additionally, these four statistics were also calculated for each species for all occupied habitat types. Three graphical approaches were used to describe the distribution of species abundances across species the entire dataset. These included standard Species Abundance Histograms as used by Preston (1948), Dominance-Diversity curves as used by Whitaker (1975), and Zipf cumulative rank-frequency plots (Newman 2005).

2. Documentation of compositional gradients. Gradients in community composition were identified via global non-metric multidimensional scaling (NMDS) using DECODA (Minchin 1990). NMDS was used as it makes no assumptions regarding the underlying nature of species distributions along compositional gradients. As such, NMDS is the most robust form of ordination for detection of ecological patterns (Minchin 1987). To ordinate sites, a matrix of dissimilarity coefficients was calculated between all pairwise combinations of sites using the Czekanowski (Bray-Curtis) index (Faith *et al.* 1987) on species abundance data which had been doubly standardized, first to make all species maxima=1, and then to equalize the total number of individuals per site. All species (including the most rarely encountered) were considered. NMDS in 1 through 4 dimensions was then performed, with 200 maximum iterations, a stress ratio stopping value of 0.9999, and a small stress stopping value of 0.01. Output was scaled in half-change units, so that an interpoint distance of 1.0 will correspond, on average, to a 50% turnover in species composition.

Because a given NMDS run may locate a local (rather than the global) stress minima, multiple NMDS runs must be conducted on a given set of data from different initial random starting points to assess the stability of an individual solution (Minchin 1987). For this ordination, DECODA used a total of 10 random starting configurations. Solutions in each of the 4 dimensions were compared using a Procrustes transformation to identify those that were statistically identical. The number of unique solutions, and number of runs which fell into each, was then calculated across each of the 4 dimensions (Minchin 1990). The modal solution out of 10 runs was identified, and was considered a global optima when it was achieved in at least 50% of starts.

Model-based cluster analysis (Banfield & Raftery 1992) was used to identify the number of compositional groups most supported by the data. A sum-of-squares model was employed as it generates spherical clusters that will be of maximal compositional similarity. The approximate weight of evidence for k clusters (AWE $_k$) was calculated for $k=1$ to $n-1$ clusters (where n =the total number of ordinated sites) via the S+MCLUST algorithm (Statistical Sciences 1995). Clustering was performed on the selected ordination output rather than raw data as the former are less susceptible to sampling or other inadvertent errors (Equihua 1990). As this procedure indicated that only a single group was present, compositional variation across it was documented by dividing the diagram into 9 regions whose boundaries were either $\frac{1}{2}$ standard deviation above or below the ordination centroid along both the first and second major axes of variation (Figure 2). Within each of these regions, the 10 most frequent taxa were identified, as well as their number of occurrences, percent frequency, total number of individuals, and average number of individuals per site within this region. In addition, each species which reached its modal abundance within that region was determined. Across the entire diagram, the most important environmental correlates to the major axes of compositional change were identified by plotting the distribution of all habitat types within the ordination space.

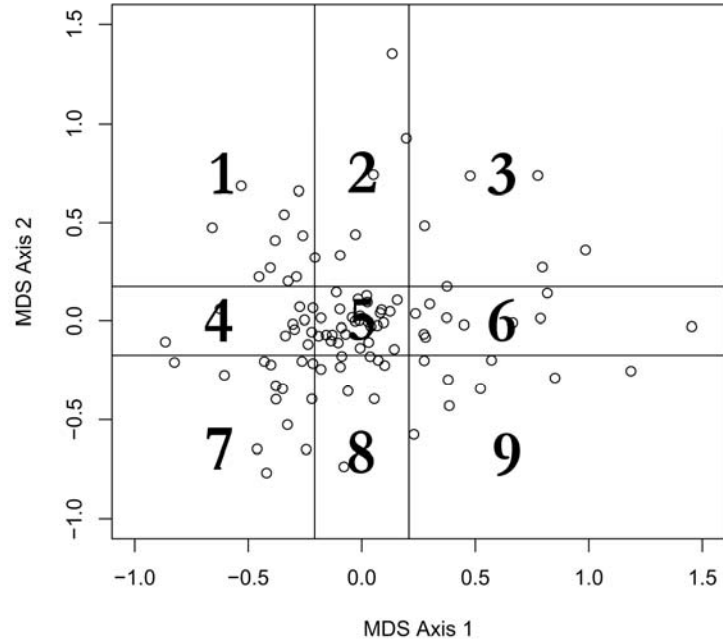


Figure 2: Location of the nine compositional regions within the ordination diagram

3. Documentation of richness and abundance patterns. The central tendency in richness across habitat types was graphically represented via box plots. In box plots, the central line represents the median of the sample, the margins of the box represent the interquartile distances, and the fences represent 1.5 times the interquartile distances. For data having a Gaussian distribution, approximately 99.3% of the data will fall inside of the fences (Velleman & Hoaglin 1981). Outliers falling outside of the fences are shown with asterisks. Non-linear regression was used to describe the power-law relationship between site richness and total abundance. An approximation of site richness and snail abundance per sample across the study region was calculated through punctual kriging of the 30 nearest sites to a given point (Burgess & Webster 1980).

Results and Discussion

Regional Faunistic Overview: While Martin (2000) reported 92 terrestrial gastropod species from Maine, this work is limited by the fact that it uncritically accepted all species listed in prior literature. As no examination was made of any specimens upon which these records were based, given the high rates of misidentification of museum lots (Hubricht 1985), it is likely that this list is too liberal in its assessment of Maine's terrestrial gastropod diversity. Through use of

distributional maps based on critically examined material (Hubricht 1985) in conjunction with personal experience in the North American land snail fauna, at least 17 of the taxa reported are highly questionable. These include *Cochlicopa nitens*, *Columella edentula*, *Euchemotrema leai*, *Euconulus chersinus*, *Pallifera carolinianus*, *Pallifera ohioensis*, *Paravitrea lamellidens*, *Pupoides albilabris*, *Strobilops affinis*, *Succinea campestris*, *Succinea indiana*, *Succinea wilsonii*, *Triodopsis juxtidentis*, *Vertigo milium*, *Vertigo modesta*, *Vertigo tridentata*, and *Zonitoides limatulus*. As our previous work added eight additional taxa to the state fauna (see above), the provisional list of Maine terrestrial gastropods stands at 83 taxa.

A total of 54 species and 66,504 individuals were observed at the 101 sampled sites (Table 1). Of these, only 55,612 were mature enough to be identifiable. Based on the updated state list, the current survey encountered approximately 2/3 of the state's terrestrial gastropod species. Also, the inherent problems associated with uncritical use of published records can be clearly seen as the most frequent species in the region (*Vertigo cristata*, which occurred in fully 85% of sampled sites) is not even included in the state list of Martin (2000). Note that in all following tables, species of high conservation value have been highlighted in **bold** type.

Table 1: Total number of sites and encountered individuals for all species included within sample.

Species	Sites	#Ind.			
			<i>Vertigo ovata</i>	15	264
<i>Vertigo cristata</i>	86	2090	<i>Helicodiscus parallelus</i>	13	127
<i>Striatura milium</i>	84	3226	<i>Cochlicopa lubrica</i>	12	467
<i>Punctum minutissimum</i>	83	8008	<i>Vallonia pulchella</i>	11	104
<i>Striatura exigua</i>	82	5254	<i>Deroceras</i> sp.	11	15
<i>Euconulus fulvus</i>	78	1525	<i>Vertigo perryi</i>	10	485
<i>Strobilops labyrinthica</i>	73	7357	<i>Cochlicopa lubricella</i>	8	53
<i>Columella simplex</i>	72	500	<i>Anguispira alternata</i>	7	27
<i>Nesovitrea electrina</i>	67	1647	<i>Zonitoides nitidus</i>	6	39
<i>Nesovitrea binneyana</i>	63	888	<i>Vertigo pygmaea</i>	6	17
<i>Planogyra asteriscus</i>	57	8288	<i>Trichia hispida</i>	5	488
<i>Gastrocopta tappaniana</i>	54	1637	<i>Discus cronkhitei</i>	5	130
<i>Vertigo ventricosa</i>	49	1337	<i>Catinella avara</i>	5	30
<i>Discus catskillensis</i>	49	1060	<i>Gastrocopta pentodon</i>	4	6
<i>Striatura ferrea</i>	49	411	<i>Vallonia costata</i>	3	278
<i>Carychium exiguum</i>	46	4472	<i>Vertigo ronneybyensis</i>	3	61
<i>Vertigo bollesiana</i>	43	519	<i>Euconulus polygyratus</i>	3	16
<i>Helicodiscus shimeki</i>	40	196	<i>Vitrina limpida</i>	3	8
<i>Carychium exile</i>	37	2410	<i>Pupilla muscorum</i>	2	24
<i>Euconulus alderi</i>	36	694	<i>Oxychylus cellarius</i>	2	9
<i>Vertigo nylanderi</i>	35	395	<i>Euchemotrema fraternum</i>	2	8
<i>Zonitoides arboreus</i>	35	224	<i>Glyphyalinia rhoadsi</i>	2	6
<i>Punctum</i> n.sp.	28	545	<i>Gastrocopta contracta</i>	2	4
<i>Vertigo gouldi</i>	27	291	<i>Vertigo morsei</i>	1	115
<i>Succinea ovalis</i>	24	233	<i>Oxyloma retusa</i>	1	2
<i>Vertigo paradoxa</i>	21	559	<i>Vallonia excentrica</i>	1	2
<i>Zoogenetes harpa</i>	18	329	<i>Neohelix albolabris</i>	1	1
<i>Vertigo elatior</i>	16	304			

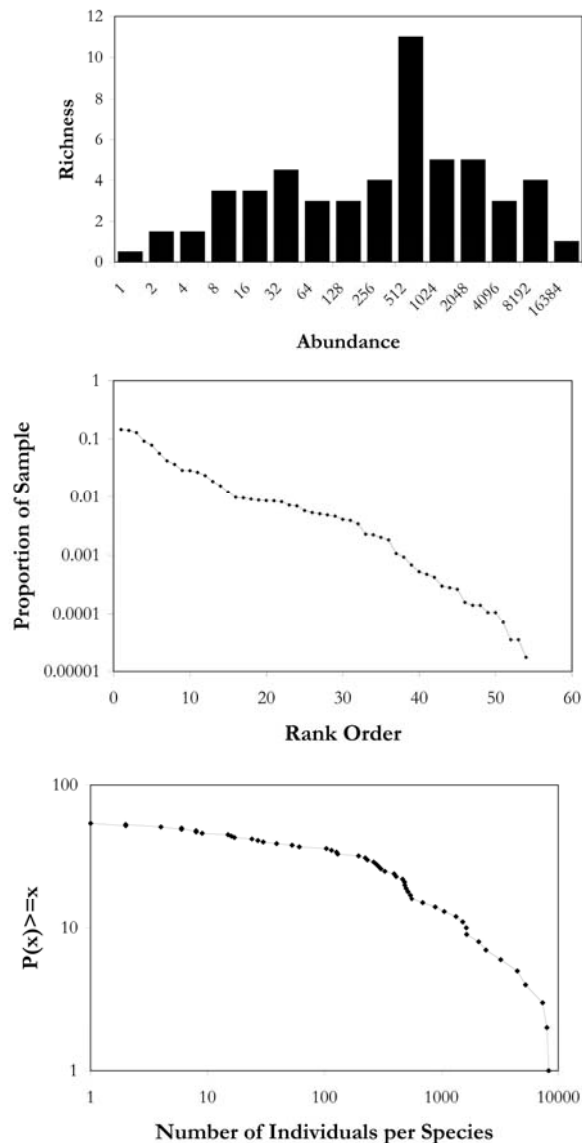


Figure 3: Distribution of abundances among encountered species: **a:** Species Abundance Distribution; **b:** Dominance-Diversity Curve; **c:** Cumulative Rank-Frequency Plot.

Examination of the species abundance distribution, dominance diversity curve, and Zipf cumulative rank-frequency plots of these data indicate that like most land snail metacommunities the fauna of this region is characterized by an even distribution of abundances. The species abundance distribution shows that while most abundance classes are rather equally occupied, there are a significantly greater number of taxa to the left of the modal abundance class than to the right (eg. there are more ‘rare’ species than ‘common’ ones). The shape of this distribution is reminiscent of a Zero Sum Multinomial which is frequently seen in ecological datasets. However as such distributions appear to be shared between many complex systems including the commercial availability of garden seeds and the song performance rates of rock bands (Nekola & Brown 2007), the ecological importance of this distribution is unclear. The dominance diversity curve also exhibits the rather equal distribution of abundances across the dataset, with the curve having a long, flat shoulder from the 10th-30th most abundant taxa. Although not exhibiting the high degree of evenness seen in other North American regional faunas (e.g. Ozarks, Southern Appalachian, Upper Midwest; Nekola 2005), it none-the-less displays a degree of evenness characteristic of tropical floras and faunas (Hubbell 2001). The Zipf cumulative rank-frequency plot is concave downward, a shape typical for ecological communities. The length of the initial plateau of uncommon species is intermediate between those seen for tropical assemblages on one hand (a shorter initial plateau and more linear drop in cumulative frequency throughout) and arctic on the other (a long initial plateau with a rapid drop in cumulative frequency).

The accumulation of unique species as a function of number of encountered individuals showed a clear power-law function (Figure 4), with the log of richness increasing as a linear function of the log of abundance. The best-fit non-linear model is $Richness = 4.72 + Total\ Abundance^{0.39}$. The model is highly significant ($p < 0.0000005$), with the pseudo- $r^2 = 0.96$. This functional relationship is also found across a wide assortment of complex systems, so it is unlikely that much unique ecological information is carried within this pattern. However, it does indicate that at least 200 individuals need to be encountered to be able to achieve maximum richness values for a given site.

This target minimum number of observed individuals per site is the same as recommended by Cameron & Pokryszko (2005) based on an inductive analytical process.

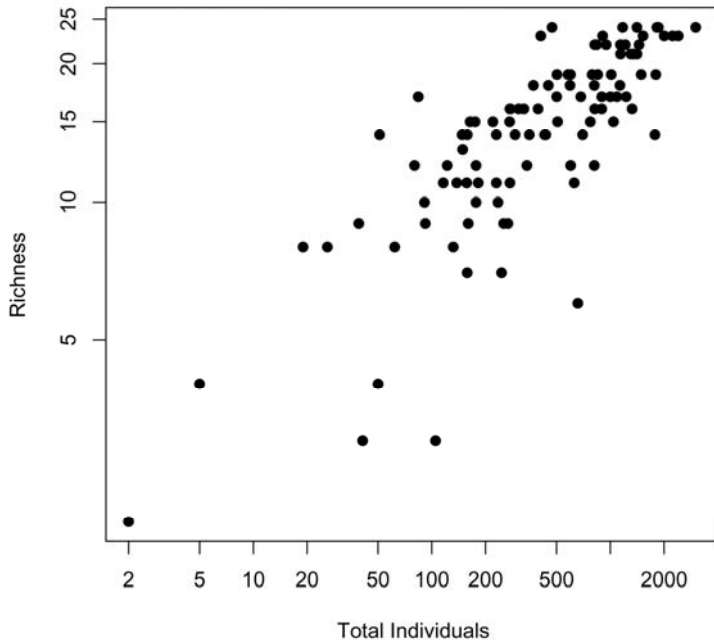


Figure 4. Power-law accumulation of unique species as a function of total observed

Diversity Patterns: 22 sites were found to harbor 20 or more species. Fourteen of these were White Cedar Wetlands, 5 were Metasedimentary Outcrops, 1 each represented a Fen, Sugar Maple forest, and Tamarack Wetland. Maximum observed site richness of 24 was observed at the Woodland Fen, Mt. Carmel Wayside, Monticello Station, Washburn Ledge, Grendell Cemetery, Collins Siding.

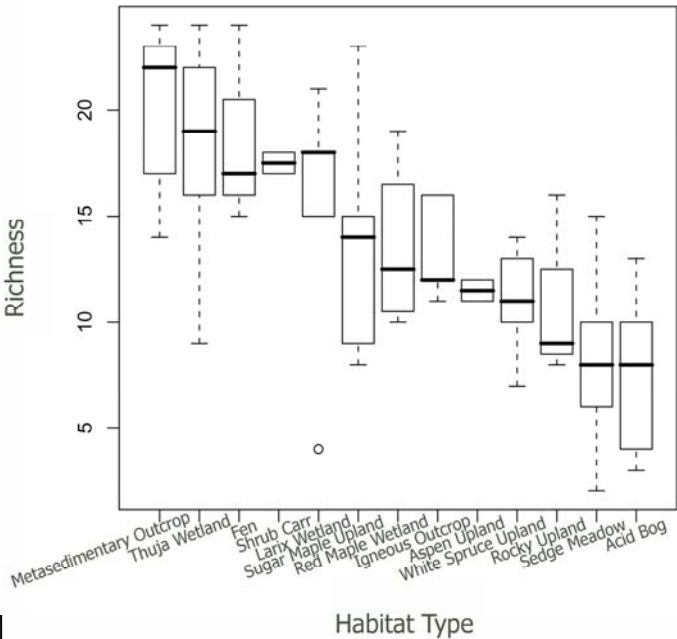


Figure 5: Boxplot showing the richness patterns per habitat type. The associated ANOVA indicates that there is a highly significant ($p < 0.0000005$) difference in richness between habitats, accounting for 53% of observed

Mean site richness significantly ($p < 0.0000005$) and strongly ($r^2 = 0.532$) varied among the 13 habitats (Figure 5). Metasedimentary outcrops had the highest values at 20.25 taxa/site. White Cedar swamp forest and Fen habitats followed with means between 18.3-18.7. Shrub Carr averaged 17.5, and Tamarack swamp forest averaged 15.2. Igneous Outcrops, Sugar Maple upland, White Spruce upland, Aspen upland, Rocky upland, and Red Maple swamp forest ranged from 11-13.8. The most species poor communities were Sedge Meadow (8.2) and Acid Bog (7.6).

Average richness per site was found to possess a strong trend across the region, being highest (> 18 taxa/site) in a region largely coincident with the boundaries of the Aroostook Lowlands biophysical region (Figure 6). This is the only part of the study region that is underlain almost entirely by metasedimentary bedrock, and which thus should have the highest base status. The lowest richness levels (< 14 taxa/site) occur in areas underlain by acidic intrusive rocks near the coast.

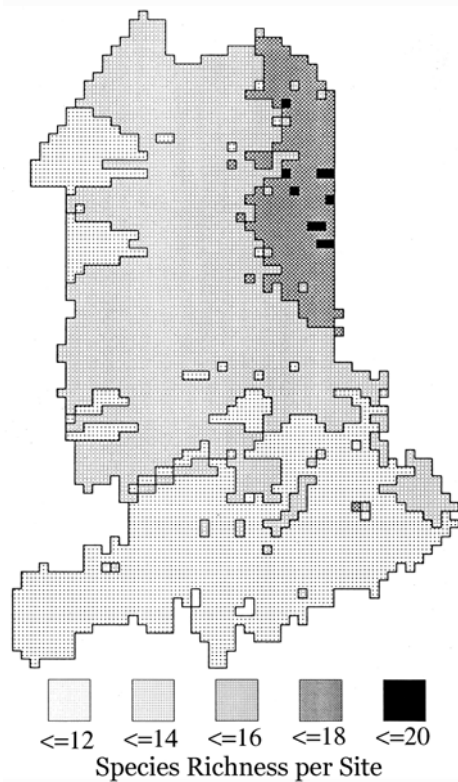


Figure 6: Distribution of community richness levels across the study area.

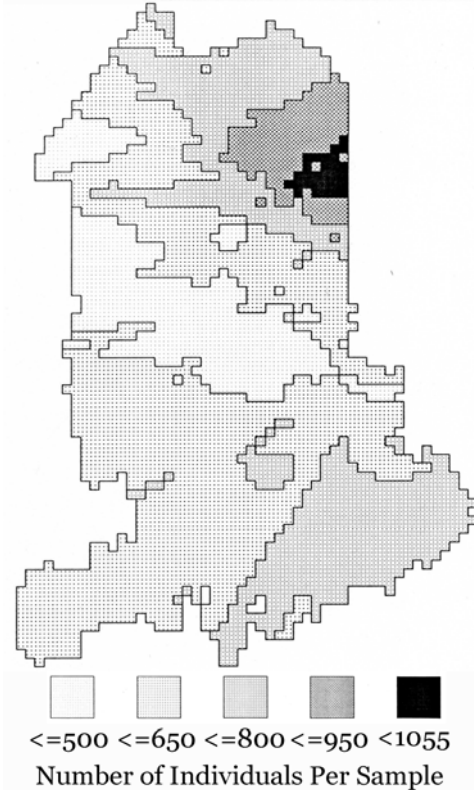


Figure 7: Distribution of community abundance levels across landscape

Average abundance per site demonstrated a largely similar pattern, reaching maximum levels (~1000 individuals/site) in the Aroostook River valley near Presque Isle and Caribou (Figure 7). Lowest abundance levels (500/site) were observed in the Aroostook Highlands biophysical region in the west-center of the study region. Unlike richness, however, abundance was observed to increase again along the coast, perhaps due to elevated base status from sea spray deposition.

Habitat Associations:

1. Bedrock Outcrops

A. Metasedimentary Outcrops (8 sites). These sites have generally developed along stream corridors where high rates of downcutting following glacial retreat were able to uncover weakly metamorphosed interbedded limestones, siltstones, and shales. In most cases the exposed rock is friable, making unstable exposures. As a result, there is often little leaf litter accumulation. The canopy of these sites is typically dominated by *Thuja occidentalis*. 39 total taxa were encountered over all sites, while an average of 711 individuals were observed per sample. The ten most frequently encountered species were *Strobilops labyrinthica*, *Vertigo gouldi* (100% of sites), *Punctum minutissimum*, *Vertigo paradoxa*, *Discus catskillensis*, *Vertigo bollesiana*, *Nesovitrea binneyana*, *Vertigo cristata*, *Striatura milium* (87.5% of sites), and *Euconulus fulvus* (75% of sites). The ten most abundant species are *Punctum minutissimum* (164.88 individuals/site), *Strobilops labyrinthica* (134.38), *Trichia hispida* (60.75), *Vertigo paradoxa* (54.88), *Discus catskillensis*

(35.63), *Vallonia costata* (34.75), *Euconulus fulvus* (28.13), *Vertigo gouldi* (27.38), *Vertigo bollesiana* (25.5), *Nesovitrea binneyana* (25.25), and *Vertigo cristata* (25.25).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Strobilops labyrinthica</i>	8	100.00	1075	134.38
<i>Vertigo gouldi</i>	8	100.00	219	27.38
<i>Punctum minutissimum</i>	7	87.50	1319	164.88
<i>Vertigo paradoxa</i>	7	87.50	439	54.88
<i>Discus catskillensis</i>	7	87.50	285	35.63
<i>Vertigo bollesiana</i>	7	87.50	204	25.50
<i>Nesovitrea binneyana</i>	7	87.50	202	25.25
<i>Vertigo cristata</i>	7	87.50	202	25.25
<i>Striatura milium</i>	7	87.50	87	10.88
<i>Euconulus fulvus</i>	6	75.00	225	28.13
<i>Zoogenetes harpa</i>	6	75.00	69	8.63
<i>Columella simplex</i>	6	75.00	38	4.75
<i>Carychium exile</i>	5	62.50	150	18.75
<i>Cochlicopa lubrica</i>	5	62.50	76	9.50
<i>Trichia hispida</i>	4	50.00	486	60.75
<i>Nesovitrea electrina</i>	4	50.00	32	4.00
<i>Zonitoides arboreus</i>	4	50.00	27	3.38
<i>Anguispira alternata</i>	4	50.00	20	2.50
<i>Succinea ovalis</i>	4	50.00	20	2.50
<i>Striatura ferrea</i>	4	50.00	11	1.38
<i>Vallonia costata</i>	3	37.50	278	34.75
<i>Vallonia pulchella</i>	3	37.50	67	8.38
<i>Helicodiscus shimeki</i>	3	37.50	16	2.00
<i>Punctum</i> n.sp.	3	37.50	16	2.00
<i>Striatura exigua</i>	3	37.50	10	1.25
<i>Planogyra asteriscus</i>	3	37.50	8	1.00
<i>Deroceras</i> sp.	3	37.50	7	0.88
<i>Oxychylus cellarius</i>	2	25.00	9	1.13
<i>Gastrocopta tappaniana</i>	2	25.00	8	1.00
<i>Euchemotrema fraternum</i>	2	25.00	8	1.00
<i>Catinella avara</i>	2	25.00	6	0.75
<i>Vertigo pygmaea</i>	2	25.00	6	0.75
<i>Euconulus polygyratus</i>	2	25.00	3	0.38
<i>Vertigo elatior</i>	1	12.50	36	4.50
<i>Pupilla muscorum</i>	1	12.50	20	2.50
<i>Cochlicopa lubricella</i>	1	12.50	2	0.25
<i>Vallonia excentrica</i>	1	12.50	2	0.25
<i>Gastrocopta contracta</i>	1	12.50	1	0.13
<i>Neohelix albolabris</i>	1	12.50	1	0.13

B. Igneous - Metamorphic Outcrops (5 sites). These sites have largely developed where resistant igneous and metamorphic rock is exposed on hillsides, mountains, and monodanoks. This rock

tends to be less friable, and massive exposures can exist, such as on the north face of Jack Mountain where vertical surfaces over 20 meters in height occur. These exposures range from base poor (e.g. the rhyolites at Horse Mountain) to relatively base rich. These sites can range from open to forested, often with some amount of *Thuja occidentalis* in the canopy. Oak, hemlock, and yellow birch are also common. 23 taxa were encountered across all sites, with an average of 272 individuals being observed per sample. The eleven most frequent taxa were *Vertigo cristata*, *Punctum minutissimum*, *Striatura exigua*, *Euconulus fulvus*, *Striatura ferrea* (100% of sites), *Strobilops labyrinthica*, *Nesovitrea binneyana*, *Vertigo paradoxa* (80%), *Striatura milium*, *Vertigo ronneybyensis* and *Vertigo bollesiana* (60%). The most abundant species were *Vertigo cristata* (50.6 individuals / site), *Punctum minutissimum* (36.2), *Striatura milium* (31.6), *Strobilops labyrinthica* (27.8), *Striatura exigua* (24.8), *Discus catskillensis* (13.4), *Vertigo ronneybyensis* (12.2), *Vertigo bollesiana* (10.2), *Euconulus fulvus* (9.6), and *Nesovitrea binneyana* (9.6).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Vertigo cristata</i>	5	100.00	253	50.60
<i>Punctum minutissimum</i>	5	100.00	181	36.20
<i>Striatura exigua</i>	5	100.00	124	24.80
<i>Euconulus fulvus</i>	5	100.00	48	9.60
<i>Striatura ferrea</i>	5	100.00	40	8.00
<i>Strobilops labyrinthica</i>	4	80.00	139	27.80
<i>Nesovitrea binneyana</i>	4	80.00	48	9.60
<i>Vertigo paradoxa</i>	4	80.00	42	8.40
<i>Striatura milium</i>	3	60.00	158	31.60
<i>Vertigo ronneybyensis</i>	3	60.00	61	12.20
<i>Vertigo bollesiana</i>	3	60.00	51	10.20
<i>Columella simplex</i>	3	60.00	16	3.20
<i>Discus catskillensis</i>	2	40.00	67	13.40
<i>Discus cronkhitei</i>	2	40.00	32	6.40
<i>Vertigo gouldi</i>	2	40.00	24	4.80
<i>Zonitoides arboreus</i>	2	40.00	21	4.20
<i>Zoogenetes harpa</i>	2	40.00	2	0.40
<i>Planogyra asteriscus</i>	1	20.00	43	8.60
<i>Helicodiscus parallelus</i>	1	20.00	5	1.00
<i>Helicodiscus shimeki</i>	1	20.00	2	0.40
<i>Carychium exile</i>	1	20.00	1	0.20
<i>Gastrocopta pentodon</i>	1	20.00	1	0.20
<i>Glyphyalinia rhoadsi</i>	1	20.00	1	0.20

2. Upland Forest

A. *Sugar Maple Woodland* (5 sites). Sugar Maple forests represent one of the most common upland communities within the region. Sites have generally developed in areas with clay-rich soils, and often retain a relatively thin layer of leaf litter. Snails in these sites are typically found in microsites that collect leaf litter, such as tip-up depressions and along the up-hill side of downed logs. 29 species were found in these sites, with an average of 201 individuals being observed per site. The eleven most frequent taxa were *Striatura exigua*, *Striatura milium* (100% of sites), *Punctum minutissimum*, *Striatura ferrea*, *Strobilops labyrinthica* (80%), *Vertigo cristata*,

Zonitoides arboreus, *Helicodiscus shimeki*, *Nesovitrea binneyana*, *Planogyra asteriscus*, and *Vertigo bollesiana* (60%). The ten most abundant species were *Punctum minutissimum* (33.6 individuals/site), *Striatura exigua* (30.2), *Striatura milium* (29.8), *Vertigo cristata* (16.8), *Striatura ferrea* (14), *Strobilops labyrinthica* (11), *Discus catskillensis* (8.6), *Zonitoides arboreus* (5.6), *Helicodiscus parallelus* (5.4), and *Cochlicopa lubricella* (5.4).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Striatura exigua</i>	5	100.00	151	30.20
<i>Striatura milium</i>	5	100.00	149	29.80
<i>Punctum minutissimum</i>	4	80.00	168	33.60
<i>Striatura ferrea</i>	4	80.00	70	14.00
<i>Strobilops labyrinthica</i>	4	80.00	55	11.00
<i>Vertigo cristata</i>	3	60.00	84	16.80
<i>Zonitoides arboreus</i>	3	60.00	28	5.60
<i>Helicodiscus shimeki</i>	3	60.00	25	5.00
<i>Nesovitrea binneyana</i>	3	60.00	21	4.20
<i>Planogyra asteriscus</i>	3	60.00	17	3.40
<i>Vertigo bollesiana</i>	3	60.00	11	2.20
<i>Columella simplex</i>	3	60.00	9	1.80
<i>Discus catskillensis</i>	2	40.00	43	8.60
<i>Helicodiscus parallelus</i>	2	40.00	27	5.40
<i>Carychium exile</i>	2	40.00	16	3.20
<i>Euconulus fulvus</i>	2	40.00	14	2.80
<i>Nesovitrea electrina</i>	2	40.00	12	2.40
<i>Cochlicopa lubricella</i>	1	20.00	27	5.40
<i>Vertigo paradoxa</i>	1	20.00	23	4.60
<i>Vertigo nylanderi</i>	1	20.00	16	3.20
<i>Euconulus polygyratus</i>	1	20.00	13	2.60
<i>Euconulus alderi</i>	1	20.00	9	1.80
<i>Glyphyalinia rhoadsi</i>	1	20.00	5	1.00
<i>Gastrocopta tappaniana</i>	1	20.00	4	0.80
<i>Gastrocopta contracta</i>	1	20.00	3	0.60
<i>Gastrocopta pentodon</i>	1	20.00	3	0.60
<i>Anguispira alternata</i>	1	20.00	1	0.20
<i>Vertigo gouldi</i>	1	20.00	1	0.20
<i>Vertigo ovata</i>	1	20.00	1	0.20

B. White Spruce Woodland. (7 sites). These sites represent mature, upland sites which support a significant component of Spruce and Fir in the canopy. Red Maple is also often a common constituent of these sites. 23 species were observed on these sites, with on average 196 individuals being observed per sample. The nine most frequent taxa were *Vertigo cristata* (100 % of sites), *Striatura exigua*, *Striatura milium* (86% of sites), *Discus catskillensis*, *Nesovitrea binneyana*, *Strobilops labyrinthica*, *Striatura ferrea*, *Helicodiscus shimeki*, and *Columella simplex* (71% of sites). The ten most abundant taxa were *Striatura exigua* (33.86 individuals/site), *Zoogenetes harpa* (25.29), *Planogyra asteriscus* (23.29), *Striatura milium* (18.14), *Vertigo cristata* (17.14),

Punctum minutissimum (11.29), *Discus catskillensis* (8.14), *Nesovitrea binneyana* (7.71), *Strobilops labyrinthica* (7.14), and *Cochlicopa lubrica* (7.14).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Vertigo cristata</i>	7	100.00	120	17.14
<i>Striatura exigua</i>	6	85.71	237	33.86
<i>Striatura milium</i>	6	85.71	127	18.14
<i>Discus catskillensis</i>	5	71.43	57	8.14
<i>Nesovitrea binneyana</i>	5	71.43	54	7.71
<i>Strobilops labyrinthica</i>	5	71.43	50	7.14
<i>Striatura ferrea</i>	5	71.43	30	4.29
<i>Helicodiscus shimeki</i>	5	71.43	29	4.14
<i>Columella simplex</i>	5	71.43	15	2.14
<i>Zoogenetes harpa</i>	3	42.86	177	25.29
<i>Punctum minutissimum</i>	3	42.86	79	11.29
<i>Zonitoides arboreus</i>	3	42.86	42	6.00
<i>Nesovitrea electrina</i>	3	42.86	28	4.00
<i>Euconulus fulvus</i>	3	42.86	23	3.29
<i>Planogyra asteriscus</i>	2	28.57	163	23.29
<i>Carychium exile</i>	2	28.57	26	3.71
<i>Cochlicopa lubricella</i>	2	28.57	9	1.29
<i>Succinea ovalis</i>	2	28.57	6	0.86
<i>Cochlicopa lubrica</i>	1	14.29	50	7.14
<i>Discus cronkhitei</i>	1	14.29	39	5.57
<i>Vertigo bollesiana</i>	1	14.29	8	1.14
<i>Helicodiscus parallelus</i>	1	14.29	1	0.14
<i>Vitrina limpida</i>	1	14.29	1	0.14

C. Aspen Woodland (4 sites). These sites represent early-successional stands which will likely succeed into Sugar Maple or White Spruce forest. Soils are often rather rich in clays, with only a thin veneer of leaf litter being present. Unlike aspen forests elsewhere in North America, there does not appear to be much bioaccumulation of Calcium in associated organic litter layers. 21 species were encountered from these sites, with an average of 146 individuals being encountered per site. The ten most frequent taxa were *Striatura exigua*, *Vertigo cristata*, *Punctum minutissimum* (100% of sites), *Striatura milium*, *Zoogenetes harpa*, *Discus catskillensis*, *Strobilops labyrinthica*, *Cochlicopa lubricella*, *Euconulus fulvus*, and *Vertigo bollesiana* (75%). The most abundant taxa were: *Striatura exigua* (26.5 individuals/site), *Striatura milium* (24), *Vertigo cristata* (19.75), *Punctum minutissimum* (13.5), *Zoogenetes harpa* (9.25), *Planogyra asteriscus* (8.75), *Vertigo paradoxa* (7.75), *Discus catskillensis* (7.25), *Strobilops labyrinthica* (6), and *Cochlicopa lubrica* (5.5).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Striatura exigua</i>	4	100.00	106	26.50
<i>Vertigo cristata</i>	4	100.00	79	19.75
<i>Punctum minutissimum</i>	4	100.00	54	13.50
<i>Striatura milium</i>	3	75.00	96	24.00

<i>Zoogenetes harpa</i>	3	75.00	37	9.25
<i>Discus catskillensis</i>	3	75.00	29	7.25
<i>Strobilops labyrinthica</i>	3	75.00	24	6.00
<i>Cochlicopa lubricella</i>	3	75.00	14	3.50
<i>Euconulus fulvus</i>	3	75.00	12	3.00
<i>Vertigo bollesiana</i>	3	75.00	4	1.00
<i>Planogyra asteriscus</i>	2	50.00	35	8.75
<i>Columella simplex</i>	2	50.00	11	2.75
<i>Vertigo paradoxa</i>	1	25.00	31	7.75
<i>Cochlicopa lubrica</i>	1	25.00	22	5.50
<i>Nesovitrea binneyana</i>	1	25.00	17	4.25
<i>Helicodiscus parallelus</i>	1	25.00	5	1.25
<i>Carychium exile</i>	1	25.00	3	0.75
<i>Anguispira alternata</i>	1	25.00	2	0.50
<i>Striatura ferrea</i>	1	25.00	1	0.25
<i>Vallonia pulchella</i>	1	25.00	1	0.25
<i>Vertigo gouldi</i>	1	25.00	1	0.25

D. Rocky Woodland (3 sites). These woodland sites developed on rocky substrate, but do not possess permanent, vertical outcrop surfaces. In general, they have formed in boulder fields on valley and mountain hillsides, and are forested in Sugar Maple, although one site along the Penobscot River at Brewer represents an artificial habitat constructed of rip-rap. Litter accumulations are often limited to the uphill side of logs and boulders. 25 species were encountered on these sites, with 147 individuals being encountered on average per site. The six most frequent species were *Punctum minutissimum* (100% of sites), *Nesovitrea electrina*, *Striatura milium*, *Euconulus fulvus*, *Discus catskillensis*, and *Vertigo cristata* (67%). The species with the largest average population sizes were *Punctum minutissimum* (41.33 individuals/site), *Cochlicopa lubrica* (18), *Helicodiscus parallelus* (15), *Zonitoides arboreus* (13), *Zoogenetes harpa* (10.33), *Nesovitrea electrina* (9.67), *Discus cronkhitei* (9), *Gastrocopta tappaniana* (6.67), and *Succinea ovalis* (5).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Punctum minutissimum</i>	3	100.00	124	41.33
<i>Nesovitrea electrina</i>	2	66.67	29	9.67
<i>Striatura milium</i>	2	66.67	10	3.33
<i>Euconulus fulvus</i>	2	66.67	9	3.00
<i>Discus catskillensis</i>	2	66.67	5	1.67
<i>Vertigo cristata</i>	2	66.67	3	1.00
<i>Cochlicopa lubrica</i>	1	33.33	54	18.00
<i>Helicodiscus parallelus</i>	1	33.33	45	15.00
<i>Zonitoides arboreus</i>	1	33.33	39	13.00
<i>Zoogenetes harpa</i>	1	33.33	31	10.33
<i>Discus cronkhitei</i>	1	33.33	27	9.00
<i>Gastrocopta tappaniana</i>	1	33.33	20	6.67
<i>Succinea ovalis</i>	1	33.33	15	5.00
<i>Striatura ferrea</i>	1	33.33	8	2.67

<i>Anguispira alternata</i>	1	33.33	4	1.33
<i>Vertigo bollesiana</i>	1	33.33	4	1.33
<i>Vertigo perryi</i>	1	33.33	4	1.33
<i>Helicodiscus shimeki</i>	1	33.33	2	0.67
<i>Strobilops labyrinthica</i>	1	33.33	2	0.67
<i>Cochlicopa lubricella</i>	1	33.33	1	0.33
<i>Columella simplex</i>	1	33.33	1	0.33
<i>Gastrocopta pentodon</i>	1	33.33	1	0.33
<i>Vallonia pulchella</i>	1	33.33	1	0.33
<i>Vertigo gouldi</i>	1	33.33	1	0.33
<i>Zonitoides nitidus</i>	1	33.33	1	0.33

3. Lowland Forest

A. *Tamarack Woodland* (5 sites). These sites represent lowland and often quite acid forest sites. Typically the ground layer is dominated by *Sphagnum* moss and various small *Carex* species. Water levels are typically less than those found in the remaining lowland forest sites. 27 total species were encountered on these sites, with an average of 474 individuals being observed per site. The nine most frequent species were *Striatura milium*, *Vertigo cristata* (100 % of sites), *Strobilops labyrinthica*, *Striatura exigua*, *Planogyra asteriscus*, *Punctum minutissimum*, *Gastrocopta tappaniana*, and *Columella simplex* (80%). The most abundant species were *Strobilops labyrinthica* (87.2 individuals/site), *Striatura exigua* (85), *Striatura milium* (66), *Planogyra asteriscus* (56.8), *Nesovitrea electrina* (33.2), *Carychium exiguum* (30.4), *Punctum minutissimum* (29.2), *Gastrocopta tappaniana* (17.8), *Vertigo cristata* (14.4), and *Carychium exile* (10.8).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Striatura milium</i>	5	100.00	330	66.00
<i>Vertigo cristata</i>	5	100.00	72	14.40
<i>Strobilops labyrinthica</i>	4	80.00	436	87.20
<i>Striatura exigua</i>	4	80.00	425	85.00
<i>Planogyra asteriscus</i>	4	80.00	284	56.80
<i>Punctum minutissimum</i>	4	80.00	146	29.20
<i>Gastrocopta tappaniana</i>	4	80.00	89	17.80
<i>Columella simplex</i>	4	80.00	29	5.80
<i>Nesovitrea electrina</i>	3	60.00	166	33.20
<i>Carychium exiguum</i>	3	60.00	152	30.40
<i>Discus catskillensis</i>	3	60.00	35	7.00
<i>Vertigo nylanderi</i>	3	60.00	31	6.20
<i>Euconulus fulvus</i>	3	60.00	27	5.40
<i>Helicodiscus shimeki</i>	3	60.00	19	3.80
<i>Vertigo elatior</i>	3	60.00	17	3.40
<i>Striatura ferrea</i>	3	60.00	12	2.40
<i>Carychium exile</i>	2	40.00	54	10.80
<i>Zonitoides arboreus</i>	2	40.00	10	2.00
<i>Succinea ovalis</i>	2	40.00	9	1.80
<i>Vertigo ventricosa</i>	2	40.00	9	1.80
<i>Nesovitrea binneyana</i>	2	40.00	7	1.40

<i>Euconulus alderi</i>	2	40.00	4	0.80
<i>Vertigo bollesiana</i>	1	20.00	2	0.40
<i>Catinella avara</i>	1	20.00	1	0.20
<i>Deroceras</i> sp.	1	20.00	1	0.20
<i>Punctum</i> n.sp.	1	20.00	1	0.20
<i>Vertigo gouldi</i>	1	20.00	1	0.20

B. Northern White Cedar - Ash Woodland (41 sites). These sites represent the most common lowland forest type in the region, being found throughout all of eastern Maine. Sites vary from acidic, with *Sphagnum* and heath-dominated ground layers, to base-rich sites lacking *Sphagnum* and supporting a diverse assemblage of forbs and rich mosses. More acidic sites tend to have an increased proportion of Red Maple in the canopy, while wetter sites tend to support higher numbers of Ash. Snail populations were primarily found in litter accumulations around tree bases, on hummocks, and in patches of deciduous leaf litter surrounded by moss polsters. 37 species were observed across all sampled sites, with the average number of individuals per site being 860. The ten most frequent taxa were *Punctum minutissimum*, *Striatura exigua* (100% of sites), *Vertigo cristata* (98%), *Striatura milium*, *Euconulus fulvus* (95%), *Nesovitrea electrina*, *Columella simplex* (90%), *Planogyra asteriscus*, *Strobilops labyrinthica*, and *Vertigo ventricosa* (88%). The most abundant taxa were *Planogyra asteriscus* (179.95 individuals/site), *Punctum minutissimum* (135.71), *Strobilops labyrinthica* (118.68), *Striatura exigua* (95.29), *Carychium exile* (51.22), *Carychium exiguum* (42), *Striatura milium* (38.93), *Vertigo cristata* (26.95), *Euconulus fulvus* (25.49), *Vertigo ventricosa* (25.29), and *Nesovitrea electrina* (22.17).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Punctum minutissimum</i>	41	100.00	5564	135.71
<i>Striatura exigua</i>	41	100.00	3907	95.29
<i>Vertigo cristata</i>	40	97.56	1105	26.95
<i>Striatura milium</i>	39	95.12	1596	38.93
<i>Euconulus fulvus</i>	39	95.12	1045	25.49
<i>Nesovitrea electrina</i>	37	90.24	909	22.17
<i>Columella simplex</i>	37	90.24	286	6.98
<i>Planogyra asteriscus</i>	36	87.80	7378	179.95
<i>Strobilops labyrinthica</i>	36	87.80	4866	118.68
<i>Vertigo ventricosa</i>	36	87.80	1037	25.29
<i>Nesovitrea binneyana</i>	35	85.37	505	12.32
<i>Gastrocopta tappaniana</i>	33	80.49	777	18.95
<i>Carychium exiguum</i>	30	73.17	1722	42.00
<i>Vertigo nylanderi</i>	27	65.85	300	7.32
<i>Carychium exile</i>	23	56.10	2100	51.22
<i>Striatura ferrea</i>	23	56.10	232	5.66
<i>Vertigo bollesiana</i>	23	56.10	215	5.24
<i>Helicodiscus shimeki</i>	21	51.22	79	1.93
<i>Euconulus alderi</i>	18	43.90	346	8.44
<i>Discus catskillensis</i>	17	41.46	455	11.10
<i>Punctum</i> n.sp.	17	41.46	398	9.71
<i>Zonitoides arboreus</i>	17	41.46	49	1.20

<i>Vertigo gouldi</i>	13	31.71	44	1.07
<i>Succinea ovalis</i>	9	21.95	54	1.32
<i>Vertigo elatior</i>	8	19.51	57	1.39
<i>Vertigo paradoxa</i>	8	19.51	24	0.59
<i>Vertigo ovata</i>	5	12.20	46	1.12
<i>Deroceras</i> sp.	5	12.20	5	0.12
<i>Vertigo perryi</i>	3	7.32	103	2.51
<i>Helicodiscus parallelus</i>	3	7.32	16	0.39
<i>Zoogenetes harpa</i>	2	4.88	3	0.07
<i>Discus cronkhitei</i>	1	2.44	32	0.78
<i>Cochlicopa lubrica</i>	1	2.44	3	0.07
<i>Vallonia pulchella</i>	1	2.44	3	0.07
<i>Oxyloma retusa</i>	1	2.44	2	0.05
<i>Vertigo pygmaea</i>	1	2.44	1	0.02
<i>Zonitoides nitidus</i>	1	2.44	1	0.02

C. Red Maple - Black Spruce Woodland (4 sites). These sites are the most acidic lowland woods habitat in the region, and support a depauperate groundlayer of *Sphagnum* and assorted heaths. Water often ponds in low spots, allowing fingernail clams (*Psidium* spp.) to become rather common. Winterberry and alder are common shrubs. 21 species were observed on these sites, with the average number of individuals being 376. The eleven most frequent species were *Striatura milium*, *Nesovitrea electrina*, *Vertigo cristata*, *Euconulus fulvus*, *Vertigo ventricosa* (100% of sites), *Punctum minutissimum*, *Striatura exigua*, *Gastrocopta tappaniana*, *Succinea ovalis*, *Euconulus alderi*, and *Columella simplex* (75%). The most abundant taxa were *Striatura milium* (86 individuals/site), *Punctum minutissimum* (46), *Strobilops labyrinthica* (39), *Carychium exiguum* (38.5), *Striatura exigua* (30.5), *Gastrocopta tappaniana* (23.25), *Nesovitrea electrina* (23), *Vertigo cristata* (15.5), and *Planogyra asteriscus* (14.25).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Striatura milium</i>	4	100.00	344	86.00
<i>Nesovitrea electrina</i>	4	100.00	92	23.00
<i>Vertigo cristata</i>	4	100.00	62	15.50
<i>Euconulus fulvus</i>	4	100.00	47	11.75
<i>Vertigo ventricosa</i>	4	100.00	47	11.75
<i>Punctum minutissimum</i>	3	75.00	184	46.00
<i>Striatura exigua</i>	3	75.00	122	30.50
<i>Gastrocopta tappaniana</i>	3	75.00	93	23.25
<i>Succinea ovalis</i>	3	75.00	36	9.00
<i>Euconulus alderi</i>	3	75.00	29	7.25
<i>Columella simplex</i>	3	75.00	14	3.50
<i>Strobilops labyrinthica</i>	2	50.00	156	39.00
<i>Carychium exiguum</i>	2	50.00	154	38.50
<i>Planogyra asteriscus</i>	2	50.00	57	14.25
<i>Discus catskillensis</i>	2	50.00	17	4.25
<i>Nesovitrea binneyana</i>	2	50.00	15	3.75
<i>Helicodiscus shimeki</i>	1	25.00	11	2.75

<i>Vertigo nylanderi</i>	1	25.00	10	2.50
<i>Helicodiscus parallelus</i>	1	25.00	6	1.50
<i>Punctum</i> n.sp.	1	25.00	6	1.50
<i>Vertigo ovata</i>	1	25.00	1	0.25

D. *Shrub Carr* (2 sites). These willow-alder-dogwood dominated wet thickets were limited to the stream and river corridors, and often graded into sedge meadows. 24 total taxa were observed, with the average number of collected individuals per site being 1197. Species which occurred on all surveyed sites included *Carychium exiguum*, *Cochlicopa lubrica*, *Nesovitrea electrina*, *Gastrocopta tappaniana*, *Succinea ovalis*, *Striatura exigua*, *Euconulus fulvus*, *Discus catskillensis*, *Vallonia pulchella*, *Striatura milium*, and *Vitrina limpida*. The most abundant species were *Carychium exiguum* (666.5 individuals/site), *Cochlicopa lubrica* (128.5), *Nesovitrea electrina* (88), *Gastrocopta tappaniana* (80.5), *Succinea ovalis* (39.5), *Vertigo perryi* (29.5), *Columella simplex* (24), *Striatura exigua* (22), *Punctum* n.sp. (22) and *Euconulus fulvus* (19).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Carychium exiguum</i>	2	100.00	1333	666.50
<i>Cochlicopa lubrica</i>	2	100.00	257	128.50
<i>Nesovitrea electrina</i>	2	100.00	176	88.00
<i>Gastrocopta tappaniana</i>	2	100.00	161	80.50
<i>Succinea ovalis</i>	2	100.00	79	39.50
<i>Striatura exigua</i>	2	100.00	44	22.00
<i>Euconulus fulvus</i>	2	100.00	38	19.00
<i>Discus catskillensis</i>	2	100.00	36	18.00
<i>Vallonia pulchella</i>	2	100.00	26	13.00
<i>Striatura milium</i>	2	100.00	13	6.50
<i>Vitrina limpida</i>	2	100.00	7	3.50
<i>Vertigo perryi</i>	1	50.00	59	29.50
<i>Columella simplex</i>	1	50.00	48	24.00
<i>Punctum</i> n.sp.	1	50.00	44	22.00
<i>Helicodiscus parallelus</i>	1	50.00	18	9.00
<i>Zonitoides nitidus</i>	1	50.00	13	6.50
<i>Euconulus alderi</i>	1	50.00	12	6.00
<i>Vertigo ventricosa</i>	1	50.00	10	5.00
<i>Catinella avara</i>	1	50.00	5	2.50
<i>Vertigo cristata</i>	1	50.00	5	2.50
<i>Zonitoides arboreus</i>	1	50.00	5	2.50
<i>Trichia hispida</i>	1	50.00	2	1.00
<i>Helicodiscus shimeki</i>	1	50.00	1	0.50
<i>Punctum minutissimum</i>	1	50.00	1	0.50

4. Lowland Openings

A. *Sedge Meadow* (9 sites). These sites are principally located on marshy stream banks, and become more common towards the south. Sites tend to be dominated by various coarse sedges such as *Carex lacustris*, and may be flooded multiple times during the year. Sites tend to be rather acidic, with snails being largely limited to accumulations of dead sedge leaves above the yearly

high-water mark. 29 species were observed, with an average of 103 individuals being collected per site. Faunas were found to be more divergent in composition than other communities, with maximum frequency being only 2/3. The most frequent species were *Vertigo ovata*, *Euconulus alderi* (67% of sites), *Punctum minutissimum*, *Striatura exigua* (56%), *Vertigo perryi*, *Nesovitrea electrina*, and *Carychium exiguum* (44%). The most abundant species were *Vertigo perryi* (33.67 individuals/site), *Vertigo ovata* (19.44), *Vertigo ventricosa* (14.22), *Euconulus alderi* (6.33) and *Nesovitrea electrina* (5.56).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Vertigo ovata</i>	6	66.67	175	19.44
<i>Euconulus alderi</i>	6	66.67	57	6.33
<i>Punctum minutissimum</i>	5	55.56	17	1.89
<i>Striatura exigua</i>	5	55.56	7	0.78
<i>Vertigo perryi</i>	4	44.44	303	33.67
<i>Nesovitrea electrina</i>	4	44.44	50	5.56
<i>Carychium exiguum</i>	4	44.44	16	1.78
<i>Vertigo ventricosa</i>	3	33.33	128	14.22
<i>Gastrocopta tappaniana</i>	3	33.33	25	2.78
<i>Euconulus fulvus</i>	3	33.33	15	1.67
<i>Columella simplex</i>	3	33.33	13	1.44
<i>Strobilops labyrinthica</i>	3	33.33	3	0.33
<i>Striatura milium</i>	2	22.22	26	2.89
<i>Vertigo pygmaea</i>	2	22.22	9	1.00
<i>Zonitoides nitidus</i>	2	22.22	6	0.67
<i>Vallonia pulchella</i>	2	22.22	4	0.44
<i>Discus catskillensis</i>	1	11.11	18	2.00
<i>Succinea ovalis</i>	1	11.11	14	1.56
<i>Zoogenetes harpa</i>	1	11.11	10	1.11
<i>Vertigo cristata</i>	1	11.11	8	0.89
<i>Cochlicopa lubrica</i>	1	11.11	5	0.56
<i>Nesovitrea binneyana</i>	1	11.11	4	0.44
<i>Pupilla muscorum</i>	1	11.11	4	0.44
<i>Punctum</i> n.sp.	1	11.11	3	0.33
<i>Deroceras</i> sp.	1	11.11	1	0.11
<i>Gastrocopta pentodon</i>	1	11.11	1	0.11
<i>Helicodiscus parallelus</i>	1	11.11	1	0.11
<i>Vertigo elatior</i>	1	11.11	1	0.11
<i>Zonitoides arboreus</i>	1	11.11	1	0.11

B. Fen. (3 sites). Peatland areas with high base-status are quite rare in the region, requiring a significant base-rich water source to keep forest cover from encroaching. These sites are largely covered by various sedges and *Scirpus caespitosus*, and support populations of many calciphile plants such as *Parnassia glauca*, *Lobelia kalmii*, and *Potentialla fruticosa*. Bryophytes tend to be limited to brown mosses such as *Campylium* and *Deapanocladus*. Perhaps the most unique microsite associated with this habitat is the marl flat found at the Woodland Fen. Such highly calcareous sites were common in New England for about a millennium following deglaciation,

before leaching removed bases from the exposed tills. 28 species were located on these sites, with the average number of individuals being 1343. *Carychium exiguum*, *Strobilops labyrinthica*, *Gastrocopta tappaniana*, *Striatura milium*, *Euconulus alderi*, *Vertigo elatior*, *Punctum minutissimum*, *Nesovitrea electrina*, *Vertigo cristata*, *Punctum n.sp.*, *Vertigo nylanderi*, *Columella simplex*, and *Euconulus fulvus* were observed on all sites. The most abundant species were *Carychium exiguum* (360 individuals/site), *Strobilops labyrinthica* (183.67), *Gastrocopta tappaniana* (148), *Planogyra asteriscus* (100.33), *Striatura milium* (81.33), *Euconulus alderi* (72.33), *Vertigo elatior* (64.33), *Punctum minutissimum* (57), *Nesovitrea electrina* (41), *Vertigo morsei* (38.33), and *Striatura exigua* (38).

Species	Occurrences	Frequency	Individuals	#/Site
<i>Carychium exiguum</i>	3	100.00	1080	360.00
<i>Strobilops labyrinthica</i>	3	100.00	551	183.67
<i>Gastrocopta tappaniana</i>	3	100.00	444	148.00
<i>Striatura milium</i>	3	100.00	244	81.33
<i>Euconulus alderi</i>	3	100.00	217	72.33
<i>Vertigo elatior</i>	3	100.00	193	64.33
<i>Punctum minutissimum</i>	3	100.00	171	57.00
<i>Nesovitrea electrina</i>	3	100.00	123	41.00
<i>Vertigo cristata</i>	3	100.00	74	24.67
<i>Punctum n.sp.</i>	3	100.00	69	23.00
<i>Vertigo nylanderi</i>	3	100.00	38	12.67
<i>Columella simplex</i>	3	100.00	19	6.33
<i>Euconulus fulvus</i>	3	100.00	18	6.00
<i>Planogyra asteriscus</i>	2	66.67	301	100.33
<i>Striatura exigua</i>	2	66.67	114	38.00
<i>Vertigo morsei</i>	1	33.33	115	38.33
<i>Vertigo ventricosa</i>	1	33.33	100	33.33
<i>Carychium exile</i>	1	33.33	60	20.00
<i>Vertigo ovata</i>	1	33.33	21	7.00
<i>Vertigo bollesiana</i>	1	33.33	20	6.67
<i>Catinella avara</i>	1	33.33	18	6.00
<i>Helicodiscus shimeki</i>	1	33.33	12	4.00
<i>Nesovitrea binneyana</i>	1	33.33	12	4.00
<i>Discus catskillensis</i>	1	33.33	8	2.67
<i>Helicodiscus parallelus</i>	1	33.33	3	1.00
<i>Zonitoides arboreus</i>	1	33.33	2	0.67
<i>Deroceras sp.</i>	1	33.33	1	0.33
<i>Striatura ferrea</i>	1	33.33	1	0.33

C. Acid Bog (5 sites). Acid peatlands dominated by various heaths, *Myrica*, and *Sphagnum* are the most common peatland habitats in the region. Sites have developed not only along the margins of ponds and streams, but also blanket upland areas near the coast. Although long considered to not contribute greatly to regional snail diversity due to their highly acid conditions and low Calcium levels, such sites do harbor a distinctive and important snail community. 20 species were observed across all sites, with 50 individuals being encountered per sample. The most frequent taxa were

Vertigo cristata, *Striatura milium*, *Nesovitrea electrina*, and *Euconulus fulvus*. The most abundant species were *Striatura milium* (9.2 individuals/site), *Nesovitrea electrina* (6), *Vertigo cristata* (4.6), *Euconulus alderi* (4), *Vertigo ovata* (4), *Zonitoides nitidus* (3.6), *Gastrocopta tappaniana* (3.2), *Vertigo perryi* (3.2), *Carychium exiguum* (3). While south of Portland these habitats support populations of the newly described obligate acidophile *Vertigo malleta*, it appears as if this species is not able to survive the winter temperatures of the survey region, and is absent from the area.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Vertigo cristata</i>	4	80.00	23	4.60
<i>Striatura milium</i>	3	60.00	46	9.20
<i>Nesovitrea electrina</i>	3	60.00	30	6.00
<i>Euconulus fulvus</i>	3	60.00	4	0.80
<i>Euconulus alderi</i>	2	40.00	20	4.00
<i>Gastrocopta tappaniana</i>	2	40.00	16	3.20
<i>Carychium exiguum</i>	2	40.00	15	3.00
<i>Striatura exigua</i>	2	40.00	7	1.40
<i>Striatura ferrea</i>	2	40.00	6	1.20
<i>Vertigo ventricosa</i>	2	40.00	6	1.20
<i>Discus catskillensis</i>	2	40.00	5	1.00
<i>Nesovitrea binneyana</i>	2	40.00	3	0.60
<i>Planogyra asteriscus</i>	2	40.00	2	0.40
<i>Vertigo ovata</i>	1	20.00	20	4.00
<i>Zonitoides nitidus</i>	1	20.00	18	3.60
<i>Vertigo perryi</i>	1	20.00	16	3.20
<i>Punctum n.sp.</i>	1	20.00	8	1.60
<i>Vallonia pulchella</i>	1	20.00	2	0.40
<i>Columella simplex</i>	1	20.00	1	0.20
<i>Vertigo pygmaea</i>	1	20.00	1	0.20

Community Composition Gradients: MDS of the 101 sample sites along a single dimension of variation demonstrated that a minimum stress configuration of 0.343459 was achieved from all 10 random starting configurations. Procrustes analysis showed that these solutions fell into only a single unique group. MDS along two dimensions of variation demonstrated that a minimum stress configuration of 0.221184 was achieved from all 10 random starting configurations. Procrustes analysis showed that these solutions fell into only a single group. MDS along three dimensions of variation demonstrated that a minimum stress configuration of 0.168363 was achieved from 3 of the 10 random starting configurations. Procrustes analysis showed that these minimum stress solutions fell into 3 unique groups. MDS along four dimensions of variation demonstrated that a minimum stress configuration of 0.137719 was achieved from 8 of the 10 random starting configurations. Procrustes analysis showed that these minimum stress solutions fell into 8 unique groups. Based on these results, the modal configuration from the two-dimensional MDS was chosen as the most stable for land snail community composition trends (Figure 8), as it was the lowest stress solution to be achieved in at least 50% of runs.

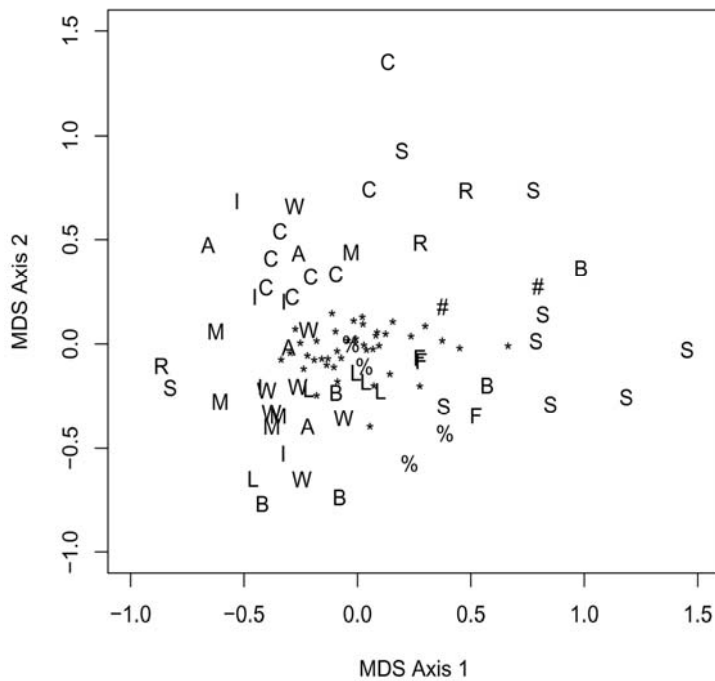


Figure 8: MDS Ordination of all 101 sites. C = Carbonate Cliff; I = Igneous Cliff; M = Sugar Maple Upland; W = White Spruce Upland; A = Aspen Upland; R = Rocky Upland; L = Tamarack Lowland; * = White Cedar Lowland; % = Red Maple Lowland; # = Shrub Carr; S = Sedge Meadow; F = Rich Fen; B = Acid Bog

This analysis helps confirm the presence of two strong axes of compositional change in the land snail communities of the region, each representing approximately 100% turnover. By observing the location of the various habitat types in ordination space, it is possible to suggest the important environmental drivers underlying these changes. The first axis appears to be most strongly associated with moisture levels, with more xeric habitats (Sugar Maple, Aspen, White Spruce and Bedrock Outcrop) being positioned along the left side of the diagram, with the wettest habitats (Sedge Meadow, Acid Bog, Fen, Shrub Carr) being positioned to the right. The second axis is somewhat more complex, appearing related to both habitat base status and level of anthropogenic disturbance. Acid and base-poor sites (Acid Bog, White Spruce upland, Red Maple wetland, Sedge Meadow) tend to be found along the bottom of the diagram, while base-rich (Carbonate Cliff, some Igneous Cliff, Rocky Woodland), and disturbed sites (roadside verges, the disturbed limestone cliff in downtown Caribou) tend to be found in the top.

Compositional turnover patterns within this diagram are shown by calculation of modal species frequencies and abundances within each of the nine compositional regions. **Ordination Region 1,**

in the upper left corner, represents base-rich dry habitats, particularly carbonate outcrop sites. A total of 11 sites were found in this region. The ten most frequent species were *Punctum minutissimum*, *Vertigo cristata* (100% of sites), *Vertigo bollesiana*, *Euconulus fulvus* (90.91%), *Strobilops labyrinthica*, *Discus catskillensis*, *Columella simplex* (81.82%), *Vertigo gouldi*, *Striatura milium*, and *Striatura exigua* (72.73%). Species reaching their modal abundances in this region include *Anguispira alternata*, *Euchemotrema fraternum*, *Gastrocopta contracta*, *Neohelix albolabris*, *Vertigo bollesiana*, and *Vertigo ronneyensis*.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Punctum minutissimum</i>	11	100.00	925	84.09
<i>Vertigo cristata</i>	11	100.00	258	23.45
<i>Vertigo bollesiana</i>	10	90.91	255	23.18
<i>Euconulus fulvus</i>	10	90.91	179	16.27
<i>Strobilops labyrinthica</i>	9	81.82	950	86.36
<i>Discus catskillensis</i>	9	81.82	292	26.55
<i>Columella simplex</i>	9	81.82	52	4.73
<i>Vertigo gouldi</i>	8	72.73	151	13.73
<i>Striatura milium</i>	8	72.73	112	10.18
<i>Striatura exigua</i>	8	72.73	90	8.18

Ordination Region 2, in the upper middle of the diagram, represents base-rich and/or disturbed sites of intermediate moisture levels. A total of 5 sites occur in this region. The ten most frequent species are *Strobilops labyrinthica* (100% of sites), *Vertigo paradoxa*, *Deroceras* sp. (80%), *Punctum minutissimum*, *Discus catskillensis*, *Vertigo gouldi*, *Vertigo cristata*, *Cochlicopa lubrica*, *Striatura milium*, and *Nesovitrea electrina*. Species reaching their modal abundance in this region include *Cochlicopa lubricella*, *Deroceras* sp., *Oxychylus cellarius*, *Pupilla muscorum*, *Trichia hispida*, *Vallonia costata*, *Vallonia excentrica*, *Vertigo gouldi*, *Vertigo paradoxa*, and *Zoogenetes harpa*.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Strobilops labyrinthica</i>	5	100.00	290	58.00
<i>Vertigo paradoxa</i>	4	80.00	297	59.40
<i>Deroceras</i> sp.	4	80.00	8	1.60
<i>Punctum minutissimum</i>	3	60.00	679	135.80
<i>Discus catskillensis</i>	3	60.00	101	20.20
<i>Vertigo gouldi</i>	3	60.00	93	18.60
<i>Vertigo cristata</i>	3	60.00	78	15.60
<i>Cochlicopa lubrica</i>	3	60.00	71	14.20
<i>Striatura milium</i>	3	60.00	37	7.40
<i>Nesovitrea electrina</i>	3	60.00	34	6.80

Ordination Region 3, in the upper right of the diagram, represents base-rich and/or disturbed sites with high moisture levels. A total of 6 sites occur in this region, which generally represent rich sedge meadows, shrub carr, and roadside verges. The ten most frequent taxa were *Nesovitrea electrina*, *Discus catskillensis*, *Vallonia pulchella* (83% of sites), *Carychium exiguum*, *Cochlicopa lubrica*, *Gastrocopta tappaniana*, *Punctum minutissimum*, *Zonitoides nitidus*, *Striatura milium*

(67%) and *Succinea ovalis* (50%). Species reaching their modal abundance in this region include *Cochlicopa lubrica*, *Helicodiscus parallelus*, *Vallonia pulchella*, *Vertigo pygmaea*, *Vitrina limpida*, and *Zonitoides nitidus*.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Nesovitrea electrina</i>	5	83.33	207	34.50
<i>Discus catskillensis</i>	5	83.33	43	7.17
<i>Vallonia pulchella</i>	5	83.33	32	5.33
<i>Carychium exiguum</i>	4	66.67	1345	224.17
<i>Cochlicopa lubrica</i>	4	66.67	316	52.67
<i>Gastrocopta tappaniana</i>	4	66.67	195	32.50
<i>Punctum minutissimum</i>	4	66.67	136	22.67
<i>Zonitoides nitidus</i>	4	66.67	36	6.00
<i>Striatura milium</i>	4	66.67	25	4.17
<i>Succinea ovalis</i>	3	50.00	94	15.67

Ordination Region 4, in the middle left of the diagram, tend represent dry upland sites of intermediate base status such as Sugar Maple, White Spruce, and Aspen forests. A total of 10 sites occur within this region. The ten most frequent taxa are *Punctum minutissimum*, *Strobilops labyrinthica*, *Striatura milium*, *Euconulus fulvus* (100% of sites), *Planogyra asteriscus*, *Striatura exigua*, *Vertigo cristata*, *Striatura ferrea*, *Nesovitrea binneyana*, and *Columella simplex* (90%). Species which reached their modal abundance in this region include *Euconulus polygyratus*, *Gastrocopta pentodon*, *Glyphyalinia rhoadsi*, and *Striatura ferrea*.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Punctum minutissimum</i>	10	100.00	1228	122.80
<i>Strobilops labyrinthica</i>	10	100.00	1215	121.50
<i>Striatura milium</i>	10	100.00	484	48.40
<i>Euconulus fulvus</i>	10	100.00	137	13.70
<i>Planogyra asteriscus</i>	9	90.00	1508	150.80
<i>Striatura exigua</i>	9	90.00	750	75.00
<i>Vertigo cristata</i>	9	90.00	229	22.90
<i>Striatura ferrea</i>	9	90.00	221	22.10
<i>Nesovitrea binneyana</i>	9	90.00	167	16.70
<i>Columella simplex</i>	9	90.00	52	5.20

Ordination Region 5 occurs in the center of the ordination diagram, and largely represents sites of both moderate moisture level and base status. 28 sites occur in this region, many representing White Cedar wetlands. The ten most frequent species are *Planogyra asteriscus*, *Punctum minutissimum*, *Striatura exigua*, *Euconulus fulvus*, *Vertigo cristata*, *Nesovitrea electrina* (100% of sites), *Striatura milium*, *Columella simplex* (96%), *Strobilops labyrinthica* (93%), and *Carychium exiguum* (82%). Species which reach their modal abundance in this region include *Carychium exile*, *Columella simplex*, *Discus catskillensis*, *Euconulus fulvus*, *Helicodiscus shimaki*, *Nesovitrea binneyana*, *Nesovitrea electrina*, *Planogyra asteriscus*, *Punctum minutissimum*, *Striatura exigua*, *Striatura milium*, *Strobilops labyrinthica*, *Vertigo cristata*, *Vertigo nylanderi*, and *Zonitoides arboreus*.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Planogyra asteriscus</i>	28	100.00	5920	211.43
<i>Punctum minutissimum</i>	28	100.00	4107	146.68
<i>Striatura exigua</i>	28	100.00	2893	103.32
<i>Euconulus fulvus</i>	28	100.00	907	32.39
<i>Vertigo cristata</i>	28	100.00	830	29.64
<i>Nesovitrea electrina</i>	28	100.00	781	27.89
<i>Striatura milium</i>	27	96.43	1070	38.21
<i>Columella simplex</i>	27	96.43	209	7.46
<i>Strobilops labyrinthica</i>	26	92.86	3745	133.75
<i>Carychium exiguum</i>	23	82.14	1048	37.43

Ordination Region 6 occurs in the middle right of the ordination diagram, and largely represents sites of moderate base-status but high moisture level. Sites are generally sedge meadows, acid bogs and fens. 10 sites occur in this region. The most frequent species are *Nesovitrea electrina* (90% of sites), *Carychium exiguum*, *Punctum minutissimum*, *Euconulus alderi*, *Striatura exigua* (80%), *Gastrocopta tappaniana*, *Punctum* n.sp., *Euconulus fulvus* (70%), *Strobilops labyrinthica*, and *Vertigo ventricosa* (60%). Species which reach their modal abundance in this region include *Carychium exiguum*, *Catinella avara*, *Euconulus alderi*, *Gastrocopta tappaniana*, *Punctum* n.sp., *Succinea ovalis*, *Vertigo elatior*, *Vertigo morsei*, *Vertigo ovata*, *Vertigo perryi*, and *Vertigo ventricosa*.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Nesovitrea electrina</i>	9	90.00	266	26.60
<i>Carychium exiguum</i>	8	80.00	1687	168.70
<i>Punctum minutissimum</i>	8	80.00	595	59.50
<i>Euconulus alderi</i>	8	80.00	355	35.50
<i>Striatura exigua</i>	8	80.00	307	30.70
<i>Gastrocopta tappaniana</i>	7	70.00	363	36.30
<i>Punctum</i> n.sp.	7	70.00	169	16.90
<i>Euconulus fulvus</i>	7	70.00	48	4.80
<i>Strobilops labyrinthica</i>	6	60.00	535	53.50
<i>Vertigo ventricosa</i>	6	60.00	437	43.70

Ordination Region 7 occurs in the lower-left of the ordination diagram, and largely represents dry, base-poor, acidic sites such as upland spruce, maple, and aspen forests. A total of 14 sites occur in this region. The ten most frequent species are *Striatura exigua*, *Striatura milium*, *Vertigo cristata* (86% of sites), *Striatura ferrea* (79%), *Strobilops labyrinthica* (64%), *Nesovitrea binneyana* (57%), *Punctum minutissimum*, *Helicodiscus shimaki*, *Columella simplex* (50%), and *Planogyra asteriscus* (43%). No species reached their modal abundance in this region.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Striatura exigua</i>	12	85.71	458	32.71

<i>Striatura milium</i>	12	85.71	380	27.14
<i>Vertigo cristata</i>	12	85.71	377	26.93
<i>Striatura ferrea</i>	11	78.57	83	5.93
<i>Strobilops labyrinthica</i>	9	64.29	51	3.64
<i>Nesovitrea binneyana</i>	8	57.14	61	4.36
<i>Punctum minutissimum</i>	7	50.00	166	11.86
<i>Helicodiscus shimiki</i>	7	50.00	50	3.57
<i>Columella simplex</i>	7	50.00	21	1.50
<i>Planogyra asteriscus</i>	6	42.86	155	11.07

Ordination Region 8 occurs in the bottom-center of the ordination diagram, and largely represents mesic, base-poor sites such as tamarack wetlands, red maple wetlands, and dry heath patches in acid bogs. A total of 9 sites occur in this region. The ten most frequent species are *Vertigo cristata* (100% of sites), *Striatura exigua*, *Striatura milium*, *Nesovitrea electrina*, *Euconulus fulvus* (89%), *Punctum minutissimum*, *Columella simplex* (78%), *Gastrocopta tappaniana* (67%), and *Strobilops labyrinthica* (56%). *Discus cronkhitei* reached its modal abundance within this region.

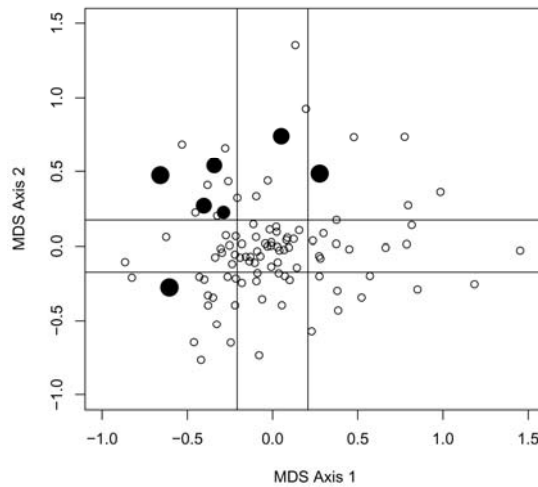
Species	Occurrences	Frequency	Individuals	#/Site
<i>Vertigo cristata</i>	9	100.00	148	16.44
<i>Striatura exigua</i>	8	88.89	604	67.11
<i>Striatura milium</i>	8	88.89	529	58.78
<i>Nesovitrea electrina</i>	8	88.89	216	24.00
<i>Euconulus fulvus</i>	8	88.89	57	6.33
<i>Punctum minutissimum</i>	7	77.78	111	12.33
<i>Columella simplex</i>	7	77.78	45	5.00
<i>Gastrocopta tappaniana</i>	6	66.67	101	11.22
<i>Strobilops labyrinthica</i>	5	55.56	513	57.00

Ordination Region 9 is found in the lower-right of the ordination diagram, and largely represents wet, acid sites such as sedge meadows and acid bogs. 8 sites occur in this region. The ten most frequent species are *Euconulus alderi* (100% of sites), *Nesovitrea electrina* (88%), *Striatura milium*, *Striatura exigua* (75%), *Vertigo ventricosa*, *Gastrocopta tappaniana*, *Vertigo ovata*, *Vertigo cristata*, *Punctum minutissimum* and *Euconulus fulvus* (63%). *Oxyloma retusa* reached its modal abundance within this region.

Species	Occurrences	Frequency	Individuals	#/Site
<i>Euconulus alderi</i>	8	100.00	133	16.63
<i>Nesovitrea electrina</i>	7	87.50	113	14.13
<i>Striatura milium</i>	6	75.00	373	46.63
<i>Striatura exigua</i>	6	75.00	106	13.25
<i>Vertigo ventricosa</i>	5	62.50	336	42.00
<i>Gastrocopta tappaniana</i>	5	62.50	281	35.13
<i>Vertigo ovata</i>	5	62.50	172	21.50
<i>Vertigo cristata</i>	5	62.50	75	9.38
<i>Punctum minutissimum</i>	5	62.50	61	7.63
<i>Euconulus fulvus</i>	5	62.50	42	5.25

Annotated Checklist and Description of Fauna: Following is an alphabetical list of all land snail species encountered during survey work in the region. Two figures are shown to help describe the biogeographic and ecological ranges for each species in the region. The Maine map shows the locations for all observed populations as a dark circle. Open circles represent the locations of sampled sites that did not harbor that species. Sites falling outside of the study region have not been mapped. Besides county boundaries, the biophysical region boundaries are also shown. The graph to the right shows the distribution of that species within the ordination diagram. Again, dark circles indicate sites of occurrence, while open circles represent sites that lacked that species. The size of the filled circle has been adjusted to indicate the relative abundance of that species within a given site, with larger circles representing sites whose faunas supported greater proportions of that species. The location of the nine ordination regions have also been shown to help interpret ecological preferences.

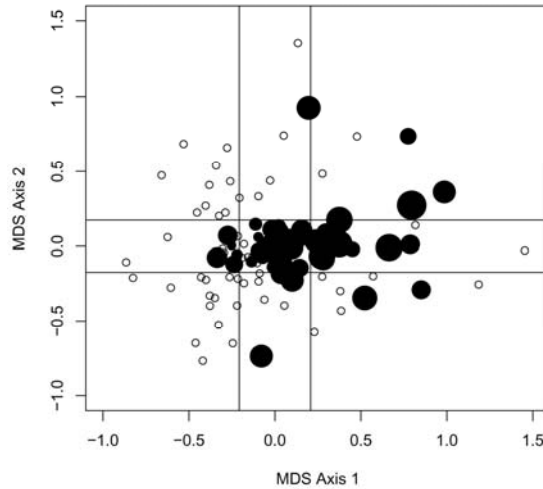
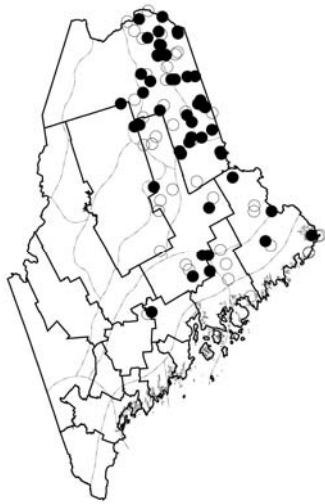
1. *Anguispira alternata* (Say, 1817)



This is the most common large (>15mm maximum dimension) snail in the region, where it is largely limited to the Aroostook Lowlands bioregion in upland wooded habitats and rock outcrop sites. This species was never abundant, and only a few shells were normally found. However, Nylander (1936) reported that this species “is common in and under decaying logs and is a great supply of food for small rodents. I often find large heaps of shells near their nest.” It seems clear that this species has become much less common over the last 70 years.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	4	50.00	20	2.50
Rocky Forest	1	33.33	4	1.33
Aspen Forest	1	25.00	2	0.50
Sugar Maple Forest	1	20.00	1	0.20

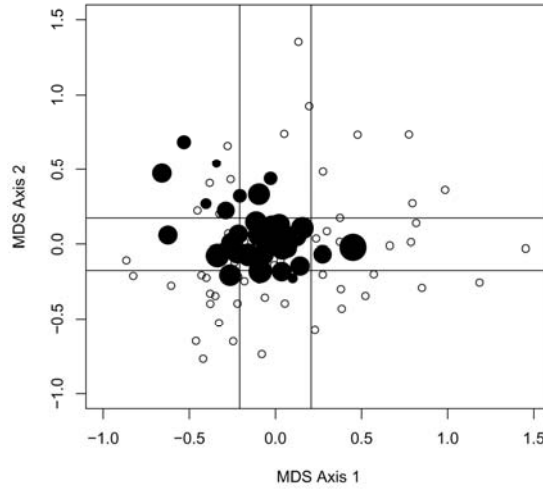
2. *Carychium exiguum* (Say, 1822)



This species is most common in the northern part of the study region where it occurs across a variety of wetland sites. While frequently found with *Carychium exile* in mesic wetlands, no evidence of introgression occurs between populations (Nekola & Barthel 2002). Nylander (1936) noted that the *Carychium* in general tended to live “in damp and moist places along springs and are found under pieces of bark and in the moss.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Fen	3	100.00	1080	360.00
Shrub Carr	2	100.00	1333	666.50
White Cedar - Ash Wetland	30	73.17	1722	42.00
Tamarack Wetland	3	60.00	152	30.40
Red Maple - Spruce Wetland	2	50.00	154	38.50
Sedge Meadow	4	44.44	16	1.78
Acid Bog	2	40.00	15	3.00

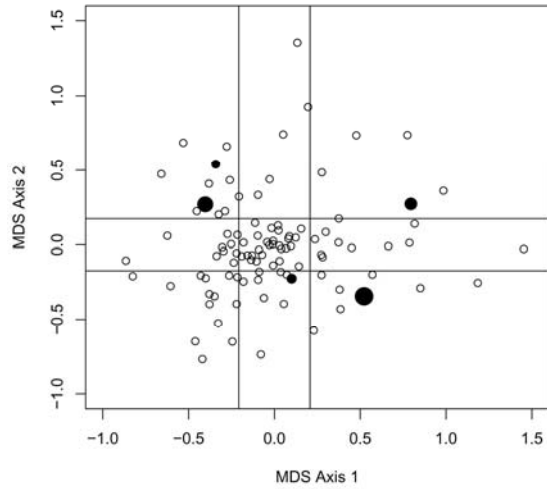
3. *Carychium exile* H.C.Lea, 1842



This species is most easily distinguished from *C. exiguum* by possessing a more narrow shell for its height and by being more striate. Morphometric analysis of populations (Nekola & Barthel 2002) demonstrates that a continual transition occurs between large and small individuals. As such, there seems little taxonomic utility in recognizing the subspecies *C. e. exile* and *C. e. canadense* Clapp, 1906. While *Carychium exile* co-occurs with *C. exiguum* in a number of mesic Northern White Cedar wetlands, it also occurs in mesic to xeric upland sites where its sibling does not occur.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	5	62.50	150	18.75
White Cedar - Ash Wetland	23	56.10	2100	51.22
Tamarack Wetland	2	40.00	54	10.80
Sugar Maple Forest	2	40.00	16	3.20
Fen	1	33.33	60	20.00
White Spruce Forest	2	28.57	26	3.71
Aspen Forest	1	25.00	3	0.75
Igneous Outcrop	1	20.00	1	0.20

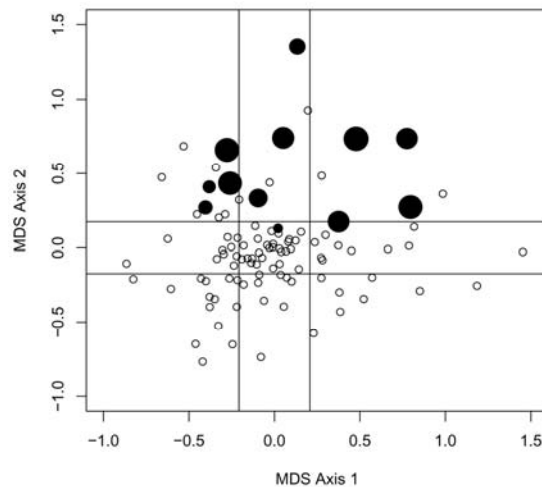
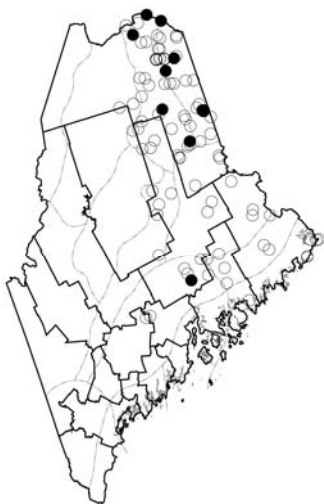
4. *Catinella avara* (Say, 1824)



This species is a rare denizen of wetland sites as well as metasedimentary outcrops. Nylander (1936) “collected it at several places along the shores of Square Lake on the Fish River.” The taxonomy of this group (as it true for most Succineads) is made difficult due to extreme plasticity in shell and anatomical morphology; however, upland rock outcrop individuals have shells that resemble to a degree *Catinella wandae* of the US Midwest.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	1	50.00	5	2.50
Fen	1	33.33	18	6.00
Metasedimentary Outcrop	2	25.00	6	0.75
Tamarack Wetland	1	20.00	1	0.20

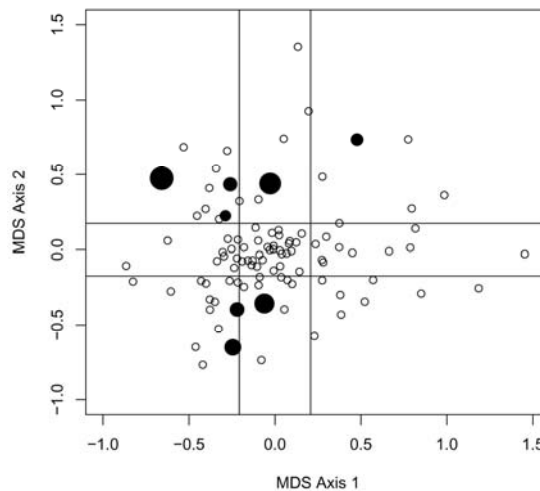
5. *Cochlicopa lubrica* (Müller, 1774)



This taxon is principally limited to the Aroostook Lowlands biophysical region where it occurs in disturbed and base-rich sites across the moisture spectrum from dry bedrock cliffs to sedge meadows and shrub carr. It is differentiated from *Cochlicopa lubricella* by having shells >2.3 mm in maximum width. Nylander (1936) reported this species to be “common under leaves and bark.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	2	100.00	257	128.50
Metasedimentary Outcrop	5	62.50	76	9.50
Rocky Forest	1	33.33	54	18.00
Aspen Forest	1	25.00	22	5.50
White Spruce Forest	1	14.29	50	7.14
Sedge Meadow	1	11.11	5	0.56
White Cedar - Ash Wetland	1	2.44	3	0.07

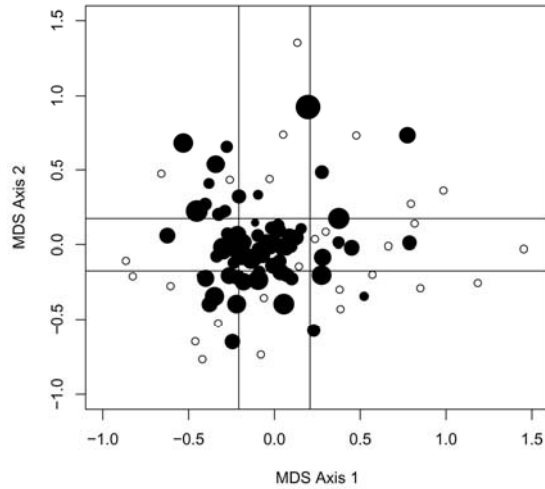
6. *Cochlicopa lubricella* (Porro, 1838)



This species is uncommonly spread across the entire study region where it appears to favor a variety of upland forest habitats. This name has been applied to those mature shells with a maximum width <2.3 mm and maximum height <6 mm (Preece 1992). Populations appearing intermediate between it and *C. lubricica* were encountered, and a morphometric analysis of this group in eastern North America is probably warranted.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Aspen Forest	3	75.00	14	3.50
Rocky Forest	1	33.33	1	0.33
White Spruce Forest	2	28.57	9	1.29
Sugar Maple Forest	1	20.00	27	5.40
Metasedimentary Outcrop	1	12.50	2	0.25

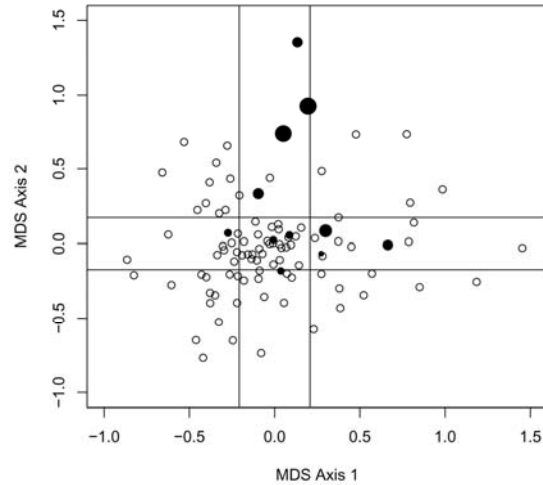
7. *Columella simplex* (Gould, 1841)



This species commonly occurs across the entire study region in all but the wettest sites. While the number of shells encountered in most litter samples is <10, this is due to the fact that it typically crawls on ferns and other vegetation up to 1 meter above the ground surface. Thus, only dead in-falling shells tend to be recovered from litter samples. Nylander (1936) reported to be found in “partly cleared forest, in some abundance.” While Coles (*personal communication*) reported the similar *Columella columella* from the cool rock talus on Horse Mountain, I was only able to locate *C. simplex* at this site. *Columella columella* is rare on tundra turf along the north shore of the St. Lawrence in Quebec, can be found in swampy taiga in central Quebec, and becomes common only in tundra and subalpine meadows in the Rockies. While possibly occurring in Maine, it seems best to not include *C. columella* from the state fauna as of this time.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Fen	3	100.00	19	6.33
White Cedar - Ash Wetland	37	90.24	286	6.98
Tamarack Wetland	4	80.00	29	5.80
Metasedimentary Outcrop	6	75.00	38	4.75
Red Maple - Spruce Wetland	3	75.00	14	3.50
White Spruce Forest	5	71.43	15	2.14
Igneous Outcrop	3	60.00	16	3.20
Sugar Maple Forest	3	60.00	9	1.80
Shrub Carr	1	50.00	48	24.00
Aspen Forest	2	50.00	11	2.75
Sedge Meadow	3	33.33	13	1.44
Rocky Forest	1	33.33	1	0.33
Acid Bog	1	20.00	1	0.20

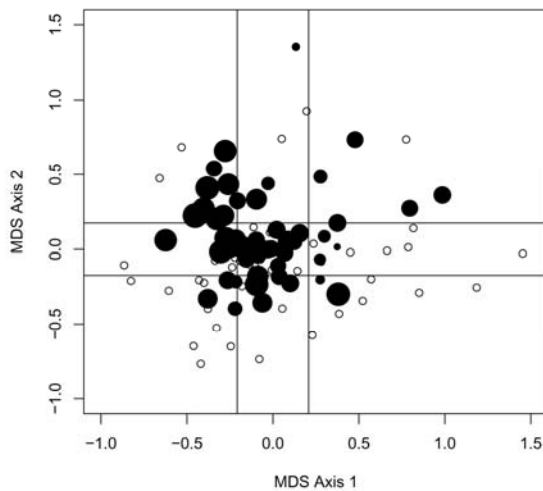
8. *Deroceras* sp.



Reported here are any internal slug plates which were recovered from litter samples. While they likely represent individuals within the genus *Deroceras*, some may also represent *Arion* species. Slug plates were largely limited to sites in the north-central part of the study region, where they were most often found in disturbed rock outcrop and various other habitats. As a group, however, multiple slug species occurs within almost all surveyed sites.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	3	37.50	7	0.88
White Cedar - Ash Wetland	5	12.20	5	0.12
Fen	1	33.33	1	0.33
Tamarack Wetland	1	20.00	1	0.20
Sedge Meadow	1	11.11	1	0.11

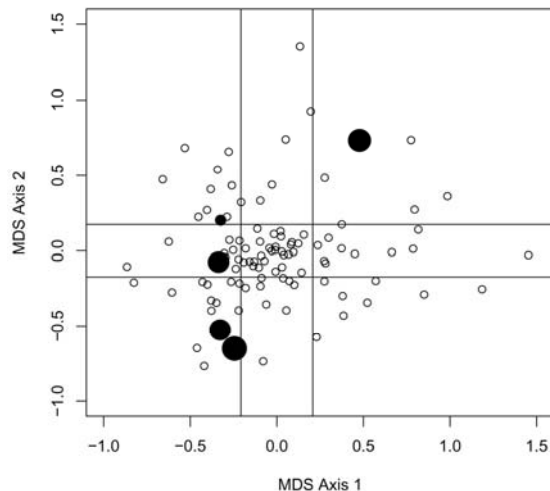
9. *Discus catskillensis* (Pilsbry, 1898)



This species is among the more common intermediate-sized species in the study region, being found over all but coastal sites across almost the entire range of habitats. The retrieval of mature adult shells was difficult from most sites, although immature shells were often common. Perhaps this species experienced pulsed reproduction during 2007. Some individuals from the north appeared intermediate with *Discus cronkhitei*. Such intermediates have also been seen in southern Ontario and Quebec, the Keweenaw Peninsula, and northern Minnesota. Nylander (1936) reported it as “the most common of land shells.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	2	100.00	36	18.00
Metasedimentary Outcrop	7	87.50	285	35.63
Aspen Forest	3	75.00	29	7.25
White Spruce Forest	5	71.43	57	8.14
Rocky Forest	2	66.67	5	1.67
Tamarack Wetland	3	60.00	35	7.00
Red Maple - Spruce Wetland	2	50.00	17	4.25
White Cedar - Ash Wetland	17	41.46	455	11.10
Igneous Outcrop	2	40.00	67	13.40
Sugar Maple Forest	2	40.00	43	8.60
Acid Bog	2	40.00	5	1.00
Fen	1	33.33	8	2.67
Sedge Meadow	1	11.11	18	2.00

10. *Discus cronkhitei* (Newcomb, 1865)

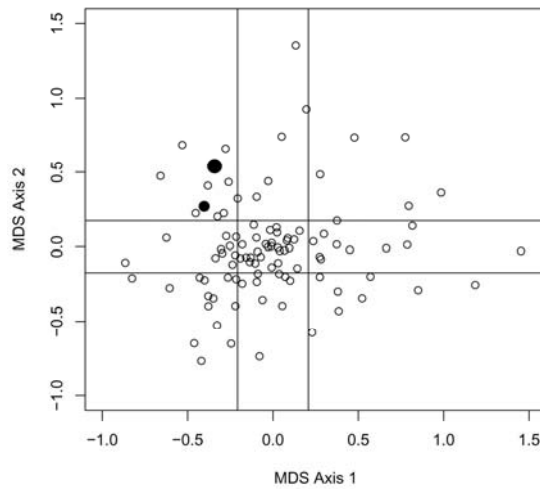


This species was rarely found in upland sites, and except for areas immediately adjacent to the coast it is far less common than preceding species. This name has been retained over *Discus whitneyi*, as it is clear that the ICZN should have allowed for the *D. cronkhitei* to be grandfathered as the epithet *cronkhitei* was in wide use for over a century, and as *D. whitneyi* was published in a rather obscure regional journal. It also seems likely that both *D. cronkhitei* and *D. catskillensis* will

be ultimately shown to be simply Western Hemisphere members of *Discus ruderatus*, which is abundant in northern Eurasian forest (Kerney & Cameron 1979).

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Igneous Outcrop	2	40.00	32	6.40
Rocky Forest	1	33.33	27	9.00
White Spruce Forest	1	14.29	39	5.57
White Cedar - Ash Wetland	1	2.44	32	0.78

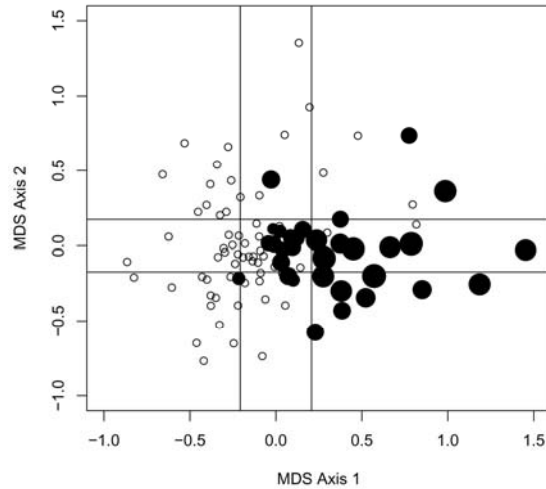
11. *Euchemotrema fraternum* (Say, 1824)



This species is currently very rare, being limited to 8 shells (all but one long dead) from two metasedimentary outcrop sites in the far northeast. However, Nylander (1936) reported it to be “common but seeming to favor high ground. I have collected it in Caribou, Woodland, on Mars Hill Mountain, and in other places.” This species has clearly experienced a significant reduction in abundance over the last 70 years.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	2	25.00	8	1.00

12. *Euconulus alderi* (Gray, 1840)



This species was first reported from North America from Iowa fens (Frest 1990). Its shells are most easily distinguished from *Euconulus fulvus* by having a shiny (rather than silky) luster to the protoconch, being darker colored, <2.8 mm in diameter, and by having spiral lines on the shell bottom that are more distinct than the transverse lines (Kerney & Cameron 1979). In the study region, this species was found away from the coast in a wide variety of base-poor wetlands. It often co-occurred with *E. fulvus* in White Cedar swamp forest.

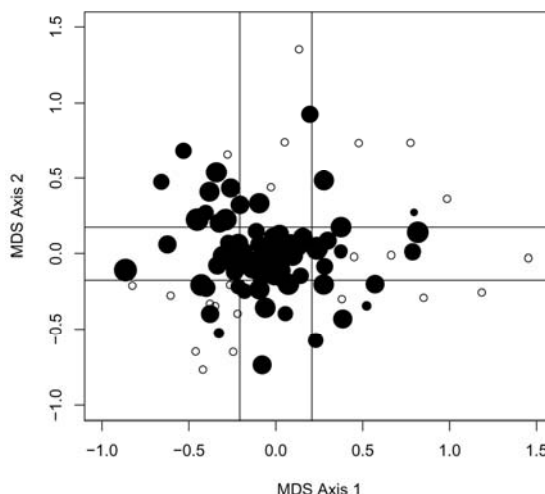
Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Fen	3	100.00	217	72.33
Red Maple - Spruce Wetland	3	75.00	29	7.25
Sedge Meadow	6	66.67	57	6.33
Shrub Carr	1	50.00	12	6.00
White Cedar - Ash Wetland	18	43.90	346	8.44
Acid Bog	2	40.00	20	4.00
Tamarack Wetland	2	40.00	4	0.80
Sugar Maple Forest	1	20.00	9	1.80

This species is currently listed by Natureserve as G3Q, however it is found at a similar frequency across most of northeastern and western North America. Following is a list of all observed sites in the study region, in order of abundance:

Woodland Fen	112	Crystal Bog 2	26
Salmon Brook 6	79	Salmon Brook 4	24
Marble Pond	54	North Brook #3 Road	21
Johnson Brook West	54	Anderson Brook	21
Hersom Road	52	Twentyfive Mile Stream	17
Wesley School	37	Aikens Brook Road	13
Portage Lake	33	Keegan NW	12

Carlisle Pond	12	Grendell Cemetery	6
Orient Wayside	12	Musquash Stream	5
Schooner Brook	11	Caribou Bog South	4
Bourgoin Brook	10	Harvey	4
Chapman	10	NW Princeton	4
Crystal 2	9	Crystal Bog 1	3
Dolby Pond	9	South Crooked Brook	3
Byron Mountain	9	Atkinson Mills	1
Collins Siding	9	McIntyre Road	1
Fogelin Pond	8	Higgins Brook	1
Bridgewater SW	7	Orient	1

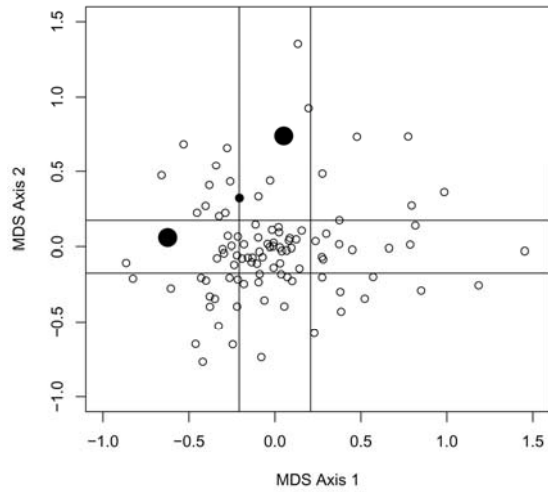
13. *Euconulus fulvus* (Müller, 1774)



This species is common throughout the entire study region where it occurs in all habitat types. Nylander (1936) reported it “found all over Aroostook County.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Red Maple - Spruce Wetland	4	100.00	47	11.75
Igneous Outcrop	5	100.00	48	9.60
Shrub Carr	2	100.00	38	19.00
Fen	3	100.00	18	6.00
White Cedar - Ash Wetland	39	95.12	1045	25.49
Metasedimentary Outcrop	6	75.00	225	28.13
Aspen Forest	3	75.00	12	3.00
Rocky Forest	2	66.67	9	3.00
Tamarack Wetland	3	60.00	27	5.40
Acid Bog	3	60.00	4	0.80
White Spruce Forest	3	42.86	23	3.29
Sugar Maple Forest	2	40.00	14	2.80
Sedge Meadow	3	33.33	15	1.67

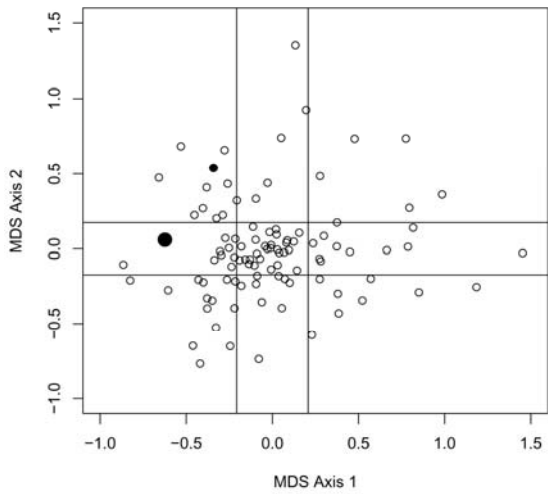
14. *Euconulus polygratus* (Pilsbry, 1899)



This is the rarest *Euconulus* in the study region, being limited to only 3 dry and base-rich metasedimentary outcrop and upland Sugar Maple forest sites in the east-central. Its shells are most easily distinguished from *Euconulus fulvus* by their slower rate of whorl width increase, and by having a frosted protoconch with indistinct transverse lines. Nylander (1936) “found a few specimens of this species.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	2	25.00	3	0.38
Sugar Maple Forest	1	20.00	13	2.60

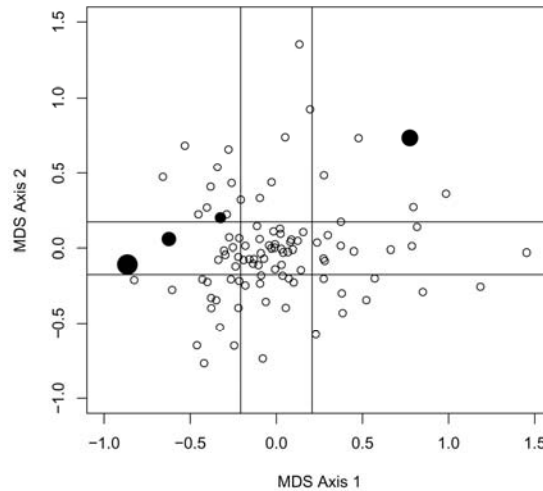
15. *Gastrocopta contracta* (Say, 1822)



The two populations found in xeric upland forest and rock outcrop sites in the region represent the northeastern-known range limits for this species. The closest sites reported by Hubricht (1985) are in eastern New York State although I have found this species in western Vermont.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Sugar Maple Forest	1	20.00	3	0.60
Metasedimentary Outcrop	1	12.50	1	0.13

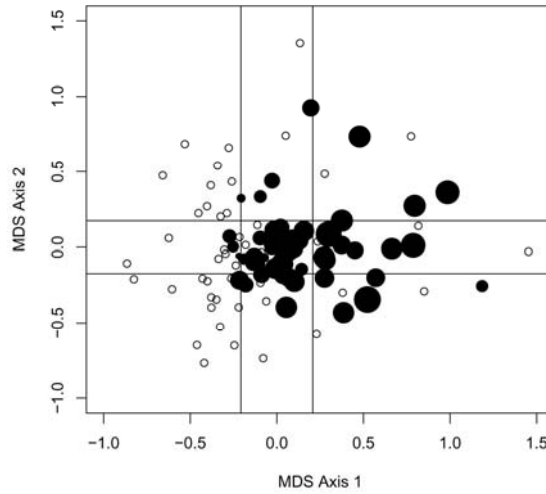
16. *Gastrocopta pentodon* (Say, 1821)



This species was rarely present in the western and central parts of the study region, where it generally occurred in xeric oak, maple, beech, and hemlock woodland. It also occurred in a single sedge meadow where it likely was a stray from the adjacent uplands. Like the preceding, these sites represent the known northeastern range limit, with the nearest reported sites in Hubricht (1985) being in southwestern Vermont. I have also seen this species in western Maine, Vermont, and eastern Massachusetts. As shown by Pearce *et al.* (2007), this taxon is clearly specifically distinct from *Gastrocopta tappaniana*.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Rocky Forest	1	33.33	1	0.33
Sugar Maple Forest	1	20.00	3	0.60
Igneous Outcrop	1	20.00	1	0.20
Sedge Meadow	1	11.11	1	0.11

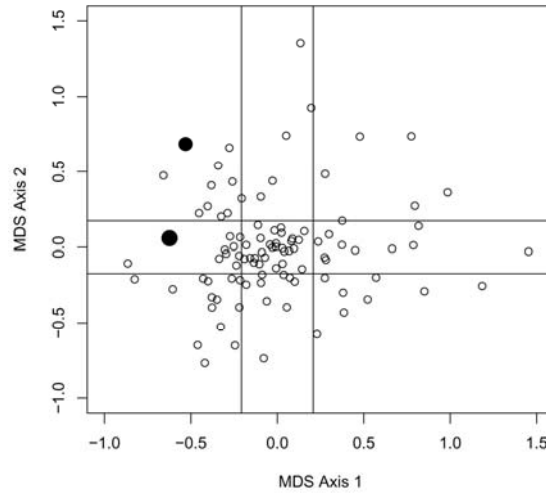
17. *Gastrocopta tappaniana* (C.B. Adams, 1842)



This species is common throughout the study region in a variety of wetland habitats. This species differs from *G. pentodon* by being much wider at a given shell height. No intermediates between these two taxa were noted.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Fen	3	100.00	444	148.00
Shrub Carr	2	100.00	161	80.50
White Cedar - Ash Wetland	33	80.49	777	18.95
Tamarack Wetland	4	80.00	89	17.80
Red Maple - Spruce Wetland	3	75.00	93	23.25
Acid Bog	2	40.00	16	3.20
Sedge Meadow	3	33.33	25	2.78
Rocky Forest	1	33.33	20	6.67
Metasedimentary Outcrop	2	25.00	8	1.00
Sugar Maple Forest	1	20.00	4	0.80

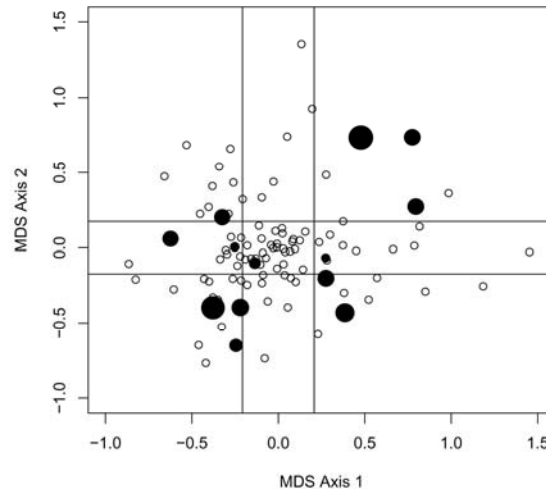
18. *Glyphyalinia rhoadsi* (Pilsbry, 1899)



This species was limited to xeric upland forests and bedrock outcrops in the central part of the study region. These stations represent the known northeastern limit of its range. The closest sites reported by Hubricht (1985) are in Oxford County, Maine.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Sugar Maple Forest	1	20.00	5	1.00
Igneous Outcrop	1	20.00	1	0.20

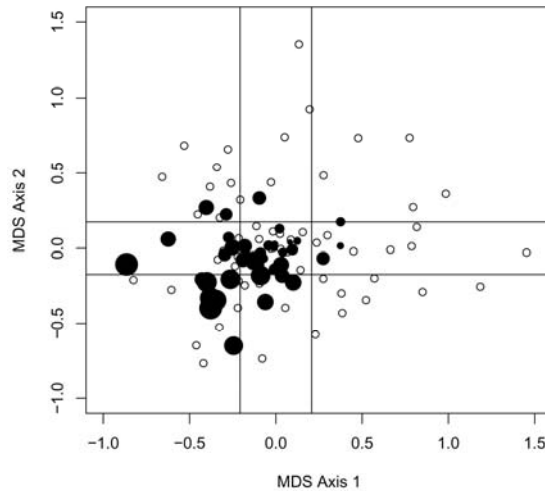
19. *Helicodiscus parallelus* (Say, 1817)



This species is found across a wide array of sites, from xeric upland forest to sedge meadows. It typically occurs in sites both warmer and drier than the related *Helicodiscus shimeki*. It differs from that species by having a wider body whorl (>1 mm as measured from the bottom), a relatively deeper and narrower umbilicus, and stronger radial threads on the protoconch surface.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	1	50.00	18	9.00
Sugar Maple Forest	2	40.00	27	5.40
Rocky Forest	1	33.33	45	15.00
Fen	1	33.33	3	1.00
Red Maple - Spruce Wetland	1	25.00	6	1.50
Aspen Forest	1	25.00	5	1.25
Igneous Outcrop	1	20.00	5	1.00
White Spruce Forest	1	14.29	1	0.14
Sedge Meadow	1	11.11	1	0.11
White Cedar - Ash Wetland	3	7.32	16	0.39

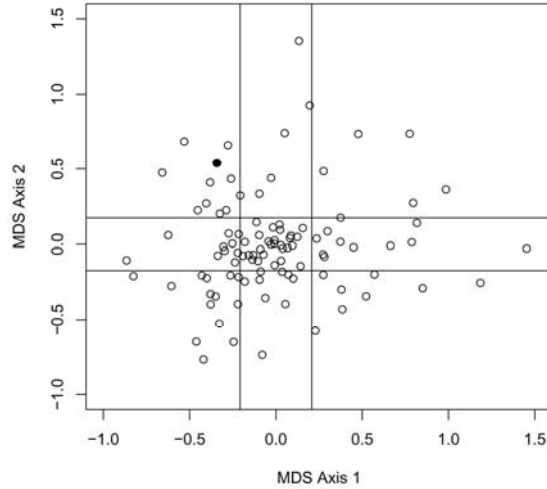
20. *Helicodiscus shimeki* Hubricht, 1962



This species is most common in the study region in dry to mesic acid sites and is scattered throughout the area. Like Nylander (1936) I found that this and the preceding species to be “seldom found more than one or two specimens at a time.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
White Spruce Forest	5	71.43	29	4.14
Sugar Maple Forest	3	60.00	25	5.00
Tamarack Wetland	3	60.00	19	3.80
White Cedar - Ash Wetland	21	51.22	79	1.93
Shrub Carr	1	50.00	1	0.50
Metasedimentary Outcrop	3	37.50	16	2.00
Fen	1	33.33	12	4.00
Rocky Forest	1	33.33	2	0.67
Red Maple - Spruce Wetland	1	25.00	11	2.75
Igneous Outcrop	1	20.00	2	0.40

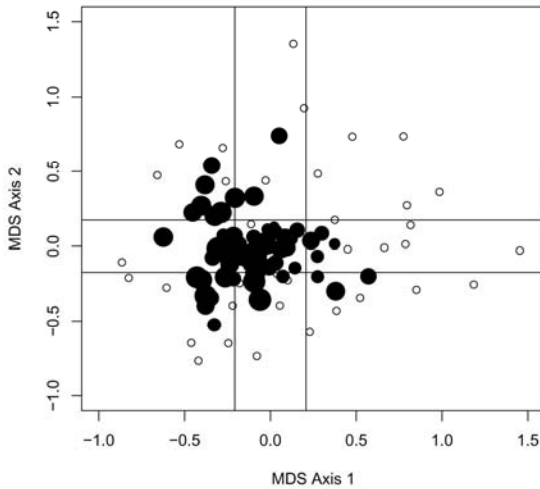
21. *Neohelix albolabris* (Say, 1816)



Only a single, long-dead shell of this species was located from a limestone talus slope along the Aroostook River east of Caribou. However, Nylander (1936) reported that while “nowhere abundant” it was found “on the hills of mixed forest, mostly hardwood.” It seems clear that this species has also precipitously decreased in abundance over the last 70 years in the region.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	1	12.50	1	0.13

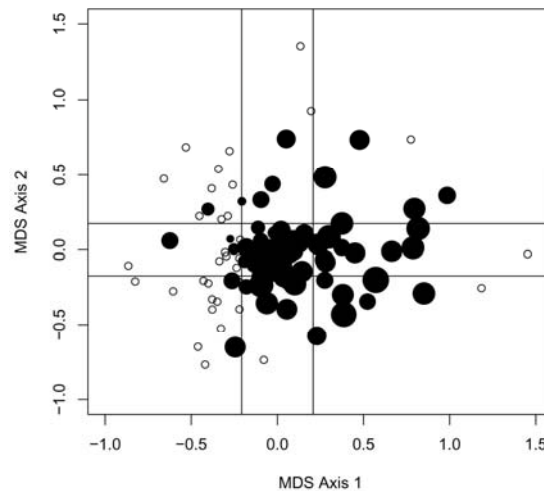
22. *Nesovitrea binneyana* (Morse, 1864)



This species is found throughout the region across a wide range of upland and mesic forests. It differs from the similar *N. electrina* by possessing a clear-white shell. Nylander (1936) reported this species to be “found sparingly along the Caribou Stream.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	7	87.50	202	25.25
White Cedar - Ash Wetland	35	85.37	505	12.32
Igneous Outcrop	4	80.00	48	9.60
White Spruce Forest	5	71.43	54	7.71
Sugar Maple Forest	3	60.00	21	4.20
Red Maple - Spruce Wetland	2	50.00	15	3.75
Tamarack Wetland	2	40.00	7	1.40
Acid Bog	2	40.00	3	0.60
Fen	1	33.33	12	4.00
Aspen Forest	1	25.00	17	4.25
Sedge Meadow	1	11.11	4	0.44

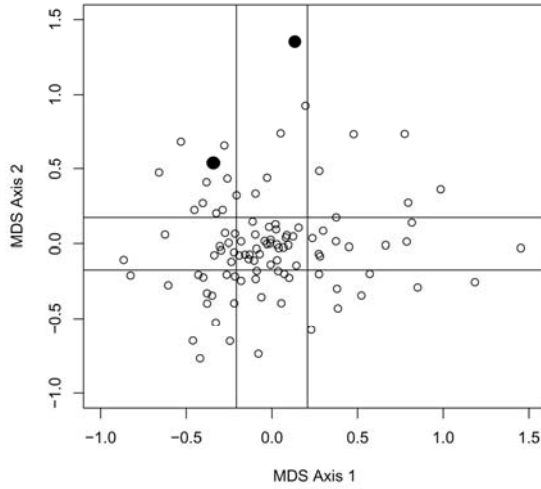
23. *Nesovitrea electrina* (Gould, 1841)



This species is also found throughout the region and represents the wet-mesic counterpart of *N. binneyana*. This species possesses a brown-honey shell, and the two taxa often co-occur in White Cedar wetlands. Nylander (1936) reported this species to be “found in many places in Aroostook.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	2	100.00	176	88.00
Fen	3	100.00	123	41.00
Red Maple - Spruce Wetland	4	100.00	92	23.00
White Cedar - Ash Wetland	37	90.24	909	22.17
Rocky Forest	2	66.67	29	9.67
Tamarack Wetland	3	60.00	166	33.20
Acid Bog	3	60.00	30	6.00
Metasedimentary Outcrop	4	50.00	32	4.00
Sedge Meadow	4	44.44	50	5.56
White Spruce Forest	3	42.86	28	4.00
Sugar Maple Forest	2	40.00	12	2.40

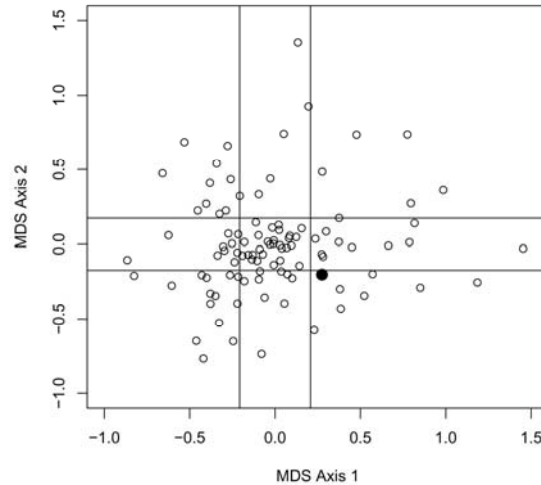
24. *Oxychylus cellarius* (Müller, 1774)



This non-native, carnivorous European species is limited to disturbed metasedimentary cliffs in the vicinity of Caribou. It was not reported by Nylander (1936) and likely represents a recent escapee.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	2	25.00	9	1.13

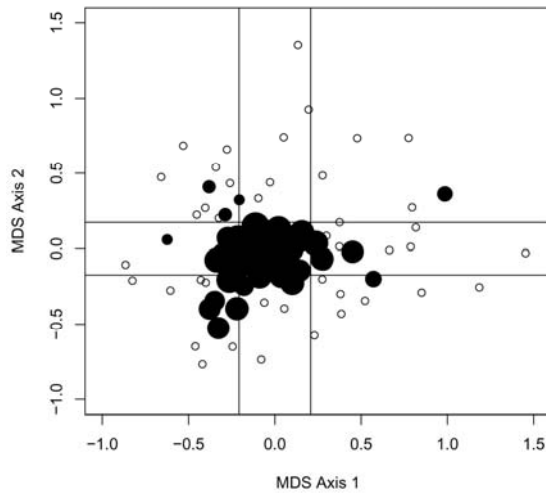
25. *Oxyloma retusa* (I. Lea, 1834)



Only a single site for this species was observed from a White Cedar wetland. Nylander (1936), however, reported that this species “used to be common on the Aroostook River flats, near the Aroostook River dam, and also in the Warren Brook bog in Caribou.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
White Cedar - Ash Wetland	1	2.44	2	0.05

26. *Planogyra asteriscus* (Morse, 1857)



This was the most abundant species encountered in the region, being present in almost all White Cedar wetlands. It also occurs at lower frequencies on rock outcrops, White Spruce, Sugar Maple, and other upland habitats. Nylander (1936) “found this small shell on my farm near the Caribou Stream, Woodland, in Perham, and at Johnson Brook, Madawaska Lake.”

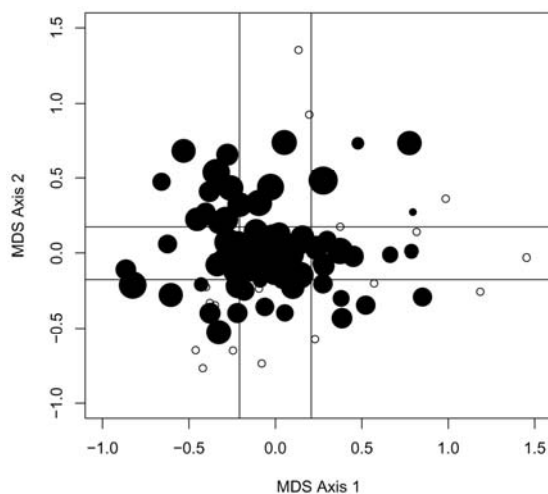
Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
White Cedar - Ash Wetland	36	87.80	7378	179.95
Tamarack Wetland	4	80.00	284	56.80
Fen	2	66.67	301	100.33
Sugar Maple Forest	3	60.00	17	3.40
Red Maple - Spruce Wetland	2	50.00	57	14.25
Aspen Forest	2	50.00	35	8.75
Acid Bog	2	40.00	2	0.40
Metasedimentary Outcrop	3	37.50	8	1.00
White Spruce Forest	2	28.57	163	23.29
Igneous Outcrop	1	20.00	43	8.60

This species is listed as G3G4 by Natureserve. Although uncommon in New York, northeastern Minnesota, and northeastern Wisconsin, it is quite common and abundant in Vermont and the northern Lower Peninsula and the entire Upper Peninsula of Michigan. The following represents the list of all encountered populations from the study region in order of abundance:

Bonderson Road	755	Spencer Cove	289
Blind Brook	582	Woodland Fen	283
Chapman	573	Harvey	274
Monticello Station	506	Aikens Brook Road	269
Phair	402	Wesley School	261
Bridgewater SW	362	Fogelin Pond	250
Grendell Cemetery	343	Orient Wayside	242

North Brook #3 Road	238	McConnell Brook	41
The Whalesback	234	Cave Hill School	37
Bourgoin Brook	211	Salmon Brook 2	33
Collins Siding	174	Anderson Brook	35
Woodland South	165	West Gouldsboro	29
French Ridge	151	Carlisle Pond	26
Gott Brook	135	Salmon Brook 6	18
Salmon Brook 5	130	Martin Lake	22
Isthmus Brook	133	Mile 18, Oxbow Road	2
Marble Pond	111	Duck Pond	19
McIntyre Road	111	Molunkus Stream	13
Little Bog Brook	97	Atkinson Mills	11
Johnson Brook East	93	South Crooked Brook	10
Crystal Bog 1	89	Sebois Lake	8
Lubec Lead Mine	90	Monticello West 1	4
Minnow Brook	87	Monticello West 3	2
Martin Brook	78	Cold Spring Wayside	3
Baker Ridge	61	Russell Rock	2
Salmon Brook 1	51	Byron Mountain	1
Woodland	52	Oakfield Hills	1
Hersom Road	45	Schooner Brook	1
Lubec Lead Mine	43		

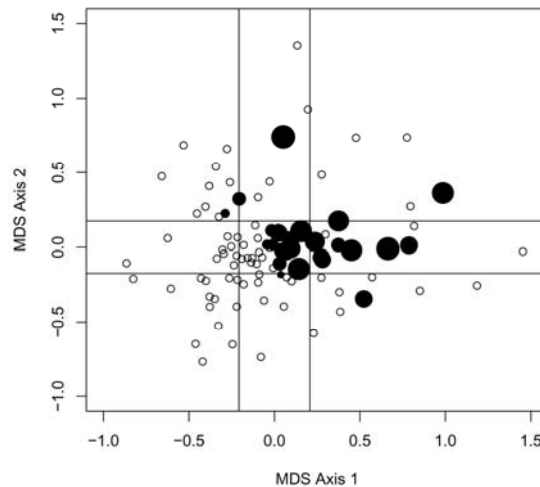
27. *Punctum minutissimum* (L.Lea, 1841)



This species is common throughout the entire study region, where it occurs in all habitat types. Populations reach their maximum abundance on metasedimentary outcrops and White Cedar swamp forest. Nylander (1936) “collected this specimen along the Caribou Stream in Woodland under leaves and bark.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
White Cedar - Ash Wetland	41	100.00	5564	135.71
Fen	3	100.00	171	57.00
Igneous Outcrop	5	100.00	181	36.20
Rocky Forest	3	100.00	124	41.33
Aspen Forest	4	100.00	54	13.50
Metasedimentary Outcrop	7	87.50	1319	164.88
Sugar Maple Forest	4	80.00	168	33.60
Tamarack Wetland	4	80.00	146	29.20
Red Maple - Spruce Wetland	3	75.00	184	46.00
Sedge Meadow	5	55.56	17	1.89
Shrub Carr	1	50.00	1	0.50
White Spruce Forest	3	42.86	79	11.29

28. *Punctum* n.sp.

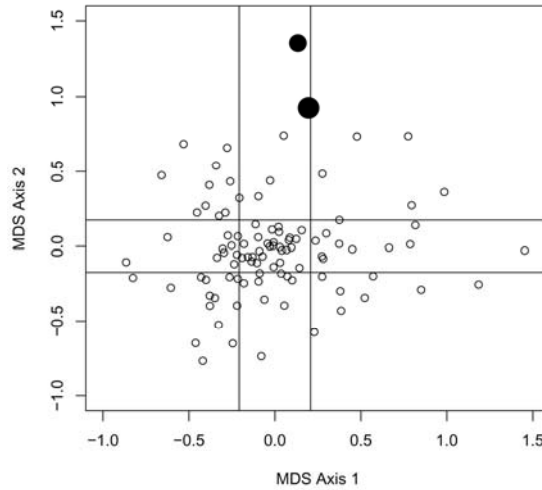


This taxon was first reported by Frest (1990) from Iowa fens. It has since been found throughout northeastern North America from a variety of open and forested calcareous wetlands. It was seen most commonly in the northern half of the study region, where it preferred mesic to wet sites of moderate base-status. It differs from *Punctum minutissimum* by possessing large (>1.25 mm diameter) and tall (>0.75 mm) shells with inflated whorls, a narrow umbilicus (<1/4 shell diameter), rusty-red color, and very closely spaced ribs of equal size. Further work will be necessary to determine its taxonomic status.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Fen	3	100.00	69	23.00
Shrub Carr	1	50.00	44	22.00
White Cedar - Ash Wetland	17	41.46	398	9.71
Metasedimentary Outcrop	3	37.50	16	2.00
Red Maple - Spruce Wetland	1	25.00	6	1.50

Acid Bog	1	20.00	8	1.60
Tamarack Wetland	1	20.00	1	0.20
Sedge Meadow	1	11.11	3	0.33

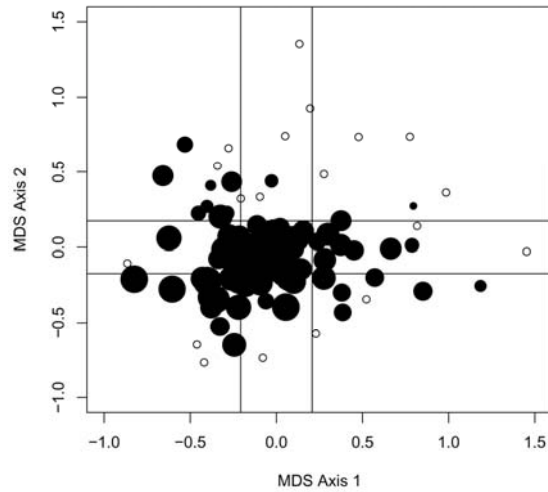
29. *Pupilla muscorum* (Linné, 1758)



This species was located at only two highly disturbed sites, one a metasedimentary cliff in downtown Caribou and the other a roadside verge in the Nashville Plantation. While Pilsbry (1948) and Hubricht (1985) report this as a native North American species, the actual story is likely far more complex. Native populations exist in subalpine forests in the Rockies and tundra habitats as far south as Churchill, Manitoba and the northern shore of the St. Lawrence in Quebec, and are commonly present as full-glacial fossils. However, these populations differ in shell features from the disturbance tolerant form common to anthropogenic habitats from the mid-Atlantic states to Iowa and Minnesota. These latter populations almost certainly represent a recently escaped European population. The populations reported here are of this latter stock, and it interesting to note that they were not present in Aroostook County at the time of Nylander (1936).

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	1	12.50	20	2.50
Sedge Meadow	1	11.11	4	0.44

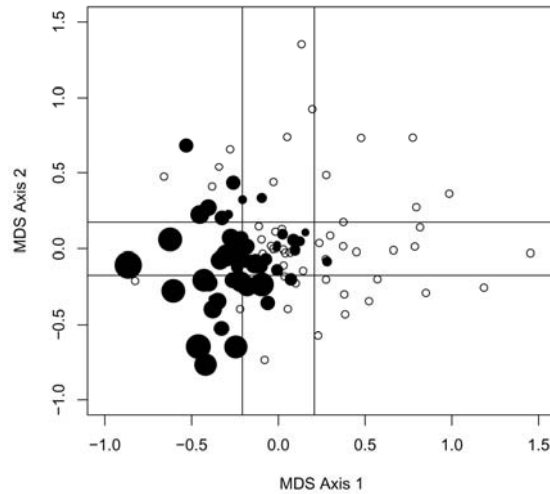
30. *Striatura exigua* (Stimpson, 1847)



This represents one of the most frequent and abundant land snails in the study region, being found throughout the area and occurring all but the most wet and base-rich sites. Nylander (1936) reported it as being “common in damp places.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
White Cedar - Ash Wetland	41	100.00	3907	95.29
Sugar Maple Forest	5	100.00	151	30.20
Igneous Outcrop	5	100.00	124	24.80
Aspen Forest	4	100.00	106	26.50
Shrub Carr	2	100.00	44	22.00
White Spruce Forest	6	85.71	237	33.86
Tamarack Wetland	4	80.00	425	85.00
Red Maple - Spruce Wetland	3	75.00	122	30.50
Fen	2	66.67	114	38.00
Sedge Meadow	5	55.56	7	0.78
Acid Bog	2	40.00	7	1.40
Metasedimentary Outcrop	3	37.50	10	1.25

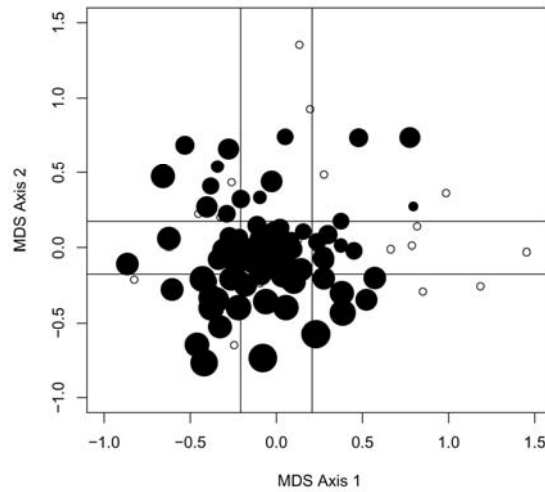
31. *Striatura ferrea* Morse, 1864



This species was found throughout the study region where it was limited to xeric and mesic sites. While typically limited to a very few shells in White Cedar wetlands, it reaches its greatest population abundance in dry, acid sites such as Sugar Maple and Igneous Bedrock outcrop sites. Nylander (1936) reported it “rare in Caribou and Woodland.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Igneous Outcrop	5	100.00	40	8.00
Sugar Maple Forest	4	80.00	70	14.00
White Spruce Forest	5	71.43	30	4.29
Tamarack Wetland	3	60.00	12	2.40
White Cedar - Ash Wetland	23	56.10	232	5.66
Metasedimentary Outcrop	4	50.00	11	1.38
Acid Bog	2	40.00	6	1.20
Rocky Forest	1	33.33	8	2.67
Fen	1	33.33	1	0.33
Aspen Forest	1	25.00	1	0.25

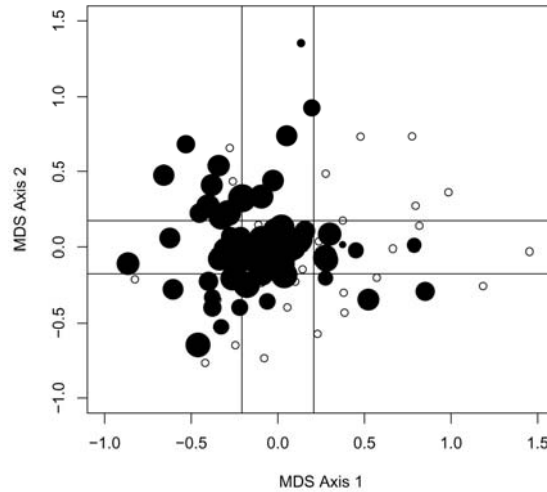
32. *Striatura milium* (Morse, 1859)



This is another of the most characteristic taxa in the regional fauna, being found throughout the study region in all but the very wettest sites. Populations appear to peak in acid, wooded wetlands and fens.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Red Maple - Spruce Wetland	4	100.00	344	86.00
Tamarack Wetland	5	100.00	330	66.00
Fen	3	100.00	244	81.33
Sugar Maple Forest	5	100.00	149	29.80
Shrub Carr	2	100.00	13	6.50
White Cedar - Ash Wetland	39	95.12	1596	38.93
Metasedimentary Outcrop	7	87.50	87	10.88
White Spruce Forest	6	85.71	127	18.14
Aspen Forest	3	75.00	96	24.00
Rocky Forest	2	66.67	10	3.33
Igneous Outcrop	3	60.00	158	31.60
Acid Bog	3	60.00	46	9.20
Sedge Meadow	2	22.22	26	2.89

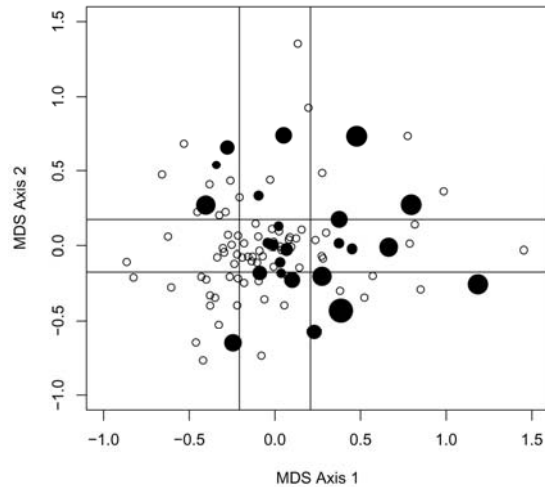
33. *Strobilops labyrinthica* (Say, 1817)



This species is found throughout the study region across a wide assortment of xeric and mesic habitats. Nylander (1936) reported it from “many places in Caribou, Woodland, and most everywhere I have collected.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	8	100.00	1075	134.38
Fen	3	100.00	551	183.67
White Cedar - Ash Wetland	36	87.80	4866	118.68
Tamarack Wetland	4	80.00	436	87.20
Igneous Outcrop	4	80.00	139	27.80
Sugar Maple Forest	4	80.00	55	11.00
Aspen Forest	3	75.00	24	6.00
White Spruce Forest	5	71.43	50	7.14
Red Maple - Spruce Wetland	2	50.00	156	39.00
Sedge Meadow	3	33.33	3	0.33
Rocky Forest	1	33.33	2	0.67

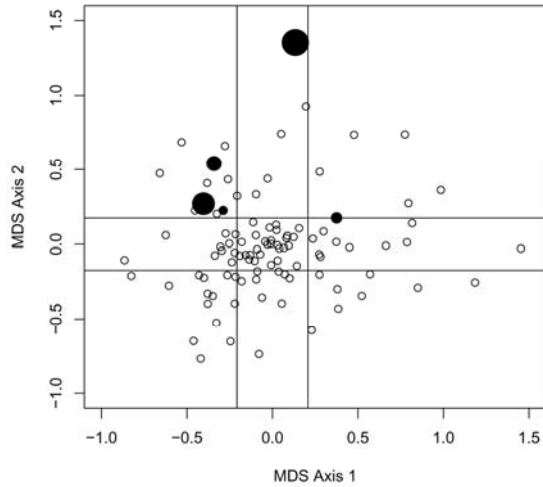
34. *Succinea ovalis* Say, 1817



This is the most common large snail in the study area, being found throughout the region across a wide assortment of mesic to wet habitats. Nylander (1936) reports this as the “most common land snail, and after rains it is found crawling from grass places into the road.” He also distinguishes the “thinner shelled” wooded wetland forms as *S. ovalis* var. *totteniana*. The taxonomy of this group is difficult with some recent workers suggesting that a number of sibling species may be present based on anatomical, shell, and habitat characteristics (Frest 1991). However, the plasticity of anatomy (Brian Coles, personal communication) and convergence in shell appearance between races suggests that a more conservative approach be taken.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	2	100.00	79	39.50
Red Maple - Spruce Wetland	3	75.00	36	9.00
Metasedimentary Outcrop	4	50.00	20	2.50
Tamarack Wetland	2	40.00	9	1.80
Rocky Forest	1	33.33	15	5.00
White Spruce Forest	2	28.57	6	0.86
White Cedar - Ash Wetland	9	21.95	54	1.32
Sedge Meadow	1	11.11	14	1.56

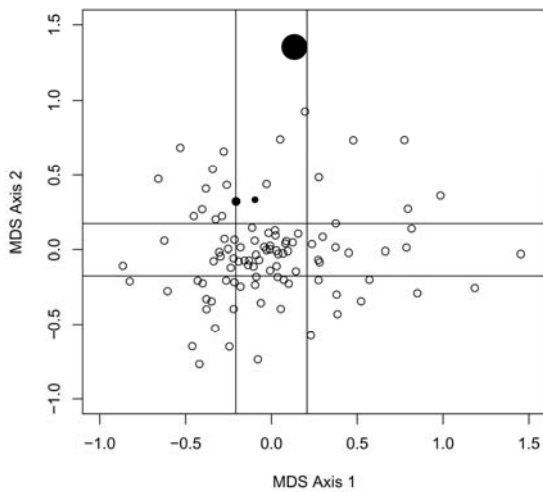
35. *Trichia hispida* (Linné, 1758)



This non-native, European species is generally limited to base-rich rock outcrop sites in the Aroostook Lowlands biophysical region. It appears to favor sites which had been subjected to high disturbance rates, such as the metasedimentary cliff in downtown Caribou and at the Mt. Carmel Wayside along the St. Johns River. This species may have recently naturalized in the region as it is not reported by Nylander (1936).

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	4	50.00	486	60.75
Shrub Carr	1	50.00	2	1.00

36. *Vallonia costata* (Müller, 1774)

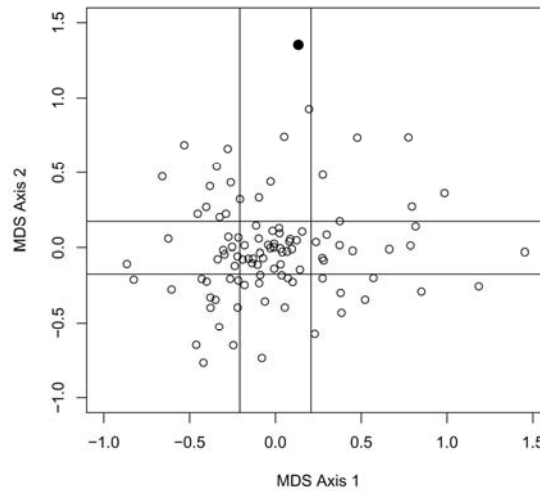


This species is limited to three disturbed metasedimentary outcrops along the Aroostook and Meduxnekeag Rivers. Although mapped as a native taxon by Hubricht (1985), this species is

largely limited to anthropogenically modified habitats, and likely represents a European exotic. Nylander (1936) reported that all *Vallonia* “are probably imported on the roots of nursery trees.” For *V. costata*, he reports “several small lots have been collected in the gardens in Caribou, and at one time several hundred of these small shells were collected around the apple trees in John McElwain’s apple orchard in Caribou. I have also found few shells in Presque Isle gardens.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	3	37.50	278	34.75

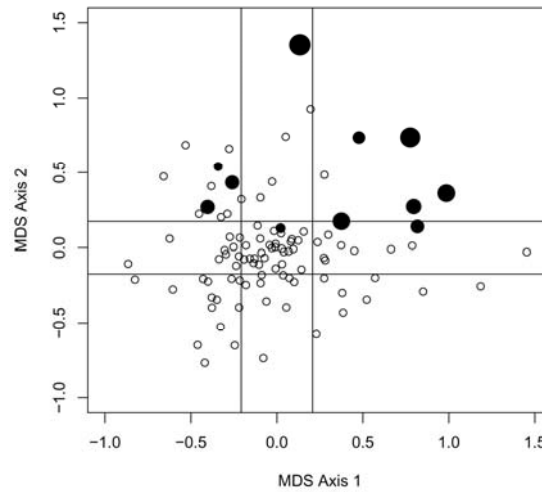
37. *Vallonia excentrica* Sterki, 1893



This species was found only at a highly disturbed metasedimentary outcrop site in downtown Caribou. Nylander (1936) reported that it was “found in Caribou.” Although listed as a native species by Hubricht (1985), it is limited to anthropogenically altered sites throughout eastern North America, and almost certainly represents a European exotic.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	1	12.50	2	0.25

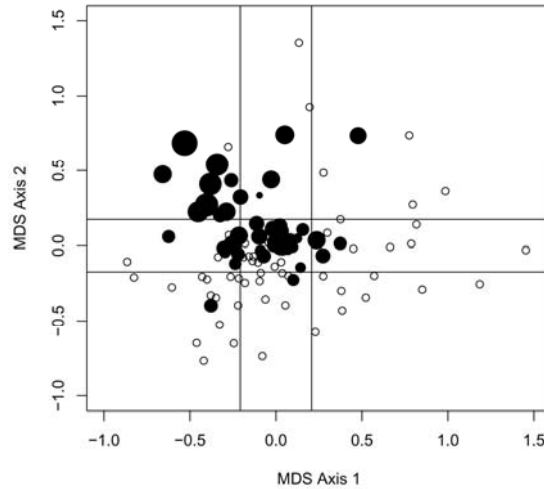
38. *Vallonia pulchella* (Müller, 1774)



This is the most abundant *Vallonia* in the study region, being found in various disturbed sites across the moisture gradient. It is particularly common in areas adjacent to roadsides. Nylander (1936) reported it “from gardens in Caribou.” While this species harbors a similar range and shares a similar preference to anthropogenically altered sites as the other two *Vallonia* from the region, this taxon does occur in North American Pleistocene sediments and can be found in numerous native sites, especially grassland areas in the continental interior. It thus seems best to consider this species a disturbance-tolerant native.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	2	100.00	26	13.00
Metasedimentary Outcrop	3	37.50	67	8.38
Rocky Forest	1	33.33	1	0.33
Aspen Forest	1	25.00	1	0.25
Sedge Meadow	2	22.22	4	0.44
Acid Bog	1	20.00	2	0.40
White Cedar - Ash Wetland	1	2.44	3	0.07

39. *Vertigo bollesiana* (Morse, 1865)



This species is found most commonly in the northern half of the study region where it occurs in a wide variety of upland and mesic base-rich habitats.

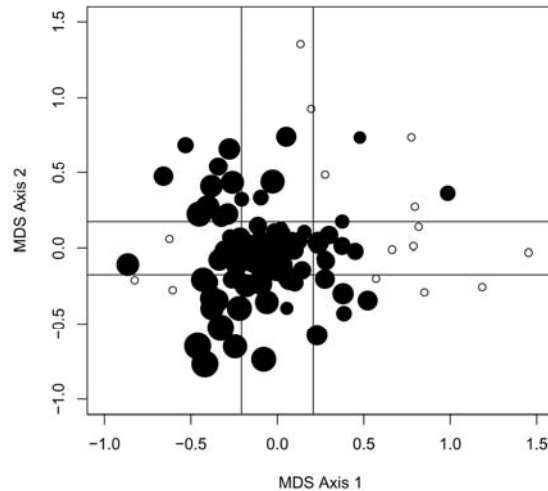
Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	7	87.50	204	25.50
Aspen Forest	3	75.00	4	1.00
Igneous Outcrop	3	60.00	51	10.20
Sugar Maple Forest	3	60.00	11	2.20
White Cedar - Ash Wetland	23	56.10	215	5.24
Fen	1	33.33	20	6.67
Rocky Forest	1	33.33	4	1.33
Tamarack Wetland	1	20.00	2	0.40
White Spruce Forest	1	14.29	8	1.14

This species is currently listed as G3G4 by Natureserve. However, it is not only one of the most frequent *Vertigo* in the study region, but it is also the most abundant *Vertigo* in Vermont and upstate New York. It is also quite frequent in the Upper Great Lakes region (Nekola 2004) and is a consistent species in algific talus slopes of the upper Midwest. As such, its high global ranking does not seem warranted. Following is a list of all observed populations in the study region, sorted by abundance:

Caribou East	84	Monticello Station	19
Mt. Carmel Wayside	51	Monticello West 1	19
Gott Brook	43	Phair	14
Jack Mountain	42	McIntyre Road	11
Russell Rock	38	Grendell Cemetery	11
Bridgewater SW	26	Blind Brook	10
Woodland Fen	20	Bonderson Road	10
Harvey	20	Monticello West 3	9

Crystal 2	8	Portage Country Club	3
Marble Pond	8	Bourgoin Brook	2
Collins Siding	8	Oakfield Hills	2
Johnson Brook West	7	Isthmus Brook	2
Horse Mountain	6	Fogelin Pond	2
Little Bog Brook	6	Molunkus Stream	1
Wesley School	6	Daigle	1
North Brook #3 Road	5	Minnow Brook	1
Chapman	5	McConnell Brook	1
Brewer Boat Ramp	4	Washburn Ledge	1
The Whalesback	4	Mile 18, Oxbow Road	1
Monticello West 2	2	Martin Brook	1
Crystal Bog 1	2	South Crooked Brook	1
Crystal 1	2		

40. *Vertigo cristata* (Sterki, 1919)

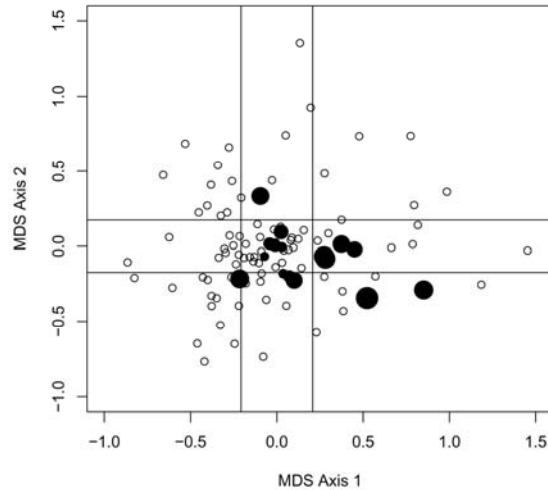


This species was the most frequent land snail encountered in the study region, being found across the entire area and from all but the wettest sites. It reaches its greatest abundance in upland and mesic acid habitats. Despite this commonness in the study region and across New England and the Upper Great Lakes (Nekola 2004), it has only been realized to be an extant member of the USA land snail fauna for the last decade (Nekola 2001).

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Igneous Outcrop	5	100.00	253	50.60
White Spruce Forest	7	100.00	120	17.14
Aspen Forest	4	100.00	79	19.75
Fen	3	100.00	74	24.67
Tamarack Wetland	5	100.00	72	14.40
Red Maple - Spruce Wetland	4	100.00	62	15.50
White Cedar - Ash Wetland	40	97.56	1105	26.95

Metasedimentary Outcrop	7	87.50	202	25.25
Acid Bog	4	80.00	23	4.60
Rocky Forest	2	66.67	3	1.00
Sugar Maple Forest	3	60.00	84	16.80
Shrub Carr	1	50.00	5	2.50
Sedge Meadow	1	11.11	8	0.89

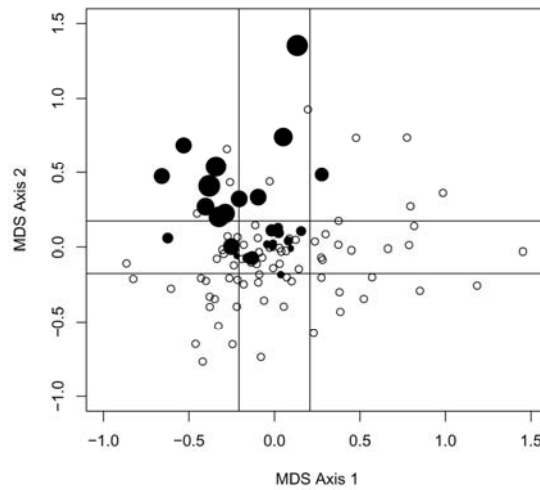
41. *Vertigo elatior* Sterki, 1894



This species is largely limited to the Aroostook Lowlands biophysical region, where it was principally limited to moderately base-rich wooded wetlands, fens, and seepage zones on metasedimentary outcrops. This taxon is very similar to *Vertigo ventricosa*, differing in its duller luster, less transparent shell, and greater height to width ratio. Nylander (1936) reported that it was “found in Woodland,” perhaps at the Woodland Fen site where a large population still exists.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Fen	3	100.00	193	64.33
Tamarack Wetland	3	60.00	17	3.40
White Cedar - Ash Wetland	8	19.51	57	1.39
Metasedimentary Outcrop	1	12.50	36	4.50
Sedge Meadow	1	11.11	1	0.11

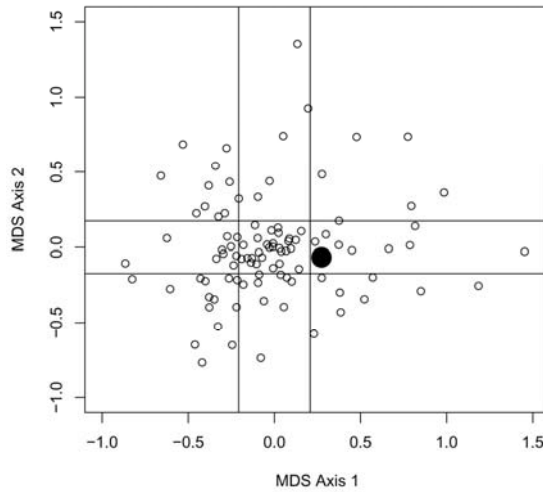
42. *Vertigo gouldi* (A. Binney, 1843)



This species was generally restricted to the northern half of the study region where it was limited to base-rich upland and mesic forest sites. It reached its peak abundance on metasedimentary outcrops. These populations represent the known northeastern range limit for this species, although given its Maine distribution it certainly must also occur in adjacent Quebec and New Brunswick. Nylander (1936) reported it “found along most places along the Caribou Stream. It is rare.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	8	100.00	219	27.38
Igneous Outcrop	2	40.00	24	4.80
Rocky Forest	1	33.33	1	0.33
White Cedar - Ash Wetland	13	31.71	44	1.07
Aspen Forest	1	25.00	1	0.25
Sugar Maple Forest	1	20.00	1	0.20
Tamarack Wetland	1	20.00	1	0.20

43. *Vertigo morsei* Sterki, 1894



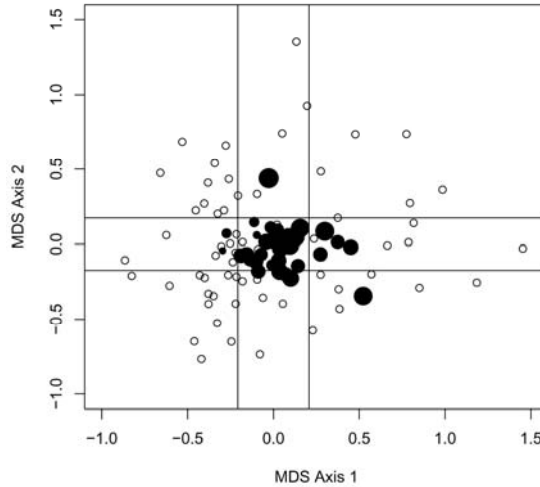
This species is limited in the study region to a single marl flat on a single fen. Although locally common within this limited habitat (perhaps 2-3 dozen individuals per square meter), the appropriate microsites cover only a fraction of a hectare. The nearest known populations are on wet shoreline turf in the Mingan Islands along the north side of the Gulf of St. Lawrence in Quebec and a spring fen in westernmost Massachusetts. This species is known from full glacial sediments in the continental interior, and it seems likely that it was much more abundant during immediate post-glacial times with base-rich open wetlands were more common throughout northeastern North America.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Fen	1	33.33	115	38.33

Natureserve lists this species as G3, and it seems that this rank is justified. It is nowhere common, and appears limited to hypercalcareous sedge meadows and fens throughout its range. While it is known from eastern Quebec to western Alberta, only in northwestern Minnesota and central Manitoba fens does it occur in more than 50% of seemingly appropriate sites. This species is also warranted of an Endangered status in Maine, as it is limited in the state to only 0.1 hectares of habitat that are isolated by over 500 km from the nearest sites. Any disruption to the hydrology of this site, and subsequent loss of the open marl flat to White Cedar forest would lead to its extirpation.

Site of occurrence: Woodland Fen, 115 individuals

44. *Vertigo nylanderi* Sterki, 1909



This species was found throughout the region in a variety of wooded wetlands, particularly White Cedar swamp forest. It was first discovered in the early 1900’s “along the Caribou Stream in Woodland” by Olaf Nylander (1936), and subsequently named for him by Victor Sterki. This species was not seen again until found in southern Ontario and northwestern Minnesota in the 1940’s (Oughton 1948, Dawley 1955). It was not again found alive until the late 1990’s when it was located at a number of sites in the western Great Lakes region (Nekola & Massart 2001; Nekola 2004). Nylander (1936) reported this species as “rare”.

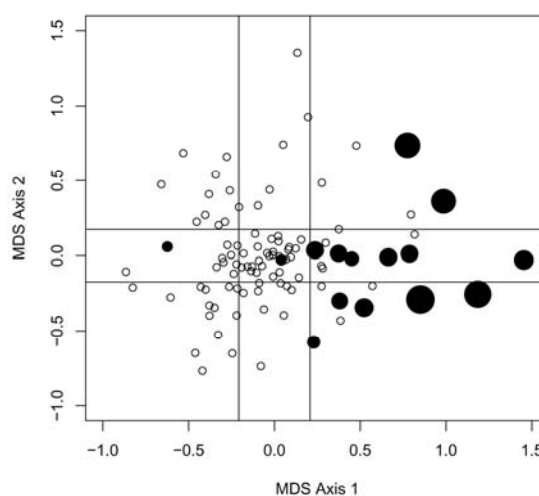
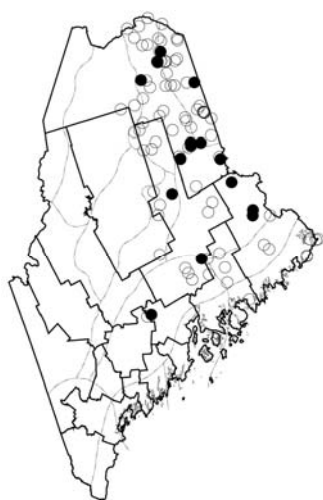
Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Fen	3	100.00	38	12.67
White Cedar - Ash Wetland	27	65.85	300	7.32
Tamarack Wetland	3	60.00	31	6.20
Sugar Maple Forest	1	20.00	16	3.20
Red Maple - Spruce Wetland	1	25.00	10	2.50

This species is currently listed as G2 by Natureserve. Given its frequency of occurrence throughout the study region, as well as northwestern Minnesota, northeastern Wisconsin, and central Manitoba, this ranking likely needs to be changed to a G4. Although perhaps too common to warrant listing within Maine, it is important that the type location at the Woodland Fen be afforded protection. Following is a list of all observed sites for this species in the study region, sorted by abundance:

Wesley School	48	Grendell Cemetery	16
Bourgoin Brook	46	Fogelin Pond	12
Chapman	40	Orient Wayside	12
North Brook #3 Road	31	Aikens Brook Road	10
Woodland South	21	Anderson Brook	10
Crystal Bog 2	19	Cave Hill School	10
Woodland Fen	18	Crystal Bog 1	9
Crystal 2	16	Johnson Brook West	9

Spencer Cove	8	Isthmus Brook	3
Birch Point	7	Salmon Brook 2	2
Bridgewater SW	6	Johnson Brook East	2
West Gouldsboro	6	Blind Brook	2
Salmon Brook 5	6	Salmon Brook 6	1
Hersom Road	5	Phair	1
Harvey	5	Duck Pond	1
Little Bog Brook	4	Collins Siding	1
Carlisle Pond	4	The Whalesback	1
McConnell Brook	3		

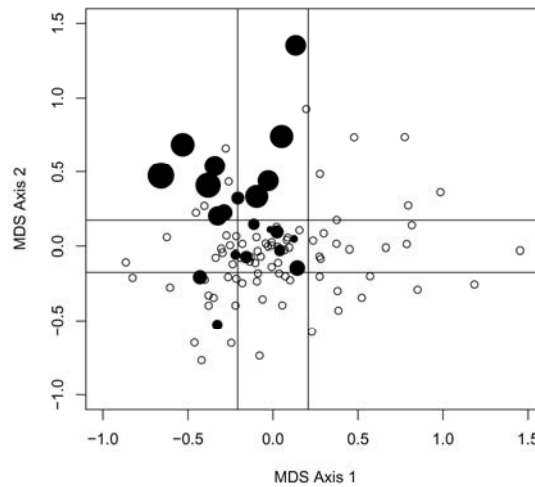
45. *Vertigo ovata* Say, 1822



This common eastern North American species was found scattered throughout the study region where it was essentially limited to sedge dominated wetlands and fens. It can be most easily observed by sieving decaying sedge litter just above the high-water level. Nylander (1936) reported that it was “found in Woodland.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Sedge Meadow	6	66.67	175	19.44
Fen	1	33.33	21	7.00
Red Maple - Spruce Wetland	1	25.00	1	0.25
Acid Bog	1	20.00	20	4.00
Sugar Maple Forest	1	20.00	1	0.20
White Cedar - Ash Wetland	5	12.20	46	1.12

46. *Vertigo paradoxa* Sterki, 1900



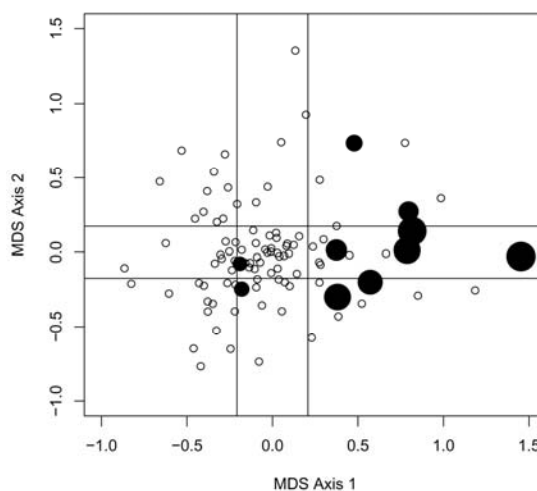
This is another species that was originally discovered by Olaf Nylander in the early 1900's. It was largely found limited to the northern half of the study region where it was most frequently observed in base-rich rock outcrop and mesic white cedar swamp forest sites. While rather frequently found in these latter habitats, rarely did the number of retrieved shells per site exceed two. A single individual was also found on shoreline base-rich igneous cliffs at Lubec in Washington County. Nylander (1936) reported that this species was "plentiful on my old farm in Woodland on the west side of the Caribou Stream just south of the Woodland Center road."

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	7	87.50	439	54.88
Igneous Outcrop	4	80.00	42	8.40
Aspen Forest	1	25.00	31	7.75
Sugar Maple Forest	1	20.00	23	4.60
White Cedar - Ash Wetland	8	19.51	24	0.59

Natureserve lists this species as G3G4Q. As this species has an extensive range from the Mingan Islands and Newfoundland in the east to perhaps as far west as interior Alaska, and is among the most common *Vertigo* species from the Straits of Mackinac to the Bruce Peninsula, this ranking does not seem justified. Additionally, preliminary DNA sequence analysis (Nekola & Coles, *unpublished data*) suggests that *V. paradoxa*, *V. arthuri*, *V. basidens*, *V. hubrichti*, *V. 'iowaensis'*, and *V. 'brierensis'* may best be best regarded as a single variable taxon. If these preliminary findings are validated in other gene regions, this single entity may have one of the widest ranges of any *Vertigo* species globally, ranging across all of northern North America south to New Mexico, Iowa, and Michigan. It would also represent the most common *Vertigo* species across much of this range. As it has precedent, the name *Vertigo arthuri* would be used for all these forms. It is interesting to note that *V. paradoxa* from near the type location in downtown Caribou looks essentially identical to material called *V. 'iowaensis'* by Frest (1991). Following is a list of all observed sites, ordered by abundance:

Washburn Ledge	206	McConnell Brook	5
Russell Rock	101	Monticello West 3	4
Caribou	59	Blind Brook	3
Caribou East	48	Bonderson Road	3
Crystal 1	31	Seboeis River Gorge	2
Crystal 2	23	Salmon Brook 5	2
Jack Mountain	24	Fogelin Pond	2
Portage Country Club	15	Bourgoin Brook	1
Monticello West 1	12	Harvey	1
Monticello West 2	9	Lubec Lead Mine	1
Bridgewater SW	7		

47. *Vertigo perryi* Sterki, 1905



This species is limited to acid sedge meadows, shrub carr, and White Cedar swamp forests in the southern half of the study region. It is most common in extensive sedge meadows, where individuals live in decaying sedge litter just above the high water level. This species is almost certainly what has been previously reported from Maine as *Vertigo tridentata* by Gleich & Gilbert (1976) and Martin (2000). In Maine this species appears essentially limited to areas which were under sea-level prior to isostatic rebound.

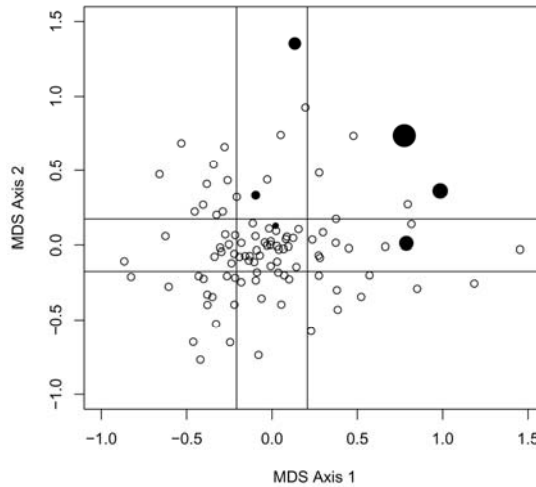
Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	1	50.00	59	29.50
Sedge Meadow	4	44.44	303	33.67
Rocky Forest	1	33.33	4	1.33
Acid Bog	1	20.00	16	3.20
White Cedar - Ash Wetland	3	7.32	103	2.51

Natureserve lists this species as G3G4. Until 2002, it was known from only two sites globally, and had not been seen alive since the early 1900's, where it was last seen in Duxbury, Massachusetts.

Over the last five years, this species has been found to be a consistent component of sedge meadow and wooded wetland sites throughout eastern Massachusetts, Connecticut, southeastern New Hampshire and southern Maine. Populations are now also known to extend as far west as north-central Wisconsin. *Vertigo perryi* can become quite abundant in sedge meadows in coastal New England, where thousands of individuals may occur per square meter. Limitation of populations to a relatively small subset of acid wetland habitats within a small part of Maine suggests that it be monitored by the state with an “SC” rank. Following is a list of all observed sites from the study region, ordered by abundance:

Clinton SE	128	Dolby Pond	52
Johnson Brook West	95	Schooner Brook	16
Musquash Stream	65	West Gouldsboro	6
Brewer Boat Ramp 1	59	Brewer Boat Ramp 2	4
Twentyfive Mile Stream	58	Sebeois Lake	2

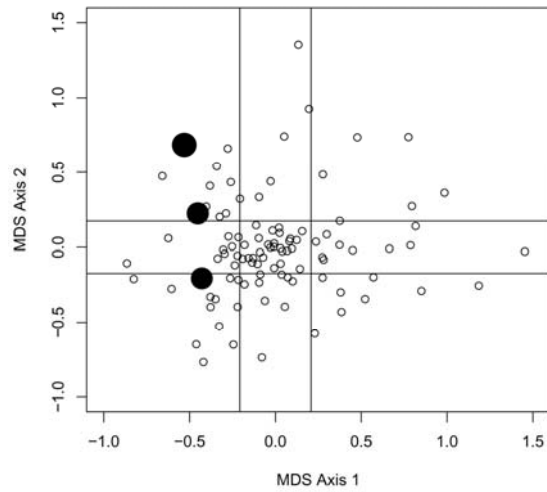
48. *Vertigo pygmaea* (Draparnaud, 1801)



This species was primarily limited to disturbed rock outcrop sites and roadside verges in the northern half of the study region. Although listed as a native North American species by Hubricht (1985), it largely limited to highly disturbed anthropogenic habitats such as road verges, field-edge rockpiles, gardens, and yards. It has apparently only recently expanded into the Midwest, and was not reported from Aroostook County by Nylander (1936). It seems clear that this species represents a recently escaped European species.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	2	25.00	6	0.75
Sedge Meadow	2	22.22	9	1.00
Acid Bog	1	20.00	1	0.20
White Cedar - Ash Wetland	1	2.44	1	0.02

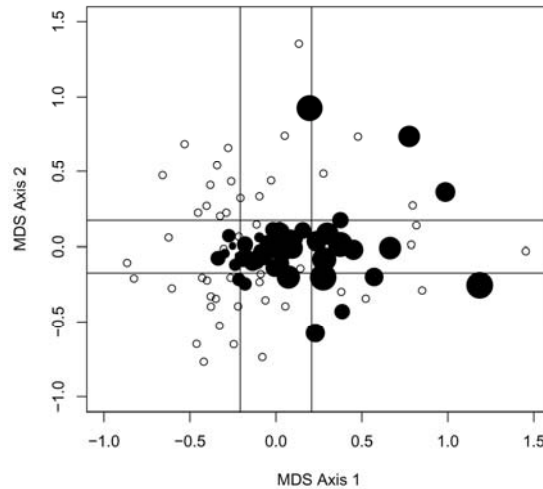
49. *Vertigo ronnebyensis* (Westerlund, 1871)



This species was limited to three igneous outcrop sites in the west-central part of the region. This taxon represents the ‘large morph’ of *Vertigo cristata* reported from the western Great Lakes region by Nekola (2001). Although close in appearance to *V. cristata*, this species is consistently 50% or larger in volume, has a less sharp crest, somewhat coarser striae and does not appear to introgress with it on sites of co-occurrence. After observing many of these populations across North America, Brian Coles and I have determined that this large race most likely represents a new world form of the Scandinavian *Vertigo ronnebyensis*, which shares a similar shell configuration and a propensity to inhabit acid upland forest habitats (Kerney & Cameron 1979). Populations for this species are now known in North America from central Quebec down the Appalachians to Ice Mountain, West Virginia (Ken Hotopp, *personal communication*), and west across the Canadian Shield to the west shore of Lake Superior and upland spruce parkland at Churchill, Manitoba. Material from central and southern Alaska also likely represents this taxon. This species will likely be found at other high elevation acid rock outcrop sites across northern Maine. However, these sites will certainly be isolated and few in number. As such, it may be prudent to monitor this species via an “SC” status.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Igneous Outcrop	3	60.00	61	12.20

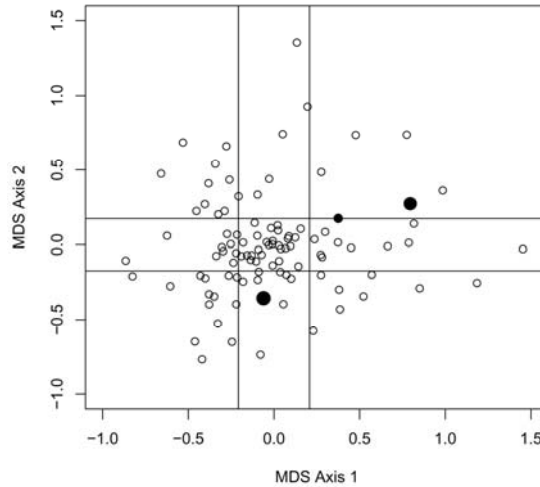
50. *Vertigo ventricosa* (Morse, 1865)



This species was found throughout the region where it occurred in a variety of often acid wetland habitats. It differs from the similar *V. elatior* by possessing a wider shell in relation to its height, being more transparent with a glossier luster, and also having a larger aperture with reduced lamellae volume. Although reported by Hubricht (1985) as far west as Illinois and as far south as North Carolina, observation of the material upon which these reports are based at the Field Museum in Chicago indicates that none of this outlying material represents *Vertigo ventricosa*. All material reported as this species from west of central New York state simply represent immature *Vertigo elatior*, while the southern Appalachian material appears to represent various forms of *Vertigo gouldi*. *Vertigo ventricosa* appears to range only as far south as northern West Virginia, and becomes common only in the New England states. It has been observed as far north as central Quebec, where it was the dominant wetland species at Schefferville.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Red Maple - Spruce Wetland	4	100.00	47	11.75
White Cedar - Ash Wetland	36	87.80	1037	25.29
Shrub Carr	1	50.00	10	5.00
Tamarack Wetland	2	40.00	9	1.80
Acid Bog	2	40.00	6	1.20
Sedge Meadow	3	33.33	128	14.22
Fen	1	33.33	100	33.33

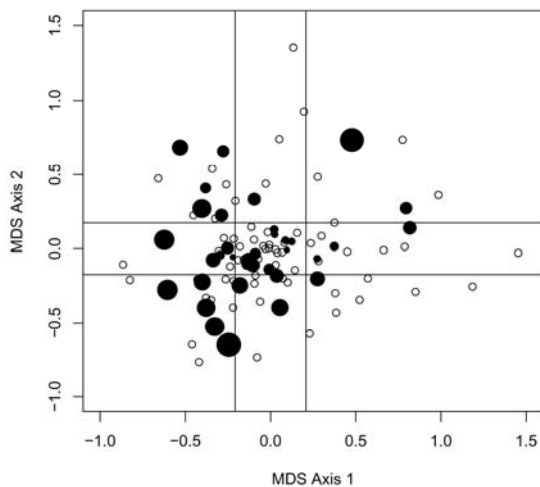
51. *Vitrina limpida* Gould, 1850



This species was rarely encountered throughout the region in a variety of disturbed habitats. Nylander (1936) reported that it “is distributed mostly everywhere. The snail is very active in the late fall when it lays its eggs. It seems to die after the eggs are laid as I have never found a living specimen in the spring.” It is unknown if the lack of encounters is due to improper timing of field work, or if the species has become rarer over time.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	2	100.00	7	3.50
White Spruce Forest	1	14.29	1	0.14

52. *Zonitoides arboreus* (Say, 1816)

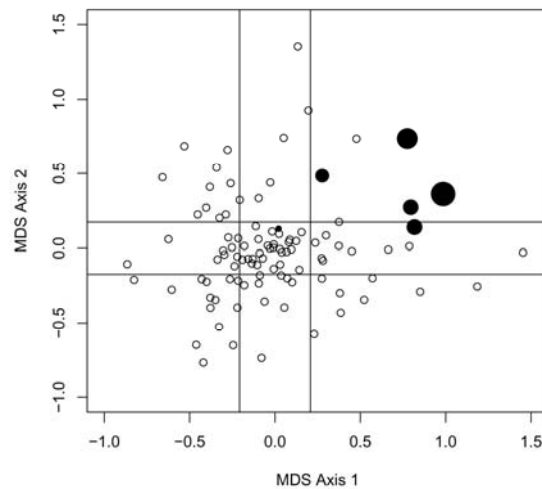


This species was found throughout the study region where it was principally restricted to upland and mesic forest sites. It is particularly fond of coarse woody debris on the forest floor, and can

often be found crawling in the space under just peeling bark. Nylander (1936) reported it as being “very common.”

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Sugar Maple Forest	3	60.00	28	5.60
Metasedimentary Outcrop	4	50.00	27	3.38
Shrub Carr	1	50.00	5	2.50
White Spruce Forest	3	42.86	42	6.00
White Cedar - Ash Wetland	17	41.46	49	1.20
Igneous Outcrop	2	40.00	21	4.20
Tamarack Wetland	2	40.00	10	2.00
Rocky Forest	1	33.33	39	13.00
Fen	1	33.33	2	0.67
Sedge Meadow	1	11.11	1	0.11

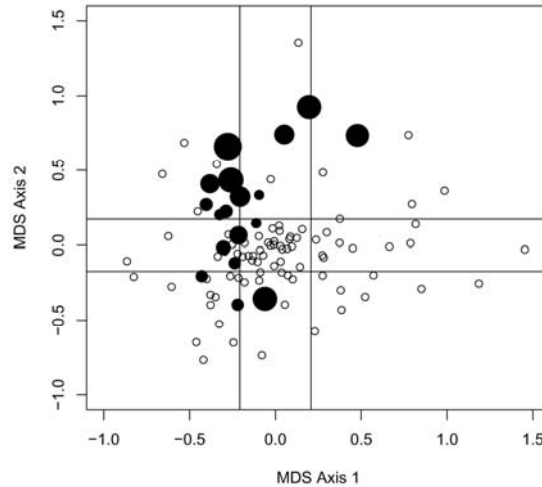
53. *Zonitoides nitidus* (Müller, 1774)



This species is much less common than *Zonitoides arboreus*, being mostly restricted to base-rich wetland sites in the southern half of the study region.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Shrub Carr	1	50.00	13	6.50
Rocky Forest	1	33.33	1	0.33
Sedge Meadow	2	22.22	6	0.67
Acid Bog	1	20.00	18	3.60
White Cedar - Ash Wetland	1	2.44	1	0.02

54. *Zoogenetes harpa* (Say, 1824)



This species was largely limited to the northern half of the study region where it occurred in a variety of upland habitats. Nylander (1936) reported finding “my first specimen at Fort Kent in August, 1899. They are common in Nils Gril’s farm in Perham and one spring a number of these shells were collected at George Norbec’s farm in Woodland, crawling on the trunks of apple trees. I have also found it near Green Mountain, New Brunswick.” This species becomes one of the most frequent snails along the north shore of the St. Lawrence, occurring over a much wider range of habitats than it does in northern Maine.

Habitat Type	Occurrences	% Frequency	# Individuals	Average/Site
Metasedimentary Outcrop	6	75.00	69	8.63
Aspen Forest	3	75.00	37	9.25
White Spruce Forest	3	42.86	177	25.29
Igneous Outcrop	2	40.00	2	0.40
Rocky Forest	1	33.33	31	10.33
Sedge Meadow	1	11.11	10	1.11
White Cedar - Ash Wetland	2	4.88	3	0.07

Species Not Encountered During this Survey: Four species previously listed by other researchers from the region were not relocated in this survey. *Appalachina sayana* was reported by Nylander (1936) as “the most common of the large shells. Its habitat is rather in lower ground than [*Neohelix*] *albolabris*.” *Neohelix dentifera* was reported by Nylander (1936) as being “rather scarce and only a specimen now and then is found together with *sayana*, in the same localities, they are distributed all over the state.” While both of these species apparently occurred in lowland forests not a even a single protochonch of any larger species was observed from any of the surveyed lowland forest sites. It is unclear if they utilize a habitat not inventoried during this survey, or if they have experienced a catastrophic loss in abundance over the last 75 years. Another large species not located during this survey is *Haplotrema concavum*, which is reported by Hubricht (1985) from Penobscot County. This species also occurs in White Cedar swamp forests in the western Great Lakes. Lastly, I was unable to locate an extant colony of the small *Paravitrea*

multidentata. Nylander (1936) reported it “found on Nils Gril’s farm in Perham. It is rare.” Given the range of other central Appalachian species in the region such as *Glyphyalinia rhoadsi* and *Euconulus polygyratus*, I would expect this colony was (is?) restricted to a rocky upland forest on a south-facing slope which moderated the minimum winter temperatures. This colony represents the known northeastern range limit for the species.

Conservation Recommendations:

A. Species of Importance

For the most part, the rarely encountered species within the region were either anthropogenic species which primarily occurred in habitats not prioritized for survey, or native species which are simply at their range limits, and which become much more common in western Maine. As such, they do not warrant conservation protection.

Only one species encountered in this survey, *Vertigo morsei*, appears warranted for legal protection in the state. This population is isolated by hundreds of kilometers from the nearest sites in Quebec and Massachusetts, and the survey work undertaken in this study documented that no other possible sites for occurrence (marly fen flats) are known to exist in Maine. As such, this species is limited to a fraction of a hectare of appropriate habitat within the state. Any alteration to the water table, or alteration of natural dynamics to this site would likely doom this population as it cannot live in wooded situations, or in areas lacking marl deposition.

Of the remaining taxa *V. perryi* and *V. ronneyensis* appear to warrant tracking at an “SC” level due to their limited number of populations in combination with their narrowly defined habitat requirements. *Vertigo perryi* is largely limited to acid Sedge meadows and White Cedar swamp forests within 150 km of the coast, and remains one of the most restricted *Vertigo* species in eastern North America. *Vertigo ronneyensis* in North America is largely a species of acid rock outcrops in taiga, and in New England is likely limited to a relatively few isolated populations in the high mountains of northern Maine, New Hampshire, and Vermont.

B. Sites of Importance.

Solem & Climo (1985) suggested that land snail community richness rarely exceeded twelve. As has been found elsewhere throughout eastern North America and western Europe, site richness levels in this study region commonly exceed this value, with fully 74% of sites harboring at least this number of co-occurring species. 22% of sites in the region were found to harbor at least 20 sympatric species. Tattersfield (1996) suggested that any site harboring at least 24 co-occurring land snail species should be considered of global conservation importance. While more recent analyses of North American (Nekola 2005), European (Pokryszko & Cameron 2005), African (Seddon *et al.* 2005), New Zealand (Barker 2005), and Australian (Stanisic *et al.* 2007) faunas indicate that this is likely a too liberal threshold, six of the surveyed sites (Woodland Fen, Mt. Carmel Wayside, Monticello Station, Washburn Ledge, Grendell Cemetery, Collins Siding) met this criteria. Only three other sites across New England meet or exceeded this richness level, with all occurring on limestone cliffs in west-central Vermont and east-central New York state. For this reason, these six sites should be afforded some form of protection to ensure that their exemplary faunas remain intact.

In addition to these, the type populations of both *Vertigo nylanderi* and *V. paradoxa* should be

afforded protection to ensure that they and their respective gene pools will be available for future researchers. These populations are vital in the determination of taxonomic status of these species, as they represent the gene pools upon which all other members of these species have been described. As such, having genes from these populations available for future study will prove invaluable. Based on our current knowledge, it seems likely that the *Vertigo nylanderi* population at the Woodland Fen represents Nylander's type location. While the type location for *Vertigo paradoxa* likely occurs in adjacent mesic White Cedar groves, the population size of these colonies is probably small. However, the remnant metasedimentary cliff populations along Caribou Stream in downtown Caribou, and along the Aroostook River just east of town are large, and within the watershed of the stream where the type colony was located. It would thus be prudent to ensure that these two populations were protected as well.

C. Appropriate management strategies.

A final comment regarding appropriate management strategies for land snail faunas must be made. Although not often used as a management tool in northern Maine, it is important to remember that proscribed fire has a serious deleterious impact on land snail communities, reducing richness by approximately 30% and abundance by 50-90% in central North America (Nekola 2002). Frequent use of fire management anywhere in the state thus represents a significant threat to the health and diversity of indigenous land snail communities. Protecting of land snails in the region will require preservation of site organic litter layers, no matter if woodland or grassland sites are being considered. This goal is not possible if fire return intervals less than 15 years are used (perhaps more in some habitats). Unless management practices become more diversified, and the rate of fire decreased, serious negative impacts on the land snail fauna may be expected.

Conclusions and Recommendations

Eastern Maine supports a surprisingly abundant and relatively diverse land snail fauna, with 54 species being observed over the entire landscape. Almost 1/4 of surveyed sites supported 20 or more taxa, which represents a higher frequency than has been observed in other similar landscapes such as northwestern Minnesota (18%) and the western Lake Superior highlands (0%). A number of species, such as *Planogyra asteriscus*, *Vertigo nylanderi*, and *Vertigo ventricosa* appear to be more frequent in this region than anywhere else in North America. Thus, even though relatively few species appear to warrant official conservation protection (*Vertigo morsei*, *V. perryi*, and *V. ronneyensis*), the fauna is of considerable biodiversity importance and should be afforded some form of protection.

Perhaps the most troubling finding from this study is the almost complete lack of large-shelled species. Reports from Nylander demonstrate that 75 years ago this was not the case. It is unclear if this landscape still supports viable populations for these taxa, and it is unknown what factor or factors have led to their loss, although loss of old growth forest habitats and coarse woody debris from the forest floor through normal silvicultural practices and aerial spraying for spruce budworm may be at least partially to blame. Given that these species were once common, I cannot recommend based on this study that they be listed for conservation protection. However, it does seem prudent for additional surveys to be made which target these large species so that their current distribution, abundance, and ecology can be ascertained. It is possible that these species may now be among the most endangered within the state.

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APPENDIX I:

Taxonomic key for the land snails of Maine and surrounding regions

1	Individuals without external shell	Slugs (not included in this key)
	Individuals with external shell	2
2	Shell as wide or wider than tall	3
	Shell taller than wide	30
3	Shell approximately as wide (.8-1.2x) as tall	4
	Shell obviously wider (>1.2x) than tall	6
4	Shell diameter >10mm	<i>Cepaea</i>
	Shell diameter <10mm	5
5	Shell umbilicate, strongly ribbed, with thickened peristome	<i>Strobilops</i>
	Shell imperforate, microscopically ribbed, with thin peristome	<i>Euconulus</i>
6	Shell diameter >10mm	7
	Shell diameter <10mm	14
7	Shell with open umbilicus	8
	Shell perforate, imperforate or rimate	12
8	Peristome expanded, white	9
	Peristome thin	11
9	Shell diameter >20mm	<i>Appalachina</i>
	Shell diameter <15mm	10
10	Long, blade-shaped parietal lamella present	<i>Euchemotrema</i>
	Parietal lamella peg-shaped, basal and palatal lamellae also present	<i>Triodopsis</i>
10	Shell ribbed and dull and usually with dark markings	<i>Anguispira</i>
	Shell smooth, shiny	11
11	Shell diameter >15mm, white, umbilicus >5mm wide	<i>Haplotrema</i>
	Shell diameter <15mm, brown, umbilicus <5mm wide	<i>Oxychilus</i>
12	Shell with rimate umbilicus	<i>Mesodon</i>
	Shell imperforate	13
13	Shell height 2/3 the width, or taller	<i>Cepaea</i>
	Shell height less than 2/3 the width	<i>Neohelix</i>
14	Peristome expanded, white	<i>Euchemotrema</i>
	Peristome thin	15
15	Aperture wider than rest of shell, shell glassy, transparent	<i>Vitrina</i>
	Aperture less wide than rest of shell, shell translucent to opaque	16
16	Umbilicus (if present) <1/4 diameter of shell	17
	Umbilicus >1/4 diameter of shell	22
17	Aperture strongly crescent-shaped, its width remaining approximately the same throughout	<i>Paravitrea</i>
	Aperture oval, its width being much greater in the middle	18
18	Adult shells with 4-6 whorls which increase less than twice in width per revolution	19
	Adult shells with <4 whorls which increase twice or more in width per revolution	20
19	Upper shell surface with dull luster and thick ribs	<i>Discus</i>
	Upper shell surface shiny and with weak ribs	<i>Zonitoides</i>
20	Shell surface with regular, widely spaced, indented ribs	<i>Glyphyalinia</i>
	Shell surface with irregular, closely spaced ribs	21
21	Shell surface without faint spiral lines	<i>Nesovitrea</i>
	Shell surface with faint spiral lines	<i>Striatura</i>
22	Adult shell diameter >3mm	23
	Adult shell diameter <3mm	24
23	Shell with prominent, raised spiral lines	<i>Helicodiscus</i>
	Shell without prominent, raised spiral lines	<i>Discus</i>
24	Peristome flared and thickened	<i>Vallonia</i>
	Peristome unflared and always unthickened	25

25	Spiral lines present on protoconch	26
	Spiral lines absent on protoconch	27
26	Whorl width increasing by more than 50% per revolution	<i>Striatura</i>
	Whorl width increasing by less than 50% per revolution	<i>Helicodiscus</i>
27	Ribs with distinct, sharp edges	28
	Ribs (if present) with indistinct, rounded edges	<i>Hawaiiia</i>
28	Ribs not continuous, with regular pieces removed so that they appear as a string of beads under high magnification; whorls increasing by more than 50% per revolution	<i>Striatura</i>
	Ribs continuous; whorls increasing by less than 50% per revolution.....	29
29	Major ribs +0.2mm tall, shell almost flat on top	<i>Planogyra</i>
	Major ribs (if any) <0.2mm tall, shell clearly peaked on top	<i>Punctum</i>
30	Lax spiral with no more than 3 whorls in mature shell	31
	Tighter spiral with 4+ whorls in mature shell	36
31	Aperture up to ½ of shell height	<i>Catinella</i>
	Aperture less than ½ of shell height	32
32	Shell and aperture broadly ovate	<i>Succinea</i>
	Shell and aperture narrowly ovate to elongate	<i>Oxyloma</i>
33	Adult shell >4mm tall	34
	Adult shell <4mm tall	36
34	Shell with glassy luster, transparent to translucent, yellow to brown; apertural lamellae lacking.....	<i>Cochlicopa</i>
	Shell dull, translucent to opaque, white.....	35
35	Aperture thin; lamellae present; shell color white	<i>Gastrocopta</i>
	Aperture with expanded peristome; lamellae absent; shell color brown	<i>Pupoides</i>
36	Shell 1¼-1½ times taller than wide, with prominent 0.2mm elevated ribs	<i>Zoogenites</i>
	Shell >1½ times taller than wide, ribs (if present) much less than 0.2mm tall	37
37	Shell 2½ times taller than wide, shell white with expanded peristome	<i>Carychium</i>
	Shell 1½-2½ times taller than wide	38
38	0-2 lamellae present in aperture	39
	3+ lamellae present in aperture	41
39	Shell white	<i>Gastrocopta</i>
	Shell brown	40
40	Shell >3mm tall	<i>Pupilla</i>
	Shell <3mm tall	<i>Columella</i>
41	Shell brown, sinulus usually strong	<i>Vertigo</i>
	Shell white to clear, sinulus absent	<i>Gastrocopta</i>

Species keys (arranged alphabetically by genus)

Anguispira: *A. alternata*

Appalachina: *A. sayana*

Carychium:

- 1 Shell width 30% of shell height; surface sharply striate *C. exile*
Shell width 40% of shell height; surface weakly striate to smooth *C. exiguum*

Catinella: *C. avara*

*Note: Species differentiation in this genus is problematic, as is true for all Succineads

Cepaea:

- Aperture lip colored *C. nemoralis*
Aperture lip white *C. hortensis*

Cochlicopa:

- 1 Mature shells >2.3 mm wide, broadly ovate shape *C. lubrica*
Mature shells < 2.3 mm wide, elliptical shape 2
- 2 Mature shells <6 mm tall *C. lubricella*
Mature shells >6 mm tall *C. morseana*

Columella:

- Shell <2½mm tall, apex tapering, 5½-6½ whorls *C. simplex*
Shell >2½mm tall, apex domed with cylindrical body, 6-7 whorls *C. columella alticola*

*Note: While *C. columella alticola* was reported from Maine by Coles (pers. comm.). However, I have been unable to locate this taxon from the reported station, and it seems likely that these individuals represent *C. simplex*.

Discus:

- 1 Shell with dark red-brown markings on top *D. rotundatus*
Shell of uniform color 2
- 2 Margin of last whorl bluntly angular *D. catskillensis*
Margin of last whorl rounded *D. cronkhitei*

*Note: The last two taxa extensively intergrade throughout southeastern Canada and the Lakes states in the USA. While it is sometimes possible to find clearly demarcated adjacent populations within the same landscape (such as northeastern Iowa and New York state), it seems likely that these taxa will ultimately be found to represent a single, poorly isolated cline.

Euchemotrema:

- Body and penultimate whorls >1¼ mm wide as measured from top of shell *E. fraternum*
Body and penultimate whorls ≤1¼ mm wide as measured from top of shell *E. leai*

Euconulus:

- 1 Whorls gradually increasing in size, with last 3 constituting <2/3 of total shell diameter as seen from top; ribs and spiral lines indistinct to almost absent on initial whorls *E. polygyratus*
Whorls increasing rapidly in size, with last 3 constituting >2/3 of total shell diameter as seen from top; distinct ribs and spiral lines present on initial whorls 2
- 2 Protoconch with indistinct to absent ribbing; shell luster shiny; dark brown-copper color; spiral lines on base as or more distinct than transverse lines *E. alderi*
Protoconch with distinct ribbing; shell luster silky; tan to light-brown color; spiral lines on base less distinct than

transverse lines *E. fulvus*

Gastrocopta:

- 1 Shell >3/4mm tall *G. armifera*
Shell <3/4mm tall 2
- 2 Basal and palatal lamellae absent *G. corticaria*
Basal and palatal lamellae present 3
- 3 Shell >2/4 mm tall; peristome flared *G. contracta*
Shell <2/4 mm tall; peristome thickened but not flared 4
- 4 Shell height slightly less than twice its width; lower palatal lamella large, deeply entering shell; to 1.8 mm tall
..... *G. pentodon*
Shell height approximately 1.3 times its width; lower palatal lamella small, not deeply entering shell; to 2.2 mm tall
..... *G. tappaniana*

Glyphyalinia:

- 1 Shell openly umbilicate *G. rhoadsi*
Shell imperforate to very narrowly rimate *G. indentata*

Haplotrema: *H. concavum*

Hawaiiia: *H. miniscula*

Helicodiscus:

- Bottom body whorl width <1 mm; umbilicus very wide (>2/3 shell diameter) and shallow (<1/2 shell height)
..... *H. shimiki*
- Bottom body whorl width >=1 mm; umbilicus less wide (<2/3 shell diameter) and deeper (approximately 1/2 shell
height) *H. parallelus*

Neohelix:

- Shell height >50% shell width; lamellae absent or only a weak parietal; lower peristome flat *N. albolabris*
- Shell height <=50% shell width; parietal lamella large and blade shaped; lower peristome bent *N. dentifera*

Nesovitrea:

- Shell brown, >4 1/2 mm diameter at 4 1/2 whorls *N. electrina*
- Shell whitish, <4 mm diameter at 4 1/2 whorls *N. binneyana*

Oxyloma: *O. retusa*

*Note: this genus, along with all Succineads, is taxonomically complex, with taxa being perhaps inseparable based on either shell or genetalic characteristics.

Oxychilus: *O. cellarius*

Paravitrea: *P. multidentata*

Planogyra: *P. asteriscus*

Punctum:

- Umbilicus <1/3 shell diameter; shell color deep rust-brown *Punctum* n.sp.
- Umbilicus at least 1/3 shell diameter, shell color tan-yellow *P. minutissimum*

Pupilla: *P. muscorum*

Pupoides: *P. albilabris*

Striatura:

- 1 Shell diameter <2mm; indistinct spiral lines on protochonch *S. milium*
Shell diameter >2mm; distinct spiral lines on protochonch 2
- 2 Prominent, widely spaced ribs present; umbilicus 1/3 shell diameter, whorls increasing by less than twice each rotation *S. exiguum*
Ribs and spiral lines weak, umbilicus 1/5 shell diameter or less, whorls increasing by twice or more in diameter with each rotation *S. ferrea*

Strobilops:

- Margin angular, shell pyramidal, 3-4 basal folds *S. aenea*
- Margin rounded, shell beehive-shaped, 5+ basal folds *S. labyrinthica*

Succinea: *S. ovalis*

- Shell apex angle >60° *S. ovalis*
- Shell apex angle <60° *S. putris*

*Note: A notoriously difficult group, which has been extensively split into a number of taxa based upon anatomical differences. However, the shells are all convergent, and given the plasticity of many of the genetical traits considered taxonomically important, it is unclear how many of these proposed taxa are valid. This state of taxonomic affairs is reminiscent of the confusion which surrounds the plant genus *Rubus* in North America. In his Flora of the Northeastern US and Canada, Henry Gleason states:

"Species in the ordinary sense of the term scarcely exist in the section *Eubatus*..... There have been produced in the American Brambles a large number, possibly as many as 10,000, of small populations of microspecies, differing from each other very slightly, although the culmination of minute differences leads to extremes which are quite unlike. In order to keep the number of taxonomic groups within bounds and make them recognizable to the student, it has been necessary to use only a limited number of combinations of characters, thereby segregating thirteen native American groups which can be regarded as collective species. These are intended for convenience only."

This summary applies almost completely to the genus *Succinea*. Thus, like Gleason did with *Rubus*, it is perhaps best to consider there to be in this genus only a relatively small group of collective species-groups within eastern North America

Triodopsis: *T. tridentata*

Vallonia:

- 1 Shell surface smooth, shiny, major ribs absent 2
Shell surface dull, major ribs present 3
- 2 Shell white; ribs low but distinct; diameter of minor axis in mature shells >1½ mm; body whorl diameter remaining relatively constant at aperture so that last portion of whorl remains approximately parallel to penultimate *V. pulchella*
Shell horn colored; ribs indistinct or lacking, making shell appear smooth; diameter of minor axis in mature shells <=1½ mm; body whorl diameter increasing rapidly at aperture so that last portion of whorl diverges from penultimate *V. excentrica*
- 3 Diameter of mature shells <2½mm, 23-35 ribs on body whorl, ribs > 0.1 mm tall *V. costata*
Diameter >2½mm, 45-50 ribs on body whorl, ribs <0.1 mm tall..... *V. gracilicosta albula*

Vertigo:

- 1 Body whorl covered with bumps; infraparietal lamella present but angular absent *V. malleata*
Shell surface lacking granulate bumps; infraparietal lamella present only with presence of angular 2
- 2 Shell surface smooth 3
Shell surface weakly to distinctly striate 16
- 3 6 or more lamellae in aperture 4
5 or fewer lamellae in aperture 7
- 4 Angular lamella absent; shell dull; light-colored crest and callus on palatal wall *V. pygmaea*
Angular lamella present; shell shiny 5
- 5 Lower palatal lamella curved and deeply entering aperture; shell <2mm tall *V. milium*
Lower palatal lamella not curved or deeply entering aperture; shell >2mm tall 6

- 6 Shell height $>2\frac{3}{4}$ mm; upper palatal lamella square *V. morsei*
 Shell height $<2\frac{3}{4}$ mm; upper palatal lamella a rounded blade; shell ovoid *V. ovata*
- 7 Four or fewer lamella 8
 Five lamella 11
- 8 Shell height >2.3 mm *V. modesta modesta*
 Shell height <2.3 mm 9
- 9 Callus on aperture margin *V. tridentata*
 Aperture margin unthickened 10
- 10 Strong sinus; shell color red-brown; weak or absent spiral striation on body whorl;
 aperture margin white *V. ventricosa*
 Weak sinus; shell color pale tan-green; faint but distinct spiral striation on body whorl;
 aperture margin usually dark brown-black *V. perryi*
- 11 Shell >2.3 mm height *V. modesta parietalis*
 Shell <2.3 mm height 12
- 12 Shell height less than $1\frac{1}{4}$ times the width *V. ovata*
 Shell height at least $1\frac{1}{4}$ times the width 13
- 13 Shell weakly striate; single large depression under both palatal lamellae *V. bollesiana*
 Shell not striate; at most separate depressions under each palatal lamellae 14
- 14 Shell surface dull; strong crest; light-colored callus on palatal wall *V. pygmaea*
 Shell surface shiny; crest less prominent; callus of same color as shell 15
- 15 Aperture approximately $\frac{1}{3}$ of shell height; shell glassy and transparent; shell globose *V. ventricosa*
 Aperture approximately $\frac{1}{4}$ of shell height; shell duller, translucent and more elongate..... *V. elatior*
- 16 Lower palatal lamella inserted near aperture margin and parallel to upper so that only its end is
 visible when viewed from front 17
 Lower palatal lamella at least partially inserted into shell and not parallel to upper palatal so that
 at least some of its long axis apparent when viewed from front 22
- 17 Parietal lamella pointed directly at lower palatal, so that parietal, palatals, and columellar
 form a cross 18
 Parietal lamella pointed at upper palatal or space between upper and lower palatals 21
- 18 Shell >2.3 mm tall, striae on shell surface indistinct; crest weak 19
 Shell <2.3 mm tall, striae distinct 20
- 19 Angular lamella absent *V. modesta modesta*
 Angular lamella present *V. modesta parietalis*
- 20 Shell <2.1 mm tall, crest narrow; shell striations fine *V. cristata*
 Shell >2.1 mm tall, crest wide; shell striations robust *V. ronneyensis*
- 21 Striae indistinct, with shell often appearing smooth under low magnification; shell conical,
 $<1\frac{3}{4}$ mm tall; deep depression over palatal lamellae *V. bollesiana*
 Striae distinct, with shell not appearing smooth under low magnification; shell elliptical,
 often $>1\frac{3}{4}$ mm tall; depression palatal lamellae weak or absent *V. gouldi*
- 22 Columellar lamella more massive than the parietal; angular lamella strong; lower palatal lamella
 so deeply inserted that most of it is obscured by the columellar wall *V. nylanderi*
 Parietal lamella more massive than the columellar; angular lamella weak or absent; lower palatal
 lamella less deeply inserted so that most is observable in apertural view..... *V. paradoxa*

Vitrina: *V. limpida*

Zonitoides:

- Shell luster satiny from microscopic spiral lines; aperture elliptical; shell yellowish *Z. arboreus*
 Shell luster glassy, microscopic spiral lines absent; aperture round; shell rusty-brown *Z. nitidus*

Zoogenites: *Z. harpa*

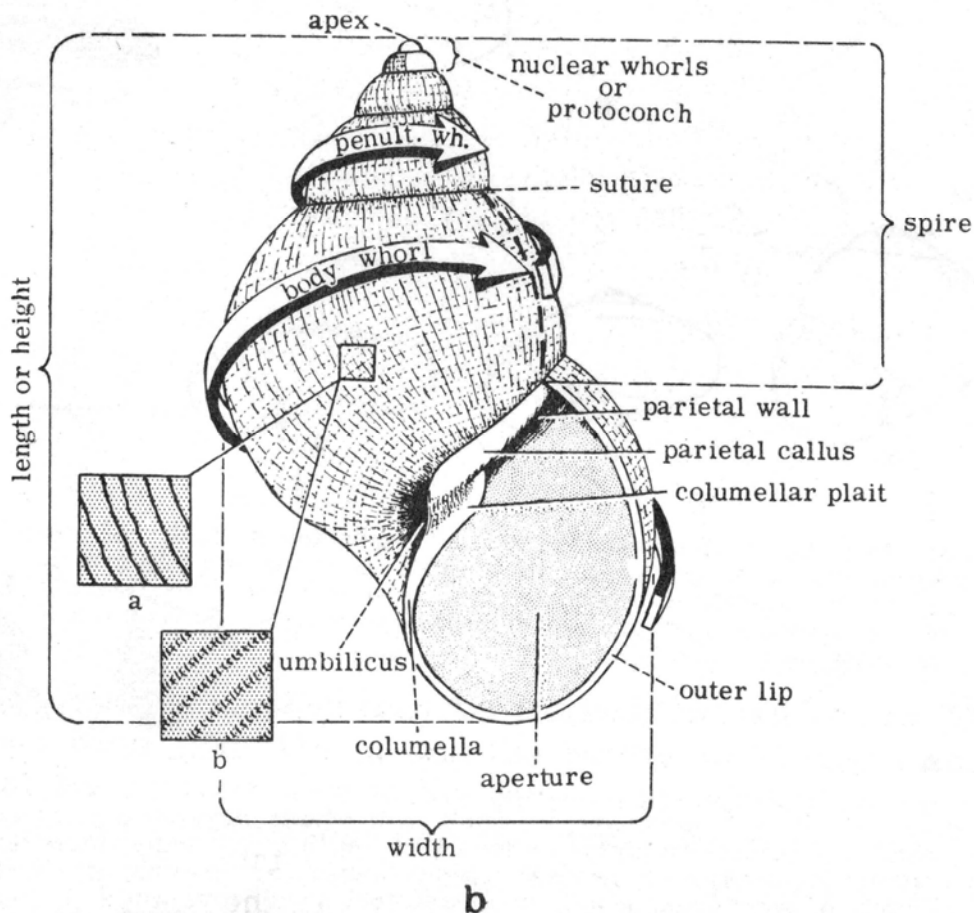
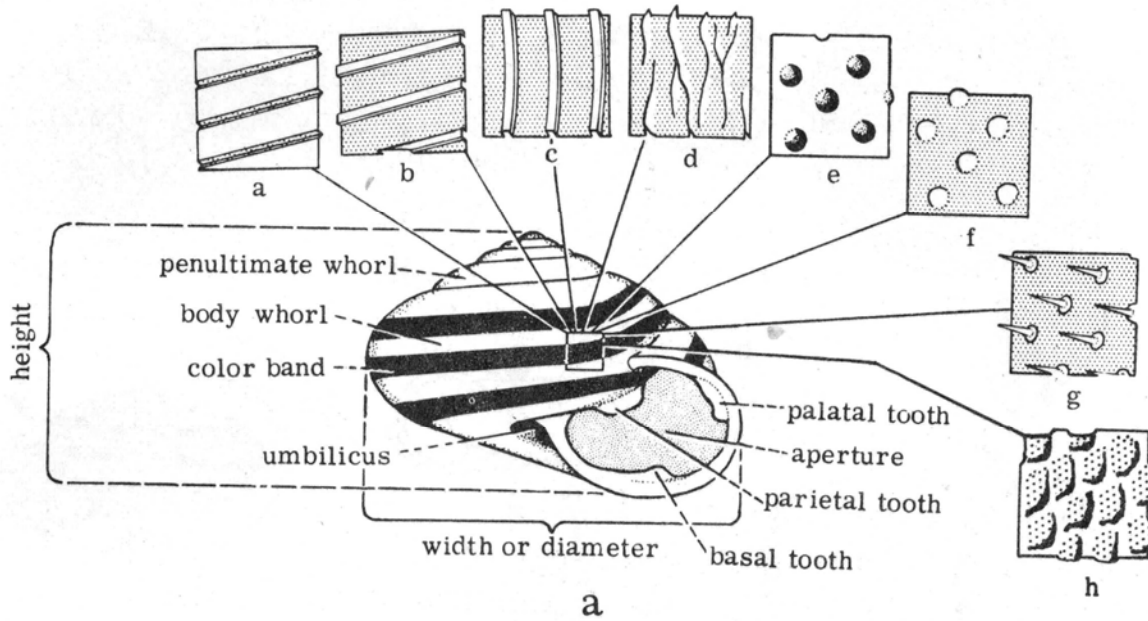
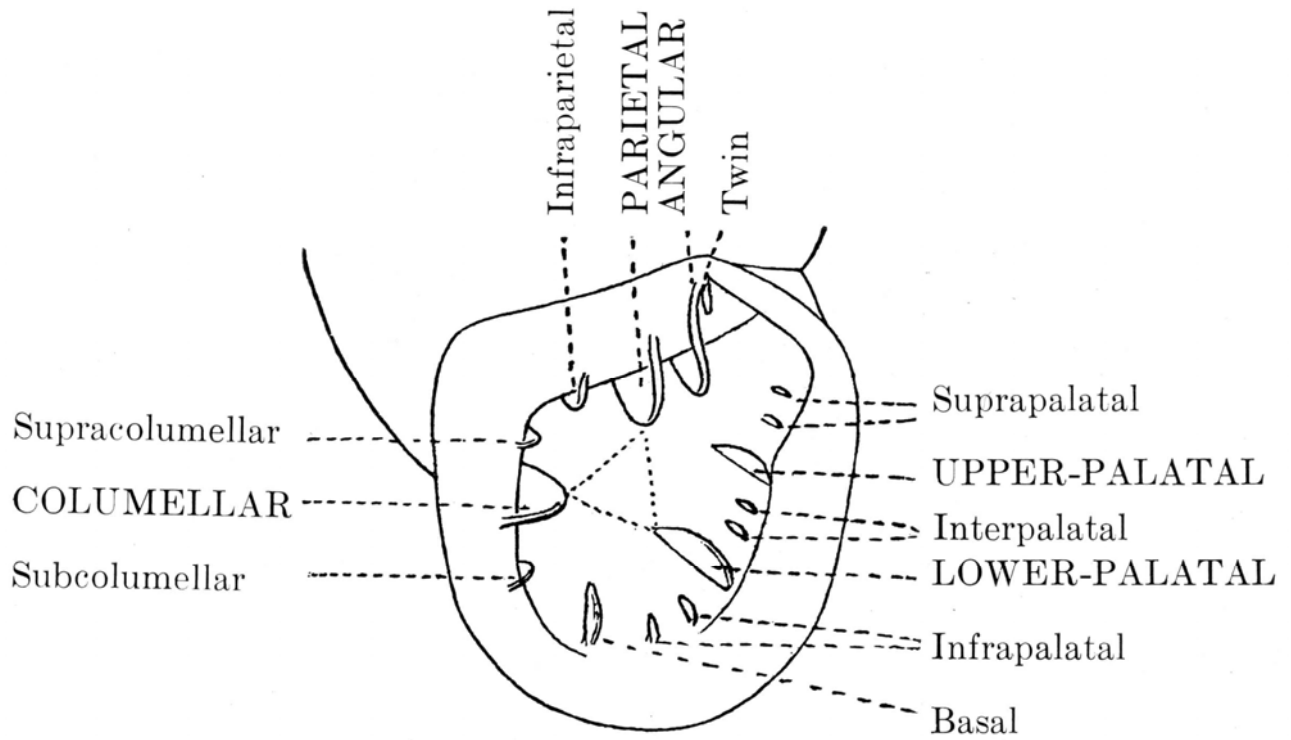
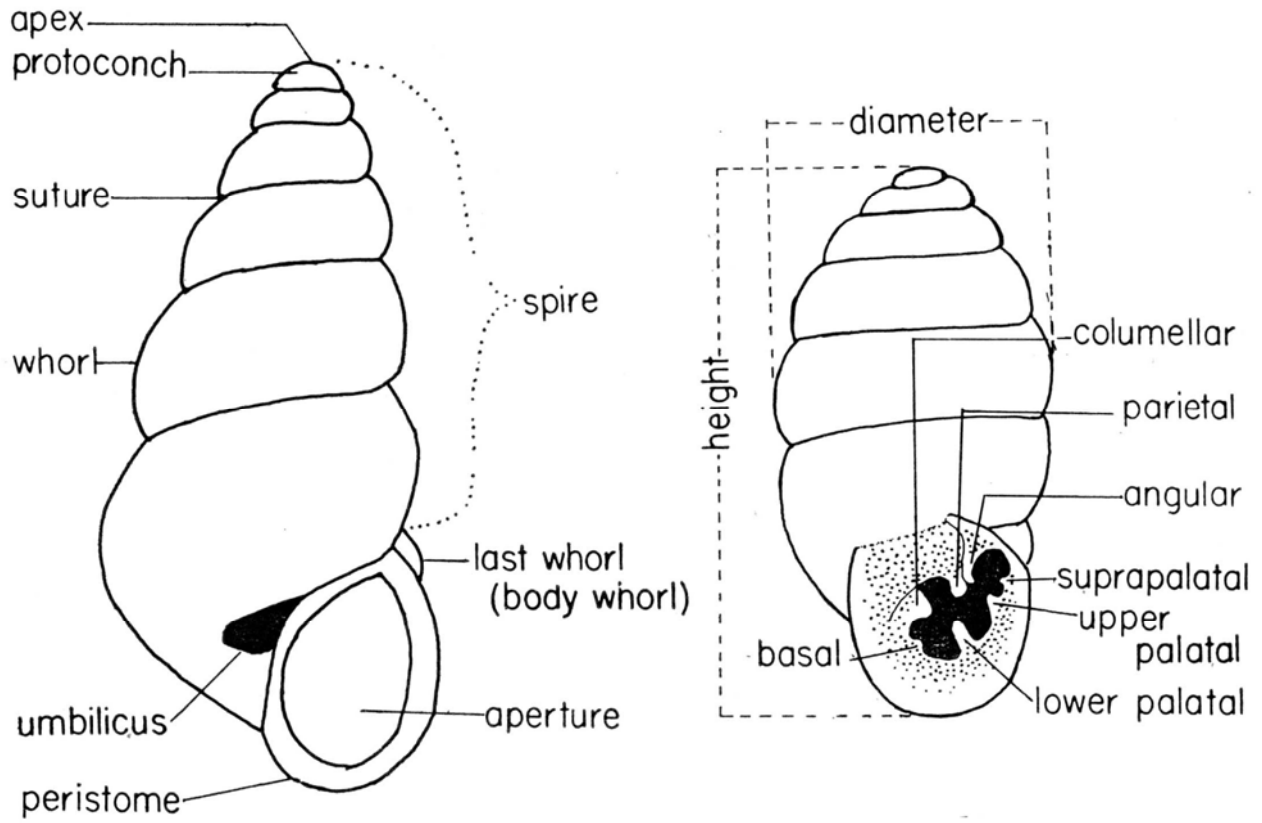


Figure 11. Shell terminology and surface sculpture. 11a, Striae (indented spiral lines) (a), lirae (raised spiral lines) (b); ribs (raised transverse lines) (c); wrinkles (d); puncta or pits (e); papillae or granules (f); hairs or bristles (g); dents (malleated) (h). 11b, Transverse or growth lines (a); spiral lines or striae (b).



APPENDIX II:

Alphabetical enumeration of sample sites by county, with location, habitat type, total abundance, and species list

Aroostook County

Aikens Brook Road: *Fraxinus-Thuja-Acer rubrum-Alnus* swamp

Collection Date: September 7, 2007	Location: 68.4523 W., 46.4055 N.
Habitat Type: Northern White Cedar / Ash Wetland	Habitat Group: Lowland Forest
Richness: 21	Total Abundance: 1132

<i>Planogyra asteriscus</i>	269	<i>Euconulus alderi</i>	13
<i>Striatura exigua</i>	241	<i>Columella simplex</i>	11
<i>Nesovitrea electrina</i>	93	<i>Punctum</i> n.sp.	10
<i>Punctum minutissimum</i>	91	<i>Vertigo cristata</i>	10
<i>Euconulus fulvus</i>	79	<i>Vertigo nylanderi</i>	10
<i>Discus catskillensis</i>	50	<i>Carychium exile</i>	8
<i>Strobilops labyrinthica</i>	46	<i>Striatura milium</i>	8
<i>Nesovitrea binneyana</i>	27	<i>Striatura ferrea</i>	4
<i>Carychium exiguum</i>	25	<i>Deroceras</i> sp.	1
<i>Gastrocopta tappaniana</i>	25	<i>Zonitoides arboreus</i>	1
<i>Vertigo ventricosa</i>	17	Immature Pupillidea	103

Birch Point: Acid *Thuja* swamp forest

Collection Date: September 6, 2007	Location: 68.2086 W., 46.0362 N.
Habitat Type: Northern White Cedar / Ash Wetland	Habitat Group: Lowland Forest
Richness: 14	Total Abundance: 429

<i>Gastrocopta tappaniana</i>	62	<i>Vertigo nylanderi</i>	7
<i>Nesovitrea electrina</i>	33	<i>Vertigo cristata</i>	6
<i>Strobilops labyrinthica</i>	28	<i>Euconulus fulvus</i>	5
<i>Striatura exigua</i>	27	<i>Nesovitrea binneyana</i>	2
<i>Vertigo ventricosa</i>	21	<i>Deroceras</i> sp.	1
<i>Carychium exiguum</i>	11	<i>Discus catskillensis</i>	1
<i>Striatura milium</i>	8	Immature Pupillidea	210
<i>Punctum minutissimum</i>	7		

Blind Brook: *Thuja* swamp forest

Collection Date: September 7, 2007	Location: 68.9291 W., 46.5788 N.
Habitat Type: Northern White Cedar / Ash Wetland	Habitat Group: Lowland Forest
Richness: 15	Total Abundance: 1042

<i>Planogyra asteriscus</i>	582	<i>Striatura exigua</i>	43
<i>Punctum minutissimum</i>	170	<i>Striatura milium</i>	35
<i>Carychium exile</i>	83	<i>Vertigo cristata</i>	25

<i>Euconulus fulvus</i>	16	<i>Vertigo nylanderi</i>	2
<i>Vertigo bollesiana</i>	10	<i>Zoogenetes harpa</i>	2
<i>Nesovitrea electrina</i>	7	<i>Columella simplex</i>	1
<i>Carychium exiguum</i>	5	Immature Pupillidea	56
<i>Vertigo paradoxa</i>	3	Immature <i>Discus</i>	2

Bonderson Road: *Larix-Thuja* swamp forest

Collection Date: September 13, 2007 Location: 68.1763 W., 46.9917 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 19 Total Abundance: 1800

<i>Planogyra asteriscus</i>	755	<i>Vertigo bollesiana</i>	10
<i>Striatura exigua</i>	218	<i>Columella simplex</i>	9
<i>Punctum minutissimum</i>	189	<i>Carychium exiguum</i>	5
<i>Strobilops labyrinthica</i>	183	<i>Vertigo paradoxa</i>	3
<i>Carychium exile</i>	113	<i>Gastrocopta tappaniana</i>	1
<i>Striatura milium</i>	84	<i>Vertigo gouldi</i>	1
<i>Vertigo cristata</i>	61	<i>Vertigo ventricosa</i>	1
<i>Euconulus fulvus</i>	16	<i>Zonitoides arboreus</i>	1
<i>Nesovitrea binneyana</i>	12	Immature Pupillidea	123
<i>Striatura ferrea</i>	11	Immature <i>Discus</i>	4

Bourgoin Brook: *Thuja-Fraxinus* swamp forest

Collection Date: September 5, 2007 Location: 68.3342 W., 47.2798 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 22 Total Abundance: 1214

<i>Strobilops labyrinthica</i>	333	<i>Discus catskillensis</i>	14
<i>Planogyra asteriscus</i>	211	<i>Euconulus alderi</i>	10
<i>Punctum minutissimum</i>	93	<i>Nesovitrea binneyana</i>	4
<i>Striatura exigua</i>	86	<i>Vertigo ventricosa</i>	3
<i>Nesovitrea electrina</i>	63	<i>Striatura ferrea</i>	2
<i>Carychium exiguum</i>	62	<i>Vertigo bollesiana</i>	2
<i>Gastrocopta tappaniana</i>	54	<i>Helicodiscus shimeki</i>	1
<i>Euconulus fulvus</i>	49	<i>Vertigo paradoxa</i>	1
<i>Vertigo nylanderi</i>	46	<i>Zonitoides arboreus</i>	1
<i>Carychium exile</i>	35	Immature Pupillidea	106
<i>Vertigo cristata</i>	22	Immature Succineidae	2
<i>Columella simplex</i>	14		

Bridgewater SW: Rich *Thuja-Fraxinus* swamp forest

Collection Date: September 11, 2007 Location: 67.8862 W., 46.3761 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 23 Total Abundance: 1527

<i>Planogyra asteriscus</i>	362	<i>Strobilops labyrinthica</i>	232
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<i>Punctum minutissimum</i>	148	<i>Gastrocopta tappaniana</i>	19
<i>Carychium exile</i>	112	<i>Nesovitrea binneyana</i>	17
<i>Striatura exigua</i>	70	<i>Columella simplex</i>	12
<i>Carychium exiguum</i>	54	<i>Vertigo elatior</i>	11
<i>Euconulus fulvus</i>	54	<i>Euconulus alderi</i>	7
<i>Vertigo ventricosa</i>	47	<i>Vertigo paradoxa</i>	7
<i>Vertigo cristata</i>	33	<i>Vertigo nylanderi</i>	6
<i>Punctum n.sp.</i>	28	<i>Striatura ferrea</i>	3
<i>Vertigo bollesiana</i>	26	<i>Vertigo gouldi</i>	3
<i>Nesovitrea electrina</i>	24	<i>Zonitoides arboreus</i>	1
<i>Striatura milium</i>	23	Immature Pupillidea	228

Burnt Landing Road: Dry, acid *Larix* forest

Collection Date: September 15, 2007

Location: 68.3716 W., 47.0961 N.

Habitat Type: Tamarack Wetland

Habitat Group: Lowland Forest

Richness: 4

Total Abundance: 5

<i>Vertigo cristata</i>	2	<i>Striatura milium</i>	1
<i>Striatura ferrea</i>	1	<i>Strobilops labyrinthica</i>	1

Byron Mountain: Leatherleaf-*Myrica* margin and islands in acid bog

Collection Date: September 6, 2007

Location: 68.0305 W., 46.0409 N.

Habitat Type: Acid Bog

Habitat Group: Lowland Grassland

Richness: 13

Total Abundance: 149

<i>Vertigo ovata</i>	20	<i>Discus catskillensis</i>	2
<i>Zonitoides nitidus</i>	18	<i>Nesovitrea electrina</i>	2
<i>Gastrocopta tappaniana</i>	14	<i>Vallonia pulchella</i>	2
<i>Carychium exiguum</i>	11	<i>Planogyra asteriscus</i>	1
<i>Euconulus alderi</i>	9	<i>Vertigo cristata</i>	1
<i>Punctum n.sp.</i>	8	<i>Vertigo pygmaea</i>	1
<i>Vertigo ventricosa</i>	4	Immature Pupillidea	56

Caribou: Disturbed, N-facing limestone cliff

Collection Date: July 23, 2002

Location: 68.0119 W., 46.8590 N.

Habitat Type: Meta-sedimentary Bedrock Outcrop

Habitat Group: Bedrock Outcrop

Richness: 14

Total Abundance: 1780

<i>Trichia hispida</i>	432	<i>Vertigo pygmaea</i>	4
<i>Vallonia costata</i>	276	<i>Deroceras laeve</i>	2
<i>Vertigo gouldi</i>	66	<i>Vallonia excentrica</i>	2
<i>Vallonia pulchella</i>	63	<i>Discus catskillensis</i>	1
<i>Vertigo paradoxa</i>	59	<i>Strobilops labyrinthica</i>	1
<i>Pupilla muscorum</i>	20	Immature Pupillidea	47
<i>Cochlicopa lubrica</i>	14	Immature <i>Vallonia</i>	796
<i>Oxychylus cellarius</i>	4		

Caribou East: *Thuja-Acer* forest on limestone cliff

Collection Date: September 14, 2007

Location: 67.9758 W., 46.8716 N.

Habitat Type: Meta-sedimentary Bedrock Outcrop

Habitat Group: Bedrock Outcrop

Richness: 22

Total Abundance: 949

<i>Punctum minutissimum</i>	395	<i>Euchemotrema fraternum</i>	7
<i>Vertigo bollesiana</i>	84	<i>Oxychylus cellarius</i>	5
<i>Strobilops labyrinthica</i>	76	<i>Striatura milium</i>	4
<i>Euconulus fulvus</i>	48	<i>Carychium exile</i>	1
<i>Vertigo paradoxa</i>	48	<i>Catinella avara</i>	1
<i>Vertigo gouldi</i>	45	<i>Gastrocopta contracta</i>	1
<i>Vertigo cristata</i>	24	<i>Succinea ovalis</i>	1
<i>Columella simplex</i>	23	<i>Neohelix albolabris</i>	1
<i>Nesovitrea binneyana</i>	16	<i>Vallonia pulchella</i>	1
<i>Discus catskillensis</i>	12	Immature Pupillidea	137
<i>Anguispira alternata</i>	10	Immature <i>Cochlicopa</i>	1
<i>Trichia hispida</i>	8		

Note: a dwarf *Cypridium* is present on open clay banks on this site. Although unlikely, it is possible that these might represent *C. candidum* based on its behavior in the Midwest. It may also represent *C. calceolus* var. *planipetalum*, which is endemic to the St. Lawrence. The identity of these plants should be checked by a local botanist.

Carlisle Pond: Acid *Thuja* swamp forest

Collection Date: September 11, 2007

Location: 68.1250 W., 46.3157 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 16

Total Abundance: 819

<i>Striatura exigua</i>	173	<i>Punctum minutissimum</i>	5
<i>Striatura milium</i>	71	<i>Columella simplex</i>	4
<i>Vertigo ventricosa</i>	67	<i>Vertigo nylanderi</i>	4
<i>Vertigo cristata</i>	56	<i>Nesovitrea binneyana</i>	3
<i>Euconulus fulvus</i>	35	<i>Striatura ferrea</i>	2
<i>Nesovitrea electrina</i>	34	<i>Strobilops labyrinthica</i>	2
<i>Planogyra asteriscus</i>	26	<i>Vertigo elatior</i>	2
<i>Gastrocopta tappaniana</i>	17	Immature Pupillidea	306
<i>Euconulus alderi</i>	12		

Chapman: Rich *Thuja-Abies-Ash-Red* Maple swamp

Collection Date: September 9, 2007

Location: 68.1735 W., 46.6480 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 23

Total Abundance: 2406

<i>Planogyra asteriscus</i>	573	<i>Strobilops labyrinthica</i>	199
<i>Punctum minutissimum</i>	324	<i>Striatura exigua</i>	176
<i>Carychium exile</i>	277	<i>Carychium exiguum</i>	135

<i>Gastrocopta tappaniana</i>	109	<i>Punctum</i> n.sp.	7
<i>Euconulus fulvus</i>	73	<i>Vertigo bollesiana</i>	5
<i>Nesovitrea electrina</i>	66	<i>Columella simplex</i>	4
<i>Striatura milium</i>	59	<i>Vertigo gouldi</i>	3
<i>Vertigo nylanderi</i>	40	<i>Helicodiscus shimeki</i>	1
<i>Vertigo ventricosa</i>	26	<i>Striatura ferrea</i>	1
<i>Vertigo cristata</i>	19	Immature Pupillidea	253
<i>Nesovitrea binneyana</i>	18	Immature Succineidae	1
<i>Euconulus alderi</i>	10	Immature <i>Discus</i>	27

Note: A substantial population of *Dryopteris goldiana* (S3) was observed in the upland Sugar Maple forest about 200 meters SW of this site.

Cold Spring Wayside: Upland *Acer-Picea-Betula lutea* forest

Collection Date: July 24, 2002

Location: 68.3430 W., 46.2387 N.

Habitat Type: Sugar Maple Forest

Habitat Group: Upland Forest

Richness: 8

Total Abundance: 62

<i>Striatura exigua</i>	24	<i>Columella simplex</i>	2
<i>Striatura milium</i>	15	<i>Nesovitrea binneyana</i>	1
<i>Vertigo cristata</i>	7	<i>Striatura ferrea</i>	1
<i>Helicodiscus shimeki</i>	4	Immature Pupillidea	6
<i>Planogyra asteriscus</i>	3		

Collins Siding: Acid *Thuja-Larix-Abies* swamp

Collection Date: September 13, 2007

Location: 68.1316 W., 47.1113 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 24

Total Abundance: 1173

<i>Striatura exigua</i>	188	<i>Gastrocopta tappaniana</i>	9
<i>Carychium exile</i>	181	<i>Vertigo bollesiana</i>	8
<i>Planogyra asteriscus</i>	174	<i>Striatura milium</i>	5
<i>Strobilops labyrinthica</i>	173	<i>Vertigo ventricosa</i>	5
<i>Punctum minutissimum</i>	78	<i>Vertigo elatior</i>	4
<i>Nesovitrea electrina</i>	43	<i>Succinea ovalis</i>	3
<i>Vertigo cristata</i>	41	<i>Helicodiscus shimeki</i>	1
<i>Carychium exiguum</i>	38	<i>Punctum</i> n.sp.	1
<i>Euconulus fulvus</i>	34	<i>Striatura ferrea</i>	1
<i>Discus catskillensis</i>	19	<i>Vertigo gouldi</i>	1
<i>Nesovitrea binneyana</i>	18	<i>Vertigo nylanderi</i>	1
<i>Columella simplex</i>	15	Immature Pupillidea	123
<i>Euconulus alderi</i>	9		

Crystal 1: Young Apsen-Maple forest

Collection Date: July 24, 2002

Location: 68.3615 W., 45.9594 N.

Habitat Type: Aspen Forest

Habitat Group: Upland Forest

Richness: 12

Total Abundance: 80

<i>Vertigo paradoxa</i>	31	<i>Anguispira alternata</i>	2
<i>Striatura milium</i>	13	<i>Punctum minutissimum</i>	2
<i>Cochlicopa lubricella</i>	11	<i>Vertigo bollesiana</i>	2
<i>Striatura exigua</i>	5	<i>Euconulus fulvus</i>	1
<i>Strobilops labyrinthica</i>	5	<i>Vertigo gouldi</i>	1
<i>Carychium exile</i>	3	Immature Pupillidea	2
<i>Vertigo cristata</i>	3		

Crystal 2: Wooded esker and swamp forest

Collection Date: October 10, 2002

Location: 68.3633 W., 45.9590 N.

Habitat Type: Upland Maple Forest

Habitat Group: Upland Forest

Richness: 14

Total Abundance: 435

<i>Punctum minutissimum</i>	139	<i>Vertigo bollesiana</i>	8
<i>Vertigo cristata</i>	57	<i>Nesovitrea electrina</i>	5
<i>Cochlicopa lubricella</i>	27	<i>Gastrocopta tappaniana</i>	4
<i>Striatura milium</i>	27	<i>Carychium exile</i>	2
<i>Strobilops labyrinthica</i>	26	<i>Discus catskillensis</i>	2
<i>Vertigo paradoxa</i>	23	<i>Striatura exigua</i>	2
<i>Vertigo nylanderi</i>	16	Immature Pupillidea	89
<i>Euconulus alderi</i>	9		

Crystal Bog 1: *Larix-Thuja-Alnus* swamp forest

Collection Date: July 23, 2002

Location: 68.3700 W., 45.9832 N.

Habitat Type: Tamarack Wetland

Habitat Group: Lowland Forest

Richness: 18

Total Abundance: 595

<i>Striatura exigua</i>	106	<i>Vertigo nylanderi</i>	9
<i>Planogyra asteriscus</i>	89	<i>Helicodiscus shimeki</i>	8
<i>Striatura milium</i>	87	<i>Succinea ovalis</i>	7
<i>Nesovitrea electrina</i>	70	<i>Columella simplex</i>	3
<i>Punctum minutissimum</i>	70	<i>Euconulus alderi</i>	3
<i>Carychium exiguum</i>	68	<i>Vertigo bollesiana</i>	2
<i>Gastrocopta tappaniana</i>	29	<i>Carychium exile</i>	1
<i>Discus catskillensis</i>	13	<i>Catinella avara</i>	1
<i>Vertigo cristata</i>	11	Immature Pupillidea	43
<i>Vertigo elatior</i>	9		

Crystal Bog 2: Wet sedge mat of fen

Collection Date: July 24, 2002

Habitat Type: Fen

Richness: 15

Location: 68.3644 W., 45.9559 N.

Habitat Group: Lowland Grassland

Total Abundance: 773

<i>Gastrocopta tappaniana</i>	243	<i>Vertigo ovata</i>	21
<i>Carychium exiguum</i>	146	<i>Vertigo nylanderi</i>	19
<i>Vertigo elatior</i>	59	<i>Catinella avara</i>	18
<i>Striatura milium</i>	54	<i>Punctum n.sp.</i>	14
<i>Strobilops labyrinthica</i>	51	<i>Nesovitrea electrina</i>	10
<i>Vertigo cristata</i>	28	<i>Columella simplex</i>	1
<i>Euconulus alderi</i>	26	<i>Euconulus fulvus</i>	1
<i>Punctum minutissimum</i>	24	Immature Pupillidea	131

Daigle: Upland Aspen-Red Maple-Spruce forest

Collection Date: September 5, 2007

Habitat Type: Aspen Forest

Richness: 11

Location: 68.4472 W., 47.1886 N.

Habitat Group: Upland Forest

Total Abundance: 157

<i>Punctum minutissimum</i>	39	<i>Euconulus fulvus</i>	5
<i>Zoogenetes harpa</i>	35	<i>Cochlicopa lubricella</i>	1
<i>Cochlicopa lubrica</i>	22	<i>Striatura ferrea</i>	1
<i>Vertigo cristata</i>	17	<i>Vallonia pulchella</i>	1
<i>Discus catskillensis</i>	12	<i>Vertigo bollesiana</i>	1
<i>Striatura exigua</i>	8	Immature Pupillidea	15

Duck Pond: *Larix-Abies-Fraxinus*-Red Maple swamp

Collection Date: September 11, 2007

Habitat Type: Tamarack Wetland

Richness: 18

Location: 68.0904 W., 46.2085 N.

Habitat Group: Lowland Forest

Total Abundance: 371

<i>Striatura exigua</i>	114	<i>Columella simplex</i>	4
<i>Vertigo cristata</i>	37	<i>Strobilops labyrinthica</i>	4
<i>Nesovitrea electrina</i>	32	<i>Carychium exiguum</i>	2
<i>Punctum minutissimum</i>	22	<i>Helicodiscus shimaki</i>	1
<i>Gastrocopta tappaniana</i>	19	<i>Striatura ferrea</i>	1
<i>Planogyra asteriscus</i>	19	<i>Vertigo nylanderi</i>	1
<i>Euconulus fulvus</i>	18	<i>Zonitoides arboreus</i>	1
<i>Striatura milium</i>	9	Immature Pupillidea	73
<i>Vertigo ventricosa</i>	8	Immature <i>Discus</i>	1
<i>Nesovitrea binneyana</i>	5		

Fogelin Pond: *Thuja* swamp forest

Collection Date: September 13, 2007

Habitat Type: Northern White Cedar / Ash Wetland

Richness: 23

Location: 68.1615 W., 46.9845 N.

Habitat Group: Lowland Forest

Total Abundance: 907

<i>Planogyra asteriscus</i>	250	<i>Euconulus alderi</i>	8
<i>Striatura exigua</i>	105	<i>Gastrocopta tappaniana</i>	6
<i>Punctum minutissimum</i>	66	<i>Punctum</i> n.sp.	5
<i>Carychium exile</i>	63	<i>Columella simplex</i>	3
<i>Strobilops labyrinthica</i>	59	<i>Nesovitrea binneyana</i>	2
<i>Vertigo ventricosa</i>	36	<i>Vertigo bollesiana</i>	2
<i>Vertigo cristata</i>	29	<i>Vertigo ovata</i>	2
<i>Euconulus fulvus</i>	20	<i>Vertigo paradoxa</i>	2
<i>Striatura milium</i>	20	<i>Helicodiscus shimeki</i>	1
<i>Carychium exiguum</i>	18	Immature Pupillidea	165
<i>Nesovitrea electrina</i>	18	Immature Succineidae	2
<i>Vertigo nylanderi</i>	12	Immature <i>Discus</i>	13

Grendell Cemetery: Rich *Thuja* swamp forest

Collection Date: September 9, 2007 Location: 68.1268 W., 46.6368 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 24 Total Abundance: 1411

<i>Planogyra asteriscus</i>	343	<i>Vertigo bollesiana</i>	11
<i>Strobilops labyrinthica</i>	154	<i>Columella simplex</i>	7
<i>Striatura exigua</i>	140	<i>Euconulus alderi</i>	6
<i>Punctum minutissimum</i>	117	<i>Nesovitrea binneyana</i>	2
<i>Carychium exile</i>	86	<i>Punctum</i> n.sp.	2
<i>Carychium exiguum</i>	73	<i>Deroceras</i> sp.	1
<i>Vertigo cristata</i>	56	<i>Helicodiscus shimeki</i>	1
<i>Striatura milium</i>	49	<i>Striatura ferrea</i>	1
<i>Gastrocopta tappaniana</i>	33	<i>Vertigo gouldi</i>	1
<i>Vertigo ventricosa</i>	25	Immature Pupillidea	249
<i>Nesovitrea electrina</i>	17	Immature Succineidae	2
<i>Euconulus fulvus</i>	16	Immature <i>Discus</i>	3
<i>Vertigo nylanderi</i>	16		

Harvey: Riparian *Thuja-Fraxinus* forest

Collection Date: September 11, 2007 Location: 67.9319 W., 46.3518 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 22 Total Abundance: 1450

<i>Planogyra asteriscus</i>	274	<i>Euconulus fulvus</i>	30
<i>Carychium exile</i>	240	<i>Vertigo bollesiana</i>	20
<i>Punctum minutissimum</i>	225	<i>Vertigo cristata</i>	18
<i>Strobilops labyrinthica</i>	214	<i>Vertigo ventricosa</i>	15
<i>Striatura exigua</i>	114	<i>Nesovitrea electrina</i>	8
<i>Carychium exiguum</i>	50	<i>Columella simplex</i>	7
<i>Gastrocopta tappaniana</i>	44	<i>Punctum</i> n.sp.	6
<i>Striatura milium</i>	35	<i>Nesovitrea binneyana</i>	5

Jack Mountain: N-facing damp, calcareous cliff

Collection Date: September 7, 2007

Location: 68.7330 W., 46.5741 N.

Habitat Type: Igneous Bedrock Outcrop

Habitat Group: Bedrock Outcrop

Richness: 16

Total Abundance: 307

<i>Vertigo bollesiana</i>	42	<i>Vertigo cristata</i>	2
<i>Vertigo ronneyensis</i>	30	<i>Vertigo gouldi</i>	2
<i>Punctum minutissimum</i>	24	<i>Zonitoides arboreus</i>	2
<i>Vertigo paradoxa</i>	24	<i>Carychium exile</i>	1
<i>Columella simplex</i>	6	<i>Glyphyalinia rhoadsi</i>	1
<i>Striatura milium</i>	5	<i>Striatura ferrea</i>	1
<i>Strobilops labyrinthica</i>	4	Immature Pupillidea	158
<i>Euconulus fulvus</i>	2	Immature <i>Discus</i>	1
<i>Striatura exigua</i>	2		

Note: this site also supported populations of *Cryptogramma stelleri* (S1) and *Woodsia glabella* (S1)

Keegan NW: Acid Willow-Alder-*Larix-Carex* thicket

Collection Date: September 5, 2007

Location: 68.0199 W., 47.2321 N.

Habitat Type: Shrub Carr

Habitat Group: Lowland Forest

Richness: 18

Total Abundance: 814

<i>Carychium exiguum</i>	247	<i>Euconulus alderi</i>	12
<i>Nesovitrea electrina</i>	74	<i>Succinea ovalis</i>	12
<i>Gastrocopta tappaniana</i>	59	<i>Striatura milium</i>	11
<i>Cochlicopa lubrica</i>	57	<i>Vertigo ventricosa</i>	10
<i>Columella simplex</i>	48	<i>Vertigo cristata</i>	5
<i>Punctum n.sp.</i>	44	<i>Trichia hispida</i>	2
<i>Striatura exigua</i>	43	<i>Helicodiscus shimaki</i>	1
<i>Euconulus fulvus</i>	37	<i>Vitrina limpida</i>	1
<i>Discus catskillensis</i>	16	Immature Pupillidea	121
<i>Vallonia pulchella</i>	14		

Littleton East: S-facing rocky slope with *Thuja, Acer*

Collection Date: September 14, 2007

Location: 67.7900 W., 46.2290 N.

Habitat Type: Rocky Forest

Habitat Group: Upland Forest

Richness: 9

Total Abundance: 160

<i>Punctum minutissimum</i>	122	<i>Discus catskillensis</i>	1
<i>Nesovitrea electrina</i>	18	<i>Vertigo gouldi</i>	1
<i>Euconulus fulvus</i>	7	<i>Zonitoides nitidus</i>	1
<i>Anguispira alternata</i>	4	Immature Pupillidea	4
<i>Columella simplex</i>	1	Immature <i>Cochlicopa</i>	1

Martin Brook: Dry *Thuja-Larix* swamp

Collection Date: September 15, 2007 Location: 67.8857 W., 47.0572 N.
 Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
 Richness: 16 Total Abundance: 328

<i>Planogyra asteriscus</i>	78	<i>Discus catskillensis</i>	9
<i>Punctum minutissimum</i>	47	<i>Carychium exiguum</i>	8
<i>Striatura exigua</i>	46	<i>Columella simplex</i>	3
<i>Strobilops labyrinthica</i>	46	<i>Vertigo ventricosa</i>	3
<i>Striatura milium</i>	20	<i>Helicodiscus shimeki</i>	1
<i>Nesovitrea binneyana</i>	18	<i>Vertigo bollesiana</i>	1
<i>Vertigo cristata</i>	14	<i>Zonitoides arboreus</i>	1
<i>Euconulus fulvus</i>	12	Immature Pupillidea	9
<i>Nesovitrea electrina</i>	12		

Martin Lake: Acid *Fraxinus-Red Maple-Alnus* swamp

Collection Date: September 15, 2007 Location: 67.8875 W., 47.0373 N.
 Habitat Type: Red Maple / Black Spruce Wetland Habitat Group: Lowland Forest
 Richness: 14 Total Abundance: 293

<i>Strobilops labyrinthica</i>	42	<i>Columella simplex</i>	7
<i>Punctum minutissimum</i>	41	<i>Nesovitrea electrina</i>	7
<i>Striatura exigua</i>	31	<i>Discus catskillensis</i>	5
<i>Vertigo ventricosa</i>	26	<i>Nesovitrea binneyana</i>	4
<i>Planogyra asteriscus</i>	22	<i>Striatura milium</i>	4
<i>Euconulus fulvus</i>	12	<i>Gastrocopta tappaniana</i>	2
<i>Carychium exiguum</i>	8	Immature Pupillidea	74
<i>Vertigo cristata</i>	8		

McConnell Brook: Riparian *Thuja* forest

Collection Date: September 7, 2007 Location: 68.5953 W., 46.6120 N.
 Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
 Richness: 18 Total Abundance: 450

<i>Punctum minutissimum</i>	171	<i>Vertigo paradoxa</i>	5
<i>Striatura milium</i>	56	<i>Vertigo nylanderi</i>	3
<i>Planogyra asteriscus</i>	41	<i>Gastrocopta tappaniana</i>	2
<i>Punctum n.sp.</i>	40	<i>Nesovitrea binneyana</i>	2
<i>Striatura exigua</i>	35	<i>Vertigo bollesiana</i>	1
<i>Nesovitrea electrina</i>	29	Immature Pupillidea	16
<i>Carychium exile</i>	17	Immature Succineidae	1
<i>Carychium exiguum</i>	12	Immature <i>Cochlicopa</i>	1
<i>Vertigo cristata</i>	11	Immature <i>Discus</i>	1
<i>Euconulus fulvus</i>	6		

McIntyre Road: Timbered *Thuja* swamp forest

Collection Date: September 6, 2007

Location: 67.8645 W., 46.0779 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 19

Total Abundance: 580

<i>Strobilops labyrinthica</i>	162	<i>Vertigo cristata</i>	10
<i>Planogyra asteriscus</i>	111	<i>Carychium exile</i>	5
<i>Punctum minutissimum</i>	68	<i>Columella simplex</i>	4
<i>Striatura exigua</i>	38	<i>Nesovitrea binneyana</i>	2
<i>Striatura milium</i>	30	<i>Vertigo ventricosa</i>	2
<i>Nesovitrea electrina</i>	22	<i>Euconulus alderi</i>	1
<i>Gastrocopta tappaniana</i>	21	<i>Punctum n.sp.</i>	1
<i>Euconulus fulvus</i>	15	<i>Vertigo elatior</i>	1
<i>Carychium exiguum</i>	14	Immature Pupillidea	61
<i>Vertigo bollesiana</i>	11	Immature Succineidae	1

Mile 18, Oxbow Road: Mature upland Aspen-*Abies*-*Picea* forest

Collection Date: September 7, 2007

Location: 68.6987 W., 46.3911 N.

Habitat Type: Aspen Forest

Habitat Group: Upland Forest

Richness: 12

Total Abundance: 122

<i>Striatura exigua</i>	32	<i>Columella simplex</i>	3
<i>Nesovitrea binneyana</i>	17	<i>Planogyra asteriscus</i>	2
<i>Striatura milium</i>	16	<i>Punctum minutissimum</i>	1
<i>Discus catskillensis</i>	15	<i>Vertigo bollesiana</i>	1
<i>Strobilops labyrinthica</i>	15	<i>Zoogenetes harpa</i>	1
<i>Euconulus fulvus</i>	6	Immature Pupillidea	7
<i>Vertigo cristata</i>	6		

Minnow Brook: Riparian *Thuja* forest

Collection Date: September 5, 2007

Location: 68.3043 W., 47.0878 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 15

Total Abundance: 273

<i>Planogyra asteriscus</i>	87	<i>Euconulus fulvus</i>	5
<i>Striatura exigua</i>	71	<i>Columella simplex</i>	1
<i>Punctum minutissimum</i>	24	<i>Striatura ferrea</i>	1
<i>Strobilops labyrinthica</i>	21	<i>Vertigo bollesiana</i>	1
<i>Striatura milium</i>	17	<i>Vertigo ventricosa</i>	1
<i>Vertigo cristata</i>	11	<i>Zoogenetes harpa</i>	1
<i>Nesovitrea binneyana</i>	8	Immature Pupillidea	16
<i>Carychium exiguum</i>	6	Immature <i>Discus</i>	2

Molunkus Stream: Mature *Acer-Tsuga-Betula lutea* forest

Collection Date: July 23, 2002

Location: 68.2773 W., 45.6635 N.

Habitat Type: Sugar Maple Forest

Habitat Group: Upland Forest

Richness: 15

Total Abundance: 175

<i>Striatura milium</i>	46	<i>Euconulus fulvus</i>	4
<i>Helicodiscus parallelus</i>	22	<i>Nesovitrea binneyana</i>	4
<i>Vertigo cristata</i>	20	<i>Striatura ferrea</i>	4
<i>Helicodiscus shimeki</i>	17	<i>Strobilops labyrinthica</i>	4
<i>Striatura exigua</i>	15	<i>Columella simplex</i>	2
<i>Planogyra asteriscus</i>	13	<i>Vertigo bollesiana</i>	1
<i>Punctum minutissimum</i>	10	Immature Pupillidea	12
<i>Zonitoides arboreus</i>	5	Immature <i>Cochlicopa</i>	1

Monticello Station: Rich *Thuja*-Ash swamp forest

Collection Date: September 6, 2007

Location: 67.8551 W., 46.2999 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 24

Total Abundance: 1827

<i>Strobilops labyrinthica</i>	519	<i>Columella simplex</i>	8
<i>Planogyra asteriscus</i>	506	<i>Nesovitrea binneyana</i>	4
<i>Punctum minutissimum</i>	178	<i>Vertigo ventricosa</i>	4
<i>Carychium exile</i>	135	<i>Cochlicopa lubrica</i>	3
<i>Striatura exigua</i>	69	<i>Helicodiscus shimeki</i>	3
<i>Nesovitrea electrina</i>	60	<i>Succinea ovalis</i>	3
<i>Striatura milium</i>	53	<i>Vallonia pulchella</i>	3
<i>Euconulus fulvus</i>	50	<i>Vertigo gouldi</i>	3
<i>Discus catskillensis</i>	43	<i>Zonitoides arboreus</i>	2
<i>Gastrocopta tappaniana</i>	36	<i>Vertigo pygmaea</i>	1
<i>Vertigo bollesiana</i>	19	<i>Zonitoides nitidus</i>	1
<i>Carychium exiguum</i>	17	Immature Pupillidea	96
<i>Vertigo cristata</i>	11		

Monticello West 1: N-facing bluff with *Thuja* & *Abies*

Collection Date: September 6, 2007

Location: 67.8641 W., 46.3052 N.

Habitat Type: Meta-sedimentary Bedrock Outcrop

Habitat Group: Bedrock Outcrop

Richness: 22

Total Abundance: 819

<i>Strobilops labyrinthica</i>	200	<i>Vertigo bollesiana</i>	19
<i>Punctum minutissimum</i>	179	<i>Carychium exile</i>	16
<i>Discus catskillensis</i>	57	<i>Striatura milium</i>	16
<i>Euconulus fulvus</i>	54	<i>Vertigo paradoxa</i>	12
<i>Nesovitrea binneyana</i>	51	<i>Striatura exigua</i>	7
<i>Vertigo cristata</i>	50	<i>Anguispira alternata</i>	4
<i>Vertigo gouldi</i>	27	<i>Planogyra asteriscus</i>	4

<i>Zonitoides arboreus</i>	4	<i>Punctum</i> n.sp.	1
<i>Zoogenetes harpa</i>	4	<i>Striatura ferrea</i>	1
<i>Columella simplex</i>	3	<i>Trichia hispida</i>	1
<i>Helicodiscus shimeki</i>	3	Immature Pupillidea	104
<i>Cochlicopa lubricella</i>	2		

Monticello West 2: *Thuja* litter on exposed riverside boulder

Collection Date: September 16, 2007 Location: 67.8690 W., 46.3127 N.
Habitat Type: Meta-sedimentary Bedrock Outcrop Habitat Group: Bedrock Outcrop
Richness: 17 Total Abundance: 84

<i>Punctum minutissimum</i>	15	<i>Vertigo bollesiana</i>	2
<i>Punctum</i> n.sp.	10	<i>Vertigo gouldi</i>	2
<i>Vertigo paradoxa</i>	9	<i>Anguispira alternata</i>	1
<i>Cochlicopa lubrica</i>	6	<i>Deroceras</i> sp.	1
<i>Strobilops labyrinthica</i>	4	<i>Nesovitrea binneyana</i>	1
<i>Vertigo cristata</i>	3	<i>Striatura milium</i>	1
<i>Zoogenetes harpa</i>	3	<i>Succinea ovalis</i>	1
<i>Euconulus polygyratus</i>	2	Immature Pupillidea	20
<i>Nesovitrea electrina</i>	2	Immature <i>Discus</i>	1

Monticello West 3: W-facing rock outcrop with *Thuja*

Collection Date: September 16, 2007 Location: 67.8656 W., 46.3071 N.
Habitat Type: Meta-sedimentary Bedrock Outcrop Habitat Group: Bedrock Outcrop
Richness: 22 Total Abundance: 838

<i>Strobilops labyrinthica</i>	449	<i>Punctum</i> n.sp.	5
<i>Punctum minutissimum</i>	162	<i>Vertigo paradoxa</i>	4
<i>Zoogenetes harpa</i>	43	<i>Planogyra asteriscus</i>	2
<i>Nesovitrea binneyana</i>	41	<i>Euconulus polygyratus</i>	1
<i>Euconulus fulvus</i>	23	<i>Gastrocopta tappaniana</i>	1
<i>Striatura milium</i>	22	<i>Nesovitrea electrina</i>	1
<i>Discus catskillensis</i>	14	<i>Striatura ferrea</i>	1
<i>Vertigo gouldi</i>	13	<i>Vallonia costata</i>	1
<i>Vertigo bollesiana</i>	9	Immature Pupillidea	26
<i>Vertigo cristata</i>	7	Immature Succineidae	1
<i>Columella simplex</i>	6	Immature <i>Cochlicopa</i>	1
<i>Carychium exile</i>	5		

Mt. Carmel Wayside: N-facing bluff with *Thuja* & *Picea*

Collection Date: September 5, 2007 Location: 68.1823 W., 47.3272 N.
Habitat Type: Meta-sedimentary Bedrock Outcrop Habitat Group: Bedrock Outcrop
Richness: 24 Total Abundance: 472

<i>Vertigo cristata</i>	61	<i>Vertigo bollesiana</i>	51
<i>Strobilops labyrinthica</i>	55	<i>Trichia hispida</i>	45

<i>Discus catskillensis</i>	41	<i>Helicodiscus shimeki</i>	4
<i>Striatura milium</i>	28	<i>Cochlicopa lubrica</i>	3
<i>Nesovitrea binneyana</i>	19	<i>Vallonia pulchella</i>	3
<i>Punctum minutissimum</i>	18	<i>Columella simplex</i>	2
<i>Succinea ovalis</i>	15	<i>Nesovitrea electrina</i>	2
<i>Zonitoides arboreus</i>	14	<i>Striatura exigua</i>	2
<i>Vertigo gouldi</i>	9	<i>Zoogenetes harpa</i>	2
<i>Striatura ferrea</i>	6	<i>Carychium exile</i>	1
<i>Anguispira alternata</i>	5	<i>Euchemotrema fraternum</i>	1
<i>Catinella avara</i>	5	Immature Pupillidea	75
<i>Euconulus fulvus</i>	5		

Nashville Plantation: Damp, grassy roadside

Collection Date: September 9, 2007

Location: 68.4523 W., 46.6933 N.

Habitat Type: Sedge Meadow

Habitat Group: Lowland Grassland

Richness: 9

Total Abundance: 92

<i>Vertigo ventricosa</i>	17	<i>Deroceras</i> sp.	1
<i>Columella simplex</i>	11	<i>Euconulus fulvus</i>	1
<i>Zoogenetes harpa</i>	10	<i>Gastrocopta tappaniana</i>	1
<i>Carychium exiguum</i>	9	<i>Strobilops labyrinthica</i>	1
<i>Pupilla muscorum</i>	4	Immature Pupillidea	37

North Brook #3 Road: *Thuja*-Yellow Birch-Ash-Red Maple forest

Collection Date: September 11, 2007

Location: 68.1237 W., 46.2840 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 21

Total Abundance: 1305

<i>Planogyra asteriscus</i>	238	<i>Discus catskillensis</i>	29
<i>Punctum minutissimum</i>	156	<i>Euconulus alderi</i>	21
<i>Carychium exile</i>	113	<i>Vertigo ventricosa</i>	17
<i>Punctum</i> n.sp.	90	<i>Striatura milium</i>	16
<i>Striatura exigua</i>	77	<i>Nesovitrea binneyana</i>	12
<i>Carychium exiguum</i>	73	<i>Vertigo cristata</i>	8
<i>Gastrocopta tappaniana</i>	57	<i>Vertigo bollesiana</i>	5
<i>Strobilops labyrinthica</i>	55	<i>Columella simplex</i>	3
<i>Euconulus fulvus</i>	40	<i>Vertigo gouldi</i>	2
<i>Nesovitrea electrina</i>	38	<i>Striatura ferrea</i>	1
<i>Vertigo nylanderi</i>	31	Immature Pupillidea	223

Oakfield Hills: Upland Maple-Birch-Beech forest

Collection Date: September 6, 2007

Location: 68.1722 W., 46.0444 N.

Habitat Type: Sugar Maple Forest

Habitat Group: Upland Forest

Richness: 23

Total Abundance: 408

<i>Striatura exigua</i>	94	<i>Striatura ferrea</i>	60
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<i>Striatura milium</i>	57	<i>Glyphyalinia rhoadsi</i>	5
<i>Discus catskillensis</i>	41	<i>Helicodiscus parallelus</i>	5
<i>Strobilops labyrinthica</i>	23	<i>Helicodiscus shimeki</i>	4
<i>Zonitoides arboreus</i>	21	<i>Gastrocopta contracta</i>	3
<i>Nesovitrea binneyana</i>	16	<i>Gastrocopta pentodon</i>	3
<i>Carychium exile</i>	14	<i>Vertigo bollesiana</i>	2
<i>Euconulus polygyratus</i>	13	<i>Planogyra asteriscus</i>	1
<i>Punctum minutissimum</i>	13	<i>Vertigo gouldi</i>	1
<i>Euconulus fulvus</i>	10	<i>Vertigo ovata</i>	1
<i>Nesovitrea electrina</i>	7	Immature Pupillidea	7
<i>Columella simplex</i>	5	Immature Succineidae	2

Orient: *Carex-Calamagrostis-Dulichium* meadow

Collection Date: September 16, 2007

Location: 67.8482 W., 45.8362 N.

Habitat Type: Sedge Meadow

Habitat Group: Lowland Grassland

Richness: 8

Total Abundance: 132

<i>Vertigo ovata</i>	20	<i>Striatura exigua</i>	1
<i>Nesovitrea electrina</i>	3	<i>Strobilops labyrinthica</i>	1
<i>Carychium exiguum</i>	1	<i>Vertigo elatior</i>	1
<i>Euconulus alderi</i>	1	Immature Pupillidea	103
<i>Punctum minutissimum</i>	1		

Orient Wayside: Rich *Thuja* swamp forest

Collection Date: September 16, 2007

Location: 67.8518 W., 45.8591 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 22

Total Abundance: 1140

<i>Strobilops labyrinthica</i>	270	<i>Vertigo nylanderi</i>	12
<i>Planogyra asteriscus</i>	242	<i>Carychium exiguum</i>	11
<i>Striatura exigua</i>	94	<i>Columella simplex</i>	11
<i>Nesovitrea binneyana</i>	68	<i>Vertigo elatior</i>	4
<i>Punctum minutissimum</i>	61	<i>Gastrocopta tappaniana</i>	3
<i>Vertigo cristata</i>	45	<i>Helicodiscus shimeki</i>	2
<i>Euconulus fulvus</i>	44	<i>Punctum</i> n.sp.	2
<i>Carychium exile</i>	43	<i>Succinea ovalis</i>	2
<i>Vertigo ventricosa</i>	25	<i>Vertigo gouldi</i>	1
<i>Nesovitrea electrina</i>	13	Immature Pupillidea	125
<i>Striatura milium</i>	13	Immature <i>Discus</i>	37
<i>Euconulus alderi</i>	12		

Oxbow Wayside: Upland *Abies*-Aspen-Balsam Poplar forest

Collection Date: July 24, 2002

Location: 68.3816 W., 46.4387 N.

Habitat Type: White Spruce Forest

Habitat Group: Upland Forest

Richness: 9

Total Abundance: 267

<i>Cochlicopa lubrica</i>	50	<i>Succinea ovalis</i>	2
<i>Columella simplex</i>	1	<i>Vertigo cristata</i>	19
<i>Discus catskillensis</i>	27	<i>Zonitoides arboreus</i>	1
<i>Punctum minutissimum</i>	23	<i>Zoogenetes harpa</i>	143
<i>Striatura milium</i>	17	Immature Pupillidea	9

Phair: Rich *Thuja* swamp forest

Collection Date: September 10, 2007

Location: 67.9525 W., 46.6254 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 17

Total Abundance: 1089

<i>Planogyra asteriscus</i>	402	<i>Vertigo bollesiana</i>	14
<i>Punctum minutissimum</i>	167	<i>Nesovitrea electrina</i>	12
<i>Strobilops labyrinthica</i>	159	<i>Nesovitrea binneyana</i>	10
<i>Carychium exile</i>	85	<i>Gastrocopta tappaniana</i>	9
<i>Striatura exigua</i>	52	<i>Columella simplex</i>	5
<i>Striatura milium</i>	50	<i>Carychium exiguum</i>	2
<i>Vertigo cristata</i>	23	<i>Vertigo ventricosa</i>	2
<i>Discus catskillensis</i>	21	<i>Vertigo nylanderi</i>	1
<i>Euconulus fulvus</i>	20	Immature Pupillidea	55

Portage Country Club: S-facing talus with *Tsuga*-Oak-*Acer*

Collection Date: September 9, 2007

Location: 68.4748 W., 46.7668 N.

Habitat Type: Igneous Bedrock Outcrop

Habitat Group: Bedrock Outcrop

Richness: 16

Total Abundance: 394

<i>Strobilops labyrinthica</i>	125	<i>Helicodiscus parallelus</i>	5
<i>Striatura exigua</i>	64	<i>Striatura ferrea</i>	3
<i>Discus catskillensis</i>	45	<i>Vertigo bollesiana</i>	3
<i>Punctum minutissimum</i>	43	<i>Columella simplex</i>	2
<i>Vertigo gouldi</i>	22	<i>Discus cronkhitei</i>	1
<i>Nesovitrea binneyana</i>	20	<i>Gastrocopta pentodon</i>	1
<i>Vertigo paradoxa</i>	15	<i>Zoogenetes harpa</i>	1
<i>Euconulus fulvus</i>	14	Immature Pupillidea	17
<i>Vertigo cristata</i>	13		

Portage Lake: Acid *Thuja*-Ash-Red Maple swamp forest

Collection Date: September 9, 2007

Location: 68.5408 W., 46.7850 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 11

Total Abundance: 628

<i>Carychium exiguum</i>	213	<i>Nesovitrea electrina</i>	31
<i>Punctum</i> n.sp.	62	<i>Succinea ovalis</i>	14
<i>Vertigo ventricosa</i>	42	<i>Vertigo ovata</i>	12
<i>Striatura exigua</i>	37	<i>Punctum minutissimum</i>	6
<i>Euconulus alderi</i>	33	<i>Deroceras</i> sp.	1
<i>Gastrocopta tappaniana</i>	32	Immature Pupillidea	145

Russell Rock: Exposed bluff with *Thuja*

Collection Date: September 6, 2007 Location: 67.8489 W., 46.3078 N.
Habitat Type: Meta-sedimentary Bedrock Outcrop Habitat Group: Bedrock Outcrop
Richness: 17 Total Abundance: 501

<i>Vertigo paradoxa</i>	101	<i>Zoogenetes harpa</i>	14
<i>Discus catskillensis</i>	62	<i>Striatura milium</i>	7
<i>Vertigo cristata</i>	39	<i>Cochlicopa lubrica</i>	2
<i>Vertigo bollesiana</i>	38	<i>Planogyra asteriscus</i>	2
<i>Strobilops labyrinthica</i>	32	<i>Columella simplex</i>	1
<i>Vertigo gouldi</i>	32	<i>Striatura exigua</i>	1
<i>Punctum minutissimum</i>	25	<i>Zonitoides arboreus</i>	1
<i>Euconulus fulvus</i>	17	Immature Pupillidea	112
<i>Nesovitrea binneyana</i>	14	Immature Succineidae	1

Salmon Brook 1: *Thuja-Abies-Betula papyrifera* swamp forest

Collection Date: July 23, 2002 Location: 68.1984 W., 46.8976 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 16 Total Abundance: 276

<i>Striatura exigua</i>	63	<i>Helicodiscus shimeki</i>	10
<i>Planogyra asteriscus</i>	51	<i>Gastrocopta tappaniana</i>	4
<i>Carychium exile</i>	34	<i>Euconulus fulvus</i>	2
<i>Discus catskillensis</i>	19	<i>Punctum minutissimum</i>	2
<i>Strobilops labyrinthica</i>	18	<i>Succinea ovalis</i>	2
<i>Nesovitrea electrina</i>	17	<i>Vertigo nylanderi</i>	2
<i>Vertigo cristata</i>	16	<i>Columella simplex</i>	1
<i>Striatura milium</i>	13	Immature Pupillidea	27
<i>Nesovitrea binneyana</i>	12		

Salmon Brook 2: Young upland Aspen-Maple-Balsam forest

Collection Date: July 23, 2002 Location: 68.1947 W., 46.8986 N.
Habitat Type: Aspen Forest Habitat Group: Upland Forest
Richness: 11 Total Abundance: 274

<i>Striatura milium</i>	67	<i>Planogyra asteriscus</i>	33
<i>Striatura exigua</i>	61	<i>Punctum minutissimum</i>	12
<i>Vertigo cristata</i>	53	<i>Columella simplex</i>	8

<i>Gastrocopta tappaniana</i>	29	<i>Columella simplex</i>	12
<i>Vertigo elatior</i>	27	<i>Punctum</i> n.sp.	11
<i>Nesovitrea electrina</i>	26	<i>Euconulus fulvus</i>	10
<i>Striatura milium</i>	19	<i>Striatura ferrea</i>	1
<i>Planogyra asteriscus</i>	18	<i>Vertigo nylanderi</i>	1
<i>Vertigo cristata</i>	15	Immature Pupillidea	286

St. Johns View Wayside: Upland Red Maple-Birch-Spruce forest

Collection Date: September 5, 2007

Location: 68.4994 W., 47.2926 N.

Habitat Type: White Spruce Forest

Habitat Group: Upland Forest

Richness: 11

Total Abundance: 116

<i>Striatura exigua</i>	76	<i>Euconulus fulvus</i>	3
<i>Nesovitrea binneyana</i>	7	<i>Columella simplex</i>	2
<i>Helicodiscus shimieki</i>	5	<i>Striatura ferrea</i>	2
<i>Vertigo cristata</i>	5	<i>Zonitoides arboreus</i>	2
<i>Striatura milium</i>	4	Immature Pupillidea	5
<i>Strobilops labyrinthica</i>	4	Immature <i>Discus</i>	1

Stockholm North: Upland *Acer-Fagus-Betula* forest

Collection Date: September 13, 2007

Location: 68.1090 W., 47.0809 N.

Habitat Type: Sugar Maple Forest

Habitat Group: Upland Forest

Richness: 9

Total Abundance: 39

<i>Striatura exigua</i>	16	<i>Zonitoides arboreus</i>	2
<i>Punctum minutissimum</i>	6	<i>Anguispira alternata</i>	1
<i>Striatura ferrea</i>	5	Immature Pupillidea	1
<i>Striatura milium</i>	4	Immature <i>Discus</i>	2
<i>Strobilops labyrinthica</i>	2		

Washburn Ledge: Wooded, N-facing shoreline limestone outcrop

Collection Date: September 9, 2007

Location: 68.1746 W., 46.7710 N.

Habitat Type: Meta-sedimentary Bedrock Outcrop

Habitat Group: Bedrock Outcrop

Richness: 24

Total Abundance: 1860

<i>Punctum minutissimum</i>	525	<i>Vertigo cristata</i>	18
<i>Strobilops labyrinthica</i>	258	<i>Helicodiscus shimieki</i>	9
<i>Vertigo paradoxa</i>	206	<i>Striatura milium</i>	9
<i>Carychium exile</i>	127	<i>Zonitoides arboreus</i>	8
<i>Discus catskillensis</i>	98	<i>Gastrocopta tappaniana</i>	7
<i>Euconulus fulvus</i>	78	<i>Deroceras</i> sp.	4
<i>Nesovitrea binneyana</i>	60	<i>Columella simplex</i>	3
<i>Cochlicopa lubrica</i>	51	<i>Striatura ferrea</i>	3
<i>Vertigo elatior</i>	36	<i>Succinea ovalis</i>	3
<i>Nesovitrea electrina</i>	27	<i>Zoogenetes harpa</i>	3
<i>Vertigo gouldi</i>	25	<i>Vertigo pygmaea</i>	2

<i>Vertigo cristata</i>	16	<i>Vertigo elatior</i>	2
<i>Helicodiscus shimeki</i>	10	<i>Deroceras</i> sp.	1
<i>Zonitoides arboreus</i>	9	<i>Punctum</i> n.sp.	1
<i>Euconulus fulvus</i>	7	<i>Vertigo gouldi</i>	1
<i>Succinea ovalis</i>	2	Immature Pupillidea	98

Hancock County

Baker Ridge: Riparian *Thuja-Abies*-Red Maple forest

Collection Date: September 4, 2007 Location: 68.2640 W., 44.9795 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 17 Total Abundance: 684

<i>Striatura exigua</i>	165	<i>Nesovitrea electrina</i>	11
<i>Punctum minutissimum</i>	131	<i>Helicodiscus shimeki</i>	5
<i>Strobilops labyrinthica</i>	82	<i>Columella simplex</i>	4
<i>Planogyra asteriscus</i>	61	<i>Vertigo gouldi</i>	4
<i>Striatura milium</i>	53	<i>Zonitoides arboreus</i>	3
<i>Euconulus fulvus</i>	26	<i>Striatura ferrea</i>	2
<i>Gastrocopta tappaniana</i>	25	Immature Pupillidea	49
<i>Nesovitrea binneyana</i>	20	Immature Succineidae	2
<i>Vertigo cristata</i>	13	Immature <i>Discus</i>	28

Cave Hill School: *Thuja-Abies*-Red Maple swamp forest

Collection Date: September 17, 2007 Location: 68.2887 W., 44.6896 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 17 Total Abundance: 1002

<i>Strobilops labyrinthica</i>	286	<i>Vertigo nylanderi</i>	10
<i>Punctum minutissimum</i>	150	<i>Striatura ferrea</i>	8
<i>Striatura exigua</i>	142	<i>Zonitoides arboreus</i>	6
<i>Striatura milium</i>	92	<i>Gastrocopta tappaniana</i>	4
<i>Nesovitrea binneyana</i>	46	<i>Helicodiscus shimeki</i>	4
<i>Planogyra asteriscus</i>	37	<i>Vertigo ventricosa</i>	2
<i>Euconulus fulvus</i>	34	<i>Columella simplex</i>	1
<i>Vertigo cristata</i>	30	Immature Pupillidea	100
<i>Nesovitrea electrina</i>	29	Immature <i>Discus</i>	21

Horseback Bog: *Gaylussacia* litter on acid *Sphagnum* bog

Collection Date: October 13, 2002

Location: 68.4388 W., 44.9667 N.

Habitat Type: Acid Bog

Habitat Group: Lowland Grassland

Richness: 4

Total Abundance: 50

<i>Striatura milium</i>	23	<i>Euconulus fulvus</i>	1
<i>Vertigo cristata</i>	7	Immature Pupillidea	17
<i>Carychium exiguum</i>	4		

The Whalesback: Rich *Thuja-Larix* swamp forest

Collection Date: September 17, 2007

Location: 68.2541 W., 44.8322 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 16

Total Abundance: 1325

<i>Strobilops labyrinthica</i>	561	<i>Columella simplex</i>	15
<i>Planogyra asteriscus</i>	234	<i>Discus catskillensis</i>	6
<i>Punctum minutissimum</i>	127	<i>Helicodiscus shimeki</i>	6
<i>Striatura ferrea</i>	87	<i>Vertigo bollesiana</i>	4
<i>Striatura exigua</i>	62	<i>Vertigo ventricosa</i>	2
<i>Euconulus fulvus</i>	40	<i>Zonitoides arboreus</i>	2
<i>Nesovitrea binneyana</i>	40	<i>Vertigo nylanderi</i>	1
<i>Vertigo cristata</i>	40	Immature Pupillidea	65
<i>Striatura milium</i>	33		

West Gouldsboro: Dry, acid Red Maple-*Thuja* swamp forest

Collection Date: September 17, 2007

Location: 68.0790 W., 44.4691 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 16

Total Abundance: 896

<i>Punctum minutissimum</i>	357	<i>Vertigo nylanderi</i>	6
<i>Strobilops labyrinthica</i>	103	<i>Vertigo perryi</i>	6
<i>Striatura exigua</i>	79	<i>Striatura ferrea</i>	5
<i>Vertigo cristata</i>	58	<i>Nesovitrea electrina</i>	4
<i>Planogyra asteriscus</i>	29	<i>Striatura milium</i>	4
<i>Columella simplex</i>	15	<i>Gastrocopta tappaniana</i>	2
<i>Euconulus fulvus</i>	15	Immature Pupillidea	192
<i>Vertigo ventricosa</i>	13	Immature <i>Discus</i>	2
<i>Helicodiscus shimeki</i>	6		

Kennebec County

Clinton SE: Large *Carex-Alnus* wetland

Collection Date: September 4, 2007

Location: 69.4430 W., 44.6112 N.

Habitat Type: Sedge Meadow

Habitat Group: Lowland Grassland

Richness: 7

Total Abundance: 246

<i>Vertigo perryi</i>	128	<i>Vallonia pulchella</i>	1
<i>Nesovitrea electrina</i>	23	<i>Zonitoides arboreus</i>	1
<i>Euconulus fulvus</i>	12	Immature Pupillidea	72
<i>Zonitoides nitidus</i>	2	Immature Succineidae	7

Penobscot County

Brewer Boat Ramp 1: *Alnus* scrub on disturbed river bank

Collection Date: October 13, 2002 Location: 68.7226 W., 44.8188 N.
Habitat Type: Shrub Carr Habitat Group: Lowland Forest
Richness: 17 Total Abundance: 1228

<i>Carychium exiguum</i>	1086	<i>Vallonia pulchella</i>	12
<i>Cochlicopa lubrica</i>	200	<i>Vitrina limpida</i>	6
<i>Gastrocopta tappaniana</i>	102	<i>Catinella avara</i>	5
<i>Nesovitrea electrina</i>	102	<i>Zonitoides arboreus</i>	5
<i>Succinea ovalis</i>	67	<i>Striatura milium</i>	2
<i>Vertigo perryi</i>	59	<i>Euconulus fulvus</i>	1
<i>Discus catskillensis</i>	20	<i>Punctum minutissimum</i>	1
<i>Helicodiscus parallelus</i>	18	<i>Striatura exigua</i>	1
<i>Zonitoides nitidus</i>	13	Immature Pupillidea	71

Brewer Boat Ramp2 : Riprap along riverbank

Collection Date: October 13, 2002 Location: 68.7232 W., 44.8186 N.
Habitat Type: Rocky Forest Habitat Group: Upland Forest
Richness: 16 Total Abundance: 274

<i>Cochlicopa lubrica</i>	54	<i>Discus catskillensis</i>	4
<i>Helicodiscus parallelus</i>	45	<i>Vertigo bollesiana</i>	4
<i>Zonitoides arboreus</i>	39	<i>Vertigo perryi</i>	4
<i>Zoogenetes harpa</i>	31	<i>Cochlicopa lubricella</i>	1
<i>Discus cronkhitei</i>	27	<i>Punctum minutissimum</i>	1
<i>Gastrocopta tappaniana</i>	20	<i>Vallonia pulchella</i>	1
<i>Succinea ovalis</i>	15	<i>Vertigo cristata</i>	1
<i>Nesovitrea electrina</i>	11	Immature Pupillidea	35
<i>Striatura milium</i>	8		

Caribou Bog North: *Thuja-Acer rubrum* lowland forest

Collection Date: October 13, 2002 Location: 68.7610 W., 44.9434 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 9 Total Abundance: 253

<i>Striatura exigua</i>	103	<i>Columella simplex</i>	12
<i>Striatura milium</i>	53	<i>Nesovitrea electrina</i>	12
<i>Gastrocopta tappaniana</i>	14	<i>Punctum minutissimum</i>	4

Piscataquis County

Atkinson Mills: Acid *Acer rubrum*-*Larix*-*Thuja* wetland

Collection Date: October 12, 2002

Location: 69.0312 W., 45.1431 N.

Habitat Type: Tamarack Wetland

Habitat Group: Lowland Forest

Richness: 15

Total Abundance: 220

<i>Striatura exigua</i>	91	<i>Strobilops labyrinthica</i>	3
<i>Punctum minutissimum</i>	38	<i>Columella simplex</i>	2
<i>Striatura milium</i>	12	<i>Euconulus fulvus</i>	2
<i>Planogyra asteriscus</i>	11	<i>Nesovitrea binneyana</i>	2
<i>Striatura ferrea</i>	10	<i>Discus catskillensis</i>	1
<i>Gastrocopta tappaniana</i>	6	<i>Euconulus alderi</i>	1
<i>Vertigo cristata</i>	6	<i>Vertigo ventricosa</i>	1
<i>Vertigo elatior</i>	6	Immature Pupillidea	29

Little Bog Brook: Rich *Thuja* swamp forest

Collection Date: September 7, 2007

Location: 68.8480 W., 46.3349 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 19

Total Abundance: 851

<i>Strobilops labyrinthica</i>	171	<i>Columella simplex</i>	10
<i>Planogyra asteriscus</i>	97	<i>Vertigo ventricosa</i>	10
<i>Striatura exigua</i>	94	<i>Carychium exiguum</i>	7
<i>Punctum minutissimum</i>	77	<i>Vertigo bollesiana</i>	6
<i>Striatura milium</i>	73	<i>Vertigo nylanderi</i>	4
<i>Carychium exile</i>	50	<i>Striatura ferrea</i>	3
<i>Vertigo cristata</i>	49	<i>Gastrocopta tappaniana</i>	1
<i>Euconulus fulvus</i>	40	<i>Helicodiscus shimaki</i>	1
<i>Nesovitrea electrina</i>	27	<i>Vertigo elatior</i>	1
<i>Nesovitrea binneyana</i>	16	Immature Pupillidea	114

Seboeis Lake: Acid *Thuja*-*Acer rubrum* wet forest

Collection Date: October 12, 2002

Location: 68.8855 W., 45.5134 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 14

Total Abundance: 230

<i>Strobilops labyrinthica</i>	63	<i>Zonitoides arboreus</i>	3
<i>Striatura exigua</i>	38	<i>Euconulus fulvus</i>	2
<i>Striatura milium</i>	24	<i>Gastrocopta tappaniana</i>	2
<i>Vertigo cristata</i>	20	<i>Nesovitrea electrina</i>	2
<i>Punctum minutissimum</i>	10	<i>Vertigo perryi</i>	2
<i>Planogyra asteriscus</i>	8	<i>Vertigo ventricosa</i>	1
<i>Striatura ferrea</i>	8	Immature Pupillidea	45
<i>Columella simplex</i>	4		

Spencer Cove: Acid *Thuja-Acer-rubrum* swamp forest

Collection Date: October 12, 2002

Location: 68.8480 W., 45.7400 N.

Habitat Type: Northern White Cedar / Ash Wetland

Habitat Group: Lowland Forest

Richness: 19

Total Abundance: 1490

<i>Punctum minutissimum</i>	349	<i>Gastrocopta tappaniana</i>	18
<i>Planogyra asteriscus</i>	289	<i>Nesovitrea electrina</i>	11
<i>Striatura exigua</i>	252	<i>Vertigo nylanderi</i>	8
<i>Striatura milium</i>	93	<i>Helicodiscus shimeki</i>	5
<i>Strobilops labyrinthica</i>	66	<i>Zonitoides arboreus</i>	5
<i>Vertigo cristata</i>	37	<i>Carychium exiguum</i>	4
<i>Euconulus fulvus</i>	34	<i>Helicodiscus parallelus</i>	4
<i>Striatura ferrea</i>	31	<i>Nesovitrea binneyana</i>	3
<i>Columella simplex</i>	28	Immature Pupillidea	234
<i>Vertigo ventricosa</i>	27	Immature Succineidae	1

Waldo County

Twentyfive Mile Stream: *Carex-Spirea-Alnus* meadow

Collection Date: September 4, 2007

Location: 69.3847 W., 44.6171 N.

Habitat Type: Sedge Meadow

Habitat Group: Lowland Grassland

Richness: 15

Total Abundance: 164

<i>Vertigo perryi</i>	58	<i>Columella simplex</i>	1
<i>Gastrocopta tappaniana</i>	23	<i>Punctum minutissimum</i>	1
<i>Euconulus alderi</i>	17	<i>Striatura exigua</i>	1
<i>Nesovitrea electrina</i>	14	<i>Strobilops labyrinthica</i>	1
<i>Carychium exiguum</i>	5	<i>Vertigo pygmaea</i>	1
<i>Punctum</i> n.sp.	3	Immature Pupillidea	30
<i>Vertigo ovata</i>	3	Immature Succineidae	2
<i>Euconulus fulvus</i>	2	Immature <i>Discus</i>	2

Washington County

Anderson Brook: Acid Red Maple-*Larix-Thuja* swamp

Collection Date: September 16, 2007

Location: 67.4561 W., 45.1750 N.

Habitat Type: Red Maple / Black Spruce Wetland

Habitat Group: Lowland Forest

Richness: 19

Total Abundance: 1013

<i>Carychium exiguum</i>	146	<i>Gastrocopta tappaniana</i>	79
<i>Punctum minutissimum</i>	133	<i>Vertigo cristata</i>	40
<i>Strobilops labyrinthica</i>	114	<i>Planogyra asteriscus</i>	35
<i>Striatura milium</i>	113	<i>Nesovitrea electrina</i>	30
<i>Striatura exigua</i>	87	<i>Euconulus fulvus</i>	27

<i>Euconulus alderi</i>	21	<i>Vertigo nylanderi</i>	10
<i>Discus catskillensis</i>	12	<i>Columella simplex</i>	6
<i>Vertigo ventricosa</i>	12	<i>Punctum</i> n.sp.	6
<i>Helicodiscus shimeki</i>	11	<i>Succinea ovalis</i>	2
<i>Nesovitrea binneyana</i>	11	Immature Pupillidea	118

French Ridge: Acid *Thuja* swamp forest

Collection Date: September 17, 2007 Location: 67.1633 W., 44.6947 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 14 Total Abundance: 700

<i>Punctum minutissimum</i>	176	<i>Striatura milium</i>	7
<i>Planogyra asteriscus</i>	151	<i>Vertigo ventricosa</i>	7
<i>Vertigo cristata</i>	89	<i>Nesovitrea binneyana</i>	5
<i>Discus catskillensis</i>	50	<i>Striatura ferrea</i>	5
<i>Striatura exigua</i>	27	<i>Helicodiscus shimeki</i>	4
<i>Nesovitrea electrina</i>	16	<i>Strobilops labyrinthica</i>	4
<i>Columella simplex</i>	8	Immature Pupillidea	143
<i>Euconulus fulvus</i>	8		

Joe Meadow Brook: Acid *Carex-Spirea* meadow

Collection Date: September 16, 2007 Location: 67.6157 W., 44.8717 N.
Habitat Type: Sedge Meadow Habitat Group: Lowland Grassland
Richness: 2 Total Abundance: 2

<i>Punctum minutissimum</i>	1	<i>Striatura exigua</i>	1
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Note: Brian Coles located a small population of *Vertigo perryi* at this site in October, 2003

Lubec Lead Mine 1: Upland *Thuja-Picea* forest on ledge

Collection Date: September 17, 2007 Location: 67.0544 W., 44.8384 N.
Habitat Type: Igneous Bedrock Outcrop Habitat Group: Bedrock Outcrop
Richness: 12 Total Abundance: 600

<i>Vertigo cristata</i>	168	<i>Strobilops labyrinthica</i>	6
<i>Punctum minutissimum</i>	97	<i>Striatura ferrea</i>	5
<i>Striatura milium</i>	76	<i>Nesovitrea binneyana</i>	3
<i>Planogyra asteriscus</i>	43	<i>Euconulus fulvus</i>	1
<i>Discus cronkhitei</i>	31	<i>Vertigo paradoxa</i>	1
<i>Zonitoides arboreus</i>	19	Immature Pupillidea	132
<i>Striatura exigua</i>	18		

Lubec Lead Mine 2: *Thuja* forest along drainageway

Collection Date: September 17, 2007 Location: 67.0585 W., 44.8381 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 15 Total Abundance: 507

<i>Striatura exigua</i>	5	<i>Vertigo cristata</i>	2
<i>Nesovitrea electrina</i>	4	<i>Columella simplex</i>	1
<i>Discus catskillensis</i>	3	<i>Euconulus fulvus</i>	1
<i>Striatura ferrea</i>	3	Immature Pupillidea	5
<i>Nesovitrea binneyana</i>	2		

Schooner Brook: *Myrica-Carex* islands in *Sphagnum* bog

Collection Date: September 17, 2007 Location: 67.1710 W., 44.6867 N.
Habitat Type: Acid Bog Habitat Group: Lowland Grassland
Richness: 10 Total Abundance: 91

<i>Nesovitrea electrina</i>	24	<i>Striatura exigua</i>	2
<i>Vertigo perryi</i>	16	<i>Vertigo ventricosa</i>	2
<i>Euconulus alderi</i>	11	<i>Nesovitrea binneyana</i>	1
<i>Striatura milium</i>	7	<i>Planogyra asteriscus</i>	1
<i>Euconulus fulvus</i>	2	Immature Pupillidea	23
<i>Gastrocopta tappaniana</i>	2		

South Crooked Brook: *Thuja-Red Maple-Alnus-Carex* swamp

Collection Date: September 16, 2007 Location: 67.8045 W., 45.5937 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 14 Total Abundance: 51

<i>Planogyra asteriscus</i>	10	<i>Vertigo ventricosa</i>	2
<i>Punctum minutissimum</i>	6	<i>Nesovitrea binneyana</i>	1
<i>Carychium exiguum</i>	5	<i>Striatura exigua</i>	1
<i>Euconulus fulvus</i>	4	<i>Striatura milium</i>	1
<i>Euconulus alderi</i>	3	<i>Vertigo bollesiana</i>	1
<i>Nesovitrea electrina</i>	3	<i>Vertigo ovata</i>	1
<i>Vertigo cristata</i>	3	Immature Pupillidea	8
<i>Punctum</i> n.sp.	2		

Wesley School: Rich *Thuja-Fraxinus-Red Maple* swamp

Collection Date: September 16, 2007 Location: 67.6590 W., 44.9274 N.
Habitat Type: Northern White Cedar / Ash Wetland Habitat Group: Lowland Forest
Richness: 23 Total Abundance: 2175

<i>Carychium exiguum</i>	274	<i>Striatura milium</i>	58
<i>Planogyra asteriscus</i>	261	<i>Gastrocopta tappaniana</i>	57
<i>Punctum minutissimum</i>	258	<i>Nesovitrea electrina</i>	51
<i>Striatura exigua</i>	166	<i>Vertigo nylanderi</i>	48
<i>Strobilops labyrinthica</i>	124	<i>Euconulus alderi</i>	37
<i>Euconulus fulvus</i>	107	<i>Nesovitrea binneyana</i>	36
<i>Vertigo ventricosa</i>	107	<i>Columella simplex</i>	9
<i>Vertigo cristata</i>	71	<i>Vertigo bollesiana</i>	6
<i>Punctum</i> n.sp.	70	<i>Helicodiscus shimeki</i>	5

<i>Striatura ferrea</i>	4	Immature Pupillidea	480
<i>Vertigo gouldi</i>	1	Immature Succineidae	1
<i>Zonitoides arboreus</i>	1	Immature <i>Discus</i>	1