

Litter-dwelling terrestrial molluscs of Nepisiguit Protected Natural Area and Mount Carleton Provincial Park, north-central New Brunswick

ROBERT G. FORSYTH

Zoology Section of the Department of Natural History, New Brunswick Museum, 277 Douglas Avenue, Saint John, New Brunswick E2K 1E5 Canada; email: rforsyth.bc.ca@gmail.com

Forsyth, R.G. 2023. Terrestrial molluscs of Nepisiguit Protected Natural Area and Mount Carleton Provincial Park, north-central New Brunswick. *Canadian Field-Naturalist* 137(1–2): 87–95. <https://doi.org/10.22621/cfn.v137i1.3051>

Abstract

No comprehensive study of the terrestrial gastropod fauna of northern New Brunswick has previously been undertaken. Most terrestrial gastropod molluscs are tiny and generally live unnoticed under debris, in leaf litter, and among other dead and living vegetation. Sifting and sorting collected samples of leaf litter are effective in sampling snails. In June–July 2015 and August 2016, 43 samples of forest leaf litter were collected in Nepisiguit Protected Natural Area and Mount Carleton Provincial Park. These samples yielded 22 species of terrestrial gastropods. Seven species are reported from New Brunswick for the first time.

Key words: Mollusca; Gastropoda; Maritime provinces; biodiversity; BiotaNB

Résumé

Aucune étude approfondie de la faune de gastéropodes terrestres du nord du Nouveau-Brunswick n'a été entreprise auparavant. La plupart des mollusques gastéropodes terrestres sont minuscules et vivent généralement inaperçus sous les débris, dans la litière de feuilles et d'autres végétaux morts et vivants. Le tamisage et le tri des échantillons prélevés de litière de feuilles sont efficaces pour échantillonner les escargots. En juin–juillet 2015 et en août 2016, 43 échantillons de litière de feuilles forestières ont été prélevés dans l'zone naturelle protégée Nepisiguit et le parc provincial Mont-Carleton. Ces échantillons ont donné 22 espèces de gastéropodes terrestres. Sept espèces sont rapportées au Nouveau-Brunswick pour la première fois.

Mots clés : Mollusca; Gastropoda; escargots; litière de feuilles; mollusques terrestres; provinces maritimes; biodiversité; BiotaNB

Introduction

Among the few publications on the terrestrial gastropods of New Brunswick, several stand out for their attempt to enumerate the fauna either locally or for the province. Bailey (1903) produced the first list of terrestrial molluscs of the province and included 25 species, all snails. Several decades later, La Rocque (1961) published an updated list, which included 26 species, both snails and slugs. Dimelow (1962, 1963) reported 10 and five species, respectively, in two separate studies of the terrestrial molluscs in southeastern New Brunswick. However, the most intensive, published study of terrestrial gastropod fauna anywhere in the province was by Clarke *et al.* (1968) who reported 24 species from Fundy National Park in southern, coastal New Brunswick. All these studies, except for some individual records cited by Bailey (1903), are from southern areas of the province. There has never been a comprehensive study of the terrestrial gastropod fauna of northern New Brunswick.

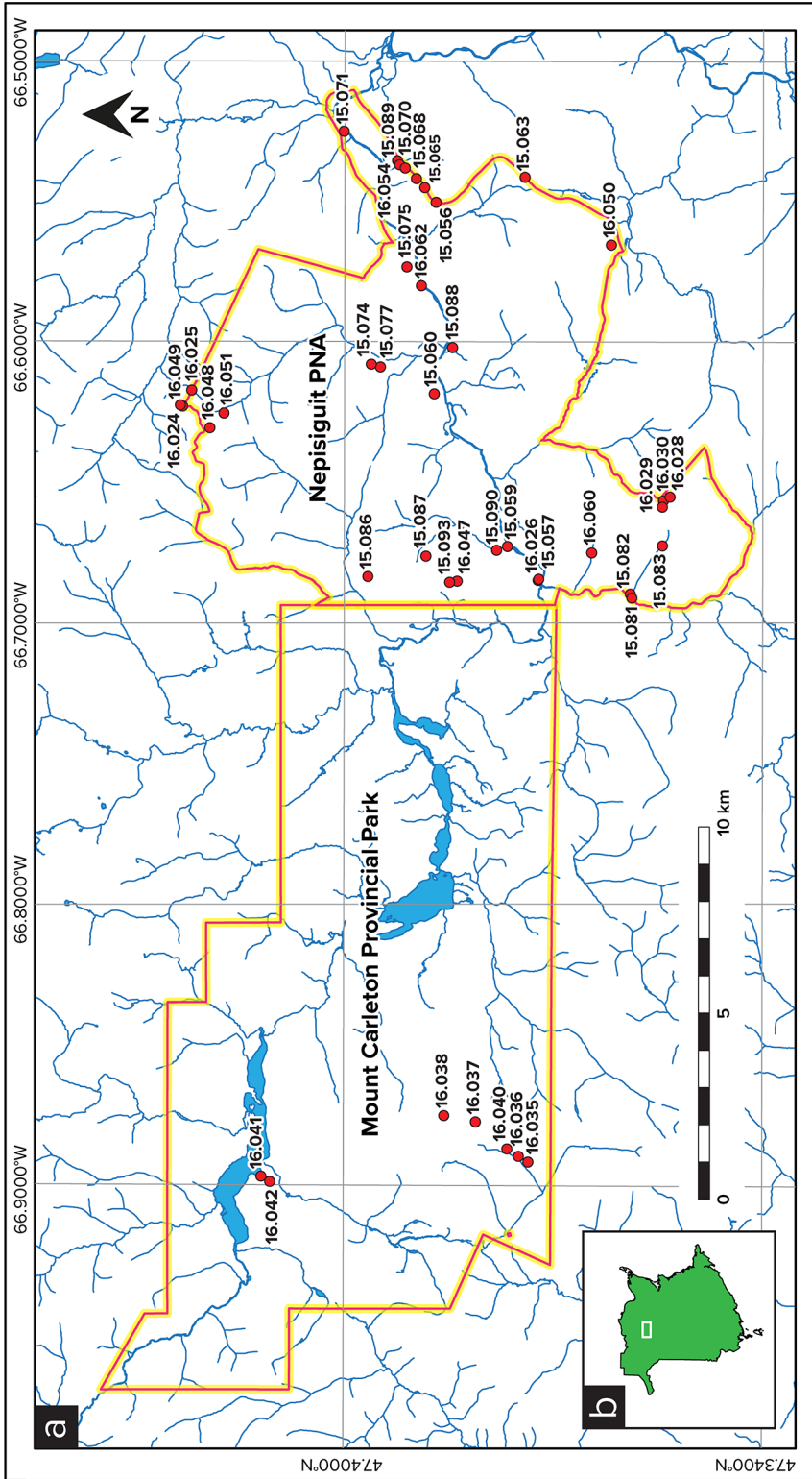
I report the results of surveys undertaken as part of the New Brunswick Museum's (NBM) BiotaNB program (McAlpine 2017, 2022) aimed at assessing the biodiversity of minute litter-dwelling terrestrial gastropods of Nepisiguit Protected Natural Area (PNA) and Mount Carleton Provincial Park (PP).

Methods

Study area

The study was conducted in 2015 and 2016 as part of NBM's biological inventory project, BiotaNB, in the Nepisiguit PNA and the adjacent Mount Carleton PP in Northumberland and Restigouche counties, north-central New Brunswick (Figure 1). Nepisiguit is a Class II PNA and Mount Carleton PP encompasses its namesake mountain, at 820 m, the highest point of land in the Maritime provinces (Zelanzny 2007).

The study area is in the Atlantic Highlands ecoregion (CCEA 2014) and the Highlands ecoregion (Zelanzny 2007). Because of its elevation, the climate in



the Highlands ecoregion is cooler and wetter than that of adjacent coastal areas. In the Köppen-Geiger system of climate classification, most of New Brunswick, including the study area, has a Dfb climate: humid continental climate, without dry season and warm summer (Kottek *et al.* 2006). The Highlands ecoregion has strong boreal affinities, with a climate that favours forests dominated by Balsam Fir (*Abies balsamea* (L.) Miller), White Birch (*Betula papyrifera* Marshall), Black Spruce (*Picea mariana* (Miller) Britton, Sterns & Poggenburgh), and White Spruce (*Picea glauca* (Moench) Voss; Zelanzy 2007).

Survey sites and specimen collections

In June 2015 and August 2016, leaf litter was collected at 36 sites in Nepisiguit PNA and seven sites in Mount Carleton PP (Figure 1, Table 1). Most geographic coordinates and elevations were obtained from a hand-held Garmin eTrex Vista HC (Olathe, Kansas, USA) global positioning system receiver, or similar, using the WGS84 geodetic datum. Coordinate degrees were rounded to four decimal places (~3 m accuracy) and elevations were rounded to 10 m to avoid false precision. Some elevations, and the approximate coordinates of one site (see note for Table 1) were subsequently derived using Google Earth Pro version 7.3.4.8642 (64 bit) for Microsoft Windows.

Because most gastropod biodiversity is composed of minute individuals that generally live somewhat cryptically under debris, in leaf litter, and among other dead and living vegetation, litter sampling is an effective means of collecting them. Thus, I gathered samples of leaf litter, augmented by visual searching and collecting snails by hand. Forest-floor litter samples were gathered by hand, with the most effort made in areas with deeper litter retaining some moisture. Litter samples were ~1–2 L, but some were larger; there was no standardization. They were dried, either at ambient room temperature or, usually, by placing in a food dehydrator. Once dried, the litter was passed sequentially through soil sieves of smaller mesh sizes, while checking for larger snails at each stage of processing. The final, finest material was then sorted by hand under a stereomicroscope. This technique has been used with success in New Brunswick and elsewhere for collecting samples of leaf-litter dwelling microsnails (Forsyth and Lepitzki 2015; Forsyth and Nicolai 2019; Forsyth *et al.* 2022). Only snails were collected by this sampling method, as slugs were not frequently found in the samples and were not identifiable in dried samples.

Identification and vouchers

Species were identified using Pilsbry (1940, 1946, 1948) supplemented by Nekola and Coles (2010, for *Columella* Westerlund, 1878), Nekola *et al.* (2018,

for *Vertigo* O.F. Müller, 1773), Forsyth and Oldham (2014, for *Strobilops* Pilsbry, 1893), and Horsáková *et al.* (2020, for *Euconulus* Reinhardt, 1883). Family-level taxa follow Bouchet *et al.* (2017), with modifications that transferred some genera from Oxychilidae to Gastrodontidae (Neiber *et al.* 2020). Common names follow Turgeon *et al.* (1998), except where not in that publication.

All specimens collected were deposited in the mollusc collection of the NBM (see Table S1 for voucher accession numbers), Saint John, New Brunswick.

Results and Discussion

Twenty-two species of terrestrial gastropods were found in leaf-litter samples collected at sites in Nepisiguit PNA and Mount Carleton PP (Table 2, Table S1). Several species are especially noteworthy.

Ice Thorn (*Carychium exile* H.C. Lea, 1842) is reported from New Brunswick for the first time; specimens were collected at two sites (16.048, 16.054; Figure 1 and Table 1) in Nepisiguit PNA. Several other species have been collected in New Brunswick before and since my study but are unpublished (R.G.F. unpubl. data). These include Simple Column (*Columella simplex* (A. Gould, 1840)), Temperate Coil (*Helicodiscus shimiki* Hubricht, 1962), Eastern Flat-coil (*Planogyra asteriscus* (E.S. Morse, 1857)), Fine-ribbed Striate (*Striatura milium* (E.S. Morse, 1859)), Callused Vertigo (*Vertigo arthuri* E. von Martens, 1882), and Delicate Vertigo (*Vertigo bollesiana* (E.S. Morse, 1865)). Temperate Coil and Callused Vertigo were probably misidentified in the literature (e.g., La Rocque 1961 summarizes all the published works on New Brunswick terrestrial molluscs up to that time) as Compound Coil (*Helicodiscus parallelus* (Say, 1817)) and Variable Vertigo (*Vertigo gouldii* A. Binney, 1843)), respectively.

I found only a single specimen of Maze Pinecone (*Strobilops labyrinthicus* (Say, 1817); site 15.075; Figure 1 and Table 1). This species is usually rather common in most leaf-litter samples in other BiotaNB sampling in other PNAs (R.G.F. unpubl. data). However, it is also of interest to note that Clarke *et al.* (1968) did not find Maze Pinecone at any of their sites in Fundy National Park, in the southern part of the province.

Glossy Pillar (*Cochlicopa lubrica* (O.F. Müller, 1774)) is often associated with anthropogenic, disturbed habitats, although it also occurs in natural environments without disturbance (Forsyth 2004; R.G.F. pers. obs. from across Canada). *Cochlicopa* cf. *lubrica* was found in several very rich sites (15.065, 15.082, 16.024, 16.025, 16.048, 16.049; Figure 1 and Table 1) in three separate areas of Nepisiguit PNA. This name is applied to these specimens with uncertainty because specimens resemble Appalachian

TABLE 1. Location and description of mollusc collection sites ($n = 43$) in Nepisiguit Protected Natural Area (PNA) and Mount Carleton Provincial Park (PP), New Brunswick, Canada.

Site	Collection date	Locality	Lat., °N	Long., °W	Elev., m	Collector(s)	Site notes	Method*
15.056	26-Jun-2015	Nepisiguit PNA; SW of Popple Depot; near main road	47.3783	66.5498	430	R.G.F.	Hardwood stand; birch (<i>Betula</i> L. sp.) dominating; on gentle slope	L, H
15.057	27-Jun-2015	Nepisiguit PNA; N side, Nepisiguit River; SSE of Mount Wightman; end of Old River Road at bridge out	47.3534	66.6838	240	R.G.F.	Spruce (<i>Picea</i> A. Dietrich sp.) woods with a few young birch	L, H
15.059	27-Jun-2015	Nepisiguit PNA; N side, Nepisiguit River; E of Melansons Gulch; along Old River Road	47.3610	66.6723	290	R.G.F.	Mixed woods, riparian zone; needle litter	L
15.060	27-Jun-2015	Nepisiguit PNA; N side, Nepisiguit River; W of Pentland Brook; along Old River Road	47.3787	66.6180	330	R.G.F.	Mixed woods	L
15.063	28-Jun-2015	Nepisiguit PNA; Corkers Gulch drainage; near main road	47.3568	66.5409	570	R.G.F.	Mixed woods, dominated by maples (<i>Acer</i> L. sp.) and birch	L
15.065	28-Jun-2015	Nepisiguit PNA; near Popple Depot; near main road	47.3811	66.5446	380	R.G.F.	Hardwood stand with deep litter and logs; ~10 m from forest road	H, L
15.068	28-Jun-2015	Nepisiguit PNA; WSW of Popple Depot; near main road	47.3831	66.5414	350	Alex Roberts; Stephen Mott	Tolerant hardwoods	L
15.070	29-Jun-2015	Nepisiguit PNA; WSW of Popple Depot; near main road	47.3858	66.5376	310	R.G.F.	Tolerant hardwood stand, maple dominant	L
15.071	29-Jun-2015	Nepisiguit PNA; N side, Nepisiguit River, NW of Popple Depot	47.4006	66.5246	260	R.G.F.	—	L
15.074	30-Jun-2015	Nepisiguit PNA; W of Pentland Brook	47.3940	66.6074	390	R.G.F.	Spruce with White Pine (<i>Pinus albicaulis</i> Engelm.) Forest, scattered Moosewood (<i>Acer pensylvanicum</i> L.), little understorey, no forbs; well-drained slope between two 200-year-old pines	L
15.075	2-Jul-2015	Nepisiguit PNA; N side, Nepisiguit River; S of Mount LaTour; near Old River Road	47.3854	66.5728	300	R.G.F.	—	H, L
15.077	3-Jul-2015	Nepisiguit PNA; W of Pentland Brook	47.3918	66.6084	360	R.G.F.	—	L
15.081	4-Jul-2015	Nepisiguit PNA; along South Branch Nepisiguit River; SW of cabin along road	47.3309	66.6905	320	R.G.F.	Upland riparian zone; mixed woods, under Yellow Birch (<i>Betula alleghaniensis</i> Britton)	L
15.082	4-Jul-2015	Nepisiguit PNA; along South Branch Nepisiguit River; at cabin	47.3312	66.6891	330	R.G.F.	Riparian zone; mixed woods, disturbed area at edge of camp lawn; under shrubby alders, young firs	L

TABLE 1. Continued.

Site	Collection date	Locality	Lat., °N	Long., °W	Elev., m	Collector(s)	Site notes	Method*
15.083	4-Jul-2015	Nepisiguit PNA; W slope of Mount Chandler; along road at stream crossing; stream	47.3235	66.6719	450	R.G.F.	Riparian zone; mixed woods with birch dominant	H, L
15.086	5-Jul-2015	Nepisiguit PNA; vicinity of Seventy Five Mile Creek	47.3947	66.6830	390	R.G.F.	Predominantly deciduous, regenerating woods; on slope; young maples, birch	L
15.087	5-Jul-2015	Nepisiguit PNA; headwaters of Melansons Gulch	47.3807	66.6757	380	R.G.F.	Regenerating forest	L
15.088	1-Jul-2015	Nepisiguit PNA; N side of Mount Marie	47.3743	66.6015	290†	Chelsey Chafe	Cedar (<i>Thuja</i> L. sp.) stand on slope	L
15.089	7-Jul-2015	Nepisiguit PNA; WSW of Popple Depot; near main road	47.3864	66.5366	310	R.G.F.	Tolerant hardwood stand; deep litter; maple, birch	L
15.090	7-Jul-2015	Nepisiguit PNA; Melansons Gulch; road up E side of gulch	47.3636	66.6736	300†	R.G.F.	Spruce woods	L
15.093	7-Jul-2015	Nepisiguit PNA; N of Mount Wightman; along road to E boundary of Mount Carleton Park	47.3749	66.6850	390	R.G.F.; Richard Blacquiere	Deciduous woods; birch, poplar	L
16.024	10-Aug-2016	Nepisiguit PNA; near branch of Lower West Brook; near N border of NPA	47.4401	66.6220	560†	Ben Philipps, Stephen Clayden	Deciduous woods	L
16.025	10-Aug-2016	Nepisiguit PNA; near N border of PNA	47.4374	66.6167	420	Ben Philipps, Stephen Clayden	Deciduous woods; seep area at head of dry brook; Yellow Birch, Sugar Maple (<i>Acer saccharum</i> Marshall), Mountain Maple (<i>Acer spicatum</i> Lamareck)	L
16.026	11-Aug-2016	Nepisiguit PNA; N side, Nepisiguit River; SSE of Mount Wightman; near end, Old River Road at bridge out	47.3556	66.6843	310	Mary Sollows	Predominantly spruce and fir; among bryophytes	L
16.028	12-Aug-2016	Nepisiguit PNA; near road down to Blue Cabin	47.3217	66.6546	590†	R.G.F.	Deciduous woods; predominantly birch	L
16.029	12-Aug-2016	Nepisiguit PNA; near road down to Blue Cabin	47.3235	66.6581	540†	R.G.F.	Mixed woods	L
16.030	12-Aug-2016	Nepisiguit PNA; near road down to Blue Cabin	47.3233	66.6559	580	R.G.F.	Mixed woods	L
16.031	12-Aug-2016	Nepisiguit PNA; road down to Blue Cabin	47.3233	66.6559	600	R.G.F.	Deciduous forest; predominantly birch	L
16.035	13-Aug-2016	Mount Carleton PP; along trail to Mount Carleton	47.3555	66.8912	480	R.G.F.	Mixed woods	L

TABLE 1. Continued.

Site	Collection date	Locality	Lat., °N	Long., °W	Elev., m	Collector(s)	Site notes	Method*
16.036	13-Aug-2016	Mount Carleton PP; along trail to Mount Carleton	47.3578	66.8892	510	R.G.F.	Mixed woods	L
16.037	13-Aug-2016	Mount Carleton PP; along Mount Carleton Trail, at junction with Big Brook Trail	47.3682	66.8770	610	R.G.F.	Mixed woods	L
16.038	13-Aug-2016	Mount Carleton PP; Mount Carleton Trail, below Mount Carleton, at junction with Head Mountain Trail	47.3759	66.8748	740	R.G.F.	Mixed woods	L
16.040	13-Aug-2016	Mount Carleton PP; along Mount Carleton Trail, ca. 3 km from top (at 3 km sign)	47.3606	66.8865	540	R.G.F.	Mixed woods	L
16.041	13-Aug-2016	Mount Carleton PP; S side of Big Nictau Lake; road along lake	47.4200	66.8966	260	R.G.F.	Mixed woods	L
16.042	13-Aug-2016	Mount Carleton PP; S side, Big Nictau Lake; along road	47.4179	66.8985	270	Don McAlpine	Mixed woods; hardwoods dominant; Paper Birch, Red Maple (<i>Acer rubrum</i> L.)	L
16.047	17-Aug-2016	Nepisiguit PNA; N of Mount Wightman	47.3600†	66.6800†	450†	Richard Blaquiere	Mixed woods; birch, spruce dominant	L
16.048	15-Aug-2016	Nepisiguit PNA; along small headwater tributary of Pentland Brook	47.4330	66.6301	520	R.G.F.	Along creek, rich hummus; very large Yellow Birch; Ostrich Fern (<i>Matteuccia struthiopteris</i> (L.) Todaro)	L
16.049	15-Aug-2016	Nepisiguit PNA; tributary of W branch, Portage Creek; at N border of PNA	47.4396	66.6224	460	R.G.F.	Sugar Maple-dominated mixed woods	H, L
16.050	15-Aug-2016	Nepisiguit PNA; near main road	47.3360	66.5650	500†	Richard Blaquiere	—	L
16.051	15-Aug-2016	Nepisiguit PNA; tributary of Portage Brook	47.4296	66.6249	490	R.G.F.	Sugar Maple, Yellow Birch, Ostrich Fern, shrubs	H, L
16.054	20-Aug-2016	Nepisiguit PNA	47.3871	66.5365	260	R.G.F.; Val Calvin	—	H, L
16.060	20-Aug-2016	Nepisiguit PNA; Mount Walker	47.3406	66.6745	500	Richard Blaquiere	—	L
16.062	20-Aug-2016	Nepisiguit PNA; along Nepisiguit River	47.3819	66.5795	260†	Charles Graves	—	L

*L = litter sample; H = visual search, hand collected.

†Subsequently derived from Google Earth. Geographic coordinates approximate.

TABLE 2. Species collected in leaf-litter samples in Nepisiguit Protected Natural Area (PNA) and Mount Carleton Provincial Park (PP), New Brunswick, in 2015 and 2016. See Table 1 for descriptions of sites and Table S1 for a list of voucher specimens, New Brunswick Museum accession numbers, and other data. Additional species observed in the study area but not found in litter samples were Upland Pillsnail (*Euchemotrema fraternum* (Say, 1824)) and Hairy Helicellid (*Trochulus hispidus* (Linnaeus, 1758)).

Species	Family	Nepisiguit PNA sites	Mount Carleton PP sites
<i>Anguispira alternata</i> (Say, 1817), Flamed Tigersnail	Discidae	16.051	
<i>Carychium exile</i> H.C. Lea, 1842, Ice Thorn	Ellobiidae	16.048, 16.054	
<i>Cochlicopa</i> cf. <i>lubrica</i> (O.F. Müller, 1774), Glossy Pillar	Cochlicopidae	15.065, 15.082, 16.024, 16.025, 16.048, 16.049	
<i>Columella simplex</i> (A. Gould, 1840), Simple Column	Truncatellinidae	15.070, 15.075, 15.089, 15.093, 16.024, 16.028, 16.051	
<i>Discus whitneyi</i> (Newcomb, 1864), Forest Disc	Discidae	15.057, 15.059, 15.060, 15.063, 15.065, 15.070, 15.071, 15.075, 15.086, 15.088, 15.089, 15.090, 15.093, 16.024, 16.028, 16.030, 16.048, 16.049, 16.051, 16.054	16.035, 16.036, 16.040, 16.042
<i>Euconulus fulvus egenus</i> (Say, 1825), Brown Hive	Euconulidae	15.063, 15.068, 15.070, 15.075, 15.077, 15.081, 15.082, 15.083, 15.087, 15.088, 15.089, 15.090, 15.093, 16.024, 16.028, 16.029, 16.030, 16.048, 16.049, 16.051, 16.060	16.035, 16.040, 16.041
<i>Helicodiscus shimiki</i> Hubricht, 1962, Temperate Coil	Helicodiscidae	15.056, 15.063, 15.070, 15.075, 15.077, 15.083, 15.086, 15.087, 15.088, 15.089, 15.090, 15.093, 16.028, 16.030, 16.049	16.042
<i>Novisuccinea ovalis</i> (Say, 1817), Ovate Ambersnail	Succineidae	15.063, 16.028	16.035
<i>Perpolita binneyana</i> (E.S. Morse, 1864), Blue Glass	Gastrodontidae	15.060, 15.063, 15.065, 15.068, 15.070, 15.071, 15.074, 15.075, 15.077, 15.083, 15.086, 15.087, 15.088, 15.089, 15.090, 15.093, 16.024, 16.025, 16.028, 16.029, 16.030, 16.047, 16.048, 16.049, 16.051, 16.054	16.040, 16.041, 16.042
<i>Planogyra asteriscus</i> (E.S. Morse, 1857), Eastern Flat-whorl	Valloniidae	15.060, 15.068, 15.071, 15.086, 15.089, 16.025, 16.028, 16.048, 16.054	16.040
<i>Punctum minutissimum</i> (I. Lea, 1841), Minute Spot	Punctidae	15.060, 15.070, 15.075, 15.083, 15.086, 15.088, 15.089, 15.090, 15.093, 16.028, 16.047, 16.048, 16.049, 16.051, 16.054, 16.062	16.035, 16.040, 16.041, 16.042
<i>Striatura exigua</i> (W. Stimpson, 1851), Ribbed Striate	Gastrodontidae	15.056, 15.057, 15.060, 15.063, 15.065, 15.068, 15.070, 15.071, 15.074, 15.075, 15.077, 15.081, 15.083, 15.086, 15.087, 15.088, 15.089, 15.090, 15.093, 16.024, 16.025, 16.028, 16.029, 16.030, 16.047, 16.048, 16.049, 16.051, 16.054, 16.062	16.035, 16.037, 16.040, 16.041, 16.042
<i>Striatura ferrea</i> E.S. Morse, 1864, Black Striate	Gastrodontidae	15.063, 15.086, 15.090, 16.028, 16.029, 16.031, 16.048, 16.049, 16.050, 16.060	16.037, 16.038, 16.040, 16.041
<i>Striatura milium</i> (E.S. Morse, 1859), Fine-ribbed Striate	Gastrodontidae	15.056, 15.065, 15.068, 15.071, 15.074, 15.077, 15.088, 15.089, 16.062	16.041
<i>Strobilops labyrinthicus</i> (Say, 1817), Maze Pinecone	Strobilopsidae	15.075	
<i>Vertigo arthuri</i> E. von Martens, 1882, Callused Vertigo	Vertiginidae	16.051	16.040
<i>Vertigo bollesiana</i> (E.S. Morse, 1865), Delicate Vertigo	Vertiginidae	15.068, 15.089	
<i>Vertigo cristata</i> Sterki in Pilsbry, 1919, Cristate Vertigo	Vertiginidae	15.057, 15.071, 15.074, 15.081, 15.083, 15.086, 15.088, 15.093, 16.030, 16.060	16.040

TABLE 2. Continued.

Species	Family	Nepisiguit PNA sites	Mount Carleton PP sites
<i>Vertigo gouldii</i> (A. Binney, 1843), Variable Vertigo	Vertiginidae	16.049, 16.061	
<i>Vitrina angelicae</i> H. Beck, 1837, Eastern Glass-snail	Vitrinidae	16.048	16.035
<i>Zonitoides arboreus</i> (Say, 1817), Quick Gloss	Gastrodontidae	15.068, 15.070, 15.075, 15.083, 15.086, 16.025, 16.026, 16.029, 16.031, 16.049, 16.051, 16.060	16.035, 16.036, 16.041, 16.042
<i>Zoogenetes harpa</i> (Say 1824), Boreal Top	Valloniidae	15.063, 15.068, 15.075, 15.081, 15.087, 15.088, 16.047, 16.048, 16.049, 16.051, 16.060, 16.062	

Pillar (*Cochlicopa morseana* (W. Doherty, 1878)), which is characterized by a thinner, more transparent “pale greenish corneus” shell (Pilsbry 1948: 1050) and lives in moist, upland woods in deep leaf litter (Hubricht 1985). However, partial cytochrome c oxidase subunit I DNA barcoding did not distinguish specimens from New Brunswick from others collected in urban areas of Ottawa and elsewhere (D. McAlpine pers. comm. 2016). Different genes or methods might differentiate this New Brunswick population, which otherwise appears so different—and in much different habitats—from the common, almost “weedy” *C. lubrica*.

Thirty-four shelled terrestrial gastropod mollusc species, excluding slugs, have been reported from New Brunswick by others (La Rocque 1961 [which summarizes earlier literature]; Dimelow 1962, 1963; Clarke *et al.* 1968; McAlpine *et al.* 2009; Forsyth 2015; Forsyth *et al.* 2016). If non-native species are removed, 29 species remain, but several of these are likely misidentifications and include some larger-bodied species which were not the focus of my study. I found 28 species. Clarke *et al.* (1968) reported 24 species from 79 sites, which is the only comparable published study for New Brunswick; collections from other BiotaNB years are still to be analyzed (R.G.F. unpubl. data). I found seven species not previously reported from the province.

Two larger species of terrestrial snails were collected in the study area but not found in leaf-litter samples. Larger snails are apparently rare and were absent from the leaf-litter samples, except for juveniles of Flamed Tigersnail (*Anguispira alternata* (Say, 1816)). Upland Pillsnail (*Euchemotrema fraternum* (Say, 1824)) was found in visual searches in the field. Hairy Helicellid (*Trochulus hispidus* (Linnaeus, 1758)) was collected around the Popple Depot buildings, but these and no other introduced species of snails were in litter samples.

Although most microsnail species are generalists (Speiser 2001) and broadly distributed (e.g., Pilsbry 1940, 1946, 1948; Hubricht 1985), my study should provide useful data on which to compare the

north-central New Brunswick terrestrial snail fauna with that in other parts of the province and, perhaps, determine any regional distribution patterns. These data are important to better understand the mollusc fauna of New Brunswick to assure sufficient conservation actions are taken.

Acknowledgements

This study would not have been possible without Don McAlpine, who has been instrumental in the establishment of the BiotaNB program of the New Brunswick Museum (NBM), and whose enthusiasm for the natural world is infectious. I thank him for inviting me to be part of BiotaNB. Richard Blacquiere, Val Calvin, Chelsey Chafe, Stephen Clayden, Charles Graves, Don McAlpine, Stephen Mott, Ben Philipps, Alex Roberts, and Mary Sollows assisted with collecting bags of leaf litter or specimens, which was especially helpful when I was busy sorting previous days' samples. I also thank Don McAlpine for arranging for DNA-barcoding of the *Cochlicopa* specimens. Mary Sollows assistance with accession of the voucher specimens into the NBM collection is greatly appreciated, and I thank her for her patience. I also am grateful to the Guest Editor, Graham Forbes, and two reviewers, Tim Pearce and Dwayne Lepitzki, for their constructive reviews of the manuscript. This study, including costs for publication, was generously funded by the NBM. Permission to collect specimens in Nepisiguit PNA was granted by the Minister of Natural Resources, province of New Brunswick under permit #SCP2015-001, and, in Mount Carleton Provincial Park, by L. Comeau, park manager, as per agreement with D. McAlpine (15 May 2015).

Literature Cited

- Bailey, G.W. 1903. The land snails of New Brunswick. Bulletin of the Natural History Society of New Brunswick 5: 15–34.
- Bouchet, P., J.P. Rocroi, B. Hausdorf, A. Kaim, Y. Kano, A. Nützel, P. Parkhaev, M. Schrödl, and E.E. Strong. 2017. Revised classification, nomenclator and typifica-

- tion of gastropod and monoplacophoran families. *Malacologia* 61: 1–526. <https://doi.org/10.4002/040.061.0201>
- CCEA (Canadian Council on Ecological Areas)**. 2014. Ecozones of Canada/Écozones du Canada. Update version 2014.02. Accessed 13 September 2022. https://www.ccea-ccae.org/wp-content/uploads/2021/01/Canada_Ecozones_V5_map_kml_v20140218.zip at <https://ccea-ccae.org/ecozones-downloads/>.
- Clarke, A.H., Jr., J.P. Kelsall, and G.R. Parker**. 1968. The land snail fauna of Fundy National Park. *National Museum of Canada Bulletin* 223: 5–22.
- Dimelow, E.J.** 1962. Land mollusks of Sackville, New Brunswick, Canada. *Nautilus* 76: 51–53.
- Dimelow, E.J.** 1963. Mollusks from hardwoods of the Chignecto Isthmus. *Nautilus* 77: 21–23.
- Forsyth, R.G.** 2004. Land Snails of British Columbia. Royal BC Museum, Victoria, British Columbia, Canada.
- Forsyth, R.G.** 2015. First record of *Carychium minimum* Müller, 1774 in New Brunswick, Canada (Mollusca: Gastropoda: Ellorbiidae). *Check List* 11: 1511. <https://doi.org/10.15560/11.1.1511>
- Forsyth, R.G., M.A. Arsenaault, and R. Curley**. 2022. Leaf-litter-dwelling microsnails of Prince Edward Island, Canada (Mollusca, Gastropoda, Eupulmonata). *Check List* 18: 1005–1015. <https://doi.org/10.15560/18.5.1005>
- Forsyth, R.G., and D.A.W. Lepitzki**. 2015. Terrestrial snails (Gastropoda: Pulmonata) from Writing-on-Stone Provincial Park, Alberta, Canada. *Check List* 11: 1636. <https://doi.org/10.15560/11.3.1636>
- Forsyth, R.G., J.E. Maunder, D.F. McAlpine, and R.G. Noseworthy**. 2016. Distributional status of an introduced land snail *Discus rotundatus* (Rotund Disc, Mollusca: Discidae) in Canada. *Canadian Field-Naturalist* 130: 235–246. <https://doi.org/10.22621/cfn.v130i3.1887>
- Forsyth, R.G., and A. Nicolai**. 2019. Terrestrial snails of the Ottawa region. *Trail & Landscape* 53: 194–197. Accessed 26 July 2023. <https://ofnc.ca/publications/trail-landscape/tlpdfs>.
- Forsyth, R.G., and M.J. Oldham**. 2014. Distribution of *Strobilops aeneus* Pilsbry, 1926, in Canada, with two new Ontario records (Mollusca: Gastropoda: Strobilopsidae). *Check List* 10: 397–401. <https://doi.org/10.15560/10.2.397>
- Horsáková, V., J.C. Nekola, and M. Horsák**. 2020. Integrative taxonomic consideration of the Holarctic *Euconulus fulvus* group of land snails (Gastropoda, Stylommatophora). *Systematics and Biodiversity* 18: 142–160. <https://doi.org/10.1080/14772000.2020.1725172>
- Hubricht, L.** 1985. The distributions of the native land mollusks of the eastern United States. *Fieldiana, Zoology (New Series)* 24: i–viii, 1–191. <https://doi.org/10.5962/bhl.title.3329>
- Kottek, M., J. Grieser, C. Beck, B. Rudolf, and F. Ruble**. 2006. World map of the Köppen-Geiger climate classification updated. *Meteorological Journal* 15: 259–263. <https://doi.org/10.1127/0941-2948/2006/0130>
- La Rocque, A.** 1961. Checklist of New Brunswick non-marine Mollusca. *Sterkiana* 3: 40–42.
- McAlpine, D.F.** 2017. BiotaNB. Counting life while New Brunswick burns (or at least warms). *NB Naturalist* 44 (3): 18–20.
- McAlpine, D.F.** 2022. BiotaNB: the New Brunswick Museum's biological inventory program enters its 2nd decade. *Newsletter of the Biological Survey of Canada* 14: 29–41.
- McAlpine, D.F., F. Schueler, J.E. Maunder, R.G. Noseworthy, and M.C. Sollows**. 2009. Establishment and persistence of the copse snail, *Arianta arbustorum* (Linnaeus, 1758) (Gastropoda: Helicidae) in Canada. *Nautilus* 123: 14–18.
- Neiber, M.T., F. Walthert, and B. Hausdorf**. 2020. Phylogenetic relationships of ghost slugs (*Selenochlamys*) and overlooked instances of limacization in Western Palaearctic Limacoidei (Gastropoda: Stylommatophora). *Molecular Phylogenetics and Evolution* 151: 106897. <https://doi.org/10.1016/j.ympev.2020.106897>
- Nekola, J.C., S. Chiba, B.F. Coles, C.A. Drost, T. von Proschwitz, and M. Horsák**. 2018. A phylogenetic overview of the genus *Vertigo* O. F. Müller, 1773 (Gastropoda: Pulmonata: Pupillidae: Vertigininae). *Malacologia* 62: 21–161. <https://doi.org/10.4002/040.062.0104>
- Nekola, J.C., and B.F. Coles**. 2010. Pupillid land snails of eastern North America. *American Malacological Bulletin* 28: 1–29. <https://doi.org/10.4003/006.028.0221>
- Pilsbry, H.A.** 1940. Land Mollusca of North America (North of Mexico). Volume I, Part 2. Monograph 3. Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania, USA.
- Pilsbry, H.A.** 1946. Land Mollusca of North America (North of Mexico). Volume II, Part 1. Monograph 3. Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania, USA.
- Pilsbry, H.A.** 1948. Land Mollusca of North America (North of Mexico). Volume II, Part 2. Monograph 3. Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania, USA.
- Speiser, B.** 2001. Food and feeding behavior. Pages 259–288 in *The Biology of Terrestrial Molluscs*. Edited by G.M. Barker. CABI, New York, New York, USA.
- Turgeon, D.D., J.F. Quinn, Jr., A.E. Bogan, E.V. Coan, F.G. Hochberg, W.G. Lyons, P.M. Mikkelsen, R.J. Neves, C.F.E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F.G. Thompson, M. Vecchione, and J.D. Williams**. 1998. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks, Second Edition. Special Publication 26. American Fisheries Society, Bethesda, Maryland, USA.
- Zelazny, V.F.** 2007. Our Landscape Heritage: the Story of Ecological Land Classification in New Brunswick. Second Edition. Department of Natural Resources, Government of New Brunswick, Fredericton, New Brunswick, Canada.

Received 15 September 2022

Accepted 23 June 2023

Guest Editor: G.J. Forbes

Supplementary Material:

Table S1. Collections and observations of litter-dwelling terrestrial molluscs of Nepisiguit Protected Natural Area and Mount Carleton Provincial Park, north-central New Brunswick.