Check List the journal of biodiversity data

LISTS OF SPECIES

Check List 12(3): 1881, 1 May 2016 doi: http://dx.doi.org/10.15560/12.3.1881
ISSN 1809-127X

Terrestrial molluscs from the Ontario Far North

Robert G. Forsyth[1,2*] and **Michael J. Oldham**[3]

1 Research Associate, Royal British Columbia Museum, 675 Belleville Street, Victoria, BC, Canada V8W 9W2
2 Research Associate, New Brunswick Museum, 277 Douglas Avenue, Saint John, NB, Canada E2K 1E5
3 Natural Heritage Information Centre, Ontario Ministry of Natural Resources and Forestry, 300 Water Street, PO Box 7000, Peterborough, ON, Canada K9J 3C7
* Corresponding author. E-mail: rforsyth@mollus.ca

Abstract: From 2009–2014, incidental collections of terrestrial molluscs were made from the Far North of Ontario, Canada. Thirty-four species of terrestrial molluscs were identified from these collections, including one exotic species, *Deroceras reticulatum,* and three newly reported species from the Far North, *Vallonia pulchella, Vertigo* cf. *genesii,* and *Gastrocopta similis*. *Vertigo* cf. *genesii* is newly reported from Ontario. Some species have not been collected in Ontario for many years and some of these only once before. Subnational conservation ranks are discussed for higher-ranked species.

Key words: Mollusca; Gastropoda; Canada; Hudson Bay Lowlands; James Bay; land snails; slugs; distribution; inventory; arctic coast; boreal forest; tundra

INTRODUCTION

Among the provinces and territories of Canada, the terrestrial snail and slug fauna of Ontario is relatively well-known. The first account of a terrestrial mollusc was in the early 1800s (Racket 1821) and pre-dates Canadian confederation and the present-day borders of Ontario. Interest grew through the 1850s to early 1900s and was especially strong in the 1930s and 1940s. As can be expected, collections were made and knowledge acquired mostly in the southern areas of the province.

However, a few naturalists did acquire collections of terrestrial molluscs from the north, either on their own accord or through others. In 1861, W. G. Binney published the first record of terrestrial snail species from the region (James Bay and Moose Factory). From Moose Factory, Binney (1861) cited nine species, two of which are large land snails not known, and never found since, in the Ontario north (*Helix monodon,* presumably *Euchemotrema leaii* (A. Binney, 1841) but possibly *E. fraternum* (Say, 1824), and "[*H.*] ... *albolabris* or [*H.*] *thyroides* [*sic*]", now either *Neohelix albolabris* (Say, 1817) or *Mesodon thyroidus* (Say, 1816)). Dall (1905) also included records from Moose Factory. However, concerning some of these purported molluscs of Moose Factory, Goodrich (1933: 7) wrote:

"Twenty-seven species are credited to the locality. The collections that Dall [1905] examined were no doubt made by several travelers and the name Moose Factory was meant, in some instances, to cover an area of several hundred square miles."

Whiteaves (1905) added additional records from near James Bay, but most of what we know about the terrestrial mollusc fauna of northern Ontario was gathered in the 1930s by Goodrich (1933; Moose Factory), Richards (1936), Whelan and Oughton (1948; Smoky Falls), and Oughton (1948). Oughton's (1948) work summarized earlier records as well as new data, contained information on unique collections from Fort Severn and other northern locales, as well as providing new records for species from the province. Oughton's publication remains important today as the first attempt to synthesize data on the geographic distribution Ontario's land snails and slugs.

In this paper, we document 34 species of terrestrial molluscs collected from Ontario's Far North. These are the first collections in many years from this part of the province, finding all but four previously reported species (one was probably misidentified) as well as adding three species new to the area, including one species new to Ontario. The applicability of subnational conservation ranks is also discussed.

MATERIALS AND METHODS

Study area

Ontario's *Far North Act, 2010*, set out a joint planning process for First Nations and the province of Ontario and laid a foundation for community-based land-use planning in the Far North. The Far North Planning Area covers 43% of Ontario's land mass and includes over 460,000 km^2 of boreal, subarctic, and tundra ecosystems. The Premier of Ontario announced in 2008 that Ontario

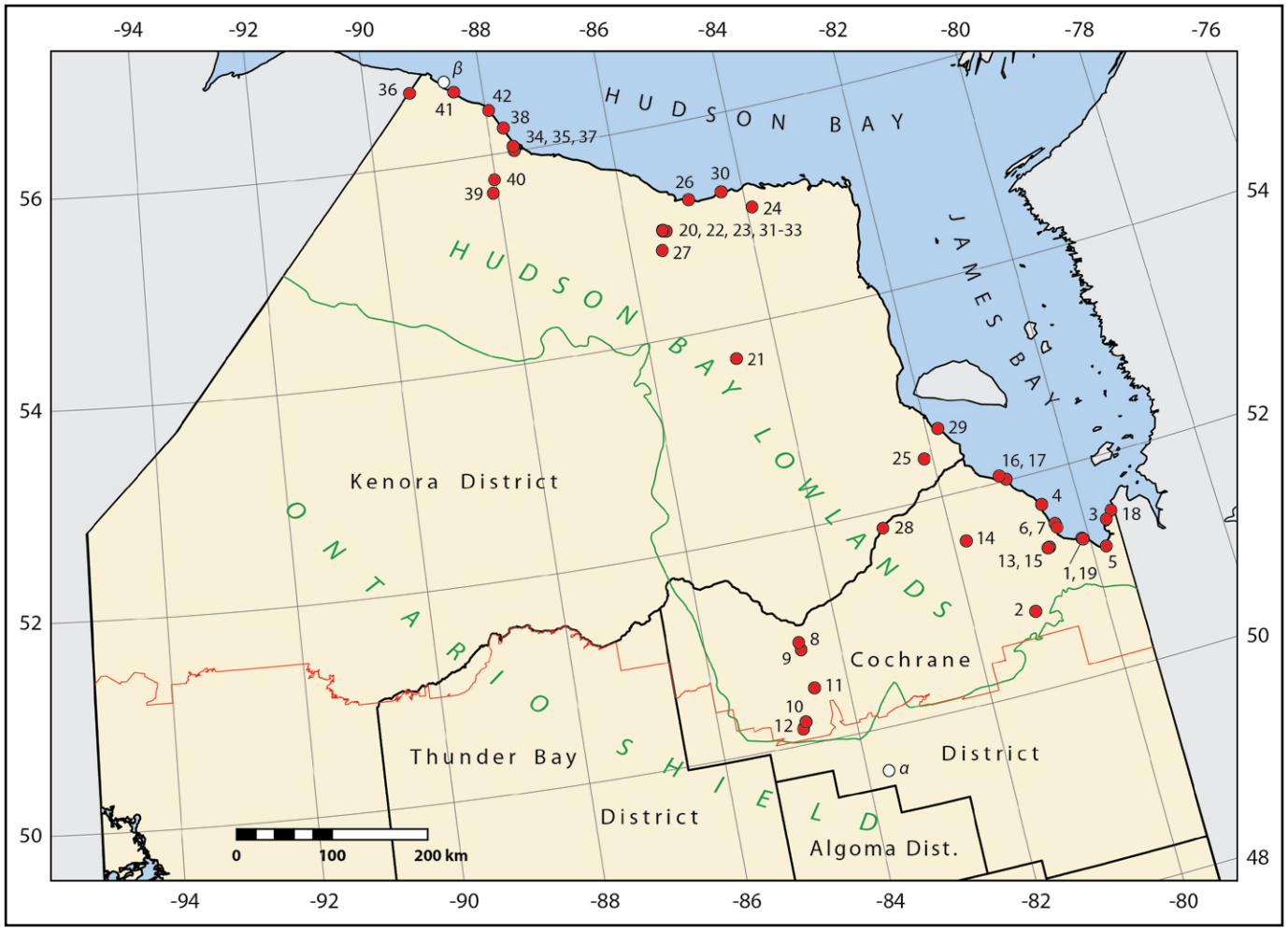

Figure 1. Northern Ontario, showing southern boundary the Far North study area (red line), the boundary between the Ontario Shield and Hudson Bay Lowlands ecozones (Crins et al. 2009; green line), boundaries of the Kenora, Cochrane, Thunder Bay, and Algoma districts (black lines), and new records (red circles), numbered and corresponding to Table 1. Two additional localities were collected that were outside of the Far North (white circles), labeled with the Greek letters α (Ontario, south of the Far North area) and β (on an island and therefore part of Nunavut), are also listed in Table 1.

will protect 225,000 km^2 of the Far North in a network of conservation lands. The Far North includes most of Kenora District, exclusive of its southwestern portion, approximately the northern half of Cochrane District, and small portions of northern Thunder Bay District. The southern boundary of the Far North is shown as a red line in Figure 1 and all species' maps. The Far North includes all of the Hudson Bay Lowlands ecozone and a portion of the Ontario Shield ecozone (underlain by Precambrian bedrock) (Figure 1), two of the three major ecological units that have been classified within the province of Ontario (Crins et al. 2009).

Multi-disciplinary teams of biologists conducted life science inventories at sites across the Far North Planning Area that were identified for their biodiversity and representational values. Over the six field seasons crews worked out of the communities of Moosonee, Sandy Lake, Attawapiskat, Hearst, Peawanuck, Pickle Lake, Fort Albany, Martin Falls, Summer Beaver, and Fort Severn.

Between 2009 and 2014, one of us (MJO) participated in biological field surveys of Ontario's Far North as part of the Far North Biodiversity Project (FNBP). During these surveys 82 study sites were visited and data were collected on a variety of features, including breeding bird survey plots, invertebrate sampling (sweep netting, malaise and pan traps), vegetation plots, soils and incidental collections of a various plant and animal taxa. Study sites visited had been previously identified as sites of natural heritage significance (e.g., provincial parks, candidate Areas of Natural and Scientific Interest, and Important Bird Area sites), but in general these sites lacked detailed biological information such as vegetation descriptions or species lists. Terrestrial molluscs were collected incidentally at some but not all of the study sites.

Within the Far North, 43 sites were surveyed for terrestrial molluscs (Figure 1; Table 1), including beach ridges, tundra, and floodplains of rivers (Figures 2–5). These sites are distributed from approximately 50° N to 57° N and from 080° W to 088° W; the southernmost site is in west-central Cochrane District, the easternmost

Table 1. Collection sites (1–43) from the Far North (Ontario), 2009–2014, with the addition of two extralimital localities (Greek letters α and β). Site identifiers (1–43; α and β) correspond to labels in Figure 1.

Site	District and locality	Locality description	Habitat remarks	Collector(s), field number	Latitude (° N)	Longitude (° W)	Date
	Cochrane District						
1	Netitishi Point IBA 137	E side of Netitishi Point on James Bay coast (between Netitishi Point and Little Netitishi Point), 38 km E of Moosonee, 22 km SE of mouth of Moose River	Under logs (driftwood) on beach ridge	M.J. Oldham 36214	51.2797	080.0963	3 July 2009
2	Gypsum Mountain Candidate ANSI	69 km SSW of Moosonee	Under logs	M.J. Oldham 36258	50.7379	081.0558	4 July 2009
3	East Point IBA 147	James Bay coast, SE side of James Bay, 50 km ENE of mouth of Moose River, 11 km W of the Quebec border	Under driftwood on cobble beach ridge	M.J. Oldham 36270	51.4036	079.6784	5 July 2009
4	Big Piskwamish Point IBA 140	SW James Bay coast, 39 km WNW of mouth of Moose River; 45 km N of Moosonee	Beach ridge, under logs	M.J. Oldham 36337	51.6965	080.5641	6 July 2009
5	Hannah Bay IBA IBA127	S end of James Bay, Hannah Bay, on W side of mouth of Harricanaw River, 47 km ESE of the mouth of the Moose River	Edge of *Carex paleacea*-dominated coastal salt marsh, under logs at transition between sedge marsh and willow thickets	M.J. Oldham 36346	51.1581	079.7882	7 July 2009
6	Moose River Estuary IBA 138	11 km N of mouth of Moose River	Narrow (20–30 m) willow thicket on inland side of beach ridge, under driftwood on beach ridge	M.J. Oldham 36474	51.4508	080.4278	10 July 2009
7	North Point IBA 139	James Bay coast, 16 km N of mouth of Moose River	Under logs on beach ridge	M.J. Oldham 36485, 36490	51.4928	080.4433	10 July 2009
8	Kenogami River Mouths Candidate ANSI	W side of Kenogami River, immediately north of mouth of Little Current River	Gravel floodplain, under logs	M.J. Oldham 36643	50.9564	084.5972	30 July 2009
9	Kenogami River Mouths Candidate ANSI	W side of Kenogami River, just N of junction with Little Drowning River	Riverine gravel bar; under logs *or* drift at river high-water level on riverine gravel bar	M.J. Oldham 36811(logs), 36812 (drift)	50.8853	084.5848	1 August 2009
10	Kenogami Wetlands Candidate Area ANSI	Pagwachuan River at Kenogami River, ca. 95 km NW of Hearst	Gravel floodplain	M.J. Oldham 36864	50.2095	084.7257	2 August 2009
11	Kenogami River, Kenogami Cedar Swamp Candidate ANSI	110 km NNW of Hearst, W side of Kenogami River	Gravel floodplain; in riverine drift	M.J. Oldham 37017	50.5076	084.5033	5 August 2009
12	Kenogami Wetlands Candidate ANSI	96 km WNW of Hearst, E side of Pagwachuan River	Gravel floodplain; live-collected and in riverine drift	M.J. Oldham 37065	50.1495	084.7844	6 August 2009
13	Moosonee	–	Under cardboard at edge of woods	M.J. Oldham 39854	51.2846	080.6395	2 July 2012
14	Kinoje Lake Candidate ANSI	SW end, ca. 88 km NW of Moosonee Airport	Lakeshore, under wet logs	M.J. Oldham 39879	51.5400	081.8077	3 July 2012
15	Moosonee Airport	–	Under debris	M.J. Oldham 39888	51.2895	080.6147	4 July 2012
16	Nomansland Point, Albany River Estuary IBA 125	W side of southern James Bay coast, ca. 44 km SE of Fort Albany	Gravelly coastal James Bay beach ridge, under logs	M.J. Oldham 40027	52.0588	081.0789	5 July 2012
17	Cockispenny Point, Albany River Estuary IBA 125	Ca. 52 km SE of Fort Albany	Edge of mossy White Spruce woods near James Bay coast	M.J. Oldham 40165	52.0139	080.9887	7 July 2012
18	East Point IBA 147	Chiyask Point, southern James Bay, just W of Quebec border, ca. 74.5 km ENE of Moosonee Airport	Under logs on upper beach	M.J. Oldham 40224	51.4714	079.5758	8 July 2012
19	Netitishi Point IBA 137	W side of Hannah Bay, ca. 34 km E of Moosonee Airport	Under logs on first beach ridge from James Bay coast	M.J. Oldham 40230	51.2903	080.1100	8 July 2012

Continued

Table 1. *Continued.*

Site	District and locality	Locality description	Habitat remarks	Collector(s), field number	Latitude (° N)	Longitude (° W)	Date
	Kenora District						
20	Peawanuck	W side of Winisk River, ca. 37 km SW of mouth at Hudson Bay, vicinity of sewage lagoons at N end of town, W of Winisk River	Dry spruce woods with open understory, Under cardboard	M.J. Oldham 37524	55.0170	085.4230	1 July 2010
21	Ekwan Subglacial Valley Candidate ANSI	On Ekwan River, ca. 164 km W of James Bay coast, ca. 154 km SSE of Peawanuck on Winisk River	Gravel floodplain of Ekwan River, under logs	M.J. Oldham 37582	53.6973	084.6572	2 July 2010
22	Peawanuck	Vicinity of Polar Bear Provincial Park office, N end of town, W of Winisk River, ca. 38 km SSW of mouth of Winisk River at Hudson Bay	Edge of woods, under debris around park office	M.J. Oldham 37600	55.0135	085.4230	3 July 2010
23	Winisk–Shamattawa Confluence Candidate ANSI	Shamattawa River, ca. 2.5 km from confluence with Winisk River, ca. 3.75 km E of Peawanuck	Under logs	M.J. Oldham 37612	55.0053	085.3653	3 July 2010
24	Sutton River	24 km SSW of mouth at Hudson Bay, at small creek entrance on E side of river	Gravelly river floodplain, under logs	M.J. Oldham 37901	55.0677	083.9059	7 July 2010
25	36 km NW of Fort Albany		Open sand dune, along E edge of dune, recently burned over glacial beach ridge under large cobbles	E. Snyder	52.3857	082.1335	7 July 2012
26	Winisk River Estuary IBA 133	Hudson Bay coast on E side of Winisk River (ca. 11 km E of mouth), just W of Oman Creek	Hummocky tundra, "drift" sample of leaves adjacent to log on tundra and hand-collected	M.J. Oldham 38022	55.2567	084.9062	10 July 2010
27	Winisk–Shamattawa Confluence Candidate ANSI	Treed ridge midway between Winisk and Shamattawa rivers, ca. 20 km S of Peawanuck, ca. 55 km SSW of Winisk River mouth at Hudson Bay	Hummocky fen	M.J. Oldham 38173	54.8352	085.4900	13 July 2010
28	Fishing Creek Candidate ANSI	Ca. 98 km SW of Fort Albany Airport	Gravel river floodplain, under logs	M.J. Oldham 39929	51.8404	082.9915	4 July 2012
29	Albany River Estuary IBA 125	Low first beach ridge	Ca. 50 m from high tide line, under logs	M.J. Oldham 39987, 40011	52.6346	081.8139	5 July 2012
30	Burntpoint Creek Camp area, Polar Bear Provincial Park	Ca. 77 km NE of Peawanuck	Beach ridge ca. 500–700 m from coast, under logs on beach ridge	M.J. Oldham, M.A. Young, J. Belliveau 40925	55.2665	084.3513	20 July 2013
31	Peawanuck	Vicinity of Polar Bear Provincial Park staff house, N end of Peawanuck, west of Winisk River about 37 km from its mouth at Hudson Bay	Disturbed ground adjacent to sandy ponds near sewage lagoons, beneath board	M.J. Oldham 41220	55.0140	085.4231	24 July 2013
32	Peawanuck	Wetland (old river channel) just NE of dump, ca. 1–2 km N of town	Moist woods and shrubby shore of former river channel	M.J. Oldham, M.A. Young 41314	55.0225	085.4238	26 July 2013
33	Peawanuck	Open disturbed shallow ponds between sewage lagoons and dump, ca. 1.5 km N of town	Shallow ponds and adjacent moist woodland edges	M.J. Oldham, M.A. Young 41321	55.0239	085.4200	26 July 2013
34	Severn River Coastline IBA 135	Road from Fort Severn to coast of Hudson Bay	Tundra, under moist cardboard	M.J. Oldham 41959	56.0469	087.6295	1 July 2014
35	Severn River Coastline IBA 135	By dirt road ca. 2 km NNE of Fort Severn, ca. 1 km W of Severn River, ca. 8 km S of Hudson Bay coast at mouth of Severn River	Hummocky moist tundra	M.J. Oldham 42217	56.0069	087.6216	5 July 2014
36	W side of Black Duck River	Ca. 1 km SE of Manitoba border, ca. 25 km SW of Hudson Bay coast hummocky fen at West Pen Island	Cobble river floodplain, riverine gravel bar, on shoreline vegetation	M.J. Oldham 42186	56.6856	089.2345	5 July 2014
37	Severn River Coastline IBA 135	By dirt road ca. 5.6 km N of Fort Severn, W side of Severn River, ca. 5 km SW of Hudson Bay coast at mouth of Severn River	River floodplain and adjacent open tundra, stream drift	M.J. Oldham 42223	56.0399	087.6238	6 July 2014

Continued

Table 1. *Continued.*

Site	District and locality	Locality description	Habitat remarks	Collector(s), field number	Latitude (° N)	Longitude (° W)	Date
	Kenora District *(continued)*						
38	Severn River Coastline IBA 135	Ca. 400 m from Hudson Bay coast (high tide line), ca. 28 km NNW of Fort Severn	Beach ridge and adjacent tundra and sedge meadows near Hudson Bay coast, under logs	M.J. Oldham 42261	56.2339	087.7403	6 July 2014
39	Severn River	Bedrock outcrop on E side of Severn River, ca. 47 km SSW of Fort Severn, ca. 57 km SW of Hudson Bay coast	Edge of river, drift at high-water line	M.J. Oldham 42390	55.6389	088.0802	8 July 2014
40	Severn River	E side of Severn River just N of major rapids (with portage road around rapids on W side of river), ca. 35 km SSW of Fort Severn, ca. 45 km SW of Hudson Bay coast	Cobble river floodplain, under logs	M.J. Oldham 42417	55.7634	088.0252	8 July 2014
41	Niskibi Cape IBA 142	Ca. 89 km NW of Fort Severn, on Hudson Bay coastal beach ridge	Coastal beach ridge and adjacent saline pond edges, drift at edge of tundra pond	M.J. Oldham 42480	56.6379	088.4826	9 July 2014
42	Niskibi Cape IBA 142	Ca. 51 km NNW of Fort Severn, on Hudson Bay coastal beach ridge, ca. 6 km SSE of Niskibi Cape	Open low beach ridges near Hudson Bay coast and adjacent saline coastal pond margins, under board	M.J. Oldham 42500	56.4179	087.9427	9 July 2014
	Outside of the Far North						
α	S of Hearst (Cochrane District, Ontario)	S side of Hwy. 523 (Gaspesie Road), ca. 10 km S of Hearst	Roadside adjacent to Black Spruce woods, under logs	M.J. Oldham 36509	49.6001	083.6919	27 July 2009
β	East Pen Island, Hudson Bay (Nunavut)	Ca. 24 km SE of Manitoba border at Hudson Bay coast, ca. 104 km NW of Fort Severn, Ontario	Open gravel beach ridge, under logs	M.J. Oldham 42203	56.7468	088.6279	5 July 2014

site is near the Ontario–Quebec border on the James Bay coast, and the northernmost and westernmost site is near the Ontario–Manitoba border near the coast of Hudson Bay (Figure 1). All Far North sites sampled for terrestrial molluscs are within the Hudson Bay Lowlands ecozone (see below).

The Hudson Bay Lowlands lie south of Hudson and James bays, part of the Arctic Ocean, and represents about one-quarter of the total area of the province, or 248,046 km^2 (Crins et al. 2009). This ecozone extends from the Quebec border west to the Manitoba border.

Figure 2. James Bay coastal beach ridge with large logs thrown up by storms under which terrestrial molluscs were collected. *Cochlicopa lubrica, Deroceras laeve, Discus whitneyi, Euconulus fulvus* aggregate, *Nesovitrea binneyana, Nesovitrea electrina, Pupilla hudsonianum, Vallonia gracilicosta, Vallonia pulchella,* and *Zonitoides arboreus* were collected here. Photo taken 3 July 2009 at Netitishi Point Important Bird Area (IBA 137), Cochrane District, by Michael J. Oldham.

Figure 3. Floodplain of the Kenogami River, Cochrane District. Terrestrial molluscs were found under rocks and logs at the upper edges of the floodplain adjacent to the forest as well as in drift accumulated at the high water line. *Carychium exiguum, Carychium exile, Cochlicopa lubrica, Columella edentula, Discus whitneyi, Euconulus fulvus* aggregate, *Gastrocopta similis, Gastrocopta tappaniana, Nesovitrea electrina, Punctum minutissimum, Striatura exigua, Strobilops labyrinthicus, Vallonia gracilicosta, Vertigo arthuri, Vertigo elatior, Vitrina angelicae, Zonitoides arboreus*, and *Zonitoides nitidus* were collected from this type of habitat along the Kengami River. Photo taken 5 August 2009 at Kenogami Cedar Swamp Candidate ANSI, Cochrane District, by Michael J. Oldham.

Figure 4. Tundra habitat and shoreline cobble beach ridge on the Hudson Bay coast at Burntpoint Creek Camp, Polar Bear Provincial Park, Kenora District. Terrestrial molluscs were collected from under logs, rocks, and driftwood on the upper beach. *Pupilla hudsonianum, Vertigo* cf. *genesii,* and *Vertigo modesta* were collected here. Photo taken on 28 July 2013 by Michael J. Oldham.

Figure 7. Limestone bedrock outcrop on the Severn River, ca. 47 km south-southwest of Fort Severn, Kenora District. Terrestrial molluscs were collected from river drift at the high water line and from beneath logs on the upper floodplain. *Carychium exiguum*, *Cochlicopa lubrica, Columella columella, Discus shimekii, Discus whitneyi, Euconulus fulvus, Euconulus fulvus* aggregate, *Gastrocopta tappaniana, Nesovitrea electrina, Punctum minutissimum, Pupilla hudsonianum, Vallonia gracilicosta, Vertigo arthuri, Vertigo cristata, Vertigo elatior, Vertigo hannai, Vertigo modesta, Vitrina angelicae,* and *Zonitoides arboreus* were collected here. Photo taken on 8 July 2014 by Michael J. Oldham.

Its southern boundary with the Ontario Shield Ecozone is defined by the northern limit of the Precambrian Canadian Shield (Crins et al. 2009). The ecozone is very flat, with underlying bedrock of Ordovician to Cretaceous limestone (Crins et al. 2009). It is poorly drained with wetlands dominant; these wetlands, dominated by open and treed bogs and fens, are the third largest in the world (Abraham and Keddy 2005). Inland the Hudson Bay Lowlands are forested, with Black Spruce (*Picea mariana*) and Tamarack (*Larix laricina*) dominant (Riley 2003), but along the coast, forests give way to marshes and, in the northernmost portion of the ecozone, tundra heath (Crins et al. 2009). Dune and beach ridges habitats are present along the coast. The climate of the Hudson Bay Lowlands is cold, semi-arid, and with short, cool summers (Crins et al. 2009).

Two additional sites outside of the Far North study area are included in this paper because they add new information from areas where not much is known (Figure 1; Table 1). One is located in Cochrane District, near Hearst (within the Ontario Shield Ecozone). The other is on a small island in Hudson Bay (East Pen Island), connected to the mainland at low tide, but actually part of the territory of Nunavut, as are all islands within southern Hudson and James bays.

Specimen collection

Specimens reported on here were collected in the Kenora and Cochrane districts, northern Ontario, Canada, in 2009 and 2010 and 2012 to 2014.

Specimens were collected opportunistically and incidentally to other fieldwork being conducted. Many specimens collected were hand-picked from beneath debris, particularly under logs on beach ridges near the James and Hudson Bay coasts and logs on the upper margins of the floodplains of major rivers. Other specimens were extracted from samples of drift collected at the edges of rivers, streams, and ponds. Live specimens were preserved in ethyl alcohol (EtOH) and empty shells were placed in plastic vials. Most specimens were collected by Michael J. Oldham (MJO), sometimes with assistance from other Ontario Ministry of Natural Resources and Forestry staff.

Specimens collected in provincial parks and protected areas were authorized by Ontario Parks collecting permits issued to MJO.

All material is deposited in the Invertebrate Collection of the Royal Ontario Museum (ROMIZ). Catalogue numbers are given in "Material examined" under each species in "Results".

Data collection

Latitudes and longitudes were recorded using a hand-held Garmin GPS receiver (GPSmap 76CS model). The datum used is NAD83.

Species identifications were made by RGF using several publications (e.g., Pilsbry 1946, 1948; Gerber 1996; Nekola and Barthel 2002; Nekola and Coles 2010; Forsyth and Oldham 2014; Nekola et al. 2015) that are listed for each species below. Suprageneric classification follows Bouchet et al. (2005) except that, based on recent findings of Nekola and Coles (2016), Gastrocoptidae (for *Gastrocopta*) is treated as a separate family rather than a subfamily of Vertiginidae, as previously done by some authors (e.g., Schileyko 1998) and *Columella* is placed as

belonging to Chondrinidae. Common names are from Turgeon et al. (1998), in most instances. When a species was not included in that work, names used are those proposed for General Status of Wild Species in Canada (Forsyth, unpublished data).

Although there have been some name changes and revised species taxonomy since Oughton's study (1948), generally his determinations have held up over time. Most differences are the results of name changes and splitting of species rather than wrong identifications. With regard to the genus *Vertigo*, we were able to cross-reference Oughton's data with the work of Nekola and Coles (2010), who verified the identities of most of Oughton's vertiginid material.

Where possible, comparisons are made with the distribution maps and data in Oughton (1948) and other publications. The collections that Oughton (1948) studied are now housed in the University of Michigan, Museum of Zoology and in the Royal Ontario Museum but are neither georeferenced nor are the collection data in electronic form. Oughton did not list or map all records, especially for common, wide-ranging species but noted:

"In the case of rare or sporadic species, I have mapped all reliable information available, but for common wide-ranging species, I have marked only those critical records that determined the known range, though I have noted all distributional data north of Manitoulin Island – Lake Nipissing" (Oughton 1948: 1).

This means that apparently all records that Oughton had from the Far North were mapped by him and included in a supplementary table (Oughton 1948: Table 1). However, we found some discrepancies between Oughton's text and what appears in the species' maps and his Table 1. Oughton's Table 1 provides records of species known to him from 10 localities in the Far North; seven of these localities are in the Cochrane District, and the remainder in the Kenora District. An additional locality, the mouth of the Harricanaw River, not in his Table 1 but otherwise included, is also included here. We took these data (Figure 6), applied geographic coordinates derived from a gazetteer of place names (CGNDB 2015; Table 2), and for each species mapped them alongside our new records.

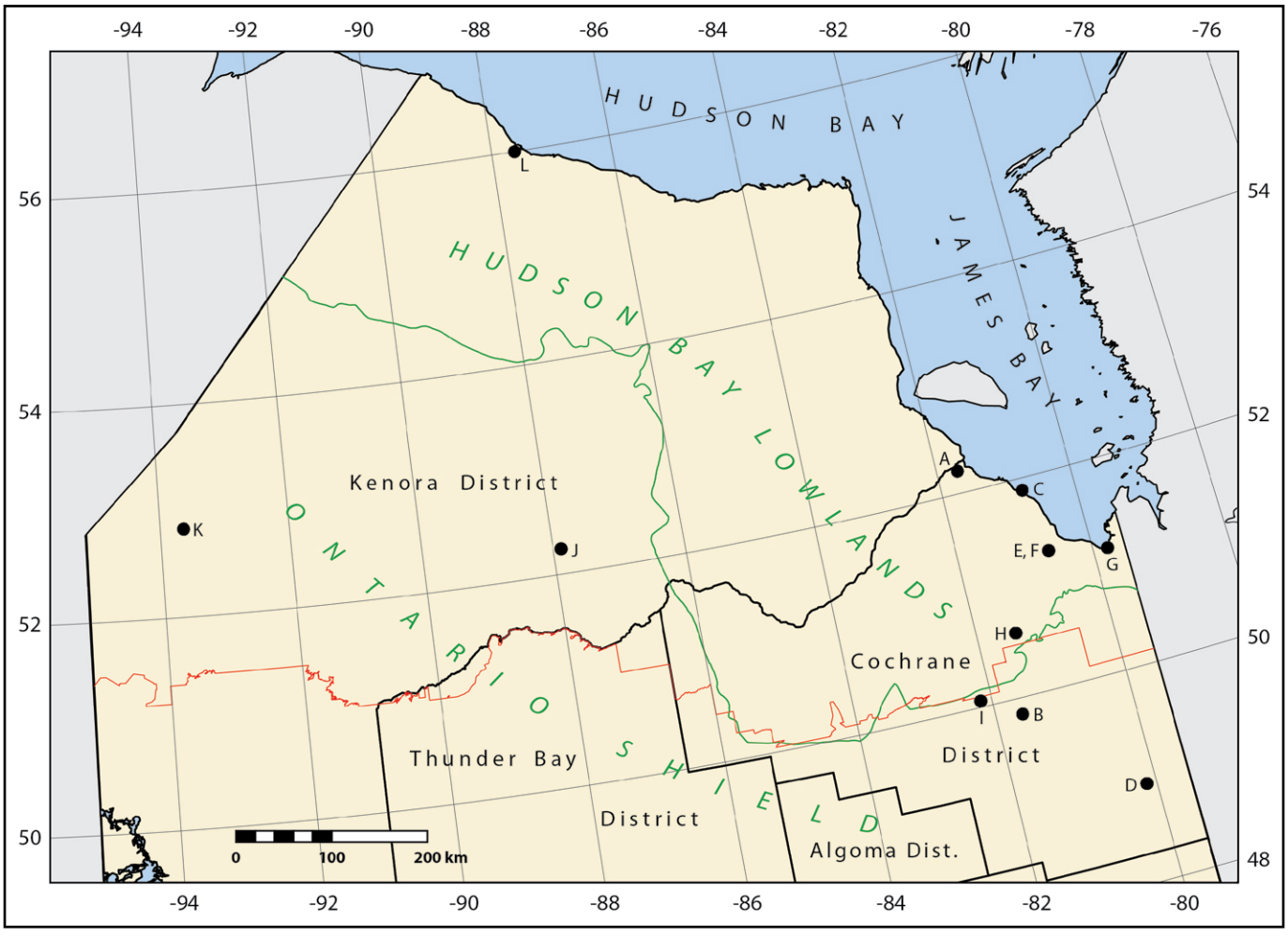

Figure 6. Northern Ontario, showing southern boundary the Far North study area (red line), the boundary between the Ontario Shield and Hudson Bay Lowlands ecozones (Crins et al. 2009; green line), boundaries of the Kenora, Cochrane, Thunder Bay, and Algoma districts (black lines), and all data points from Oughton (1948), with labels corresponding to Table 2.

Table 2. Localities recorded by Oughton (1948) from the Far North and some outlying areas within Cochrane and Kenora districts, with approximate geographic coordinates derived from a gazetteer of place names (CGNDB 2015).

Label on Figure 2	District and locality	Latitude (° N)	Longitude (° W)
	Cochrane District		
A	Fort Albany	52.21	081.68
B	Fraserdale *	49.85	081.62
C	Halfway Point	51.88	080.80
D	Low Bush *	48.92	080.14
E	Moose Factory	51.26	081.00
F	Moosonee	51.27	080.64
G	Mouth of Harricanaw River	51.15	079.78
H	Onakawana	50.60	081.43
I	Smoky Falls *	50.06	082.17
	Kenora District		
J	Attawapiskat Lake	52.24	087.88
K	Borthwick Lake	52.83	093.64
L	Fort Severn	55.00	087.61

* Outside of the Far North study area.

Abbreviations

The following abbreviations are used in the text:

ANSI Area of Natural and Scientific Interest
ca. *circa* (approximately)
cf. *confer* (compare with; used here to indicate a tentative identification)
IBA Important Bird Area
ROMIZ Royal Ontario Museum, Invertebrate Zoology

RESULTS

A total of 34 species belonging to 16 families (as applied here) were recorded from the Far North.

Phylum Mollusca
Class Gastropoda
Informal Group Pulmonata
Informal Group Eupulmonata
Superfamily Ellobioidea
Family Ellobiidae
Genus *Carychium* Müller, 1774

Carychium exiguum (Say, 1822); Obese Thorn; S4
Figures 7 and 8

Pupa exigua Say (1822): 375.
Carychium exiguum — Oughton (1948): 78. Pilsbry (1948): 1052. Nekola and Barthel (2002): 515.

Identification — This species differs from *Carychium exile* in that the last whorl bulges beyond the plane of the aperture, "... giving a 'bellied' appearance when viewed from the side" (Clapp *in* Winslow 1922: 3); sculpture is usually not as strongly developed. Some *Carychium* shells are difficult to distinguish to species.

Material examined — Cochrane District: **Site 9**: ROMIZ M11572, 1 specimen, dry shell (in drift). **Site 11**: ROMIZ M11591, 6 specimens, dry shells. **Site 12**: ROMIZ M11608, 1 specimen, dry shell. *Kenora District:* **Site 39**: ROMIZ M11686, 22 specimens, dry shells.

Range in Ontario — Oughton (1948) described the range of *Carychium exiguum* as the southern half of Ontario. His most northern record is at Moosonee (Oughton 1948: Table 1 and map on p. 78) and westernmost record is at Heron Bay (Thunder Bay District, ca. 48.66° N, 086.28° W). The new Cochrane District records are perhaps just outside of Oughton's inferred range for this species (indicated by horizontal hatching in his maps). However, the record from drift of the Severn River, the first from Kenora District, is ca. 690 km northwest of Moosonee, the closest of Oughton's records.

Figure 7. *Carychium exiguum* (worn shell from drift sample), Site 39, ROMIZ M11686. Scale bar = 1 mm.

Habitat — All specimens were collected from drift samples at the edge of large rivers making it difficult to infer anything about the habitat they were living in.

Carychium exile H. C. Lea, 1842; Ice Thorn; S4
Figures 9 and 10

Carychium exile H. C. Lea (1842): 109 — Pilsbry (1948): 1058. Nekola and Barthel (2002): 515.
Carychium exile canadense G. H. Clapp (1906): 139 — Richards (1936): 59. Whelan and Oughton (1939): 100. Oughton (1948): 78. Pilsbry (1948): 1059.

Identification — *Carychium exile* is more slender than *C. exiguum*, with the last whorl not bulging beyond the plane of the aperture, and with sculpture usually stronger.

Carychium exile canadense is said to be larger than the

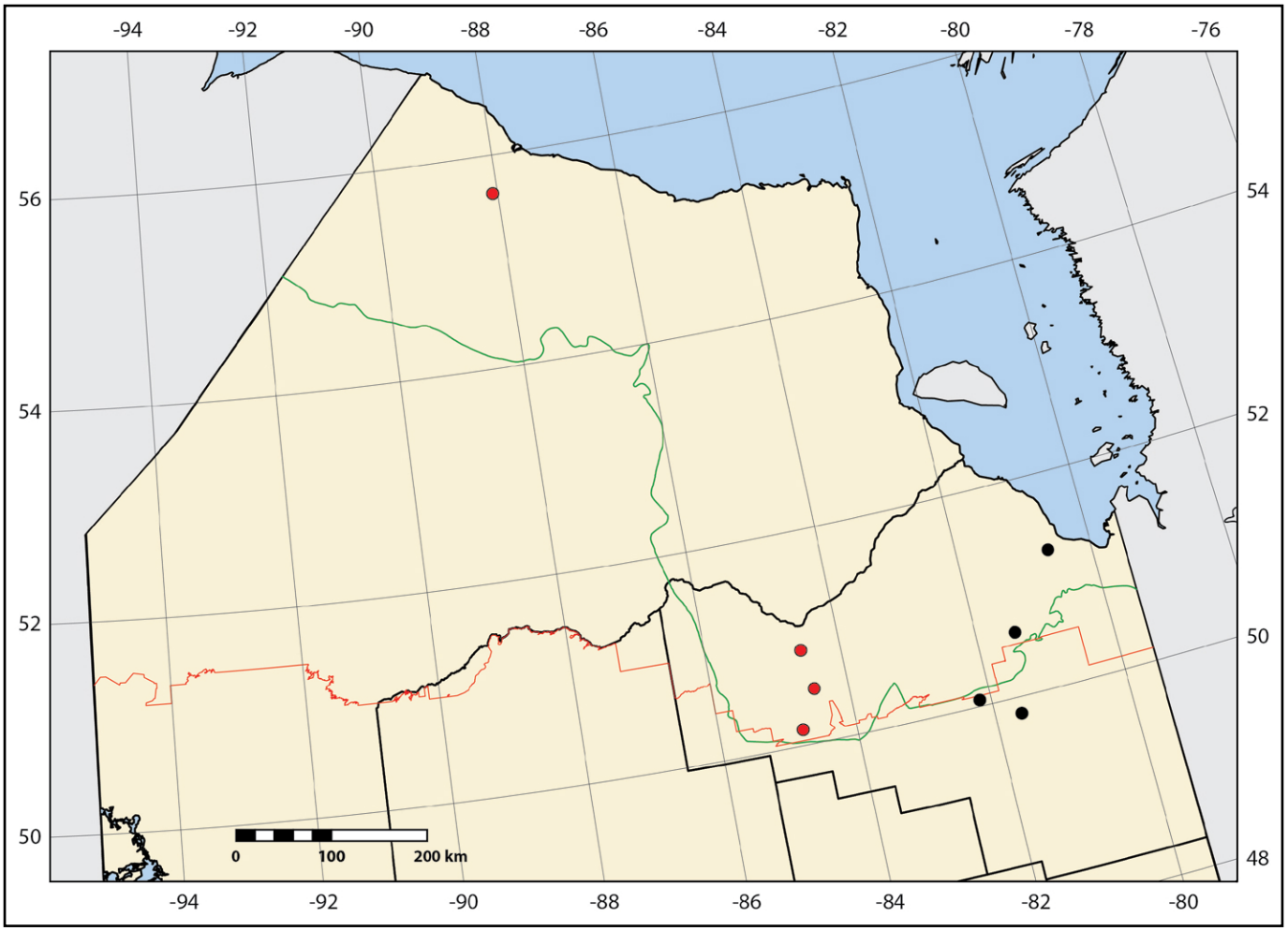

Figure 8. Records of *Carychium exiguum* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

Figure 9. *Carychium exile* (worn shell from drift sample), Site 12, ROMIZ M11609. Scale bar = 1 mm.

typical form. In the material seen by Oughton (1948), nearly all lots he studied belonged to the *canadense* form. However, based on morphometric analyses of shells, *C. exile canadense* was synonymized with *C. exile* by Nekola and Barthel (2002).

Material examined — Cochrane District: **Site 9**: ROMIZ M11573, 8 specimens, dry shells (in drift). **Site 11**: ROMIZ M11592, 30 specimens, dry shells. **Site 12**: ROMIZ M11609, 13 specimens, dry shells.

Range in Ontario — According to Oughton (1948) this species occurs north to the south end of James Bay; his northernmost record is at Moosonee and westernmost record is at Schreiber (Thunder Bay District, ca. 48.55° N, 087.27° W). The new Cochrane District records are probably not outside of Oughton's inferred range for this species but fill a gap in the known range. Hawkins et al. (1997, 1998) found this species 60 km southwest of Thunder Bay (48.13° N, 089.78° W) and we have a collection from the city of Thunder Bay (48.3119° N, 089.3786° W; RGF unpublished data).

Habitat — All specimens were collected from drift samples at the edge of large rivers making it difficult to infer anything about the habitat they were living in.

Clade Stylommatophora
Subclade Elasmognatha
Superfamily Succineoidea
Family Succineidae

The family Succineidae is a taxonomically difficult group represented by five genera in Canada (Grimm et al. 2010); we choose to follow Schileyko (2007) and

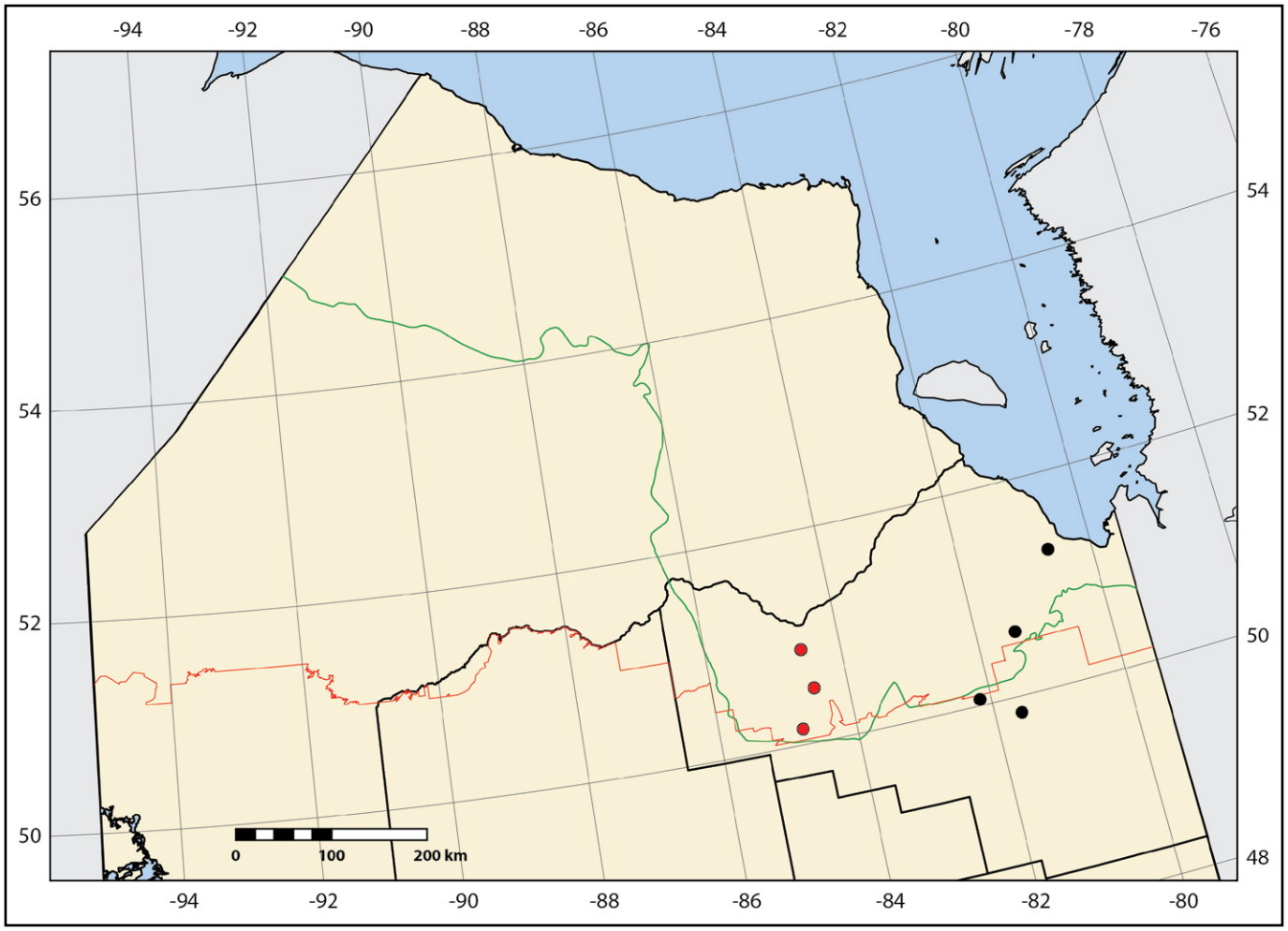

Figure 10. Records of *Carychium exile* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

recognize *Mediappendix* as a full genus, not a subgenus of *Catinella* Pease, 1870 (e.g., Pilsbry 1948 and most subsequent authors).

Succineid genera are best distinguished by characters of the reproductive system, but species are poorly known and perhaps over-named, and identification is difficult, perhaps currently impossible. We have been able to separate our Far North material into three groups, based on shell shape. In some cases, we have been able to verify the genus by anatomical study. We do not feel confident that species are well enough known to definitively apply species' names to our material.

Genus *Mediappendix* Pilsbry, 1948

Mediappendix cf. ***vermeta*** (Say, 1829); Subovate Ambersnail; SU
Figures 11 and 12
[?] *Succinea avara* Say (1821): 260.
Succinea avara — Richards (1936): 58. Whelan and Oughton (1939): 100. Oughton (1948): 74. Pilsbry (1948): 837.
Succinea vermeta Say (1829): 230.
Catinella vermeta — Turgeon et al. (1998): 145, 294.

Identification — We include here all small succineids (apparently adult) having subovate apertures, and

Figure 11. *Mediappendix* cf. *vermeta*, Site 7, ROMIZ M11564. Scale bar = 1 mm.

strongly convex spire whorls. We dissected one specimen (ROMIZ M11564) and found it to have the large, rounded appendix on the penis, characteristic of the genus.

Mediappendix differs morphologically from *Catinella* and *Quickella* C. Boettger, 1939 (most prominently by the medial appendix on the penis, by which it gets its

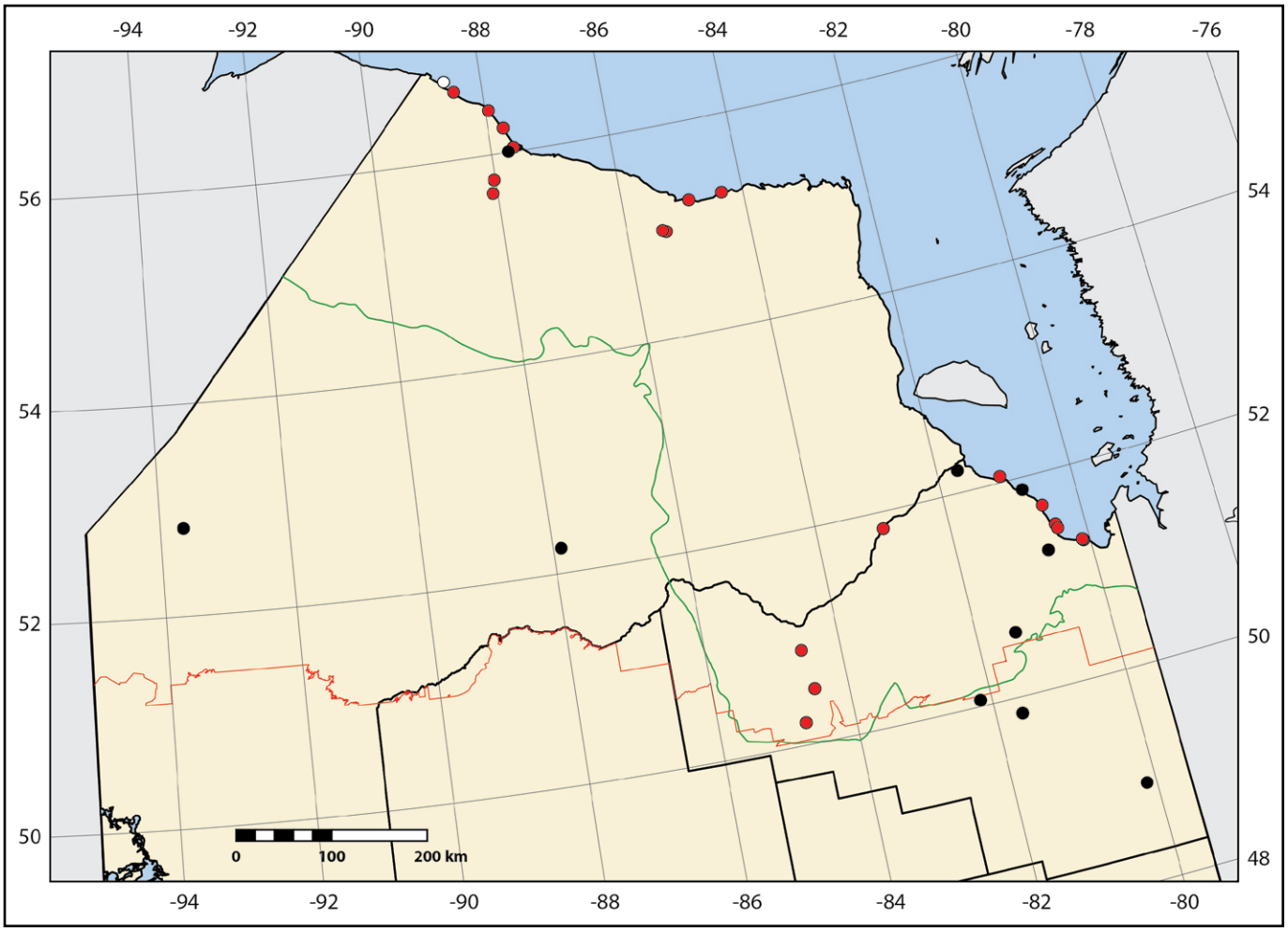

Figure 12. Records of *Mediappendix* cf. *vermeta* in Kenora and Cochrane districts, Ontario, and Nunavut. Black circles: data from Oughton (1948); red circles: new records; white circle: new record outside of the Far North.

name). These three taxa are also geographically separate, with *Mediappendix* in North America, *Catinella* on Pacific Islands, and *Quickella* in Western Europe. It is incongruent to subsume North American *Mediappendix* within *Catinella* when *Quickella* is well recognized as separate. Until the 1980s, this species was known as *Succinea* (or *Catinella*) *avara*, a name based on an immature specimen from a non-specific locality, and thus, was treated as a *species dubium* by Hoagland and Davis (1987). Since Turgeon et al. (1998), *vermeta* has replaced *avara*. We provisionally apply the species name *vermeta* to our material, as the putative widespread *Mediappendix* species in eastern North America (Turgeon et al. 1998) and Ontario (Oughton 1948). Oughton noted that there is a great amount of variation in shells of Ontario material.

Material examined — Cochrane District: **Site 1**: ROMIZ M11527, 6 specimens, 70% EtOH. **Site 4**: ROMIZ M11544, 5 specimens, 70% EtOH. **Site 6**: ROMIZ M11559, 3 specimens, 70% EtOH. **Site 7**: ROMIZ M11564, 57 specimens, dry shells, and 39 specimens, 70% EtOH. **Site 9**: ROMIZ M11574, 9 specimens, dry shells (in drift). **Site 10**: ROMIZ M11588, 2 specimens, 70% EtOH. **Site 11**: ROMIZ M11593, 6 specimens, 70% EtOH. **Site 16**: ROMIZ M11717, 2 specimens, 70% EtOH. **Site 19**: ROMIZ M11718, 3 specimens, 70% EtOH. *Kenora District:* **Site 23**: ROMIZ M11635, 1 specimen, dry shell. **Site 26**: ROMIZ M11648, 4 specimens, 70% EtOH. **Site 28**: ROMIZ M11716, 3 specimens, 70% EtOH. **Site 30**: ROMIZ M11656, 10 specimens, 70% EtOH. **Site 32**: ROMIZ M11661, 2 specimens, 70% EtOH. **Site 37**: ROMIZ M11670, 3 specimens, dry shells. **Site 38**: ROMIZ M11684, 4 specimens, 70% EtOH. **Site 39**: ROMIZ M11704, 23 specimens, dry shells. **Site 40**: ROMIZ M11705, 1 specimen, 70% EtOH. **Site 41**: ROMIZ M11708, 13 specimens, dry shells. **Site 42**: ROMIZ M11710, 11 specimens, 70% EtOH. *Additional material (outside Far North):* **Site β**: ROMIZ M11715, 1 specimen, 70% EtOH.

Range in Ontario — Oughton (1948) considered this species throughout all of Ontario, but remarked that it was possibly absent from Temagami Forest and Algonquin Park. Our Far North records fill gaps in the geographic distribution of this species.

Habitat — This species was found in a variety of habitats (mostly open), most often along the margins of water bodies. At some sites near the coast, it was collected from tundra or under driftwood on beach ridges.

Genus *Novisuccinea* Pilsbry, 1948

Novisuccinea cf. ***ovalis*** (Say, 1817); Oval Ambersnail; S5 Figures 13 and 14

Succinea ovalis Say (1817b): 15 — W.G. Binney (1861): 330. Richards

(1936): 58. Whelan and Oughton (1939): 100. Oughton (1948): 75.
Novisuccinea ovalis — Hoagland and Davis (1987): 491.
Succinea obliqua Say (1824): 260, pl. 15, figure 7. — W. G. Binney (1861): 330. Dall (1905): 58. Richards (1936): 58.

Identification — We included here succineids that are relatively large, with short spires, and capacious apertures. We dissected one specimen (ROMIZ M11534) and found it to have the chief diagnostic character of the genus *Novisuccinea*: that is, the oviduct wraps around the much more slender duct of the bursa copulatrix. This was a character largely overlooked by Pilsbry (1948) but recognized as important by Hoagland and Davis (1987) who treated *Novisuccinea* as a genus apart from *Succinea*. Incidentally, Russian workers were the first to recognize *Novisuccinea* as a genus but failed to recognize the significance of this character and included what seem to be noncongeneric species in *Novisuccinea* (see, for example, Schileyko and Likharev 1986).

Figure 13. *Novisuccinea* cf. *ovalis,* Site 2, ROMIZ M11534. Scale bar = 1 mm.

We tentatively apply the species name *Novisuccinea ovalis* to our material, as this is the common, widespread *Novisuccinea* in eastern North America (Pilsbry 1948) and Ontario (Oughton 1948).

Material examined — Cochrane District: **Site 2**: ROMIZ M11534, 7 specimens, 70% EtOH. **Site 13**: ROMIZ M11713, 1 specimen, 70% EtOH.

Range in Ontario — According to Oughton (1948), this species is common throughout southern Ontario, distributed north to the southern James Bay coast, but also in the Rainy River District of western Ontario. Within the Far North area, Oughton (1948) described it as being common in the Moose River drainage.

Habitat — Our Far North collection was made from under logs in forest and under cardboard at the forest

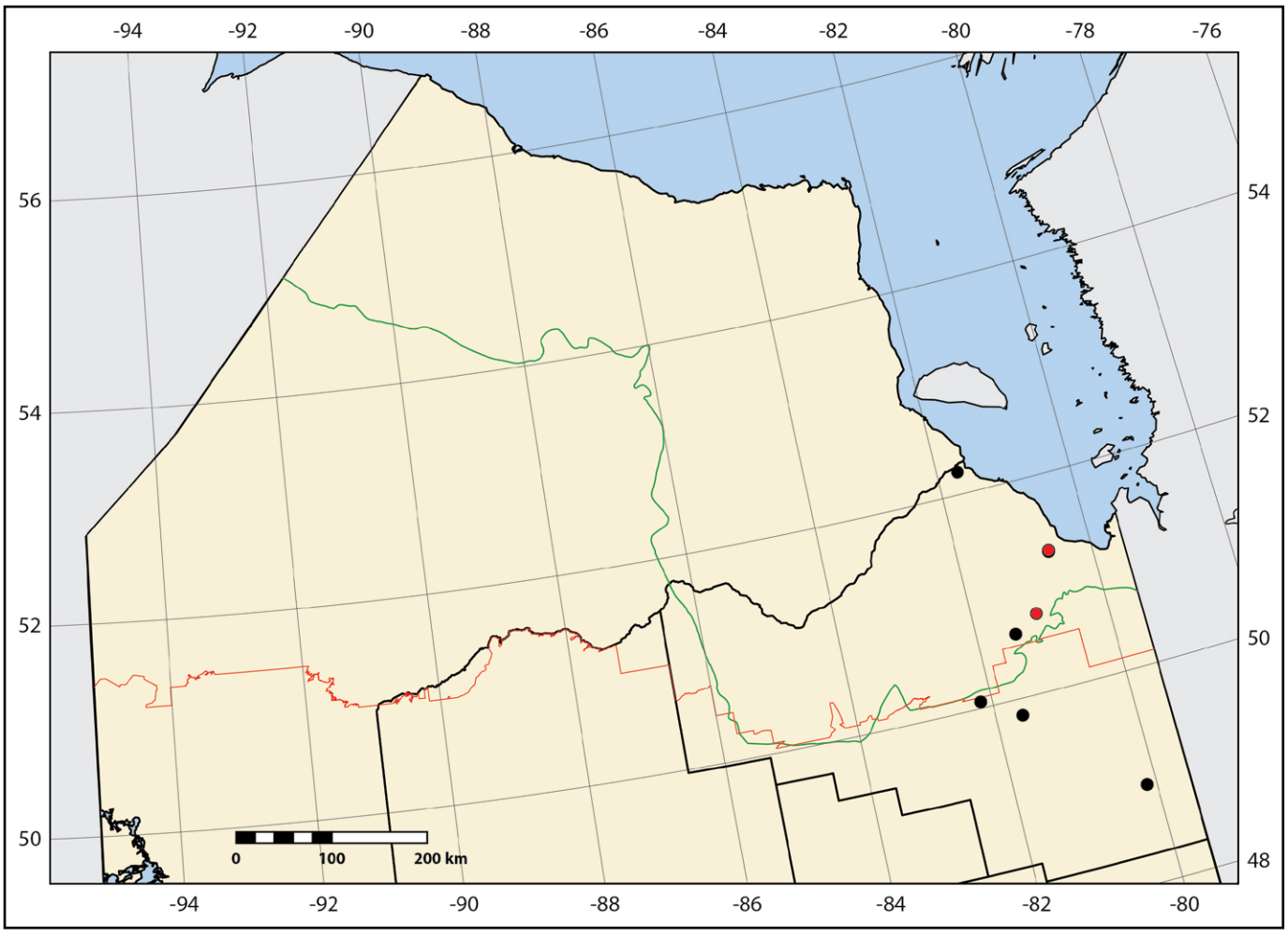

Figure 14. Records of *Novisuccinea* cf. *ovalis* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

edge. *Novisuccinea ovalis* is characteristic of wooded habitats elsewhere in Ontario and throughout its range (Hubricht 1985; RGF pers. obs.)

Genus *Oxyloma* Westerlund, 1885

Oxyloma cf. ***retusum*** (I. Lea, 1834); Blunt Ambersnail; SU

Figures 15 and 16

Succinea retusa I. Lea (1834): 117, pl. 19, f. 86. — Dall (1905): 56. Whiteaves (1905): 4. Richards (1936): 58.
[?] *Succinea haydeni* — Goodrich (1933): 9.

Identification — We include here all succineid species not having the appearance of either of the two previous species. The aperture is elongate, narrowing towards the apex and in side view, the shell is somewhat flattened. We very provisionally use the name *Oxyloma* cf. *retusum* for these specimens only because that is the species previously identified from the Far North (Oughton 1948).

Material examined — *Cochrane District:* **Site 3**: ROMIZ M11540, 4 specimens, 70% EtOH. **Site 5**: ROMIZ M11553, 32 specimens, 70% EtOH. **Site 6**: ROMIZ M11560, 1 specimen, dry shell. **Site 8**: ROMIZ M11568, 7 specimens, 70% EtOH. **Site 12**: ROMIZ M11610, 1 specimen, 70% EtOH, and 1 specimen, dry shell. **Site 14**: ROMIZ M11624, 5 specimens, 70% EtOH. *Kenora District:* **Site 20**: ROMIZ M11625, 1 specimen, dry shell. **Site 21**: ROMIZ M11628, 1 specimen, 70% EtOH. **Site 27**: ROMIZ M11614, 1 specimen, 70% EtOH. **Site 29**: ROMIZ M10968, 14 specimens, 70% EtOH. **Site 36**: ROMIZ M11669, 1 specimen, 70% EtOH. **Site 37**: ROMIZ M11671, 2 specimens, dry shells. **Site 40**: ROMIZ M11706, 1 specimen, 70% EtOH.

Figure 15. *Oxyloma* cf. *retusum,* Site 36, ROMIZ M11669. Scale bar = 1 mm.

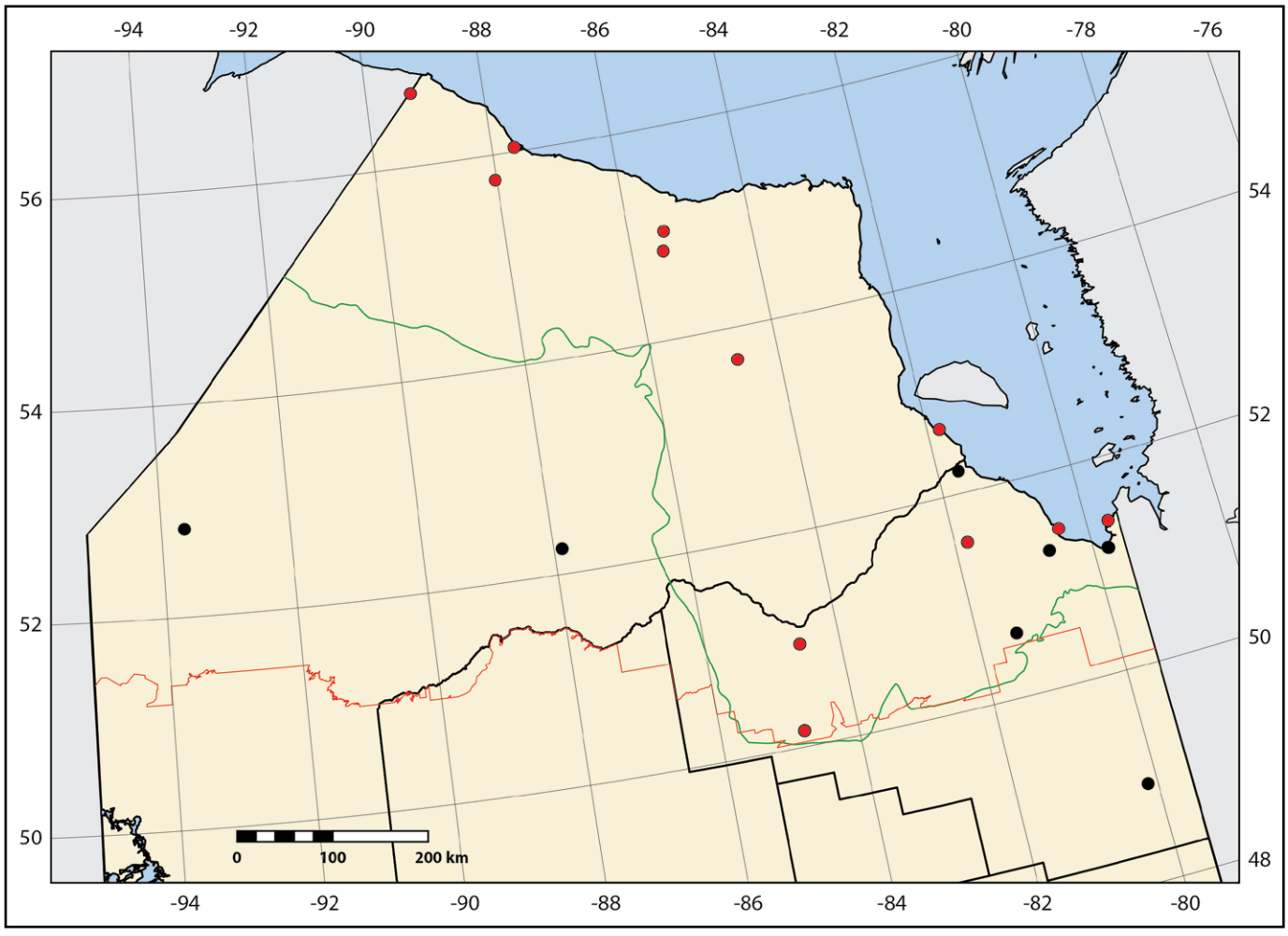

Figure 16. Records of *Novisuccinea* cf. *ovalis* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

Range in Ontario — Oughton (1948) gave the distribution of this species north to James Bay and Borthwick Lake.

Habitat — Specimens were collected from under logs or driftwood on coastal beach ridges as well as gravel floodplains of rivers, on vegetation in river floodplains, hummocky fen, willow thickets, and under cardboard in dry spruce woods. Other specimens were collected in drift of the Pagwachuan and Severn rivers.

Subclade Orthurethra
Superfamily Cochlicopoidea
Family Cochlicopidae
Genus *Cochlicopa* Risso, 1826

Cochlicopa lubrica (Müller, 1774); Glossy Pillar; S5
Figures 17 and 18
Helix lubrica Müller 1774: 104.
Achatina lubrica — W.G. Binney (1861): 330.
Cochlicopa lubrica — Dall (1905): 33. Whiteaves (1905): 4. Goodrich (1933): 8. Richards (1936): 58. Whelan and Oughton (1939): 100. Oughton (1948): 73.
Cionella lubrica — Pilsbry (1948): 1047.

Identification — *Cochlicopa* species are recognized by their elongate-fusiform, very smooth, shiny, and translucent dark-amber or reddish-brown shells. Our Far North specimens appear to be the common, widespread species, *C. lubrica*.

Material examined — *Cochrane District:* **Site 1**: ROMIZ M11528, 4 specimens, 70% EtOH. **Site 2**: ROMIZ M11535, 1 specimen, dry shell. **Site 4**: ROMIZ M11545, 2 specimens, 70% EtOH. **Site 6**: ROMIZ M11561, 7 specimens, 70% EtOH. **Site 8**: ROMIZ M11569, 1 specimen, dry shell. **Site 9**: ROMIZ M11575, 2 specimens, dry shells (under logs) and 9 specimens, dry shells (in drift). **Site 11**: ROMIZ

Figure 17. *Cochlicopa lubrica*, Site 23, ROMIZ M11636. Scale bar = 1 mm.

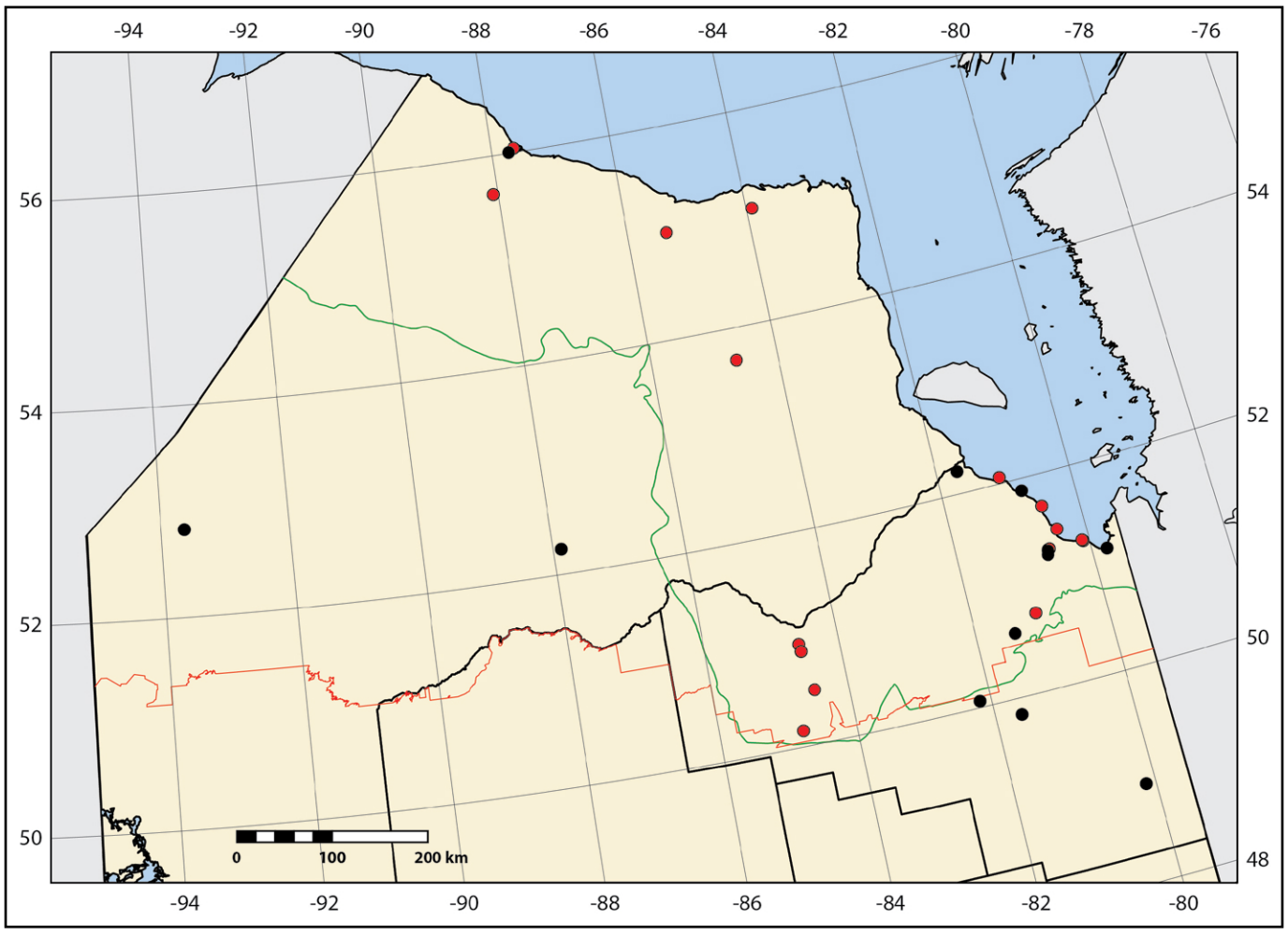

Figure 18. Records of *Cochlicopa lubrica* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

M11594, 19 specimens, dry shells. **Site 12**: ROMIZ M11611, 64 specimens, dry shells. **Site 13**: ROMIZ M10954, 2 specimens, 70% EtOH. **Site 15**: ROMIZ M10957, 18 specimens, 70% EtOH. **Site 19**: ROMIZ M10987, 6 specimens, 70% EtOH. **Site 16**: ROMIZ M10981, 2 specimens, 70% EtOH. *Kenora District:* **Site 21**: ROMIZ M11629, 1 specimen, 70% EtOH. **Site 23**: ROMIZ M11636, 3 specimens, dry shells. **Site 24**: ROMIZ M11642, 1 specimen, dry shell. **Site 37**: ROMIZ M11672, 11 specimens, dry shells. **Site 39**: ROMIZ M11687, 34 specimens, dry shells.

Range in Ontario — As commented by Oughton (1948), *Cochlicopa lubrica* is one of the more common species of land snails in Ontario, and he inferred that it occurs throughout the north. In southern Ontario, many populations are strongly associated with humans and could perhaps be introductions, but Far North populations are expected to be native. A similar situation is suspected in British Columbia (Forsyth 2005). The new Far North records fill gaps in the geographic distribution of this species.

Habitat — Most specimens (empty shells) were collected from drift which accumulates at the upper edge of the river's high water line. Other specimens were collected alive from beneath logs on the floodplains of large rivers. These logs are generally in areas of willow thickets at the upper edge of the floodplain.

Superfamily Pupilloidea
Family Pupillidae
Genus *Pupilla* Turton, 1831

Pupilla hudsonianum Nekola & Coles *in* Nekola, Coles & Horsák, 2015; Hudsonian Column; S4
Figures 19 and 20

Pupilla muscorum, in part, non *Pupilla muscorum* (Linnaeus, 1758) — Goodrich (1933): 8. Oughton (1948): 54. Pilsbry (1948): 933. Nekola and Coles (2010): 41.
Pupilla hudsonianum Nekola and Coles *in* Nekola et al. (2015): 211.

Identification — For some time, we have known that *Pupilla* from the Far North do not look the same as *P. muscorum* that is common in disturbed habitats in southern Ontario but were more similar to *Pupilla* from western Canada. Recently, *P. hudsonianum* was newly described for the wide-ranging, native boreal taxon (Nekola et al. 2015). Oughton (1948), Nekola and Coles (2010) and others identified northern Ontario *Pupilla* as *P. muscorum,* but that species is now thought to be an introduction from Europe (Nekola et al. 2015). *Pupilla hudsonianum* differs from *P. muscorum* by its more tapered spire, weaker crest, and fine, crowded, sharp, colabral threads, and silky sheen (Nekola et al. 2015).

Material examined — Cochrane District: **Site 4**: ROMIZ M11546, 3 specimens, dry shells. **Site 7**: ROMIZ M11565, 70 specimens, dry shells, and 83 specimens, 70% EtOH. **Site 16**: ROMIZ M10982, 26 specimens, 70% EtOH. **Site 19**: ROMIZ M10991, 2 specimens, 70% EtOH. *Kenora District:* **Site 22**: ROMIZ M11631, 2 specimens, dry shells. **Site 26**: ROMIZ M11649, 4 specimens, dry shells. **Site 29**: ROMIZ M10969, 15 specimens, 70% EtOH. **Site 30**: ROMIZ M11657, 16 specimens, 70% EtOH. **Site 32**: ROMIZ M11662, 21 specimens, 70% EtOH. **Site 37**: ROMIZ M11673, 3 specimens, dry shells. **Site 39**: ROMIZ M11688, 44 specimens, dry shells.

Figure 19. *Pupilla hudsonianum*, Site 4, ROMIZ M11546. Scale bar = 1 mm.

Range in Ontario — According to Oughton (1948), "*Pupilla muscorum*" occurs as two disjunct populations in the southern Great Lakes region and along the coasts of James and Hudson bays. He did not distinguish between true *P. muscorum,* which is introduced from Europe, and the native *P. hudsonianum* (see below), and his records from Fort Severn and Moose Factory doubtlessly are *P. hudsonianum*. Most southern Ontario records of *Pupilla* are probably the true, introduced *P. muscorum*, although specimens from Manitoulin Island (45.8261° N, 082.5532° W) appear to be *P. hudsonianum* (RGF, unpublished data). The new records considerably increase the number of occurrences in Ontario for this species, but the distribution of this species in Ontario and elsewhere will remain uncertain until more specimens are re-examined.

Habitat — Specimens of this species were mainly collected from beneath large logs on coastal beach ridges of James and Hudson Bays. In the Hudson Bay coastal zone, where there are no large trees, these logs have been washed down larger rivers to Hudson Bay and then deposited on shore by storms. Coastal beach ridges are often dominated by clumps of willows and Sea Lymegrass (*Leymus mollis*). Other collections are from hummocky tundra and moist woodland suggesting that this species occurs in a variety of habitats in northern Ontario.

Family Strobilopsidae
Genus *Strobilops* Pilsbry, 1893

Strobilops labyrinthicus (Say, 1817); Maze Pinecone; S4
Figures 21 and 22

Helix labyrinthica Say (1817c): 124 — W. G. Binney (1861): 330.
Strobilops labyrinthica [*sic*] — Dall (1905): 27. Oughton (1948): 66. Pilsbry (1948): 854.
Strobilops labyrinthicus — Forsyth and Oldham (2014): 397.

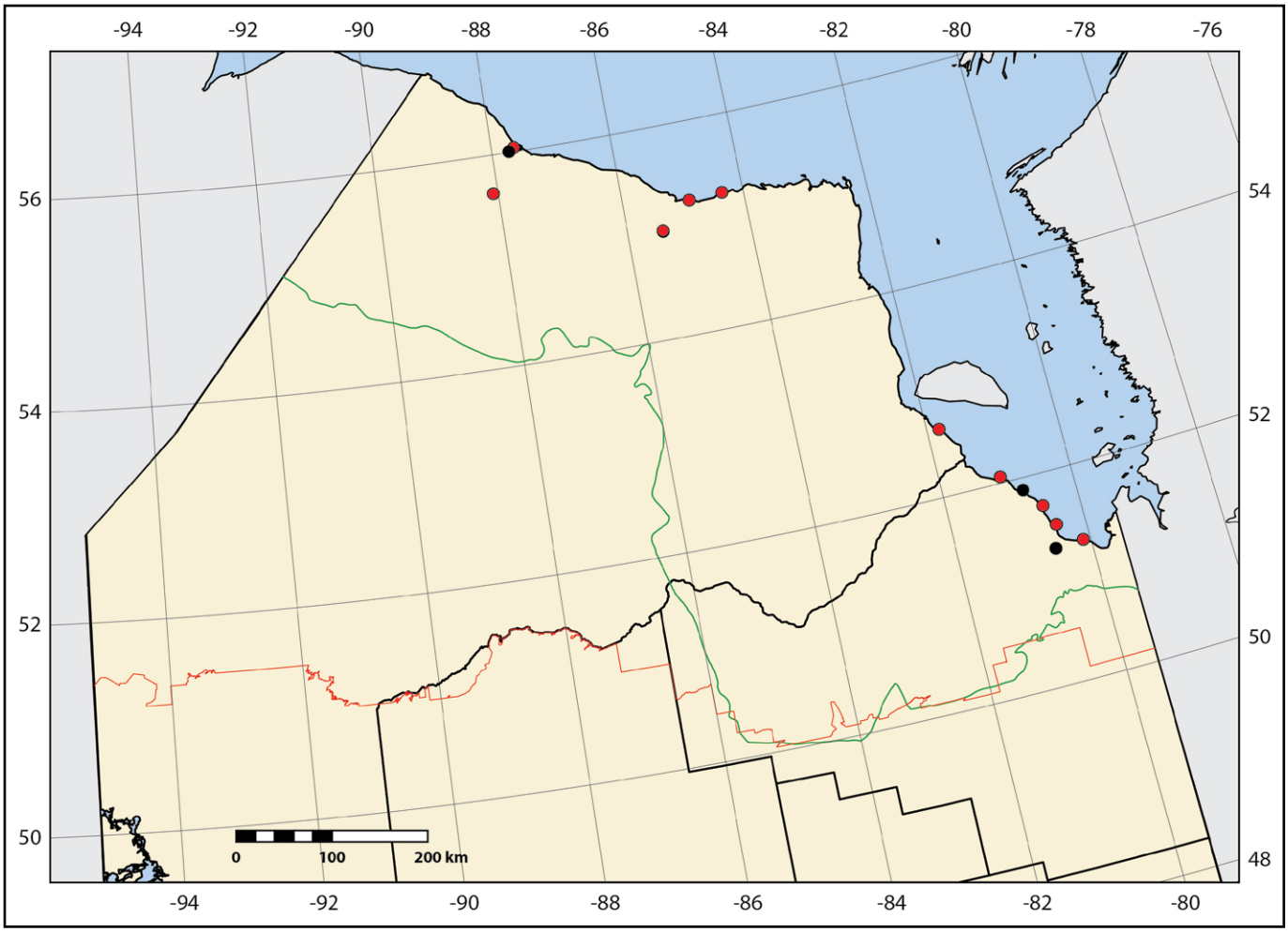

Figure 20. Records of *Pupilla hudsonianum* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948) and Goodrich (1933) (both as *P. muscorum*); red circles: new records.

Identification — Three species of *Strobilops* occur in Ontario (Oughton 1948; Pilsbry 1948; Forsyth and Oldham 2014). The majority of Far North specimens are weathered and no longer translucent, so we could not see the lamellae within the last whorls of these shells (a useful character for species' determination; see especially Forsyth and Oldham 2014), but based on its size and shape, these are *S. labyrinthicus*.

Material examined — Cochrane District: **Site 9**: ROMIZ M11576, 1 specimen, dry shell (in drift). **Site 11**: ROMIZ M11595, 1 specimen, dry shell. **Site 12**: ROMIZ M11612, 2 specimens, dry shells. *Kenora District:* **Site 28**: ROMIZ M10960, 1 specimen, 70% EtOH.

Range in Ontario — Dall (1905) recorded this species from Moose Factory, based on material that he had seen; but W.G. Binney (1861) earlier had reported it from this locality, but along with several others, including larger more southern species, which suggests that the locality was wrong or imprecise. Oughton (1948) did not have records of this species from Cochrane or Kenora districts. His northernmost confirmed records were at Lake Temagami (Nipissing District; ca. 47.00° N, 080.08° W) and Batchawana Bay, Lake Superior (Algoma District; ca. 46.91° N, 084.61° W). However, he also mapped another, unconfirmed record from Heron Bay (Thunder Bay District, ca. 48. 66° N, 086. 28° W). Hawkins et al. (1997, 1998) found this species 60 km southwest of Thunder Bay (48.13° N, 089.78° W), and we have a collection from the city of Thunder Bay (48.3119° N, 089.3786° W; RGF, unpublished data). There are also published records from Rainy River District (Baker 1939). Thus, our recent collections confirm the previous record of this species from the Far North. We expect

Figure 21. *Strobilops labyrinthicus* (worn shell from drift sample), Site 12, ROMIZ M11612. Scale bar = 1 mm.

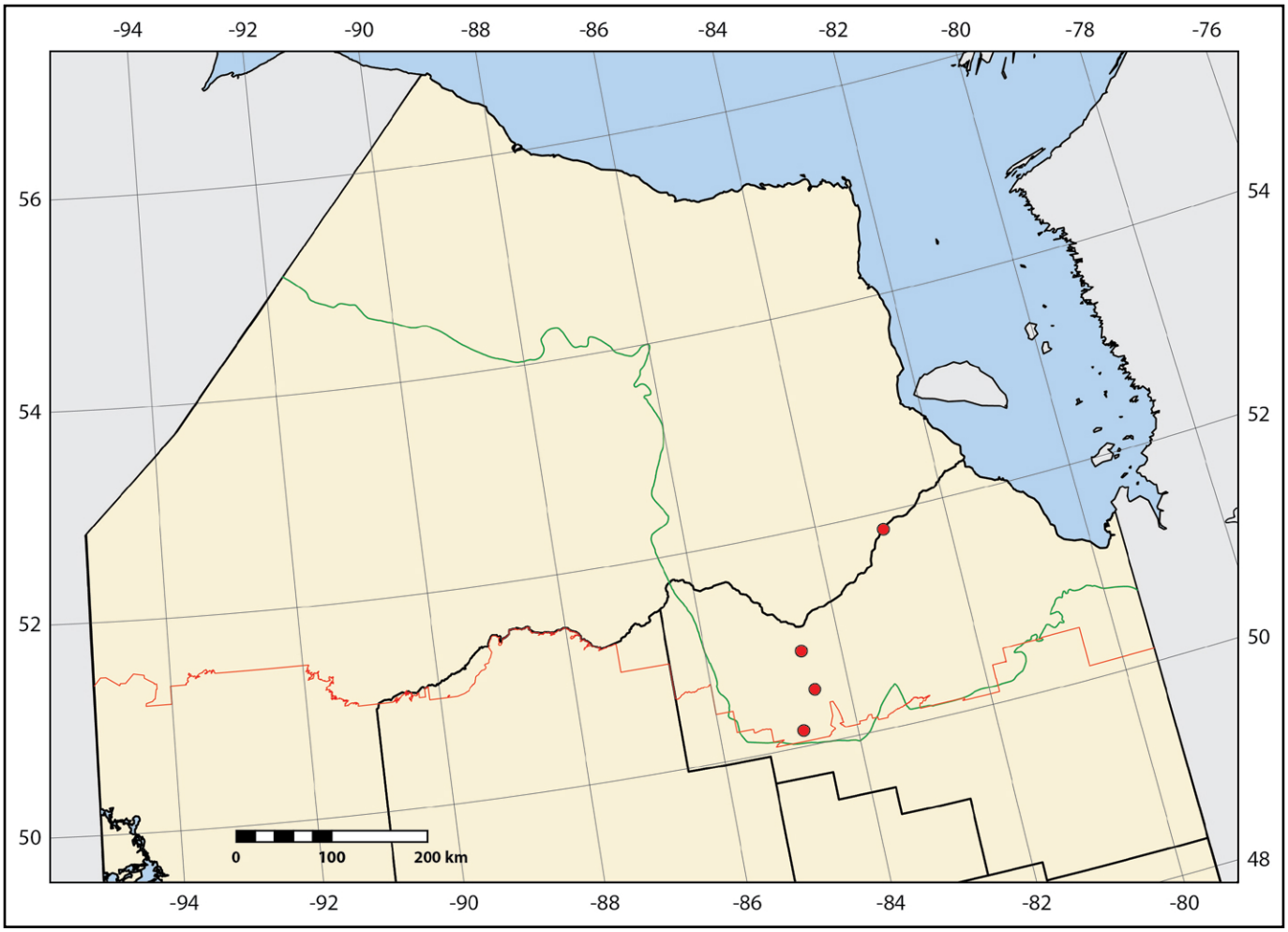

Figure 22. Records of *Strobilops labyrinthicus* in Kenora and Cochrane districts, Ontario. Red circles: new records. Not recorded from northern Ontario by Oughton (1948).

that *Strobilops labyrinthicus* occurs all along the north shore of Lake Superior and north into the Hudson Bay Lowlands.

Habitat — Our Far North collections are mostly empty shells extracted from stream drift along the Kenogami River. The most northerly specimen was collected live from beneath a log in forest along the Albany River. Elsewhere in Ontario, *Strobilops labyrinthicus* occurs in wooded habitats (RGF, pers. obs.)

Family Valloniidae
Genus *Vallonia* Risso, 1826

Vallonia gracilicosta Reinhardt, 1883; Multirib Vallonia; S5
Figures 23 and 24
Vallonia gracilicosta Reinhardt (1883): 42 — Pilsbry (1948): 1028. Gerber (1996): 111.
Vallonia albula Sterki (1893): 263 — Oughton (1948): 68. Pilsbry (1948): 1031.
Vallonia gracilicosta albula — Gerber (1996): 113.

Identification — This is one of the ribbed species of *Vallonia*, and mainly differs from the most common, other ribbed species in Ontario (*V. costata* [Müller, 1774]) by having a greater number of ribs that are therefore more closely spaced. Some especially worn shells from our drift samples had the ribs nearly completely eroded off.

Oughton (1948), Pilsbry (1948), and others made a distinction between *V. albula* and *V. gracilicosta*, although the differences between them were not well stated. In the latest revision of the genus, Gerber (1996) treated *albula* as a subspecies of *V. gracilicosta*. Because his distribution map does not show a pattern of two geographically separate subspecies and because the characters used to distinguish these subspecies seem based on subtle but variable and over-lapping conchological differences, we have not identified our material to subspecies. Hubricht (1985) had earlier included *V. albula* as a synonym of *V. gracilicosta* without comment.

Material examined — Cochrane District: **Site 9**: ROMIZ M11577, 13 specimens, dry shells (in drift). **Site 11**: ROMIZ M11596, 3 specimens, dry shells. **Site 12**: ROMIZ M11613, 28 specimens, dry shells. **Site 19**: ROMIZ M10990, 2 specimens, 70% EtOH. *Kenora District:* **Site 39**: ROMIZ M11689, 51 specimens, dry shells.

Range in Ontario — Oughton (1948, as *V. albula*) thought this species rather scarce and mapped scattered

Figure 23. *Vallonia gracilicosta*, Site 39, ROMIZ M11689. Scale bar = 1 mm.

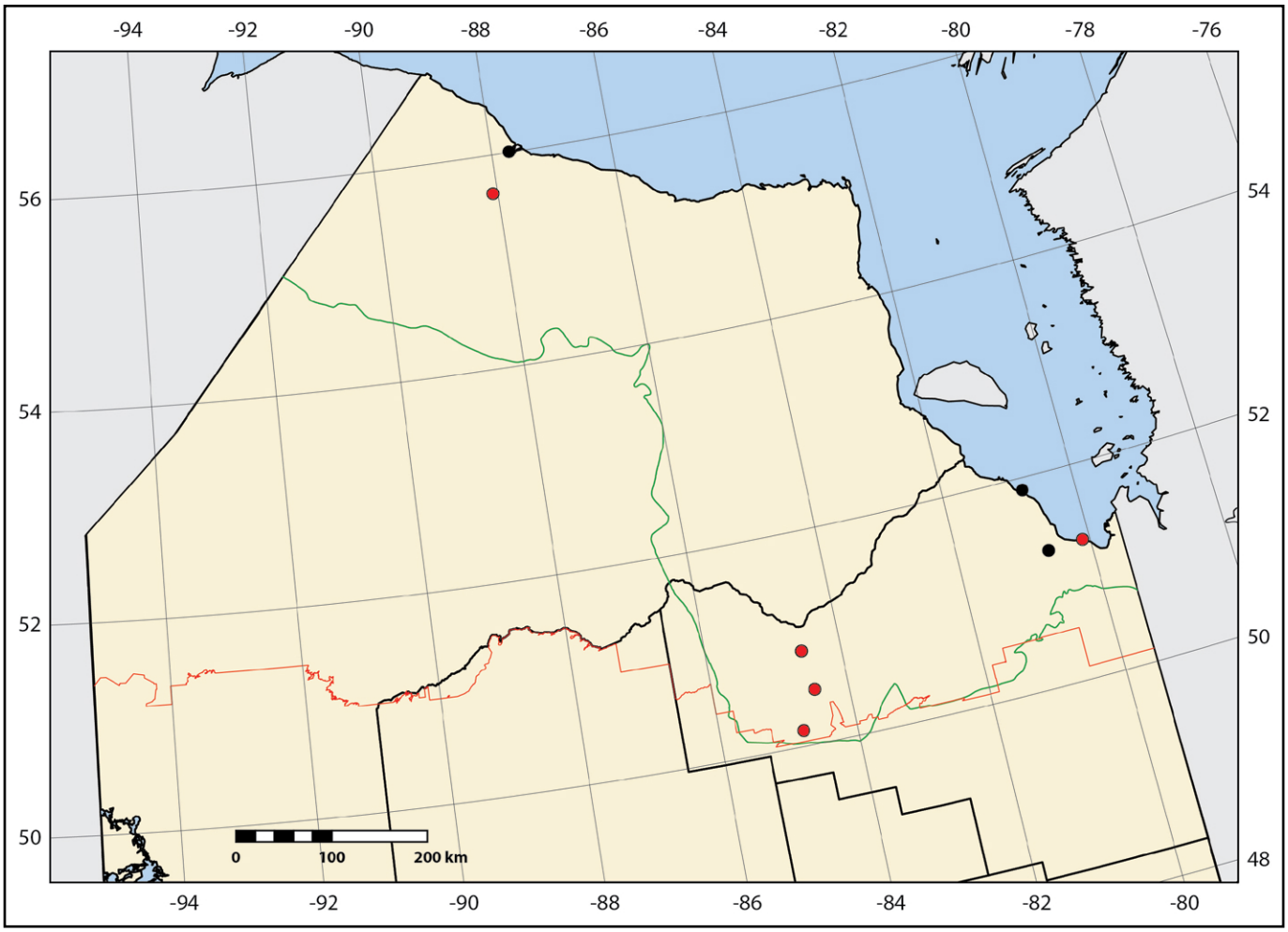

Figure 24. Records of *Vallonia gracilicosta* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948, as *V. albula*); red circles: new records.

occurrences north and west to the south end of James Bay (Halfway Point and Moosonee), Fort Severn, and Heron Bay, Lake Superior (Thunder Bay District, ca. 48.66° N, 086.28° W). The new records fill gaps.

Habitat — Empty shells were collected from river drift along the Kenogami and Severn rivers and live individuals were found under logs on a coastal James Bay beach ridge.

Vallonia pulchella (Müller, 1774); Lovely Vallonia; S4 Figures 25 and 26

Helix pulchella Müller (1774): 30.

Vallonia pulchella — Pilsbry (1948): 1023. Gerber (1996): 48.

Identification — This species lacks the prominent ribs of *Vallonia gracilicosta*. A second, unribbed species, *V. excentrica* Sterki, 1893, also occurs in Ontario, but the differences are slight. In *V. pulchella,* the last whorl

expands outward at a near right angle, whereas in *V. excentrica,* the expansion is more gradual (Pilsbry 1948; Gerber 1996). Among our Far North material, none clearly had the appearance of *V. excentrica*.

Material examined — Cochrane District: **Site 1**: ROMIZ M11529, 11 specimens, 70% EtOH. **Site 19**: ROMIZ M10989, 2 specimens, 70% EtOH.

Range in Ontario — Oughton (1948) did not distinguish between *Vallonia excentrica* and *V. pulchella* and mapped all his records together as the latter. However, the new occurrences are well north of his records from Renfrew, Simcoe, and Bruce counties. From Cochrane District, we have two additional collections (not part of the FNBP) from 12.8 km northwest of Tunis (48.91630° N, 080.97246° W) and Rawcourt Lake (49.07996° N, 081.20107° W) (RGF, unpublished data).

Habitat — This species was collected from beneath logs on beach ridges at two nearby sites on the southern James Bay coast.

Genus *Zoogenetes* Morse, 1864

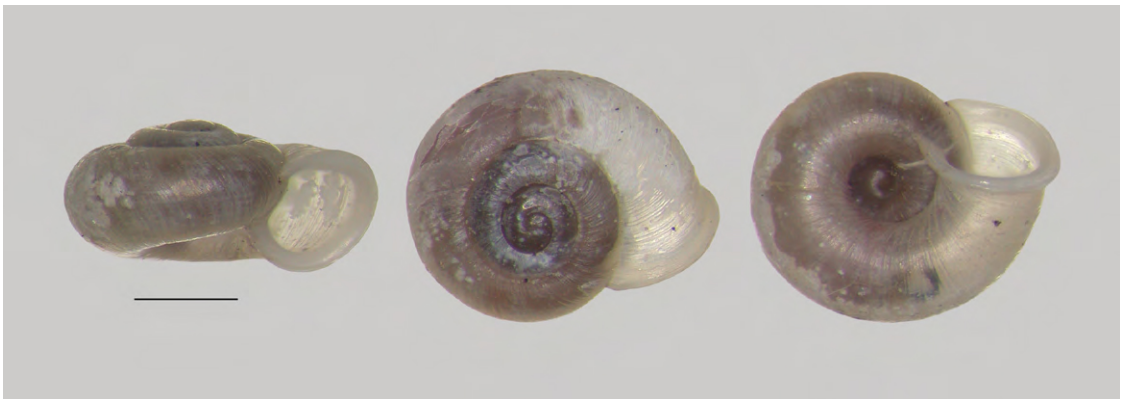

Figure 25. *Vallonia pulchella,* Site 1, ROMIZ M11529. Scale bar = 1 mm.

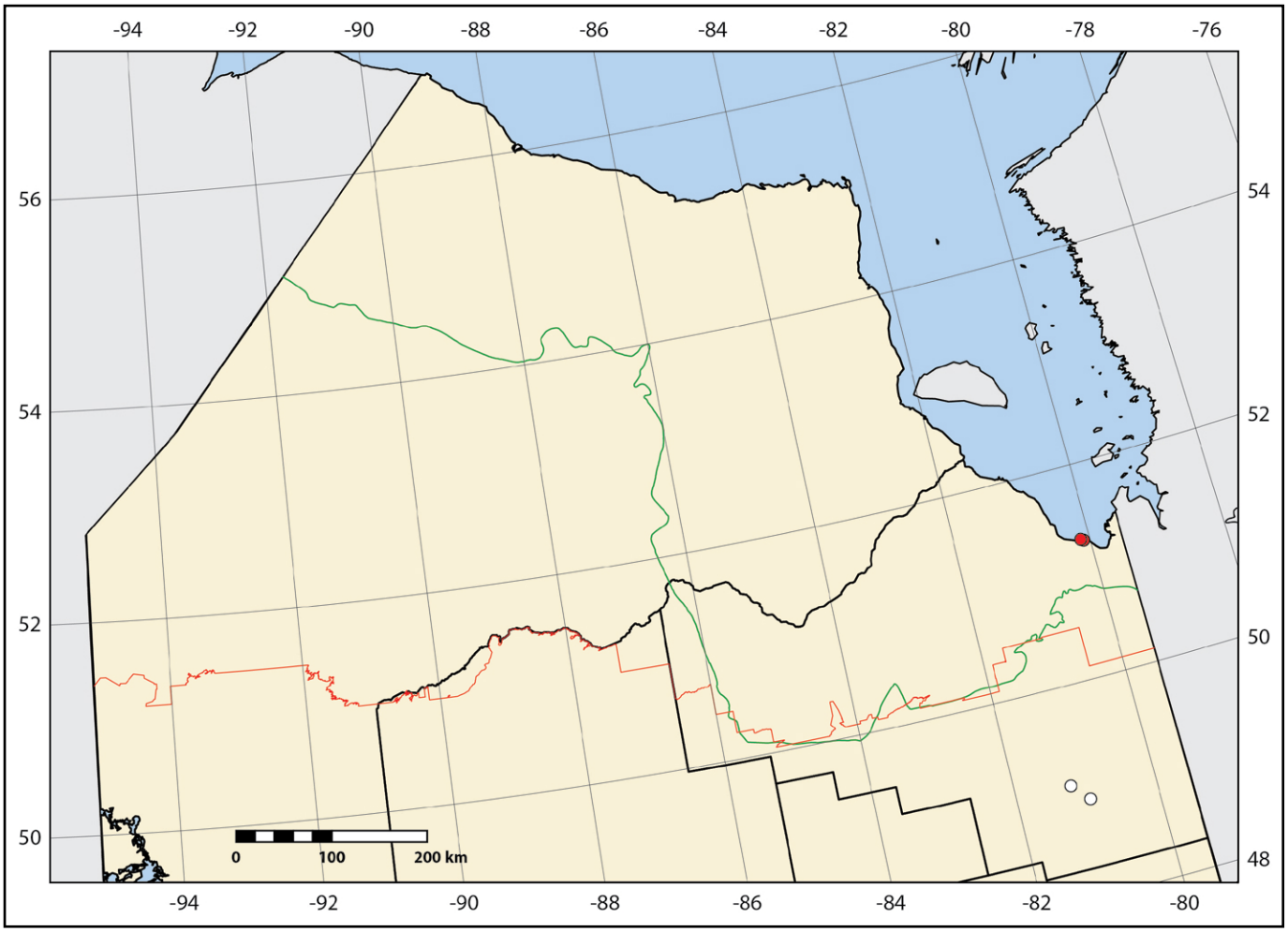

Figure 26. Records of *Vallonia pulchella* in Kenora and Cochrane districts, Ontario. Red circles: new records; white circles: unpublished records outside of Far North area (RGF, unpublished data; see text). Not recorded from northern Ontario by Oughton (1948).

Zoogenetes harpa (Say, 1824); Boreal Top; S4
Figures 27 and 28

Helix harpa Say (1824): 256, pl. 15, fig. 1.
Bulimus harpa — W.G. Binney (1861): 330.
Zoogenetes harpa — Dall (1905): 21. Whelan and Oughton (1939): 100. Oughton (1948): 72. Pilsbry (1948): 1043.

Identification — There are no other species like *Zoogenetes harpa* in Ontario, with its conic-ovate shell having sculpture of widely spaced, lamellar colabral riblets. These riblets, formed by the periostracum, may be eroded off in shells from river drift.

Material examined — Kenora District: **Site 24**: ROMIZ M11643, 2 specimens, dry shells. **Site 37**: ROMIZ M11674, 2 specimens, dry shells.

Range in Ontario — This is a northern species, largely absent from southern Ontario. Oughton (1948) recorded it south as far as Giants Tomb Island, Georgian Bay (ca. 44.90° N, 080.00° W) and Algonquin Park (ca. 45.83° N, 078.43° W), and north to James Bay, Attawapiskat Lake, and Borthwick Lake. The new records expand the known range of *Zoogenetes harpa* north to the coast of Hudson Bay, beyond the Oughton's inferred range. Oughton's (1948) record from Fort Albany is ca. 350 km south-southeast of the nearest new occurrence.

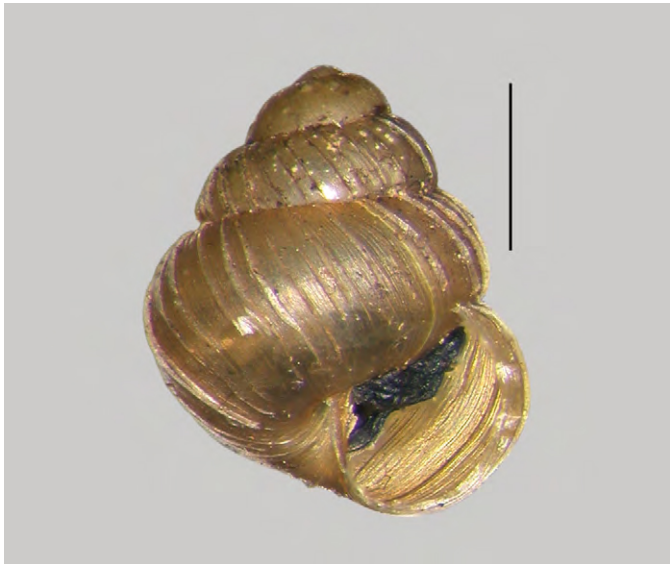

Figure 27. *Zoogenetes harpa*, Site 24, ROMIZ M11643. Scale bar = 1 mm.

Habitat — Specimens were collected under logs and in drift samples along large rivers (Sutton and Severn) flowing into Hudson Bay.

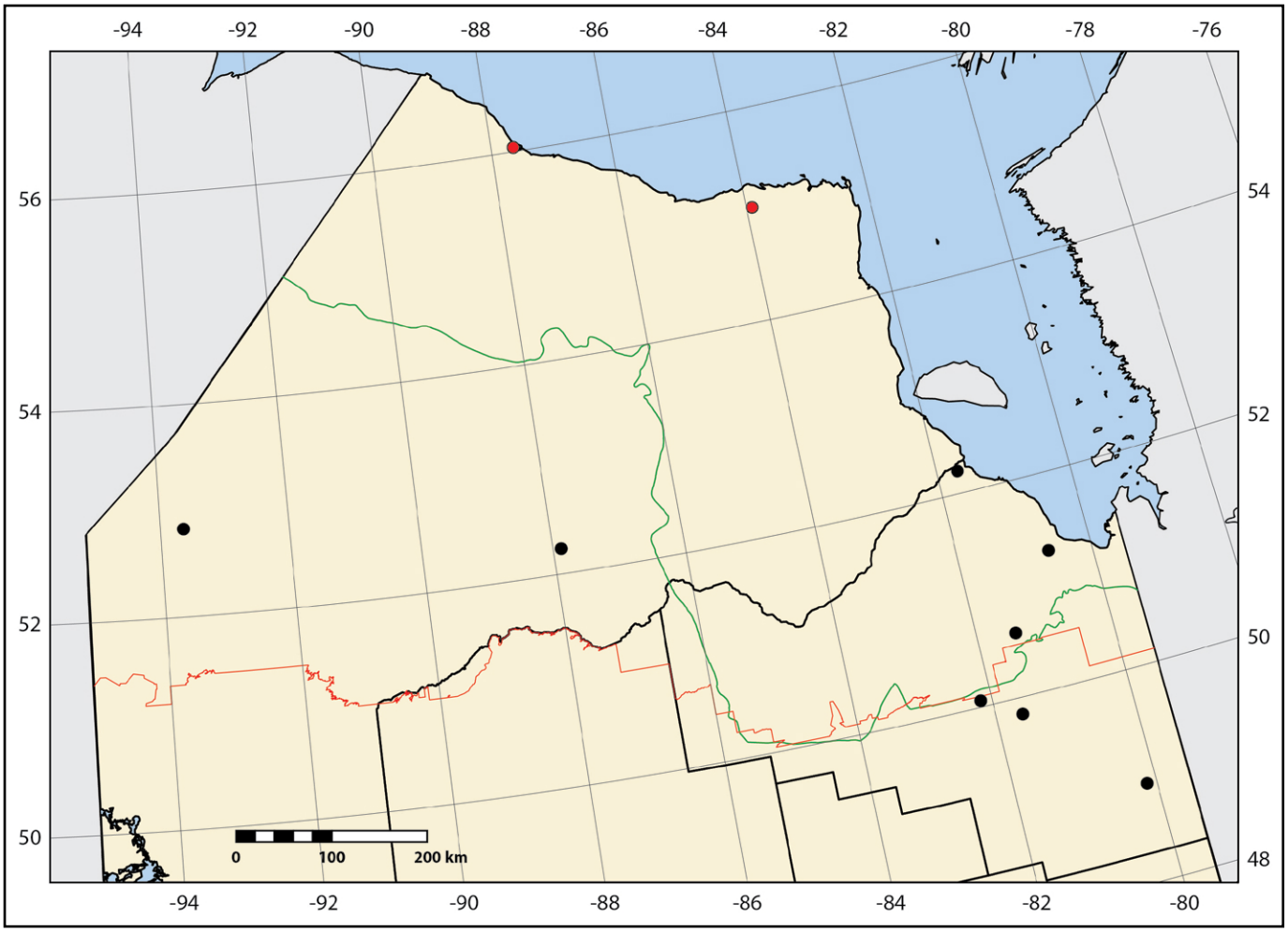

Figure 28. Records of *Zoogenetes harpa* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

Family Chondrinidae
Genus *Columella* Westerlund, 1878

Columella columella (G. von Martens, 1830); Mellow Column; S4?
Figures 29 and 30
Pupa columella G. von Martens (1830): 171.
Pupa alticola Ingersoll (1875): 128.
Columella alticola — Oughton (1948): 48. Pilsbry (1948): 1003.
Columella columella — Pokryszko (1990): 233.
Columella columella alticola — Nekola and Coles (2010): 36.

Identification — We differentiated this species from *Columella edentula* by its more cylindrical form, greater number of whorls, and elongate aperture. The aperture is higher than wide and is more elongate in mature individuals. The last or penultimate whorl is often slightly smaller in calibre than adjacent whorls, but otherwise shells are nearly cylindrical. Unlike most *Vertigo* species, there are no lamellae inside the aperture.

Although Pilsbry (1948) considered the North American *Columella alticola* distinct from the Palaearctic *C. columella*, he did remark on the great similarity of these two taxa. Forcart (1959) was the first author to expressly treat *alticola* as a subspecies of *C. columella*. He wrote only that if consistent morphological differences between the taxa were found, then *alticola* should be a subspecies of *C. columella*, but gave no evidence other than reiterating Pilsbry's comments (1948). Bequaert and Miller (1973), and later, Nekola and Coles (2010) maintained the subspecific status of *alticola*, but provided no rationale. Thus, except on purely geographic grounds, there is currently no evidence to suggest that subspecies are warranted. The most thorough and recent discussion

Figure 29. *Columella columella*, Site 26, ROMIZ M11650. Scale bar = 1 mm.

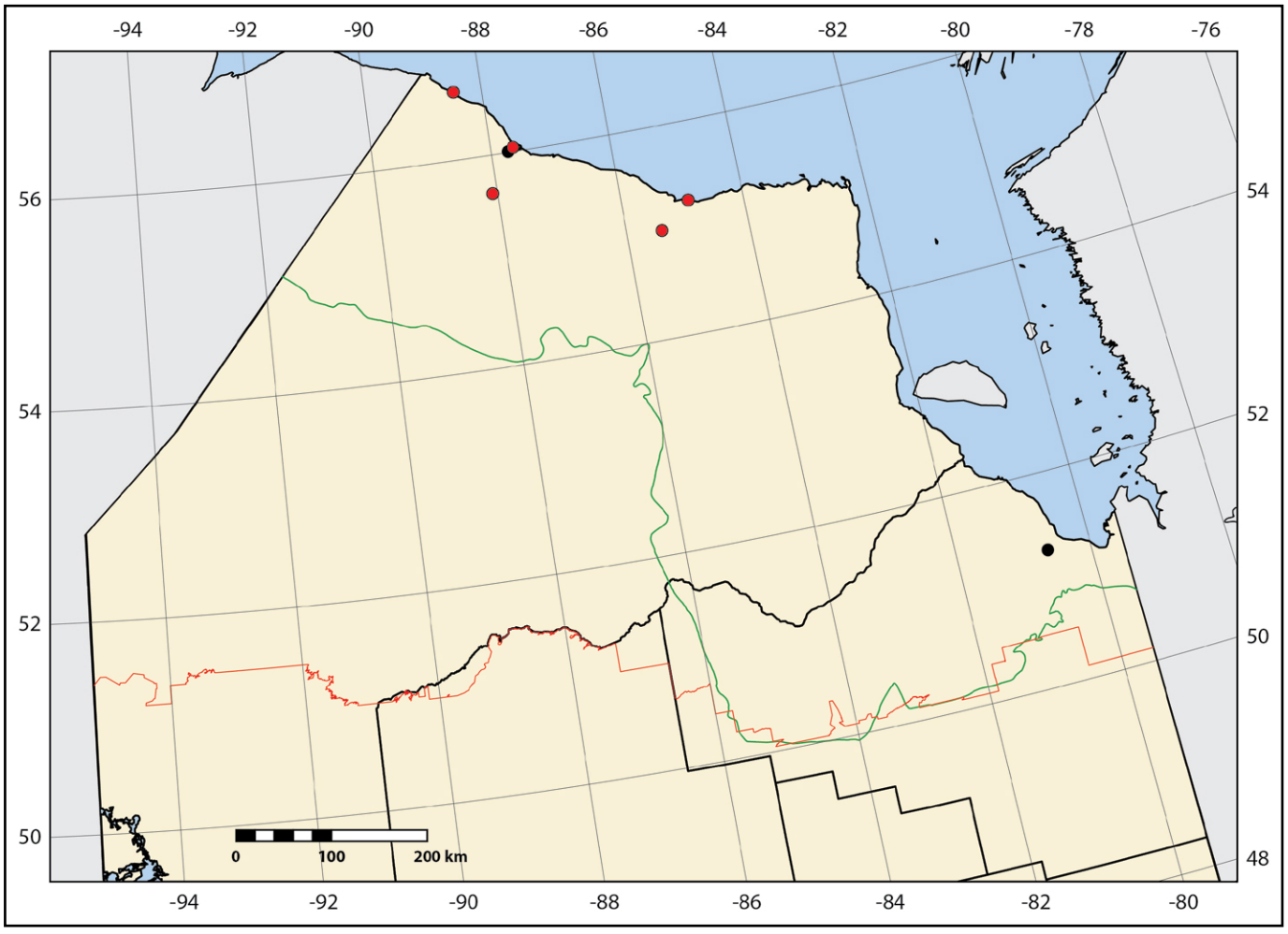

Figure 30. Records of *Columella columella* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948, as *C. alticola*); red circles: new records.

of *Columella* species in the Palaearctic was by Pokryszko (1990), who did not recognize any subspecies, but she also reserved judgement on the affinity of North American snails. Prozorova et al. (2007) commented that the North American shell characters of the taxon are fully consistent with those of the Eurasian *C. columella*. This approach is followed here and North American populations included within a wide-ranging *C. columella*.

Material examined — Kenora District: **Site 26**: ROMIZ M11650, 4 specimens, dry shells. **Site 32**: ROMIZ M11663, 27 specimens, 70% EtOH. **Site 37**: ROMIZ M11675, 6 specimens, dry shells. **Site 39**: ROMIZ M11690, 55 specimens, dry shells. **Site 41**: ROMIZ M11709, 2 specimens, dry shells.

Range in Ontario — This species was previously known in Ontario from the two localities recorded by Oughton (1948) and one site on the north shore of Lake Superior (Nekola and Coles 2010). The Lake Superior population may be disjunct, as the region is known to harbour disjunct populations of arctic/alpine organisms (Given and Soper 1981; Crins et al. 2009). Our new records add five additional occurrences within the inferred range of Oughton (1948).

Habitat — Specimens of this alpine–arctic species (Forsyth 2004, 2005; Nekola and Coles 2010) were collected from drift along the Severn River, from moist woods and the shrubby shore of former river channel at Peawanuck, and from moist tundra near the mouth of the Winisk River.

Columella edentula (Draparnaud, 1805); Toothless Column; S4?

Figures 31 and 32

Pupa edentula Draparnaud (1805): 59, pl. 3, fig. 28–29.
Columella edentula — Whelan and Oughton (1939): 100. Oughton (1948): 48. Pilsbry (1948): 1002.
Columella simplex — Nekola and Coles (2010): 36.

Figure 31. *Columella edentula* (worn shell from drift), Site 9, ROMIZ M11578. Scale bar = 1 mm.

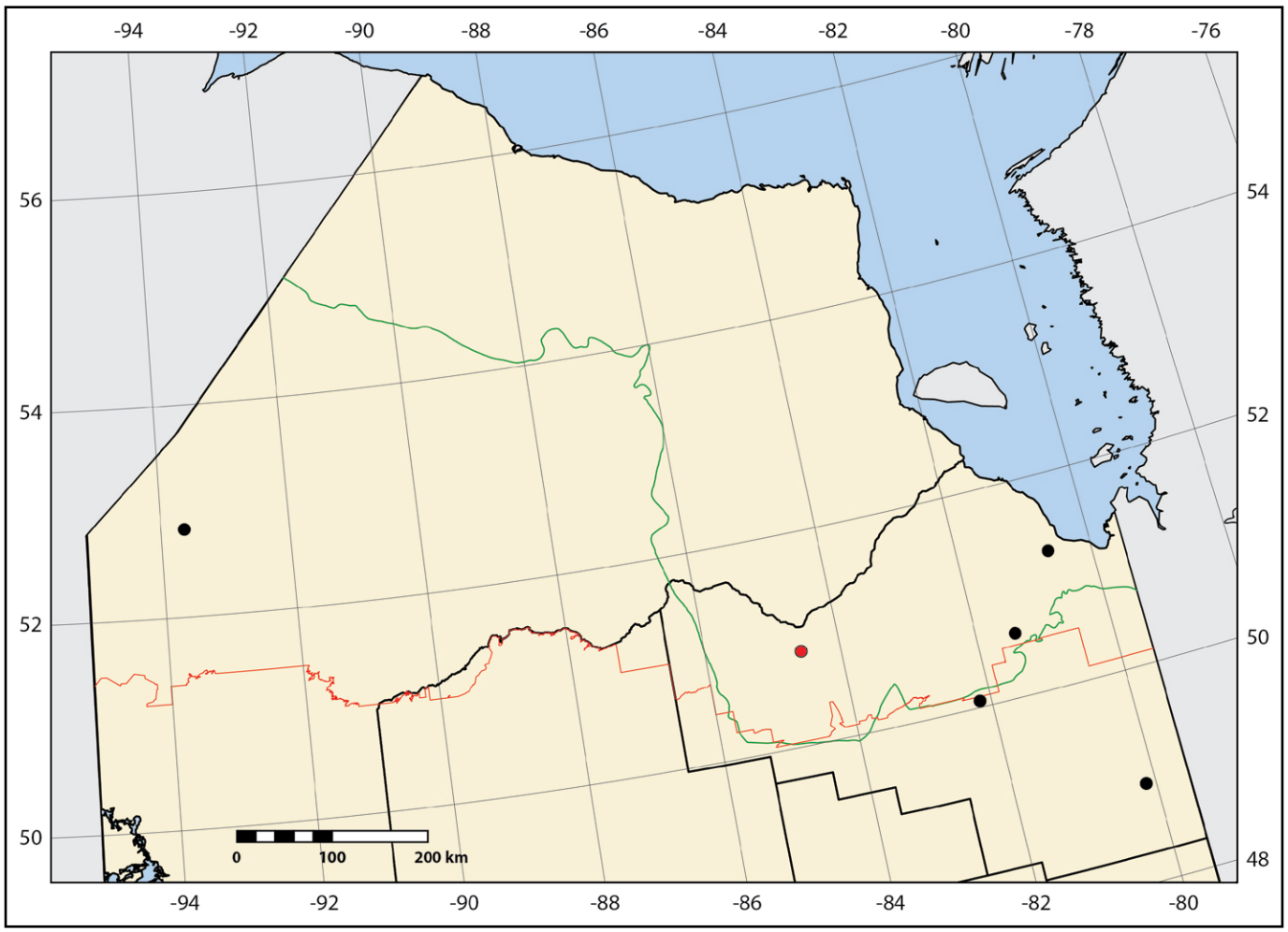

Figure 32. Records of *Columella edentula* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circle: new record.

Identification — This *Columella* species is somewhat shorter, more tapered (less cylindrical), and with fewer whorls than *Columella columella*. The aperture is wider than high. *Columella edentula* differs from *Vertigo* cf. *genesii* by its shallower sutures and coarser surface sculpture.

The taxonomy of North American *Columella* species is unresolved. *Columella edentula* was described from France, and North American populations would not take this name if they were found to be specifically distinct from those of Europe. In North America, this taxon or possibly group of species is known as either *C. edentula* (e.g., Pilsbry 1948; Oughton 1948) or *C. simplex* (e.g., Hubricht 1985; Turgeon et al. 1998; Nekola and Coles 2010). Additionally, several authors have suggested that *C. edentula* or *C. simplex* could be a complex of similar species (Oughton 1948; Pilsbry 1948; Hubricht 1985; Nekola and Coles 2010). Differentiation of North American *C. simplex* from Eurasian *C. edentula* and presence of purported other species has often been promoted but little evidence has been offered on how they differ. There does seem to be subtle morphological differences in shells and animals between certain populations across the continent but nothing has been done to resolve the taxonomy. We choose to use the earliest available name until evidence is given to support separation Eurasian and North American populations into separate species.

Material examined — Cochrane District: **Site 9**: ROMIZ M11578, 1 specimen, dry shell (in drift).

Range in Ontario — Oughton (1948) gave the range of this species as most of the province, north to southern James Bay and Borthwick Lake.

Habitat — The single recent Far North specimen (an empty shell) was collected from drift at the high-water line along the Kenogami River.

Family Vertiginidae
Genus *Vertigo* Müller, 1774

Vertigo arthuri E. von Martens, 1882; Callus Vertigo; S4
Figures 33 and 34
Vertigo bollesiana var. *arthuri* E. von Martens (1882): 140.
Vertigo arthuri — Pilsbry (1948): 977. Nekola and Coles (2010): 47.
Vertigo gouldii, in part, non *V. gouldii* (A. Binney, 1843) — Oughton (1948): 58
Vertigo gouldii paradoxa Sterki *in* Nylander (1900): 103 — Oughton (1948): 59.
Vertigo gouldi [*sic*] *paradoxa* — Pilsbry (1948): 972.
Vertigo paradoxa — Nekola and Coles (2010): 53.
Vertigo gouldii hubrichti Pilsbry (1934): 99.
Vertigo gouldi [*sic*] *hubrichti* — Pilsbry (1948): 973.
Vertigo hubrichti — Nekola and Coles 2010: 50.

Identification — This is a variable *Vertigo* species, having a small (< 1.9 mm high), cylindrical shell with sharp, rather regularly spaced colabral rib-striae. There are usually 5 or 6 lamellae present in adults: 2 parietal lamellae as well as 1 columellar, 2 palatal, and typically 1 basal lamella. The lower palatal lamella is long, with its length easily visible. In some, there is a massive crest on the last whorl (see for example Pilsbry 1948) and a thick, white callus inside the aperture on which the palatal lamellae rest. In others, this crest is weak and the callus inconspicuous.

Figure 33. *Vertigo arthuri* (worn shell from drift), Site 39, ROMIZ M11691. Scale bar = 1 mm.

Analysis of mitochondrial DNA sequences has shown that this species encompasses several taxa previously believed distinct at the species or subspecies level within a broadly defined *Vertigo gouldii* group (Nekola et al. 2009). Typical *V. arthuri* and *V. paradoxa* represent ends of a grade from heavily to only weakly callused forms. Nekola and Coles (2010) continued to utilize names for the range of variation within this species that Nekola et al. (2009) had discounted (synonymized). Our specimens most resemble the typical form of *V. arthuri*.

Material examined — Cochrane District: **Site 11**: ROMIZ M11597, 6 specimens, dry shells. **Site 12**: ROMIZ M11615, 6 specimens, dry shells. *Kenora District:* **Site 37**: ROMIZ M11676, 1 specimen, dry shell. **Site 39**: ROMIZ M11691, 9 specimens, dry shells.

Range in Ontario — Although not known to Oughton (1948) from Ontario, he suspected that it may occur in areas adjacent to Manitoba. However, Nekola and Coles (2010) identified this species, or its synonyms, from most of Ontario south of Cochrane District. Our new records from the Severn River, Kenora District, are far from the most northern previous records in Ontario, but fill a distribution gap with occurrences in northern Manitoba (Nekola and Coles 2010).

Habitat — Recent Far North specimens were collected from drift samples along the Kenogami, Pagwachuan, and Severn rivers.

Vertigo cristata Sterki *in* Pilsbry, 1919; Cristate Vertigo; S4
Figures 35 and 36
Vertigo gouldii cristata Sterki *in* Pilsbry (1919): 100 — Oughton (1948): 58.
Vertigo gouldii, in part, non *V. gouldii* (A. Binney, 1843) — Oughton (1948): 58.

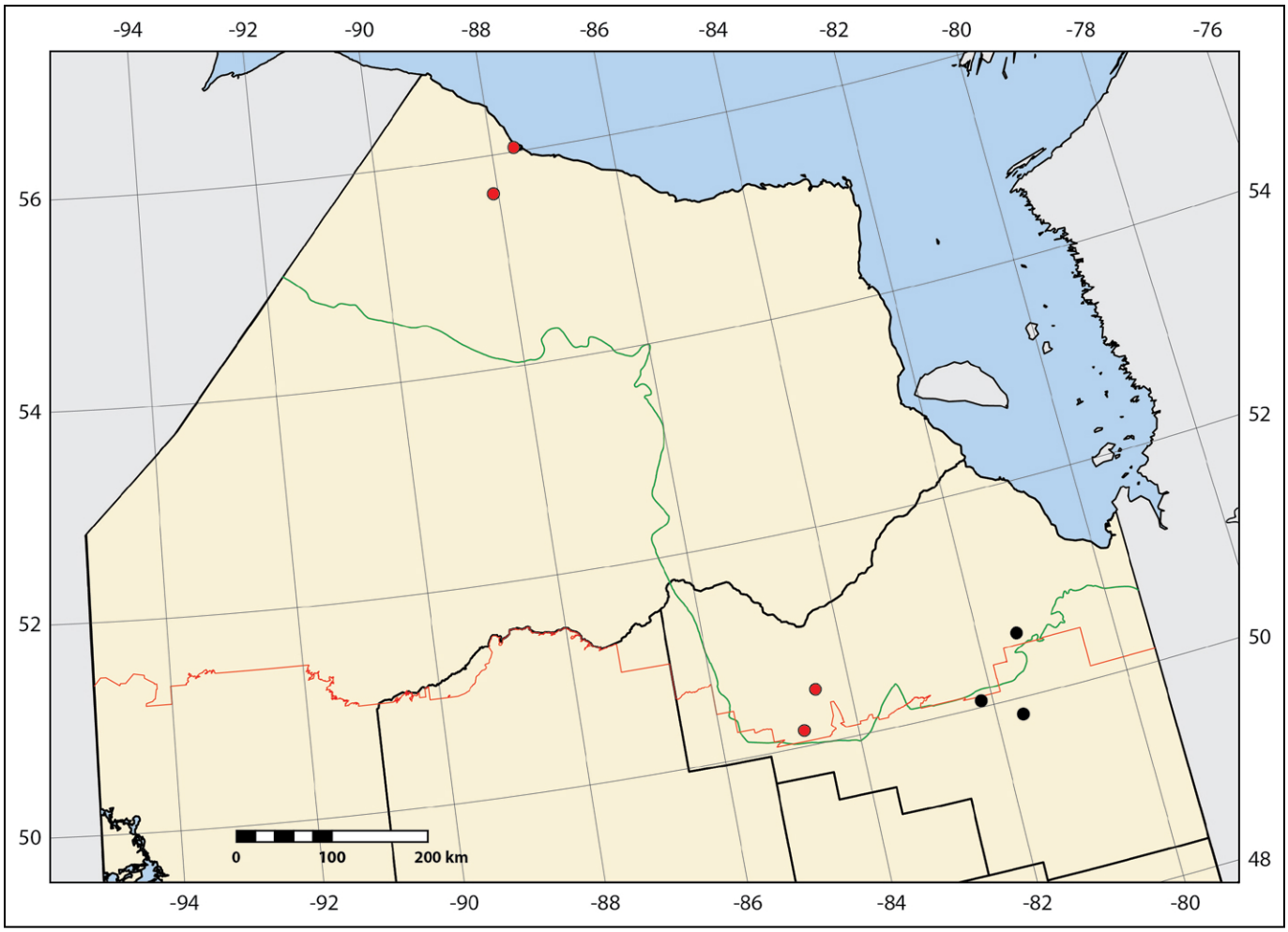

Figure 34. Records of *Vertigo arthuri* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948, updated as per Nekola and Coles 2010, as *V. arthuri* and *V. paradoxa*); red circles: new records.

Figure 35. *Vertigo cristata,* Site 22, ROMIZ M11632. Scale bar = 1 mm.

Vertigo gouldi [*sic*] *cristata* — Pilsbry (1948): 973.
Vertigo cristata — Nekola and Coles (2010): 48.

Identification — This species is recognized by the combination of its sharply rib-striate surface sculpture, relatively small (short palatal) lamellae that form a cross. The lamellae of *Vertigo modesta* also form a cross (when four lamellae are present), but the shell averages slightly larger and the sculpture is less distinct.

Oughton (1948) and others until quite recently, did not treat this taxon as a separate species. However, based on analysis of mitochondrial DNA data, Nekola et al. (2009) showed that *Vertigo cristata* is not closely related to *V. gouldii,* with which it had been earlier confused. They also showed that western North American populations with *V. cristata*-like shell characters are a separate species, *V. coloradensis* (Cockerell, 1891), from the eastern boreal *V. cristata*. We interpret our material as belonging to *V. cristata*.

Material examined — Kenora District: **Site 22**: ROMIZ M11632, 3 specimens, dry shells. **Site 33**: ROMIZ M11666, 1 specimen, dry shell. **Site 39**: ROMIZ M11692, 2 specimens, dry shells.

Range in Ontario — Although Oughton (1948) did not map *Vertigo cristata* separately from "*V. gouldii*" comparison with Nekola and Coles (2010) shows that the record of *V. gouldii* from Borthwick Lake is *V. cristata*. Recent Far North records are a minimum of ca. 480 km northeast of the Borthwick Lake location. *Vertigo cristata* is therefore known from most of Ontario (Nekola and Coles 2010; this study).

Habitat — Recent collections are from river drift along the Severn River and from under debris in moist woodland at Peawanuck.

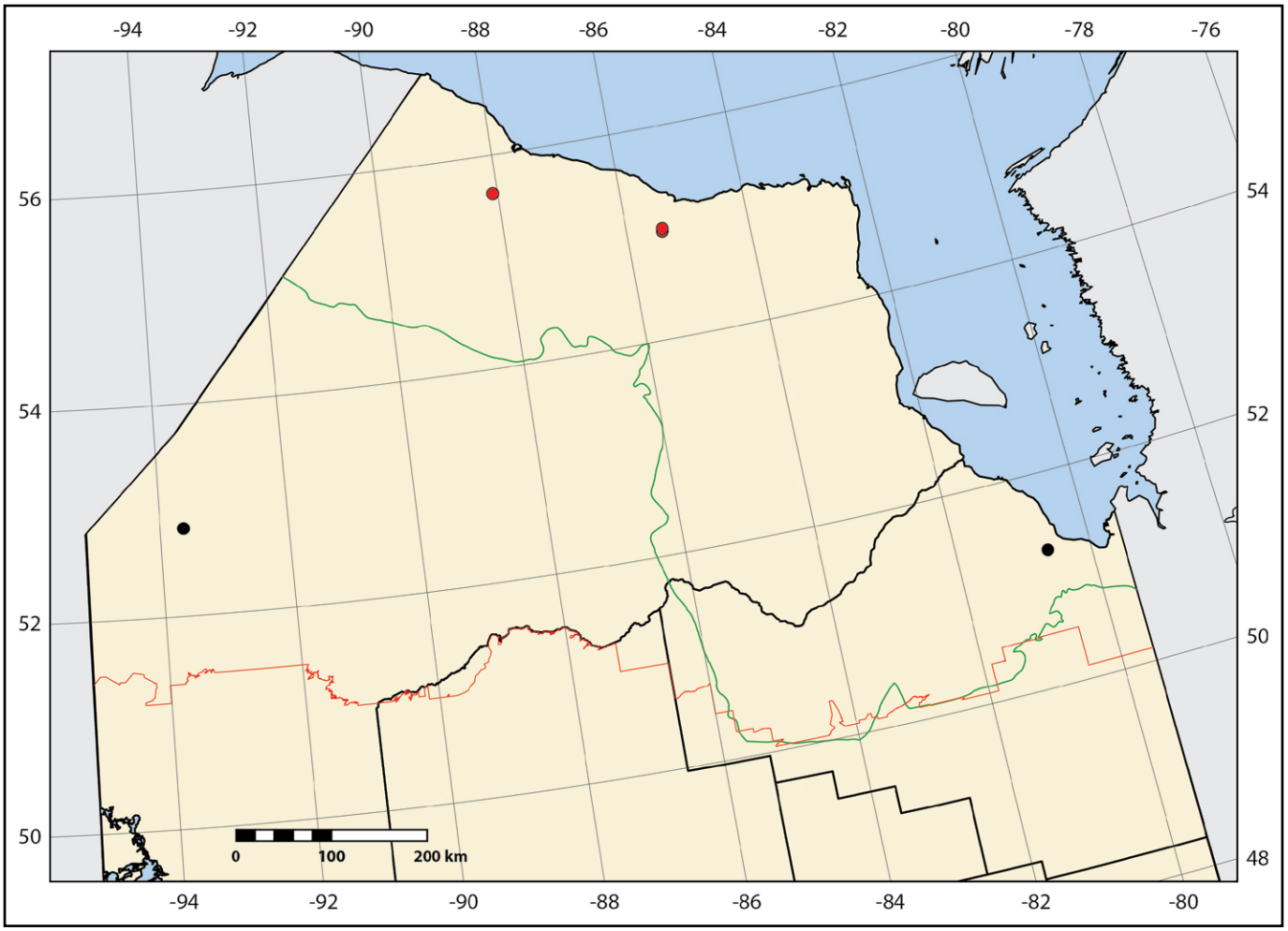

Figure 36. Records of *Vertigo cristata* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948, updated as per Nekola and Coles 2010); red circles: new records.

Vertigo elatior Sterki, 1894; Tapered Vertigo; S4
Figures 37 and 38

Vertigo ventricosa var. *elatior* Sterki (1894): 5.
Vertigo ventricosa, in part, non *V. ventricosa* (Morse, 1865) — Goodrich (1933): 9.
Vertigo ventricosa ... var. *elatior* ...? — Whelan and Oughton (1939): 100.
Vertigo ventricosa elatior — Oughton (1948): 64.
Vertigo elatior — Pilsbry (1931): 93; (1948): 956. Nekola and Coles (2010): 48.

Identification — This *Vertigo* species is recognized by its conical-ovate, smoothish shell, in adults with a conspicuous indentation on the outer lip. *Vertigo ventricosa* (Morse, 1865) is most similar, but with a comparatively shorter spire.

Vertigo elatior has been considered separate from *V. ventricosa* since at least Pilsbry (1931). Oughton (1948) followed the earlier practice of treating *elatior* as a form of *V. ventricosa*.

Material examined — Cochrane District: **Site 9**: ROMIZ M11579, 2 specimens, dry shells (in drift). **Site 11**: ROMIZ M11598, 1 specimen, dry shell. **Site 12**: ROMIZ M11616, 1 specimen, dry shell. *Kenora District:* **Site 39**: ROMIZ M11693, 5 specimens, dry shells.

Range in Ontario — Oughton (1948) did not clearly differentiate records between *V. elatior* and *V. ventricosa*.

Figure 37. *Vertigo elatior,* Site 39, ROMIZ M11693. Scale bar = 1 mm.

However, Nekola and Coles (2010) re-examined the historical specimens from the Far North and identified all as *Vertigo elatior.* This species is widespread over most of the province (Nekola and Coles 2010; RGF unpublished data).

Habitat — Recent Far North specimens were collected from drift along the Kenogami, Pagwachuan, and Severn rivers.

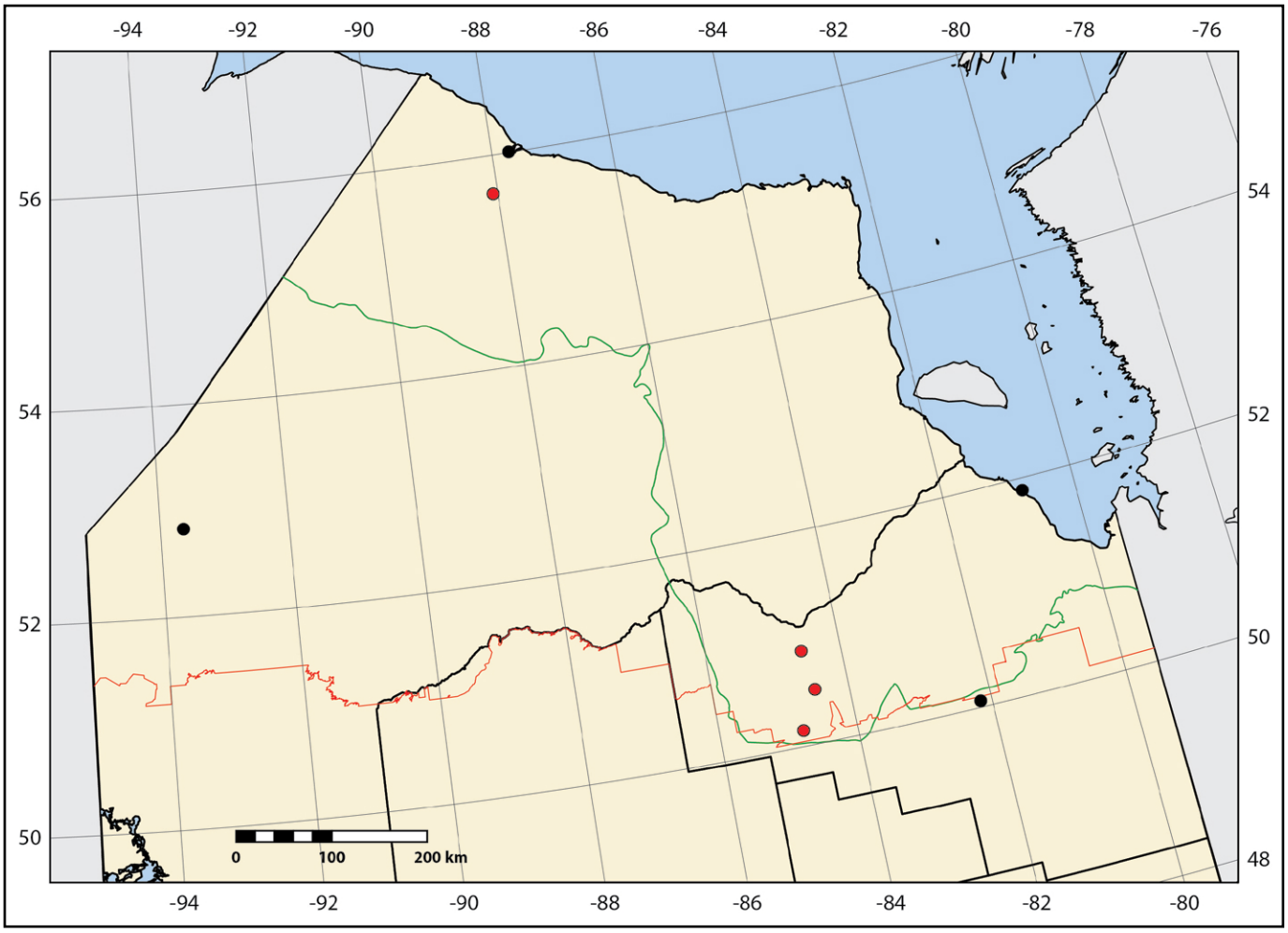

Figure 38. Records of *Vertigo elatior* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948, as *V. ventricosa*, updated as per Nekola and Coles 2010); red circles: new records.

Vertigo cf. ***genesii*** (Gredler, 1856); Round-mouth Vertigo; S2
Figures 39 and 40
Pupa genesii Gredler (1856): 122.
Vertigo aff. *genesii* — Nekola and Coles (2010): 49.

Identification — This small (height 2.0 mm in our Far North specimen), smoothish *Vertigo* lacks all traces of lamellae within the aperture, and there is no crest. Adult specimens of *Vertigo modesta*, which may also lack lamellae, are larger. *Vertigo oughtoni* is more cylindrical and has at least a lower palatal lamella present.

Material examined — *Kenora District*: **Site 26**: ROMIZ M11651, 1 specimen, dry shell.

Range in Ontario — *Vertigo* cf. *genesii* is here newly reported from the arctic coast of Ontario. Nekola and Coles (2010) mapped this species from northern Manitoba, including the arctic coast near Churchill, and the north shore of the Gulf of St. Lawrence, Quebec. Whether the North American populations represent *V. genesii*, a species described from Europe, or a distinct species remains to be determined (Nekola and Coles 2010).

Habitat — The single recent Far North specimen was from hummocky tundra near the mouth of the Winisk River. Elsewhere in North America, it was reported from leaf litter in sedge meadows, shoreline turf, and shrub marsh (Nekola and Coles 2010).

Figure 39. *Vertigo* cf. *genesii,* Site 26, ROMIZ M11651. Scale bar = 1 mm.

Vertigo hannai Pilsbry, 1919; Wrinkled Vertigo; SU
Figures 41 and 42
Vertigo martini Hanna and Johnston (1913): 120; non *V. martini* Sayn, 1911.
Vertigo hannai Pilsbry (1919): 114, new name for *V. martini* Hanna & Johnston, 1913 — Nekola and Coles (2010): 49.

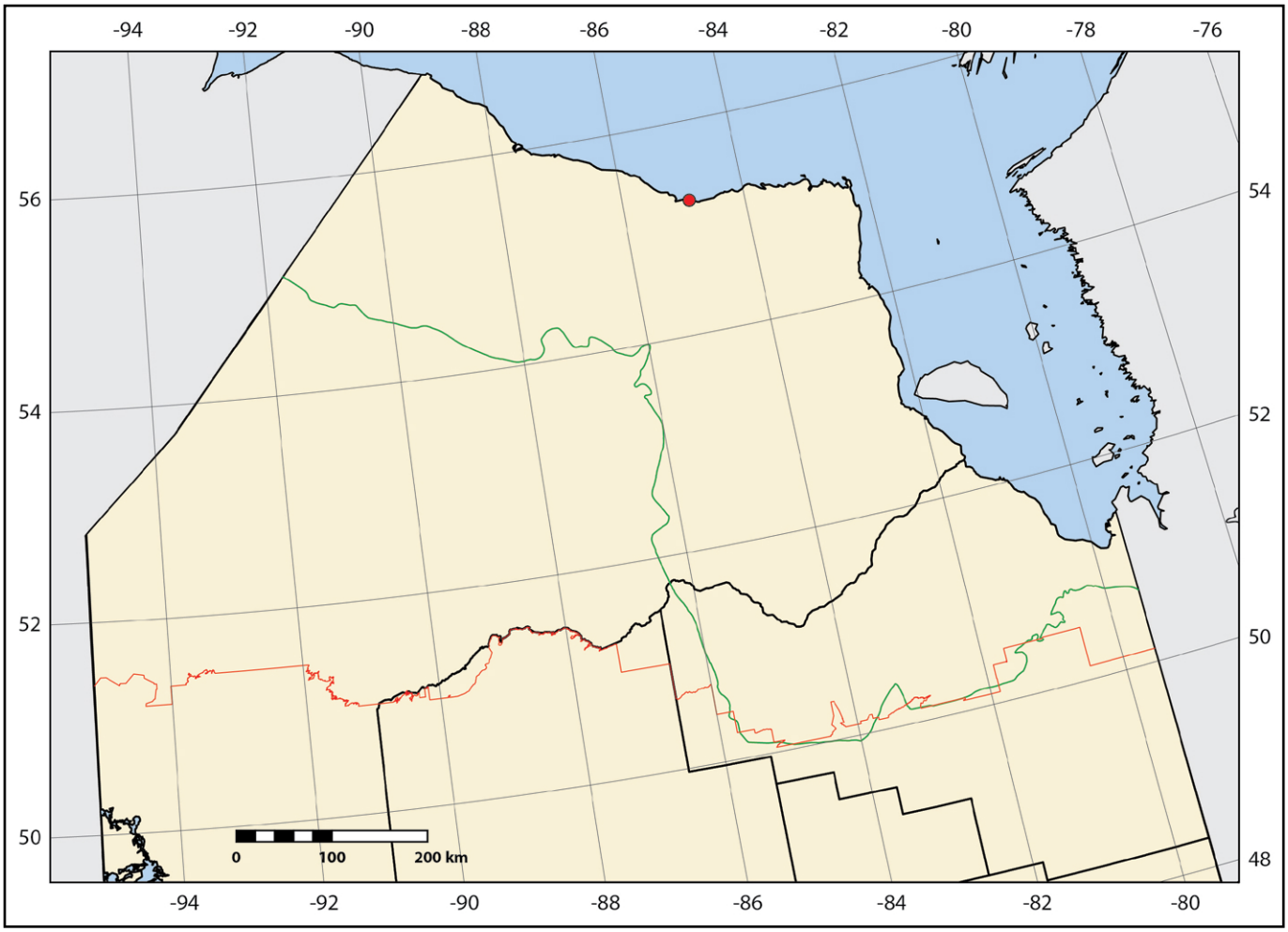

Figure 40. Records of *Vertigo* cf. *genesii* in Kenora and Cochrane districts, Ontario. Red circles: new records. Not previously reported from Ontario by Oughton (1948) and Nekola and Coles (2010).

Vertigo gouldi [*sic*] *hannai* — Pilsbry (1948): 976.
Vertigo binneyana, non *V. binneyana* Sterki, 1890 — Oughton (1948): 56.

Identification — This species is recognized by the combination of its narrow, irregularly and rather widely spaced colabral rib-striae; rather strongly developed lamellae that number six (2 parietal, 1 columellar, 1 basal, and 2 palatal lamellae); a thin, sharp and slightly expanded outer lip that has almost no trace of an indentation; and a crest that is absent or scarcely evident.

This would appear to be the species that Oughton (1948) called *Vertigo binneyana*.

Figure 41. *Vertigo hannai,* Site 39, ROMIZ M11694. Scale bar = 1 mm.

Material examined — *Kenora District:* **Site 37**: ROMIZ M11677, 2 specimens, dry shells. **Site 39**: ROMIZ M11694, 24 specimens, dry shells.

Range in Ontario — In Ontario, *Vertigo hannai* has only ever been found from the Severn River (Nekola and Coles 2010; this study). Although described as a Pleistocene fossil from Kansas (Hanna and Johnston 1913), it has been collected alive around Churchill, Manitoba (Nekola and Coles 2010).

Habitat — Both recent Far North collections were from drift along the Severn River and confirm that the species is likely still extant in Ontario.

Vertigo modesta (Say, 1824); Cross Vertigo; S4
Figures 43 and 44
Pupa modesta Say (1824): 259, pl. 15, fig. 5.
Vertigo modesta — Oughton (1948): 60. Pilsbry (1948): 982. Nekola and Coles (2010): 50.

Identification — This species is recognized by the combination of its large size (relative to other species of *Vertigo*), weakly striate shell surface, and typically four lamellae (the two palatal lamellae short) that form a cross. In some individuals the upper palatal and sometimes other lamellae are missing; three lamellae, with the upper palatal lamella lacking is common in our Far

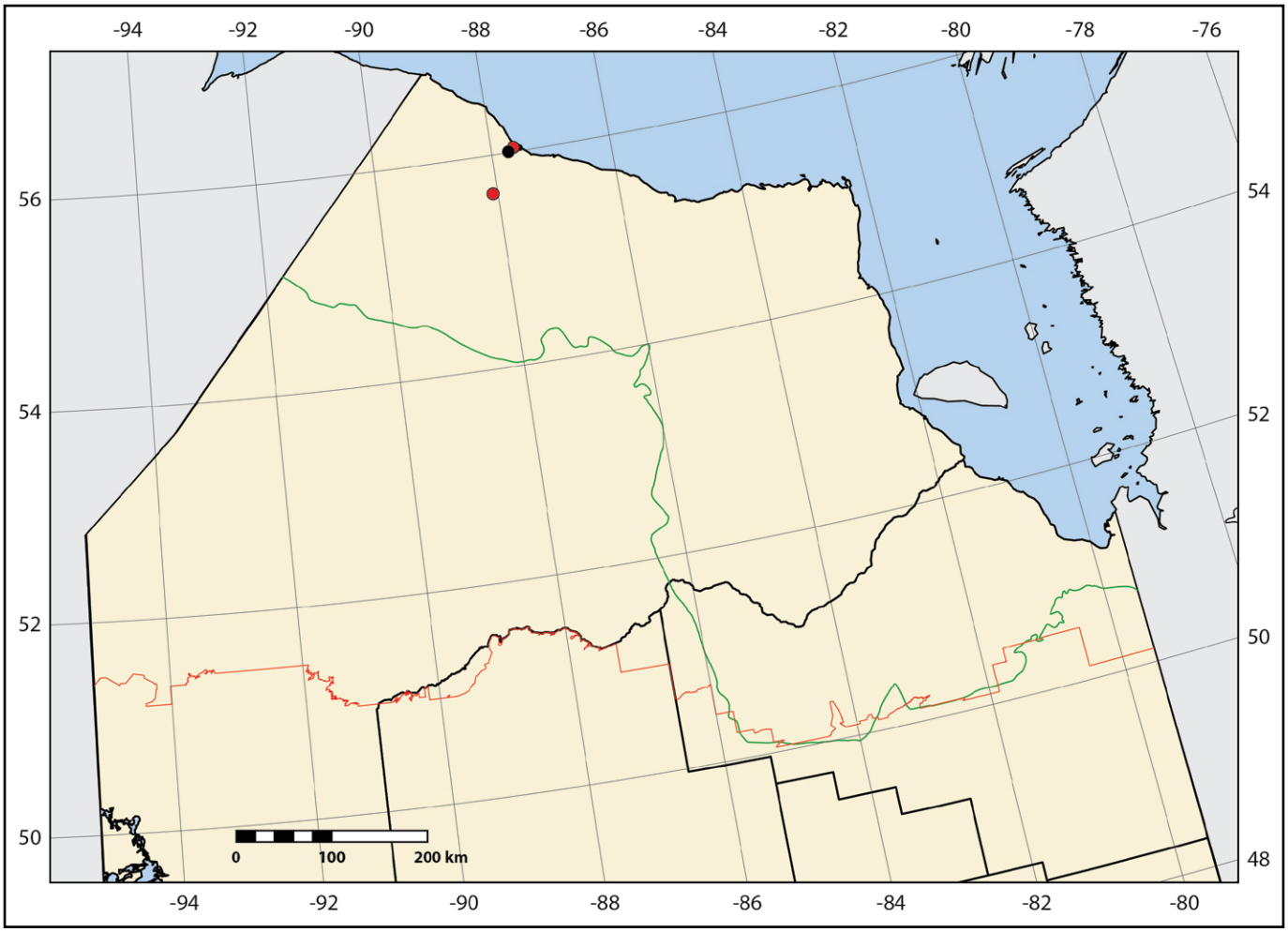

Figure 42. Records of *Vertigo hannai* in Kenora and Cochrane districts, Ontario. Black circle: data from Oughton (1948, presumably as *V. binneyana*, updated as per Nekola and Coles 2010); red circle: new record.

Figure 43. *Vertigo modesta,* Site 26, ROMIZ M11652. Scale bar = 1 mm.

North specimens. Such specimens however, are larger than other *Vertigo* species in the Far North. There is a little or no crest.

Material examined — Cochrane District: **Site 4**: ROMIZ M11547, 6 specimens, dry shells. **Site 12**: ROMIZ M11617, 1 specimen, dry shell. *Kenora District:* **Site 26**: ROMIZ M11652, 49 specimens, dry shells. **Site 30**: ROMIZ M11658, 19 specimens, 70% EtOH. **Site 32**: ROMIZ M11664, 14 specimens, 70% EtOH. **Site 37**: ROMIZ M11678, 13 specimens, dry shells. **Site 39**: ROMIZ M11695, 171 specimens, dry shells. **Site 41**: ROMIZ M11714, 4 specimens, dry shells. *Additional material (outside Far North):* **Site β**: ROMIZ M11712, 21 specimens, 70% EtOH.

Range in Ontario — This species is likely distributed throughout the northern two-thirds of Ontario, occurring as far south as the north shore of Lake Superior (Oughton 1948). He thought that it probably is more abundant than represented in collections.

Habitat — Specimens were collected from beneath logs on coastal James and Hudson Bay beach ridges, in moist woods at Peawanuck, from hummocky tundra, and as components of drift at the edge of the Severn River.

Vertigo oughtoni Pilsbry, 1948; Nunavut Vertigo; S2
Figures 45 and 46
Vertigo alpestris — Oughton (1948): 55.
Vertigo alpestris oughtoni Pilsbry (1948): 968.
Vertigo oughtoni — Nekola and Coles (2010): 52.

Identification — This *Vertigo* is recognized by the combination of its irregular striae, small lamellae, rather

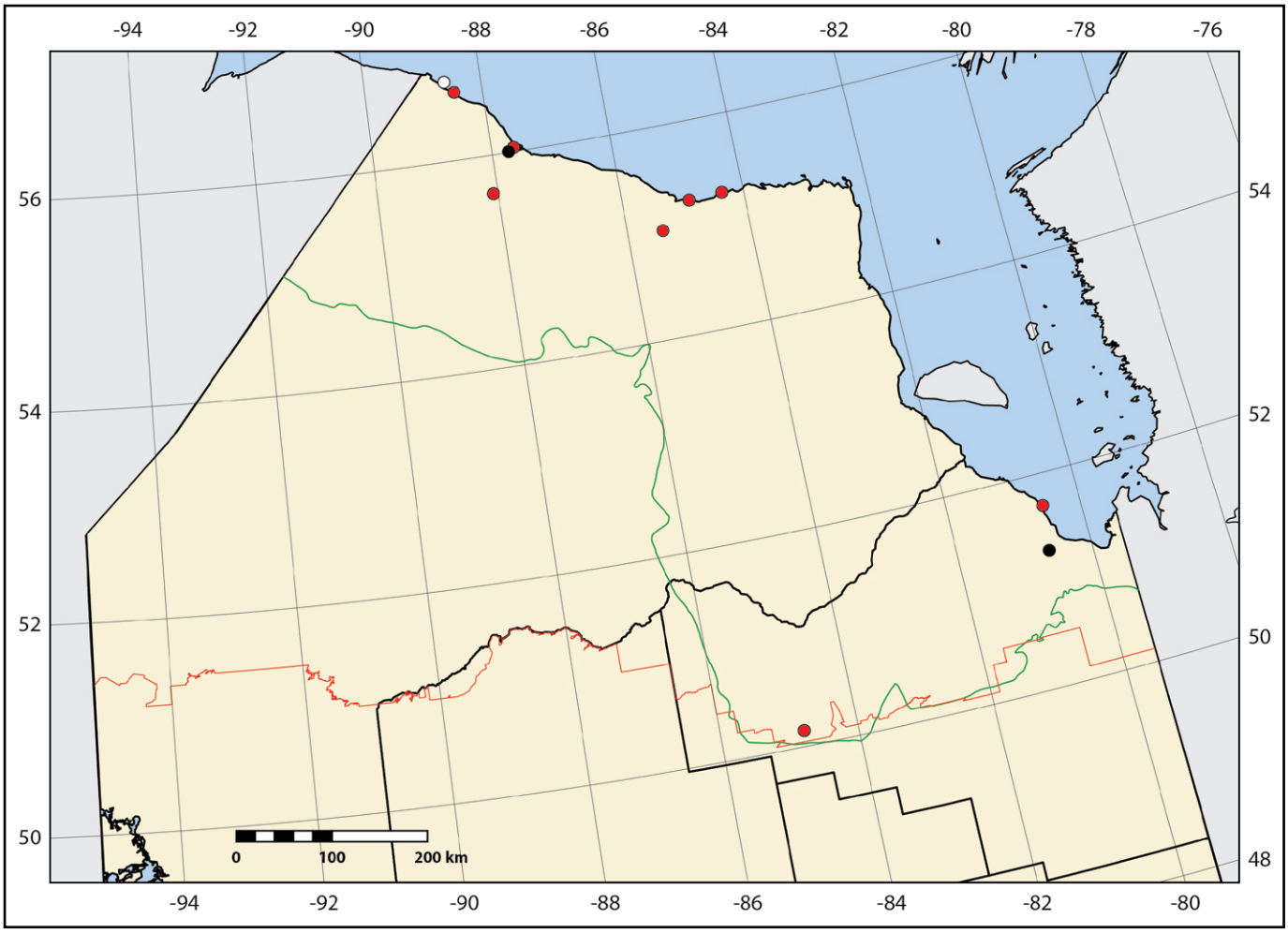

Figure 44. Records of *Vertigo modesta* in Kenora and Cochrane districts, Ontario, and Nunavut. Black circles: data from Oughton (1948, updated as per Nekola and Coles 2010); red circles: new records; white circle: new record outside of the Far North.

cylindrical shell, thin outer lip and absence or near absence of a crest. In most specimens, the upper palatal lamella is lacking, but occasionally a very small one is present (although Oughton [1948] reported the range of lamellae to vary from 0–4). *Vertigo* cf. *genesii* is stouter, never with any trace of lamellae; *V. modesta* (which often has a reduced number of teeth) is larger.

Oughton (1948) called his Far North material *Vertigo alpestris* Alder, 1838. Pilsbry (1948) originally described *V. oughtoni* from Baffin Island, Nunavut, as *V. alpestris oughtoni*. However, as noticed by Waldén (1966), and later Nekola and Coles (2010), this taxon is unrelated to *V. alpestris* and specifically distinct.

Material examined — *Cochrane District:* **Site 4**: ROMIZ M11548, 5 specimens, dry shells. *Kenora District:* **Site 26**: ROMIZ M11653, 2 specimens, dry shells. **Site 30**: ROMIZ M11659, 1 specimen, 70% EtOH. **Site 32**: ROMIZ M11665, 1 specimen, dry shell. **Site 37**: ROMIZ M11679, 2 specimens, dry shells.

Range in Ontario — The only previous occurrence of this species in Ontario, from drift of the Severn River, was reported by Oughton (1948), as *V. alpestris* (Nekola and Coles 2010). Our samples expand the range of *V. oughtoni* southeast to southern James Bay, adding five additional occurrences in Ontario for *V. oughtoni*.

Figure 45. *Vertigo oughtoni*, Site 4, ROMIZ M11548. Scale bar = 1 mm.

Habitat — Specimens were collected from beneath logs on coastal James and Hudson Bay beach ridges, in moist woods at Peawanuck, from hummocky tundra, and as components of drift at the edge of the Severn River.

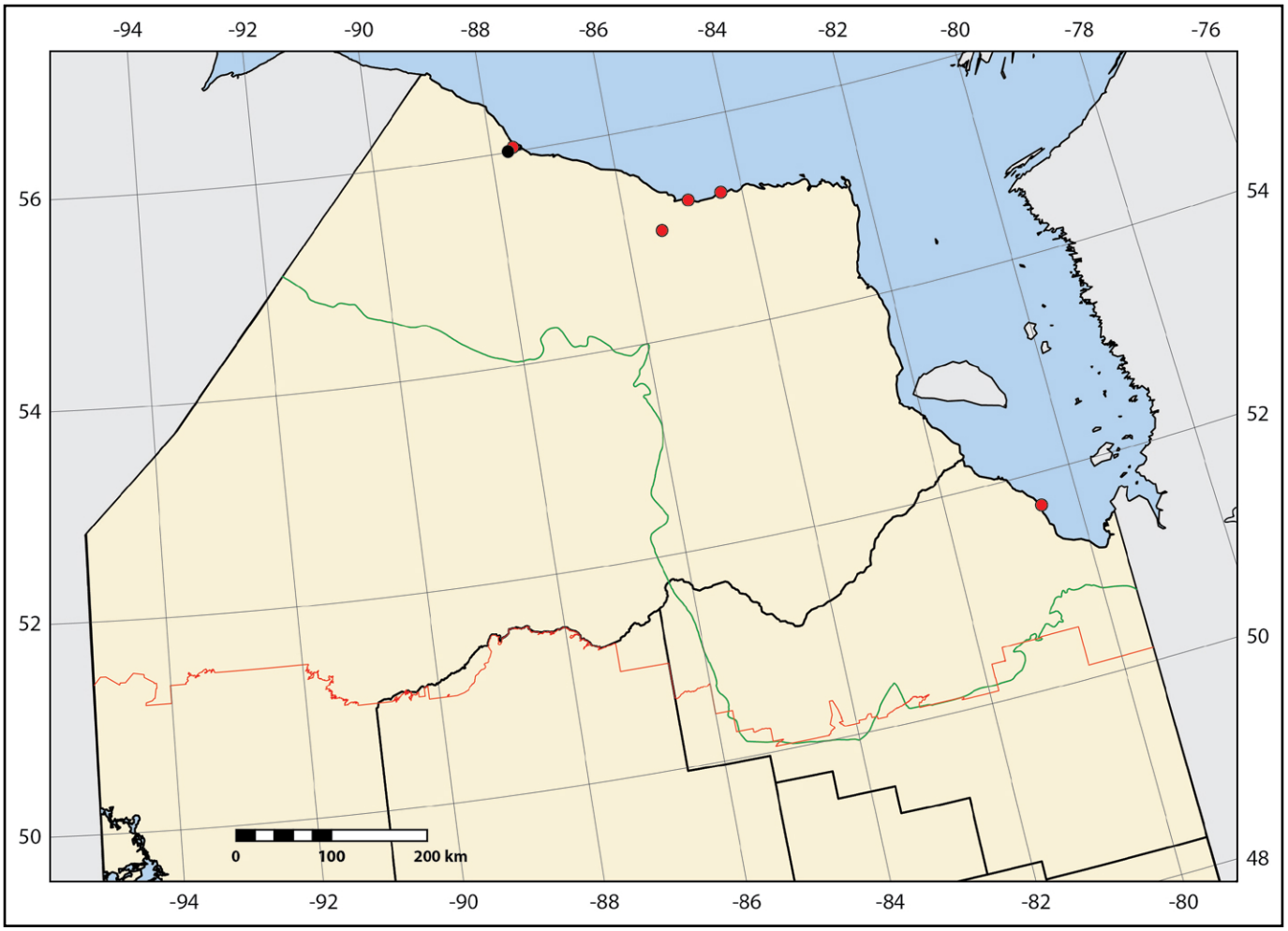

Figure 46. Records of *Vertigo oughtoni* in Kenora and Cochrane districts, Ontario. Black circle: data from Oughton (1948, as *Vertigo alpestris*, updated as per Nekola and Coles 2010); red circle: new record.

Family Gastrocoptidae
Genus *Gastrocopta* Wollaston, 1878

Gastrocopta similis (Sterki, 1909); Great Lakes Snaggletooth; S3?
Figures 47 and 48
Bifidaria armifera var. *similis* Sterki (1909): 53.
Gastrocopta armifera, in part — Oughton (1948): 50.
Gastrocopta similis — Nekola and Coles (2010): 40.

Identification — *Gastrocopta similis* and *G. armifera* (Say, 1824) are the largest (height < 4 mm) of the *Gastrocopta* species in Ontario. This species is nearly identical in appearance to *G. armifera* (Say, 1824), but is distinguished from it by the more flat-fronted, rather than strongly "pyramidal" columellar lamella (Nekola and Coles 2010).

Oughton (1948) did not recognize this species in Ontario, instead calling all his material *G. armifera*. Pilsbry (1948) considered *similis* to be just a form of that species; however, Hubricht (1972) and recently Nekola and Coles (2010) have treated these as separate species.

Material examined — Cochrane District: **Site 9**: ROMIZ M11580, 1 specimen, dry shell (in drift). **Site 11**: ROMIZ M11599, 1 specimen, dry shell. **Site 12**: ROMIZ M11618, 3 specimens, dry shells.

Range in Ontario — Oughton (1948), who did not differentiate between this species and *G. armifera*, and

Figure 47. *Gastrocopta similis* (worn shell from drift), Site 11, ROMIZ M11599. Scale bar = 1 mm.

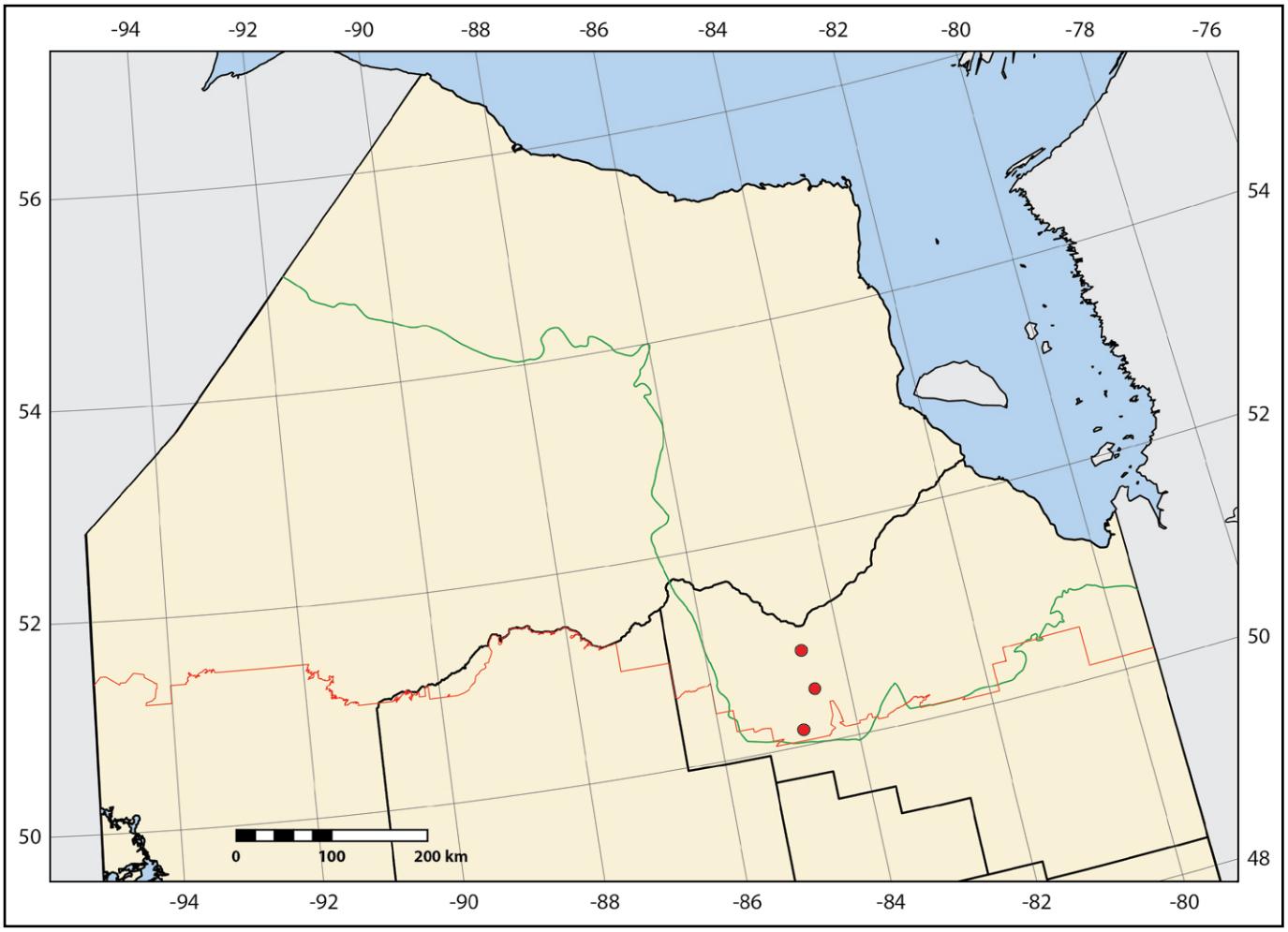

Figure 48. Records of *Gastrocopta similis* in Kenora and Cochrane districts, Ontario. Red circles: new records. Not reported from northern Ontario previously (Oughton 1048; Nekola and Coles 2010).

Nekola and Coles (2010), who did, had no records of these species north of Ottawa, but unlike those authors, we also have records of *G. similis* from Manitoulin Island (RGF, unpublished data). Therefore, the Far North records are well outside the known range of the species. As an obligatory calciphile (Nekola and Coles 2010), we do not expect that it would occur on the non-calcareous terrain of the Precambrian Ontario Shield, although one Far North sample was taken near the boundary between the Ontario Shield and the Hudson Bay Lowlands.

Habitat — All Far North specimens were collected as empty shells from drift along the Kenogami River.

Gastrocopta tappaniana (C. B. Adams, 1841); White Snaggletooth; S4

Figures 49 and 50

Pupa tappaniana "Ward, Mss" C. B. Adams (1841): [1] — C. B. Adams (1842): 158.

Gastrocopta tappaniana — Oughton (1948): 53. Pilsbry (1948): 889. Pearce et al. (2007): 66. Nekola and Coles (2010): 40.

Identification — The shell is minute (<2 mm high), ovate-conic, translucent-whitish when fresh but opaque and white in our material collected in river drift. In adults, the aperture has several lamellae (denticles) within, including a simple (not bifid) parietal lamella and a series of palatal lamellae that are placed on an opaque, white callus ridge. Among Ontario *Gastrocopta* spp., *G. tappaniana* most resembles *G. pentodon* (Say, 1821) but is less slender, slightly larger, and more conical (Pearce et al. 2007).

Figure 49. *Gastrocopta tappaniana* (worn shell from drift), Site 9, ROMIZ M11581. Scale bar = 1 mm.

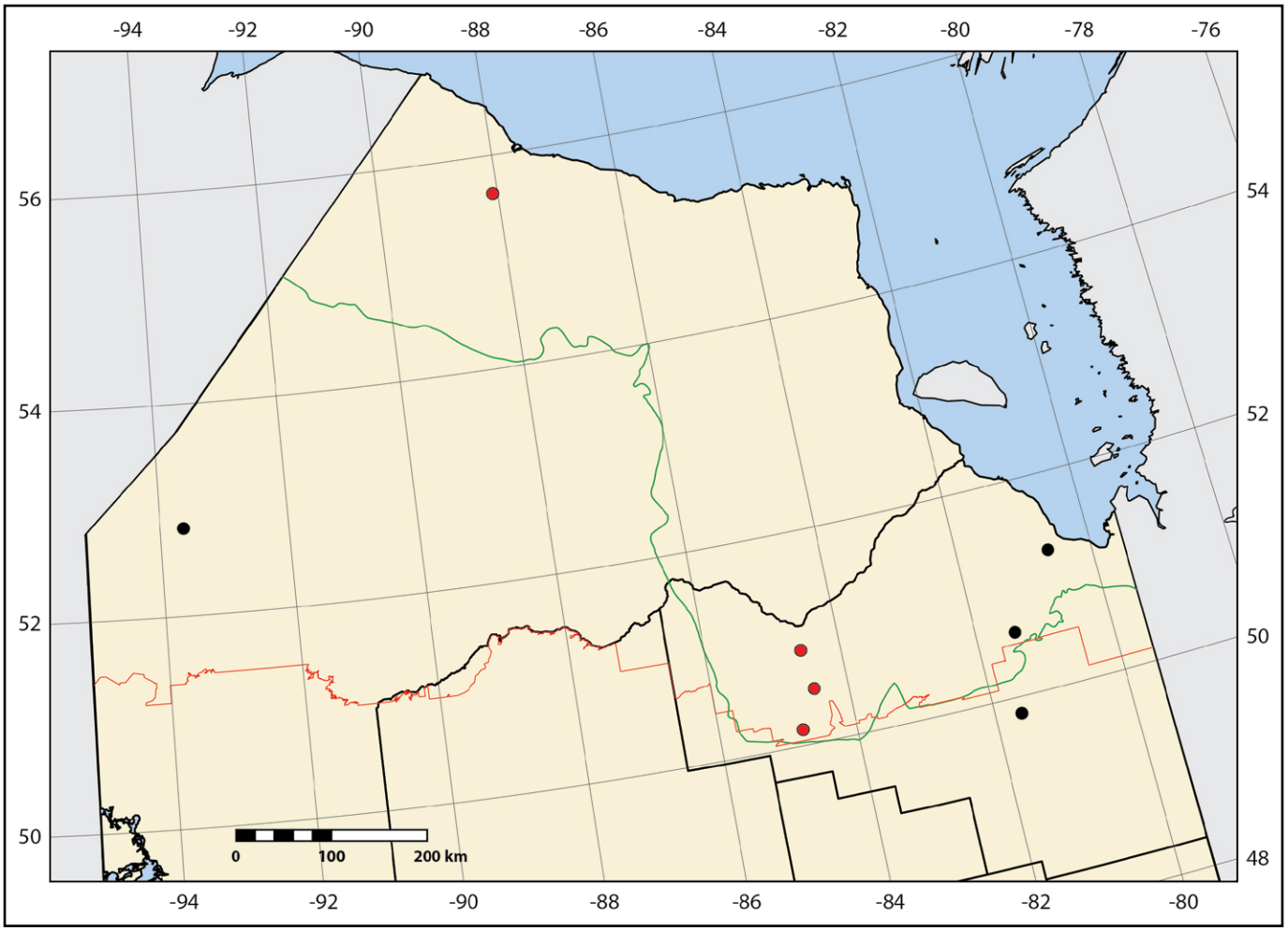

Figure 50. Records of *Gastrocopta tappaniana* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

Material examined — Cochrane District: **Site 9**: ROMIZ M11581, 4 specimens, dry shells (in drift). **Site 11**: ROMIZ M11600, 5 specimens, dry shells. **Site 12**: ROMIZ M11619, 19 specimens, dry shells. *Kenora District:* **Site 39**: ROMIZ M11696, 4 specimens, dry shells.

Range in Ontario — Oughton (1948) and Nekola and Coles (2010) recorded this species throughout much of Ontario and north to Moose Factory and Borthwick Lake. Our northernmost new record, from drift of the Severn River, is ca. 480 km northeast of Borthwick Lake and outside Oughton's inferred range for this species.

Habitat — Recent Far North specimens were collected from drift along the Kenogami, Pagwachuan, and Severn rivers.

Informal Group Sigmurethra
Superfamily Punctoidea
Family Punctidae
Genus *Punctum* Morse, 1864

Punctum minutissimum (I. Lea, 1841); Small Spot; S4
Figures 51 and 52
Helix minutissima I. Lea (1841): 17.
Punctum minutissimum — Pilsbry (1948): 644.
Punctum pygmaeum — Whelan and Oughton (1939): 100. Oughton (1948): 39.

Identification — The shell is very tiny, and brown when fresh, with numerous colabral riblets. We used the combination of minute size, general form, and sculpture to identify our material.

Figure 51. *Punctum minutissimum* (worn shell from drift sample), Site 9, ROMIZ M11582. Scale bar = 1 mm.

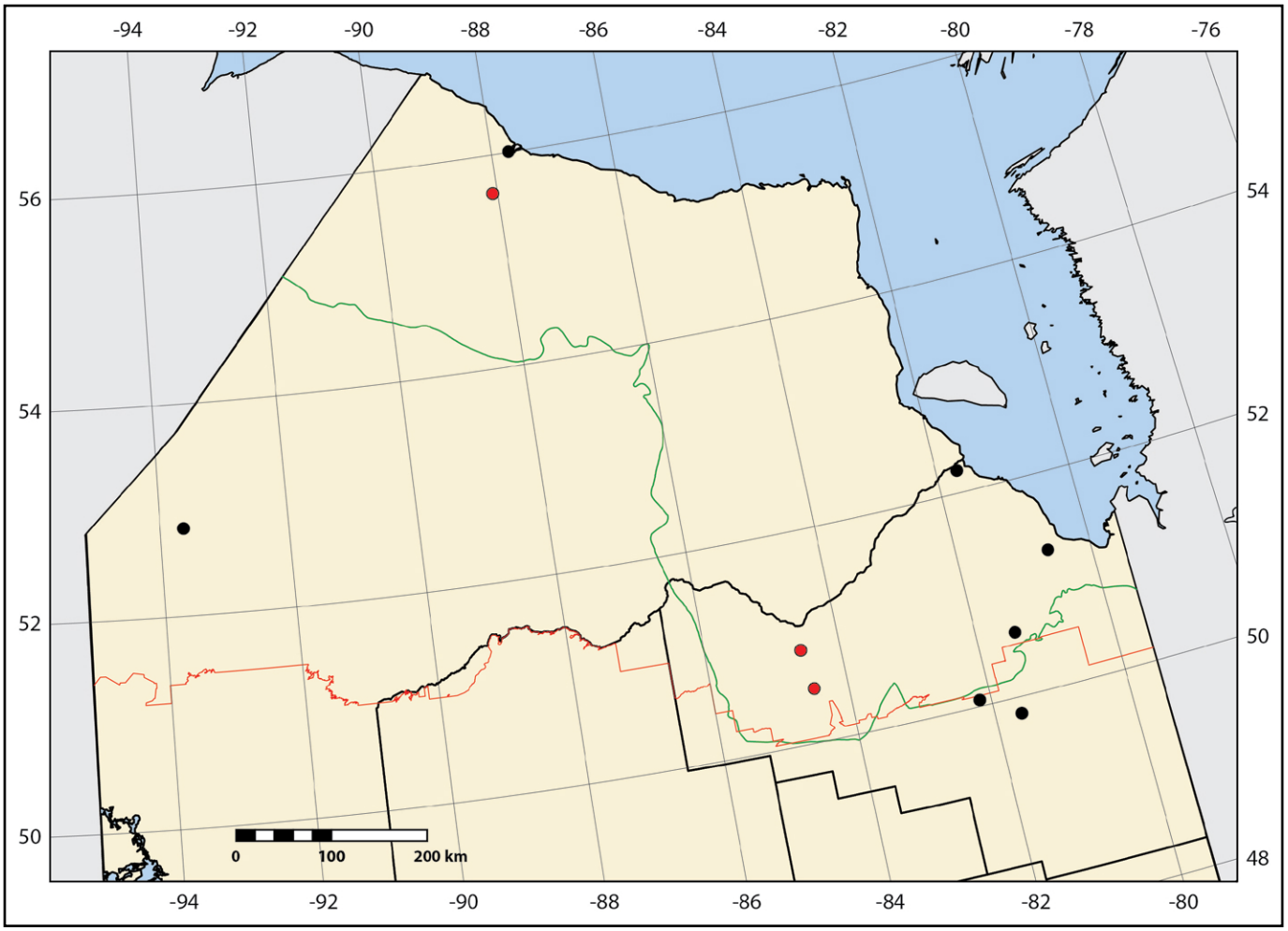

Figure 52. Records of *Punctum minutissimum* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

Material examined — Cochrane District: **Site 9**: ROMIZ M11582, 3 specimens, dry shells (in drift). **Site 11**: ROMIZ M11601, 1 specimen, dry shell. *Kenora District:* **Site 39**: ROMIZ M11697, 8 specimens, dry shells.

Range in Ontario. — According to Oughton (1948), the inferred range of this species is all of Ontario. The recent Far North collections fill distributional gaps.

Habitat — Recent Far North specimens were collected from drift along the Kenogami and Severn rivers.

Family Discidae
Genus *Discus* Fitzinger, 1833

Discus shimekii (Pilsbry, 1890); Striate Disc; SU
Figures 53 and 54
Zonites shimekii Pilsbry (1890): 3.
Discus shimekii — Oughton (1948): 38.
Discus shimeki [*sic*] — Pilsbry (1948): 617.

Identification — The shell is small (width <5.9 mm in

Figure 53. *Discus shimekii* (one of the least worn shells, from drift), Site 39, ROMIZ M11698. Scale bar = 1 mm.

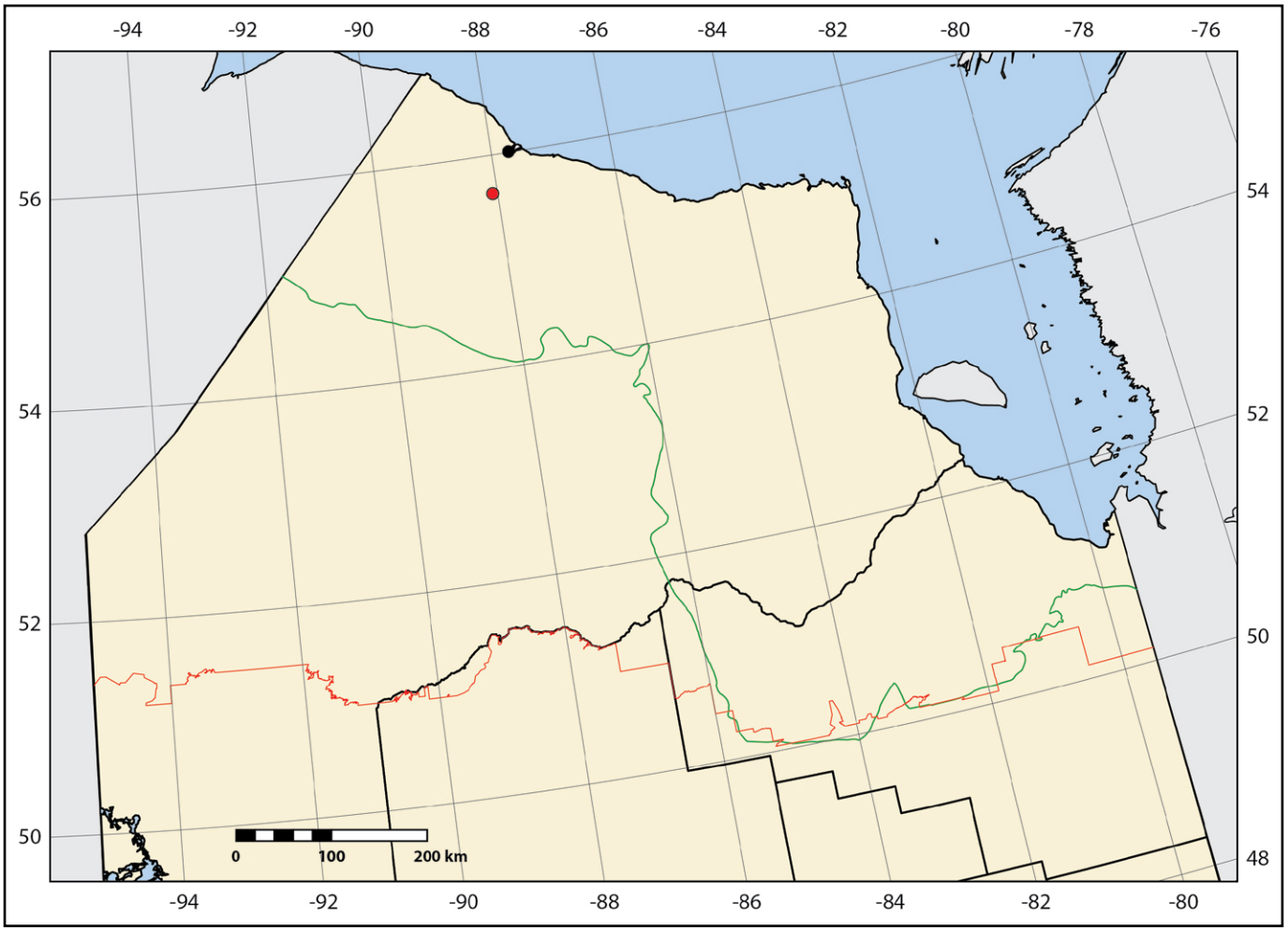

Figure 54. Records of *Discus shimekii* in Kenora and Cochrane districts, Ontario. Black circle: data from Oughton (1948); red circle: new record.

Far North specimens), depressed-heliciform, yellow-brown when fresh, with numerous colabral riblets that are less sharp all over and noticeably weaker on the base compared with *Discus whitneyi,* which is slightly smaller and often flatter in our material and has a broader, more funnel-shaped umbilicus.

Material examined — Kenora District: **Site 39**: ROMIZ M11698, 26 specimens, dry shells.

Range in Ontario — *Discus shimekii* was only found once before in Ontario. Oughton (1948) identified "slightly worn" shells of this species from among drift collected at Fort Severn, Kenora District. Our new records are also from river drift and slightly to well-worn, but with the best examples retaining some periostracum (Figure 52). Oughton (1948) thought that these shells were washed out fossils; our new records could indicate that the species is extant in the province, although periostracum may persist in Pleistocene fossil land snails (David Campbell, pers. comm.). This is a montane and boreal species that elsewhere in Canada, occurs from Yukon and northern British Columbia, south along the Rockies, Alberta, and the Northwest Territories (Forsyth 2004; RGF unpublished data). The Far North records are the easternmost occurrences in Canada, and probably among the easternmost in North America; *D. shimekii* is known as Pleistocene fossils in loess deposits in the U.S. Midwest (Pilsbry 1948; Hubricht 1985).

Habitat — Our single Far North collection came from river drift along the Severn River. The only other record of this species in Ontario was also from drift of this river (Oughton 1948).

Discus whitneyi (Newcomb, 1864); Forest Disc; S5
Figures 55 and 56

Helix striatella Anthony (1840): 278; non *Helix striatella* Rang, 1831 — W.G. Binney (1861): 330.
Helix whitneyi Newcomb (1864): 118.
Discus whitneyi — Roth (1988): 129.
Helix cronkhitei Newcomb (1865): 180.
Pyramidula striatella — Dall (1905): 50. Whiteaves (1905): 4.
Pyramidula cronkhitei anthonyi Pilsbry *in* Pilsbry and Ferriss (1906): 153 — Goodrich (1933): 8. Richards (1936): 59. Whelan and Oughton (1939): 100.
Discus cronkhitei — Oughton (1948): 36. Pilsbry (1948): 600.

Identification — The shell is depressed-heliciform, dark brown when fresh, with numerous strong colabral riblets. These riblets continue almost equally strong onto the base and into the umbilicus. We did not see among our material any that could confidently be called *Discus catskillensis* (Pilsbry, 1896), which is characterized

Figure 55. *Discus whitneyi,* Site 22, ROMIZ M11633. Scale bar = 1 mm.

(perhaps weakly so) by a more angular periphery. However, immature *Discus whitneyi* tend also to be more angular than adults.

Material examined — Cochrane District: **Site 1**: ROMIZ M11530, 19 specimens, 70% EtOH. **Site 2**: ROMIZ M11536, 3 specimens, 70% EtOH. **Site 3**: ROMIZ M11541, 14 specimens, 70% EtOH. **Site 4**: ROMIZ M11549, 35 specimens, 70% EtOH. **Site 5**: ROMIZ M11554, 25 specimens, 70% EtOH. **Site 6**: ROMIZ M11562, 37 specimens, dry shells. **Site 7**: ROMIZ M11566, 9 specimens, 70% EtOH. **Site 8**: ROMIZ M11570, 6 specimens, 70% EtOH. **Site 9**: ROMIZ M11583, 1 specimen, dry shell (under logs) and 12 specimens, dry shells (in drift). **Site 10**: ROMIZ M11589, 1 specimen, dry shell. **Site 11**: ROMIZ M11602, 59 specimens, dry shells. **Site 12**: ROMIZ M11620, 16 specimens, dry shells. **Site 16**: ROMIZ M10980, 3 specimens, 70% EtOH. **Site 18**: ROMIZ M10985, 2 specimens, 70% EtOH. **Site 19**: ROMIZ M10992, 12 specimens, 70% EtOH. *Kenora District:* **Site 22**: ROMIZ M11633, 16 specimens, dry shells. **Site 23**: ROMIZ M11637, 2 specimens, dry shells. **Site 24**: ROMIZ M11644, 3 specimens, dry shells. **Site 25**: ROMIZ M10996, 3 specimens, dry shells. **Site 28**:

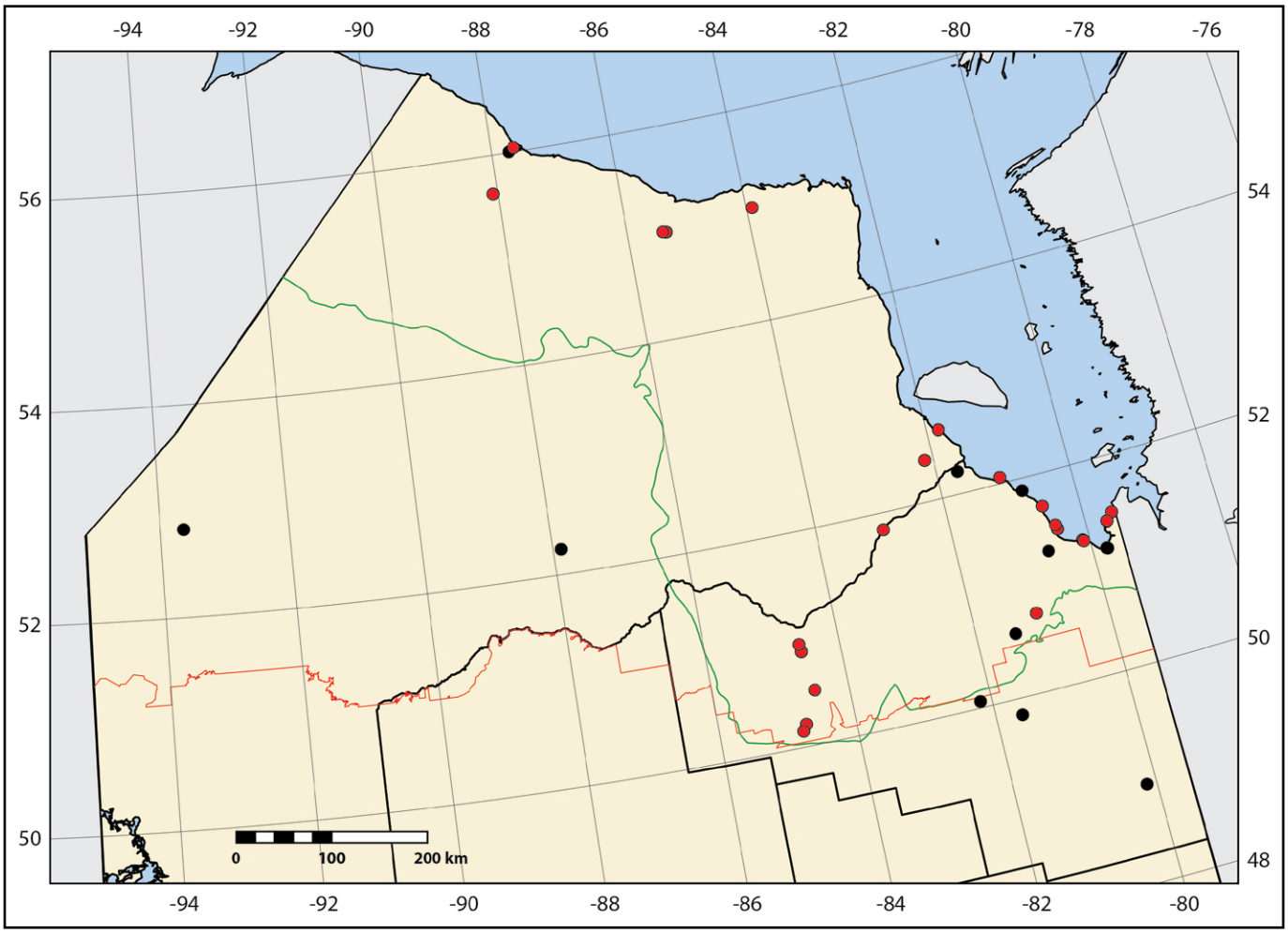

Figure 56. Records of *Discus whitneyi* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948, as *D. cronkhitei*); red circles: new records.

ROMIZ M10963, 4 specimens, 70% EtOH. **Site 29**: ROMIZ M10967, 67 specimens, 70% EtOH; ROMIZ M10976, 1 specimen, dry shell. **Site 37**: ROMIZ M11680, 14 specimens, dry shells. **Site 39**: ROMIZ M11699, 164 specimens, dry shells.

Range in Ontario — *Discus whitneyi* probably occurs throughout all of Ontario, although in the south, the dominant species of *Discus* seems to be *D. catskillensis*. Oughton (1948) did not separate *Discus catskillensis* from *D. whitneyi* (or *D. cronkhitei*, as he called it).

Habitat — *Discus whitneyi* was the most commonly collected terrestrial gastropod during Far North fieldwork and was found in a variety of habitats including forests, willow thickets, and sand dunes and beach ridges at the coast. Snails were collected from under logs and cobbles. Additional material was gathered in drift samples.

Superfamily Gastrodontoidea
Family Gastrodontidae
Genus *Striatura* Morse, 1864

Striatura exigua (Stimpson, 1850); Ribbed Striate; S4 Figures 57 and 58
Helix exigua Stimpson (1850): 175.
Striatura exigua — Whelan and Oughton (1939): 100. Pilsbry (1946): 490. Oughton (1948): 28.

Identification — The shell is minute (< 2 mm in diameter), depressed-heliciform, and translucent pale yellowish.

Figure 57. *Striatura exigua* (worn shell from drift), Site 11, ROMIZ M11603. Scale bar = 1 mm.

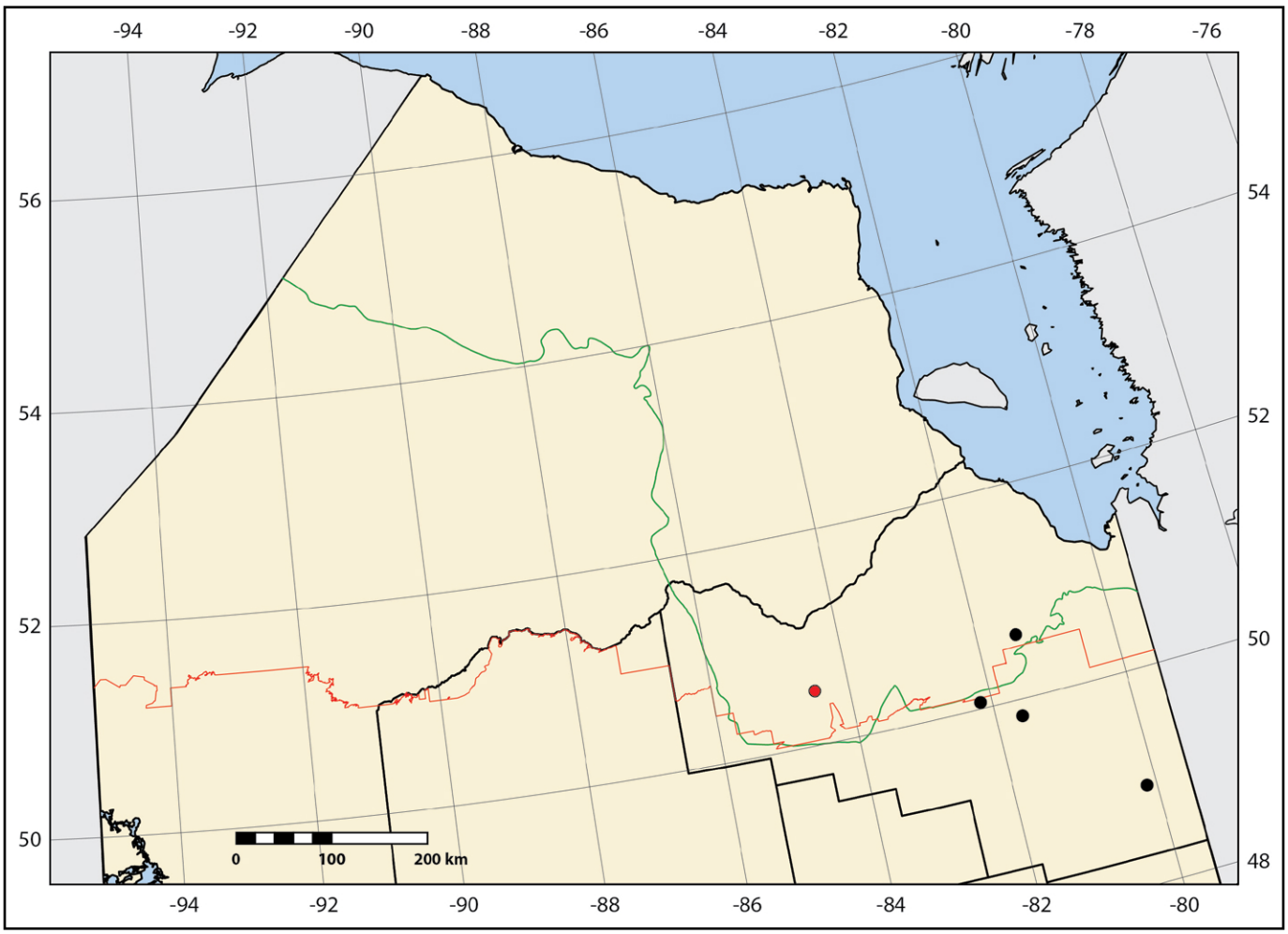

Figure 58. Records of *Striatura exigua* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circle: new record.

The umbilicus is large, about one-third of the shell width. The shell surface has widely spaced colabral riblets, with narrow spiral striae between. In Ontario, only *Striatura milium* (Morse, 1859) is similar, but that species has fewer, higher, and more widely spaced colabral riblets.

Material examined — Cochrane District: **Site 11**: ROMIZ M11603, 1 specimen, dry shell.

Range in Ontario — Oughton (1948) characterized this species as abundant and throughout much of the province and inferred it from all areas south of James Bay. The new record fills a gap but is within this range inferred by Oughton.

Habitat — The only Far North specimen collected was found in drift on the gravel floodplain of the Kenogami River. *Striatura exigua* is a forest-dwelling species, living in leaf litter (Whelan and Oughton 1939).

Genus *Zonitoides* Lehmann, 1862

Zonitoides arboreus (Say, 1817); Quick Gloss; S5
Figures 59 and 60
Helix arboreus [*sic*] Say (1817a): sp. 2, pl. 4, fig. 4.
Helix arborea — W. G. Binney (1861): 330.
Zonitoides arboreus — Dall (1905): 42. Whiteaves (1905): 4. Richards (1936): 58. Whelan and Oughton (1939): 100. Pilsbry (1946): 480.
Zonitoides arborea [*sic*] — Oughton (1948): 31.

Figure 59. *Zonitoides arboreus,* Site 23, ROMIZ M11638. Scale bar = 1 mm.

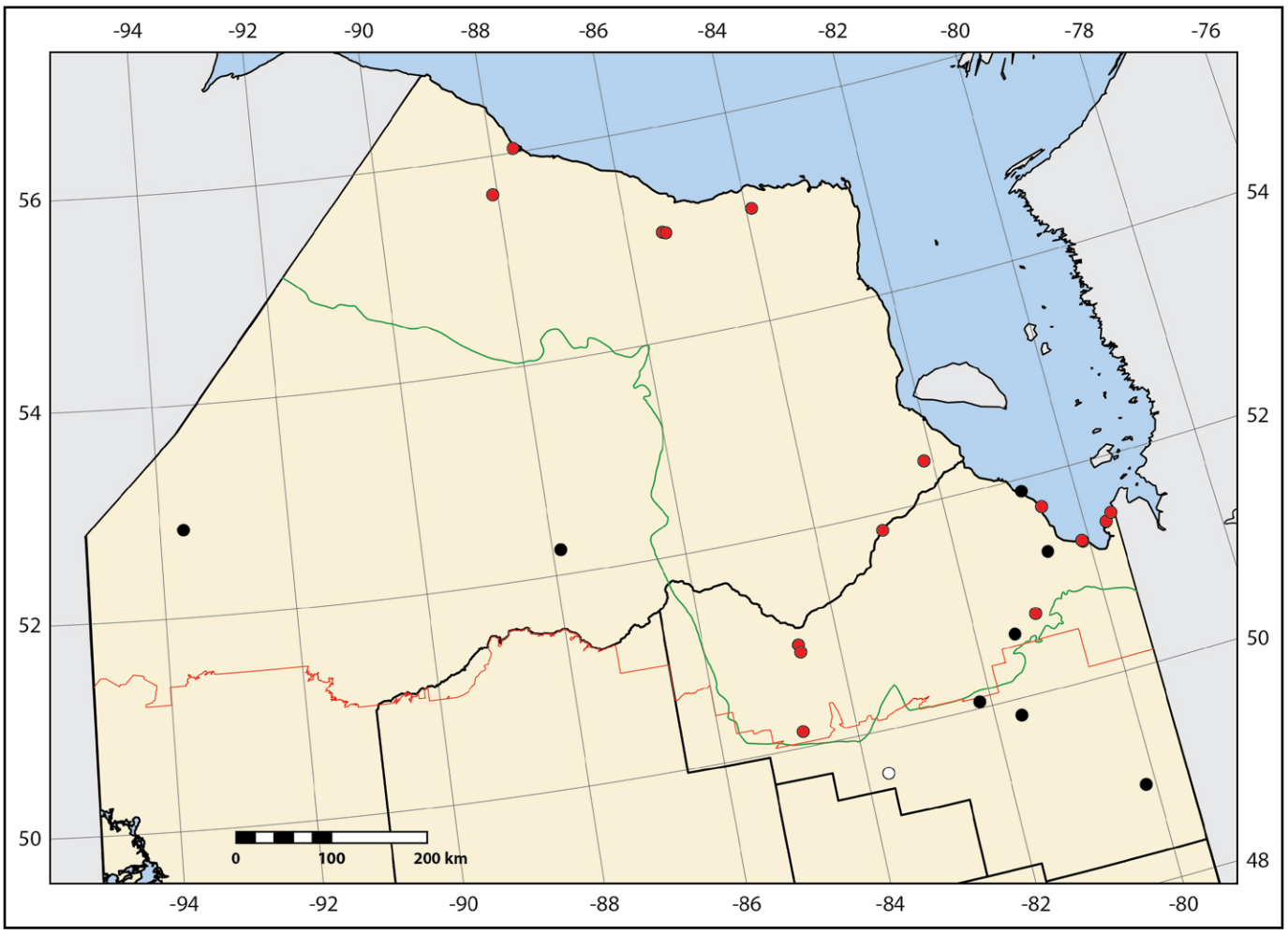

Figure 60. Records of *Zonitoides arboreus* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records; white circle: new record from outside of the Far North.

Identification — *Zonitoides arboreus* differs from *Z. nitidus* by having exceedingly fine spiral striae (on fresh shells) and a flatter spire. The animals are also differently pigmented; *Z. arboreus* are paler and *Z. nitidus* are almost black.

Material examined — *Cochrane District:* **Site 1**: ROMIZ M11531, 3 specimens, 70% EtOH. **Site 2**: ROMIZ M11537, 3 specimens, dry shells. **Site 3**: ROMIZ M11542, 8 specimens, 70% EtOH. **Site 4**: ROMIZ M11550, 17 specimens, 70% EtOH. **Site 8**: ROMIZ M11571, 1 specimen, dry shell. **Site 9**: ROMIZ M11584, 3 specimens, dry shells (in drift). **Site 12**: ROMIZ M11621, 9 specimens, dry shells. **Site 18**: ROMIZ M10984, 1 specimen, 70% EtOH. **Site 19**: ROMIZ M10994, 11 specimens, 70% EtOH. *Kenora District:* **Site 20**: ROMIZ M11626, 1 specimen, dry shell. **Site 23**: ROMIZ M11638, 2 specimens, dry shells. **Site 24**: ROMIZ M11645, 1 specimen, dry shell. **Site 25**: ROMIZ M10995, 1 specimen, dry shell. **Site 28**: MJO 39929, 2 specimens, 70% EtOH. **Site 37**: ROMIZ M11681, 2 specimens, dry shells. **Site 39**: ROMIZ M11700, 19 specimens, dry shells. *Additional material (outside the Far North):* **Site α**: ROMIZ M11711, 4 specimens, dry shells.

Range in Ontario — This species has a large range in Ontario. Oughton (1948) reported it north to southern James Bay as well as Attawapiskat and Borthwick lakes. Recent Far North collections extend the range north to the coast of Hudson Bay.

Habitat — Specimens were collected from under rocks and logs on coastal James Bay beach ridges, under logs and in drift on the floodplains of the Albany, Kenogami, Severn and Shamattawa rivers, and under logs and cardboard in spruce woods at Peawanuck and near Hearst.

Zonitoides nitidus (Müller, 1774); Black Gloss; S5
Figures 61 and 62
Helix nitida Müller (1774): 32.
Zonitoides nitidus — Goodrich (1933): 8. Richards (1936): 58. Pilsbry (1946): 476.
Zonitoides nitida [*sic*] — Oughton (1948): 32.

Identification — *Zonitoides nitidus* differs from *Z. arboreus* by the absence of exceedingly fine spiral striae (on fresh shells) and a slightly more raised spire. The animals are also differently pigmented; *Z. arboreus* are paler and *Z. nitidus* are almost black.

Material examined — *Cochrane District:* **Site 5**: ROMIZ M11555, 3 specimens, 70% EtOH. **Site 9**: ROMIZ M11585, 1 specimen, dry shell (under log). **Site 11**: ROMIZ M11604, 12 specimens, dry shells. *Kenora District:* **Site 28**: ROMIZ M10964, 1 specimen, 70% EtOH.

Range in Ontario — Oughton (1948) recorded this species north to Lake Attawapiskat and Fort Albany. The recent collections increase the number of Far North occurrences to six but do not extend the range of this species beyond previously known limits.

Habitat — Specimens were collected from under logs at the transition between a coastal James Bay sedge (*Carex paleacea*) dominated marsh and willow thickets, and under logs and in drift on the floodplains of the Albany and Kenogami rivers. *Zonitoides nitidus* is often characterized as a wetland species (Forsyth 2004), although in southern Ontario, it is common in more upland habitats (RGF, pers. obs.).

Family Euconulidae
Genus *Euconulus* Reinhardt, 1833

Euconulus fulvus (Müller, 1774) aggregate; Brown Hive; S4S5
Figures 63–64
Helix fulva Müller (1774): 56.
Helix chersina, non *Euconulus chersinus* (Say, 1821) — W.G. Binney (1861): 330.
Euconulus fulvus — Goodrich (1933): 8. Richards (1936): 59. Whelan and Oughton (1939): 100. Pilsbry (1946): 235. Oughton (1948): 18. Horsák et al. (2013): 98.

Identification — *Euconulus* species are very similar and difficult to distinguish and there is certainly an opportunity for taxonomic revision of this genus. The common, widespread, Holarctic *Euconulus* species is believed to be *E. fulvus* (Pilsbry 1948; Oughton 1948; Forsyth 2004); however, there may be at least one other, highly cryptic species in Canada. Very loosely, specimens seem to fall into two groups: those with more yellowish brown shells, less shining (but silky) and with finer (weaker) basal spiral striae; and, those with more reddish brown shells, often highly shining and with coarser spiral striae. In British Columbia, Forsyth (2004) recognized these two forms from different habitat types, and called the latter form, which also has

Figure 61. *Zonitoides nitidus*, Site 5, ROMIZ M11555. Scale bar = 1 mm.

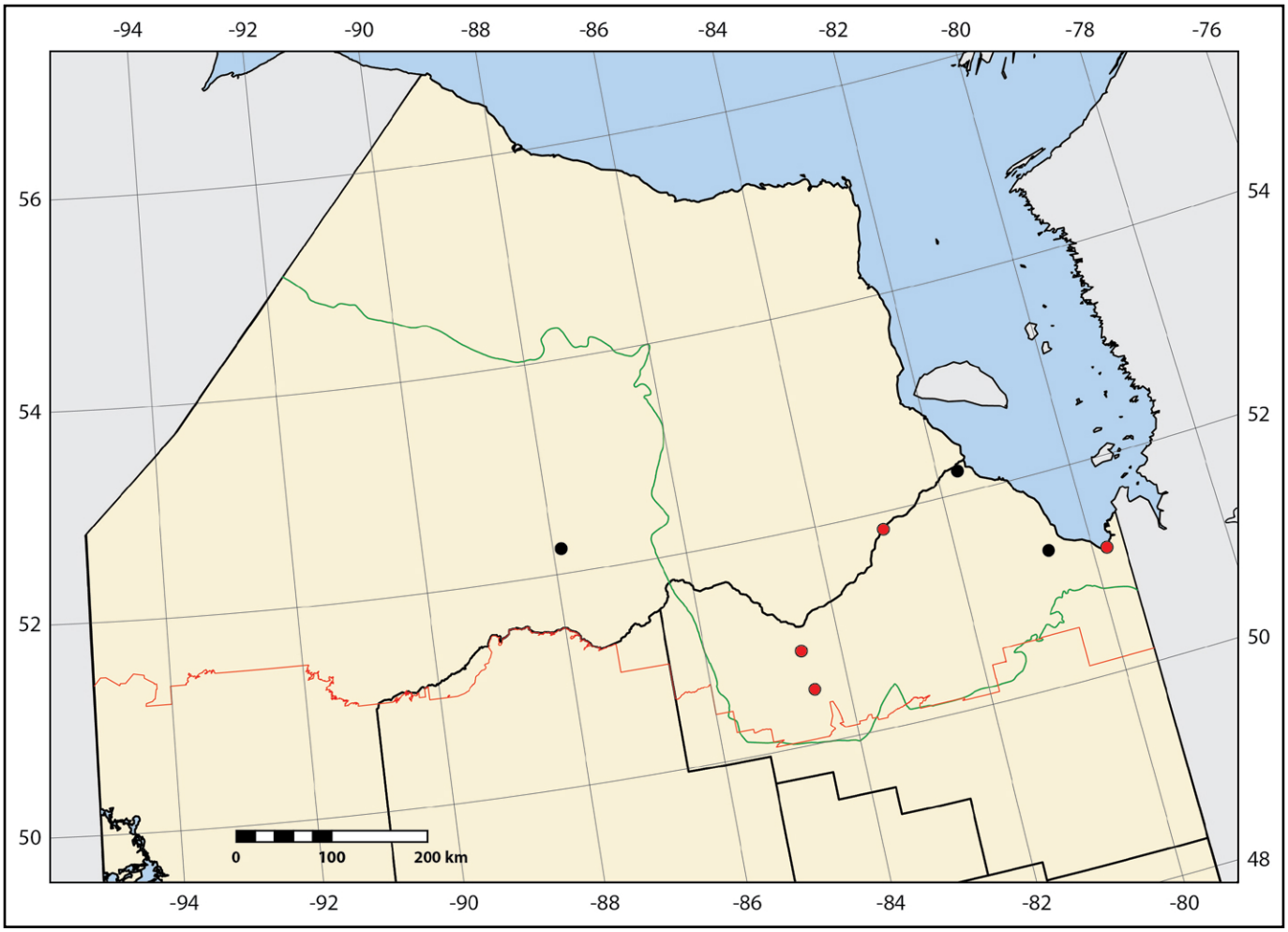

Figure 62. Records of *Zonitoides nitidus* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records. Although Oughton mapped Fort Albany, he did not mention it in his text or Table 1 (record not mapped here).

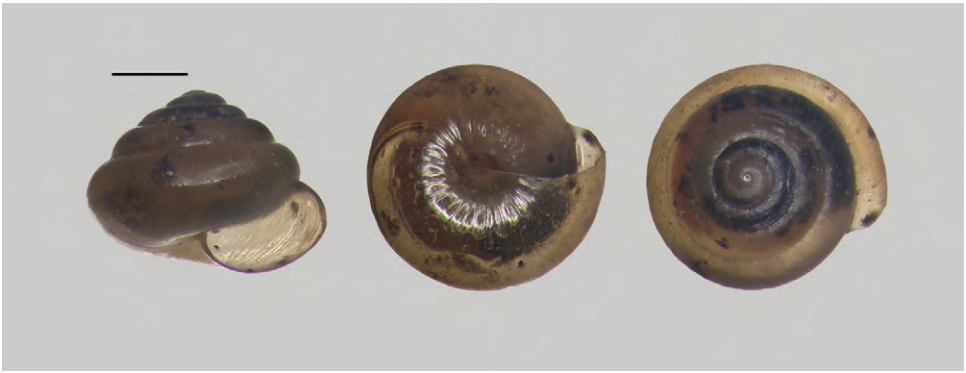

Figure 63. *Euconulus fulvus* aggregate, Site 4, ROMIZ M11551. Scale bar = 1 mm.

very dark, almost black body pigmentation, *E. praticola* (Reinhardt, 1883).

We think that shells of some of our Far North material are slightly darker, more reddish and shinier than other material in our samples. We also noticed that there is some variation in pigmentation of the animal: some animals were quite dark, some had very clearly defined, rather large dark blotches visible through the apical shells surfaces of the whorls; others (perhaps shells more *praticola*-like) were more generally suffused with grey, with some blotches, but not strongly contrasting. However, we are not certain that we can adequately distinguish between species—if that is what they are—and provisionally identify all our material as *E. fulvus* aggregate. Old, worn shells are even more difficult, as noted by Horsák et al. (2013) for the species in Europe.

The name *Euconulus praticola* was first utilized for North American snails by Forsyth (2004) for hygrophilic, dark-bodied *Euconulus* in British Columbia that had previously gone unnoticed in the literature and collections. In Ontario and the adjacent United States, other authors had discovered the same or similar form (Grimm 1996;

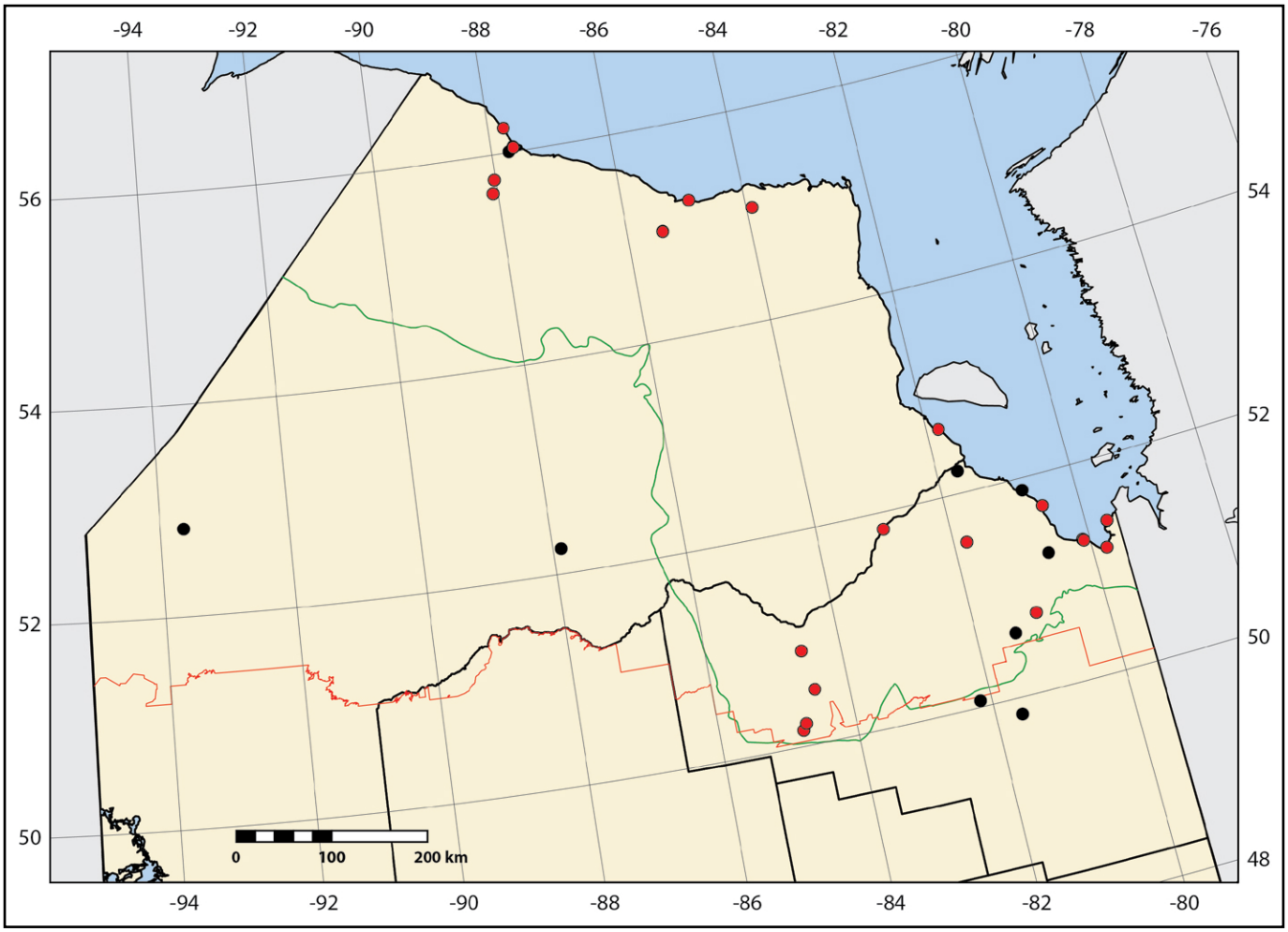

Figure 64. Records of *Euconulus fulvus* aggregate in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948)/ Red circles: new records.

Nekola 2004) but called it *E. alderi* (Gray, 1840). The differing names in use have their basis in the European literature and research that is still incomplete.

For several decades European and especially British literature called the wetland species *Euconulus alderi*. However, Falkner et al. (2002), in an annotation as part of a checklist, advocated using *praticola* for this form and suggested that *E. alderi* is a junior synonym of *E. trochiformis* (Montagu, 1803), which they thought is a woodland species separate from both *E. alderi* and *E. fulvus*. The main objection to the classification of Falkner et al. is that the details of their research have never been fully communicated. Although there has been resistance by some, especially in Britain, to accept this taxonomy, other authors have accepted it (e.g., Horsák et al. 2013). Regardless, whether North American populations are the same species as those in Europe is not known. Clearly, the systematics of this group is in need of revision; molecular data may help in this regard.

Material examined: — *Cochrane District:* **Site 1**: ROMIZ M11532, 1 specimen, 70% EtOH. **Site 2**: ROMIZ M11538, 3 specimens, 70% EtOH. **Site 3**: ROMIZ M11543, 2 specimens, 70% EtOH. **Site 4**: ROMIZ M11551, 2 specimens, 70% EtOH. **Site 5**: ROMIZ M11556, 2 specimens, 70% EtOH. **Site 9**: ROMIZ M11586, 4 specimens, dry shells (in drift). **Site 10**: ROMIZ M11590, 1 specimen, dry shell. **Site 11**: ROMIZ M11605, 10 specimens, dry shells. **Site 12**: ROMIZ M11622, 7 specimens, dry shells. **Site 14**: ROMIZ M10955, 4 specimens, 70% EtOH. **Site 19**: ROMIZ M10988, 4 specimens, 70% EtOH. *Kenora District:* **Site 20**: ROMIZ M11627, 2 specimens, dry shells. **Site 22**: ROMIZ M11634, 2 specimens, dry shells. **Site 24**: ROMIZ M11646, 3 specimens, 70% EtOH. **Site 26**: ROMIZ M11654, 2 specimens, 70% EtOH. **Site 28**: ROMIZ M10961, 3 specimens, 70% EtOH. **Site 29**: ROMIZ M10971, 1 specimen, 70% EtOH. **Site 34**: ROMIZ M11667, 5 specimens, 70% EtOH. **Site 37**: ROMIZ M11682, 9 specimens, dry shells. **Site 38**: ROMIZ M11685, 2 specimens, 70% EtOH. **Site 39**: ROMIZ M11701, 88 specimens, dry shells. **Site 40**: ROMIZ M11707, 3 specimens, 70% EtOH.

Range in Ontario — *Euconulus fulvus* aggregate occurs throughout the entire province, as indicated by Oughton (1948), although in southern areas of the province *E. polygyratus* (Pilsbry, 1899) is also present. The recent Far North collections fill gaps within the known range of this genus in Ontario.

Oughton (1948) did not recognize a *praticola*-like form, nor did anyone else, prior to Grimm (1996 as *E. alderi*), who wrote: "... seen from scattered alvars MPE [Mixedwood Plains ecozone] and mostly western muskeg to tundra habitats. Arctic–alpine to Hudsonian" (Grimm 1996).

Habitat — Recent Far North specimens were collected from drift samples, under logs on gravel floodplains of rivers and coastal beach ridges, under cardboard on tundra, and along the margins of spruce woods. Some material, such as that collected from under logs along a wet lakeshore and at the margin of a *Carex paleacea*-dominated coastal salt marsh, has a *praticola*-like appearance. This concurs with published records of *E. praticola* from British Columbia, which are characteristic of wetland habitats (Forsyth 2004, 2005).

Family Oxychilidae
Genus *Nesovitrea* C. M. Cooke, 1921

Nesovitrea binneyana (Morse, 1864); Blue Glass; S4
Figures 65 and 66
Helix binneyana Morse (1864): 13, 61.
Retinella binneyana — Whelan and Oughton (1939): 100. Pilsbry (1946): 259. Oughton (1948): 25.

Identification — Species of the genus *Nesovitrea* are recognized by their sculpture of rather widely-spaced, incised colabral lines. We identified slightly smaller, pale-coloured shells (and animals) as *N. binneyana*, and larger, darker specimens as *N. electrina*. It is possible that some worn shells from drift identified as *N. electrina* could be *N. binneyana*.

Figure 65. *Nesovitrea binneyana*, Site 23, ROMIZ M11639. Scale bar = 1 mm.

Material examined — Cochrane District: **Site 19**: ROMIZ M10993, 2 specimens, 70% EtOH. *Kenora District:* **Site 23**: ROMIZ M11639, 2 specimens, 70% EtOH. **Site 28**: ROMIZ M10962, 1 specimen, 70% EtOH.

Range in Ontario — Oughton (1948) reported this species north to James Bay and Borthwick Lake near the Manitoba border. The new record, Site 23, from the confluence of the Winisk and Shamattawa rivers lies north of the range inferred by Oughton (1948) by approximately 200 km.

Habitat — Specimens were collected from beneath logs on the gravel floodplains of the Albany and Shamattawa rivers and under logs on a southern James Bay coastal beach ridge.

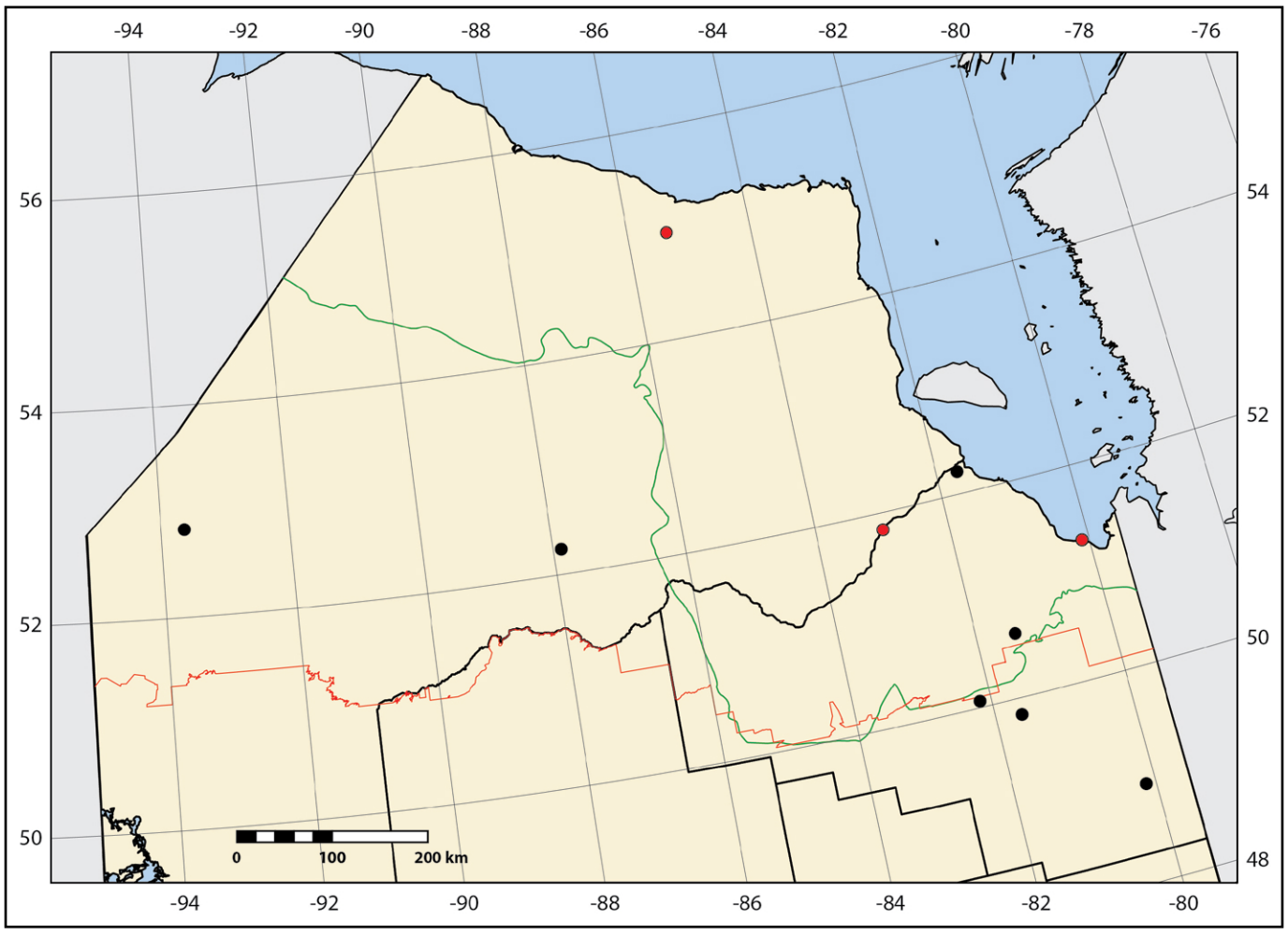

Figure 66. Records of *Nesovitrea binneyana* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

Figure 67. *Nesovitrea electrina,* Site 11, ROMIZ M11606. Scale bar = 1 mm.

Nesovitrea electrina (Gould, 1841); Amber Glass; S4 Figures 67 and 68

Helix electrina Gould (1841): 183.

Retinella hammonis — Goodrich (1933): 8. Richards (1936): 58. Whelan and Oughton (1939): 100. Oughton (1948): 26.

Retinella electrina — Pilsbry (1946): 256.

Identification —We separated this species from *Nesovitrea binneyana* by its slightly larger, darker coloured shell having more deeply incised colabral striae. The body is more darkly pigmented as well in *N. electrina* and this character was used when available. It is possible that some worn shells from drift could be *N. binneyana*.

Material examined — *Cochrane District:* **Site 1**: ROMIZ M11533, 4 specimens, 70% EtOH. **Site 2**: ROMIZ M11539, 1 specimen, dry shell. **Site 5**: ROMIZ M11557, 5 specimens, 70% EtOH. **Site 6**: ROMIZ M11563, 1 specimen, dry shell. **Site 9**: ROMIZ M11587, 1 specimen, dry shell (under logs), and 2 specimens, dry shells (in drift). **Site 11**: ROMIZ M11606, 14 specimens, dry shells. **Site 12**: ROMIZ M11623, 7 specimens, dry shells. *Kenora District:* **Site 29**: ROMIZ M10972, 5 specimens, 70% EtOH. **Site 37**: ROMIZ M11683, 6 specimens, dry shells. **Site 39**: ROMIZ M11702, 34 specimens, dry shells.

Range in Ontario — This species likely occurs throughout Ontario; Oughton (1948) had collections north to the coast of Hudson Bay. The new records fill gaps

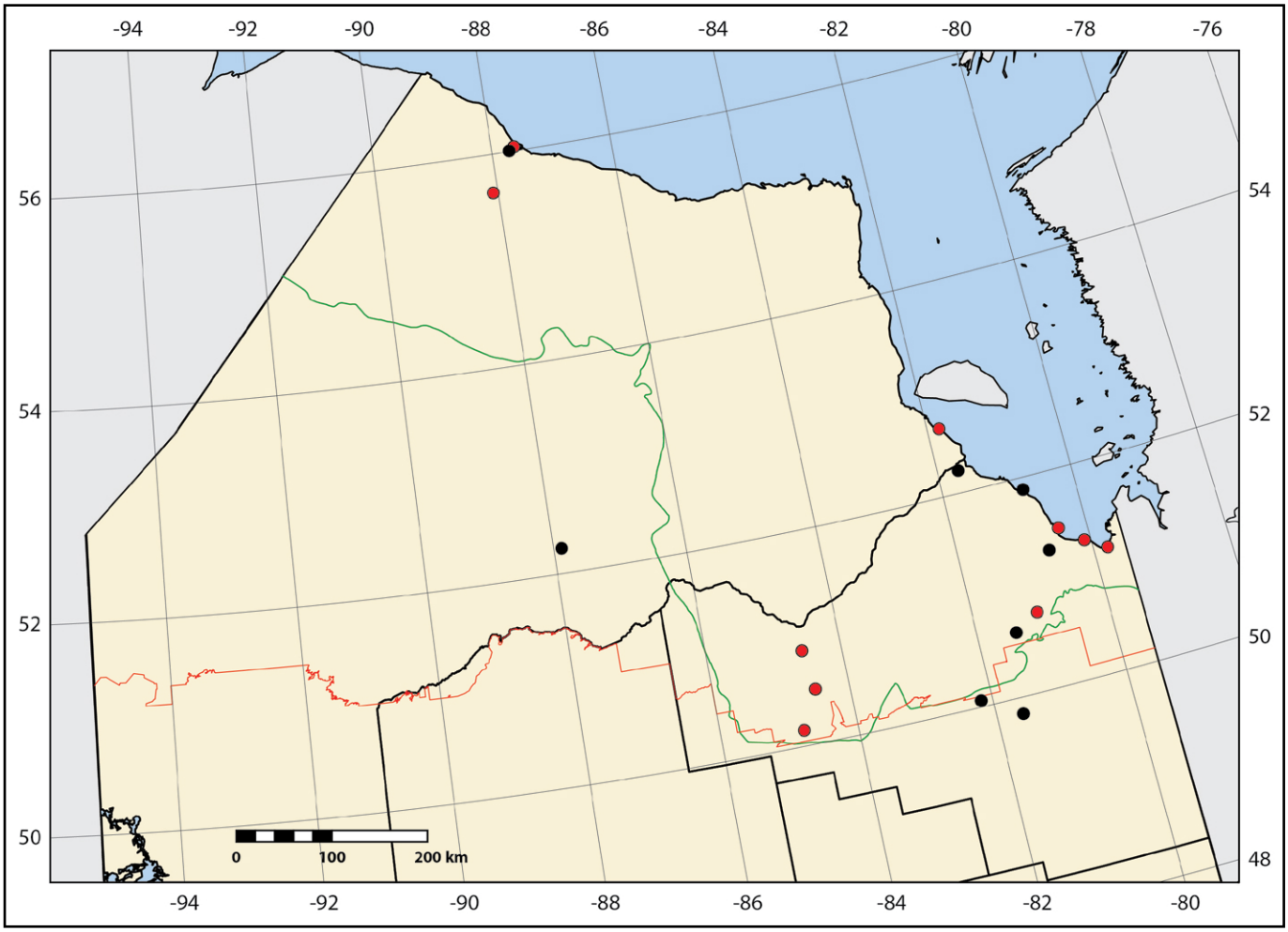

Figure 68. Records of *Nesovitrea electrina* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

within the range. In agreement with Oughton (1948), *Nesovitrea electrina* is much commoner in the Far North than *N. binneyana*.

Habitat — Specimens were collected from under logs on coastal beach ridges, at the transition between a coastal James Bay sedge (*Carex paleacea*) dominated marsh and willow thickets, under logs and in drift on the floodplains of the Kenogami and Severn rivers.

Superfamily Limacoidea
Family Agriolimacidae
Genus *Deroceras* Rafinesque, 1820

Deroceras laeve (Müller, 1774); Meadow Slug; S5
Figure 69
Limax laevis Müller (1774): 539.
Limax (Deroceras?) gracilis Rafinesque (1820): 10.
Limax campestris A. Binney (1842): 52.
Deroceras laeve var. *campestre* — Richards (1936): 59.
Deroceras gracile — Whelan and Oughton (1939): 100. Oughton (1948): 44.
Deroceras laeve — Pilsbry (1948): 539.

Identification — This is a small, dark brown slug with a short keel at the posterior end of the tail, and a pattern of concentric ridges on the mantle. Genitalia best characterize *Deroceras* species (e.g., Wiktor 2000), but genital polymorphism (complete or partial loss of the male reproductive organs) is common, with all individuals in some populations aphallic (Wiktor 2000). We did not dissect our specimens; we recognized this species by the dark pigmentation and thin-skin, along with more general characters of the genus.

Material examined — *Cochrane District:* **Site 5**: ROMIZ M11558, 3 specimens, 70% EtOH. **Site 7**: ROMIZ M11567, 6 specimens, 70% EtOH. **Site 17**: ROMIZ M10983, 1 specimen, 70% EtOH. **Site 19**: ROMIZ M10986, 1 specimen, 70% EtOH. *Kenora District:* **Site 21**: ROMIZ M11630, 1 specimen, 70% EtOH. **Site 23**: ROMIZ M11640, 2 specimens, 70% EtOH. **Site 24**: ROMIZ M11647, 3 specimens, 70% EtOH. **Site 26**: ROMIZ M11655, 3 specimens, 70% EtOH. **Site 29**: ROMIZ M10966, 2 specimens, 70% EtOH. **Site 31**: ROMIZ M11660, 2 specimens, 70% EtOH. **Site 35**: ROMIZ M11668, 1 specimen, 70% EtOH.

Range in Ontario — *Deroceras laeve* occurs throughout Ontario, as inferred by Oughton (1948). This species has a huge distribution in both the Palaearctic and Nearctic realms. It is apparently autochthonous from the tropics of Central America north to Baffin Island, Nunavut (Pilsbry 1948; Wiktor 2000). This is the only native species of slug in Ontario's Far North and the most widespread species in the province. The new records fill gaps in the species' distribution as presented by Oughton (1948).

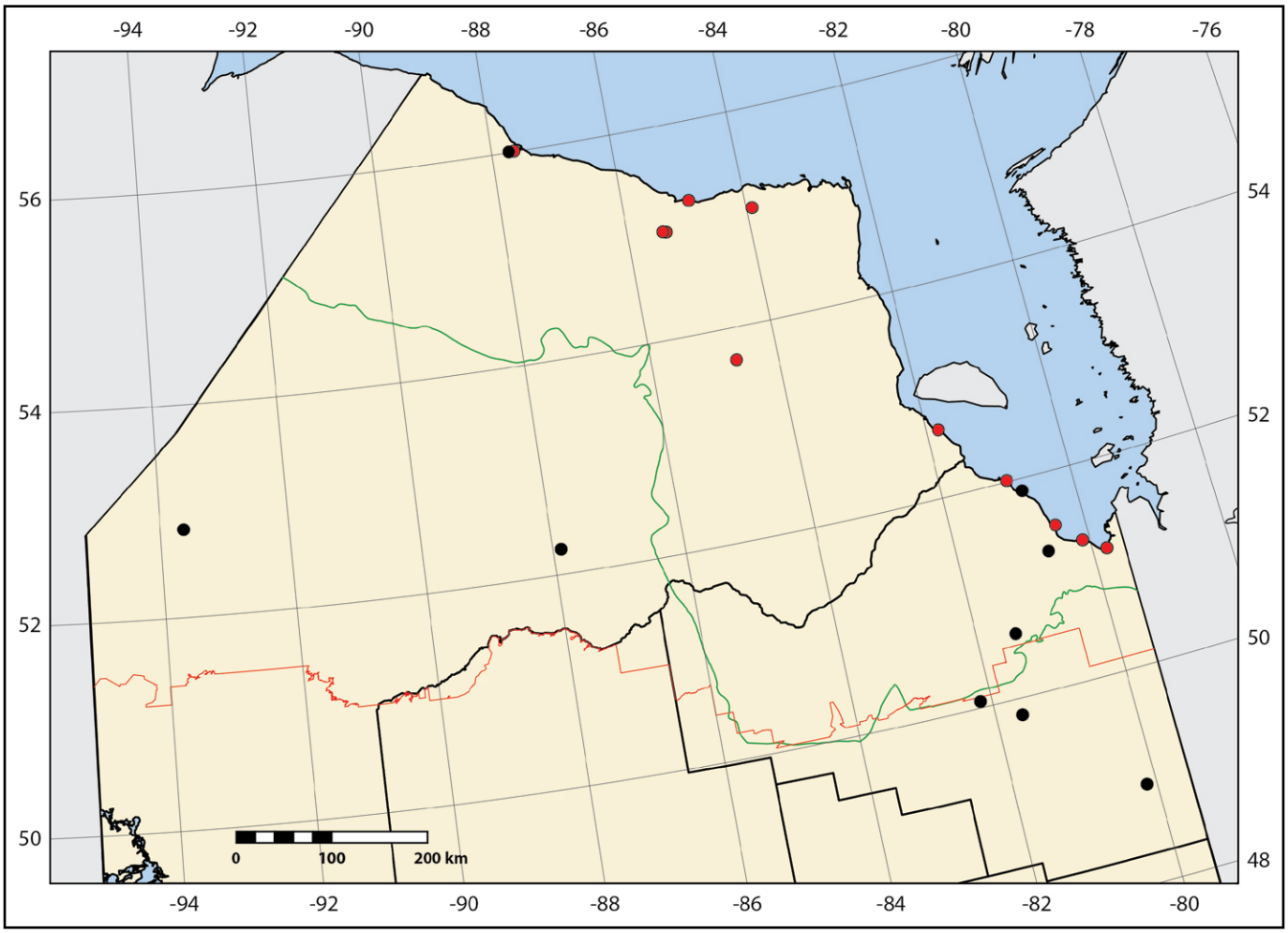

Figure 69. Records of *Deroceras laeve* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

Habitat — Specimens were collected from under logs and boards on coastal James Bay beach ridges, under logs on the floodplains of major rivers, hummocky tundra, in moist spruce woods and willow thickets, and on disturbed ground.

Deroceras reticulatum (Müller, 1774); Grey Fieldslug; SNA

Figure 70

Limax reticulatus Müller (1774): 10.

Deroceras reticulatum — Oughton (1948): 43. Pilsbry (1948): 534. Wiktor (2000): 507. Grimm et al. (2010): 86.

Agriolimax agrestis, non *Deroceras agreste* (Linnaeus, 1758) — Goodrich (1933): 9.

Deroceras agreste, non *Deroceras agreste* (Linnaeus, 1758) — Whelan and Oughton (1939): 100.

Identification — This slug is larger than *Deroceras laeve* and pale grey with darker mottling. Genitalia best characterize *Deroceras* species (e.g., Wiktor 2000), and while we did not dissect the single specimen collected, the thick-skinned, mottled appearance clearly indicates that it is *D. reticulatum*.

Material examined — Cochrane District: **Site 15**: ROMIZ M10958, 1 specimen, 70% EtOH.

Range in Ontario — Introduced from Europe and the only non-native terrestrial gastropod in the Far North. *Deroceras reticulatum* is a common, widespread, invasive species throughout southern Ontario (Grimm et al. 2010; RGF unpublished data). The previous most northern "confirmed" location for this species was Smoky Falls, Cochrane District, just outside the Far North (Whelan and Oughton 1939; Oughton 1948). Earlier, however, Goodrich (1933: 9) reported "numbers of a grayish-white slug" that he tentatively identified as *Agriolimax agrestris* before losing the specimens in transit. For many years, the differences between *Deroceras agreste* and the much more invasive *D. reticulatum* were not understood and the species were combined under the earlier name, as *A. agrestis* or *D. agreste* (Wiktor 2000). The new record perhaps validates the earlier report by Goodrich (1933), which Richards (1936) doubted and thought was *D. laeve*. Moosonee is on the northwest bank of the Moose River opposite the island in the river occupied by Moose Factory. Long cold winters do not appear to limit the northern spread of this invasive species, as pointed out by Oughton (1948). Elsewhere in Canada, this species occurs north of 60° N (Hay River, Northwest Territories,

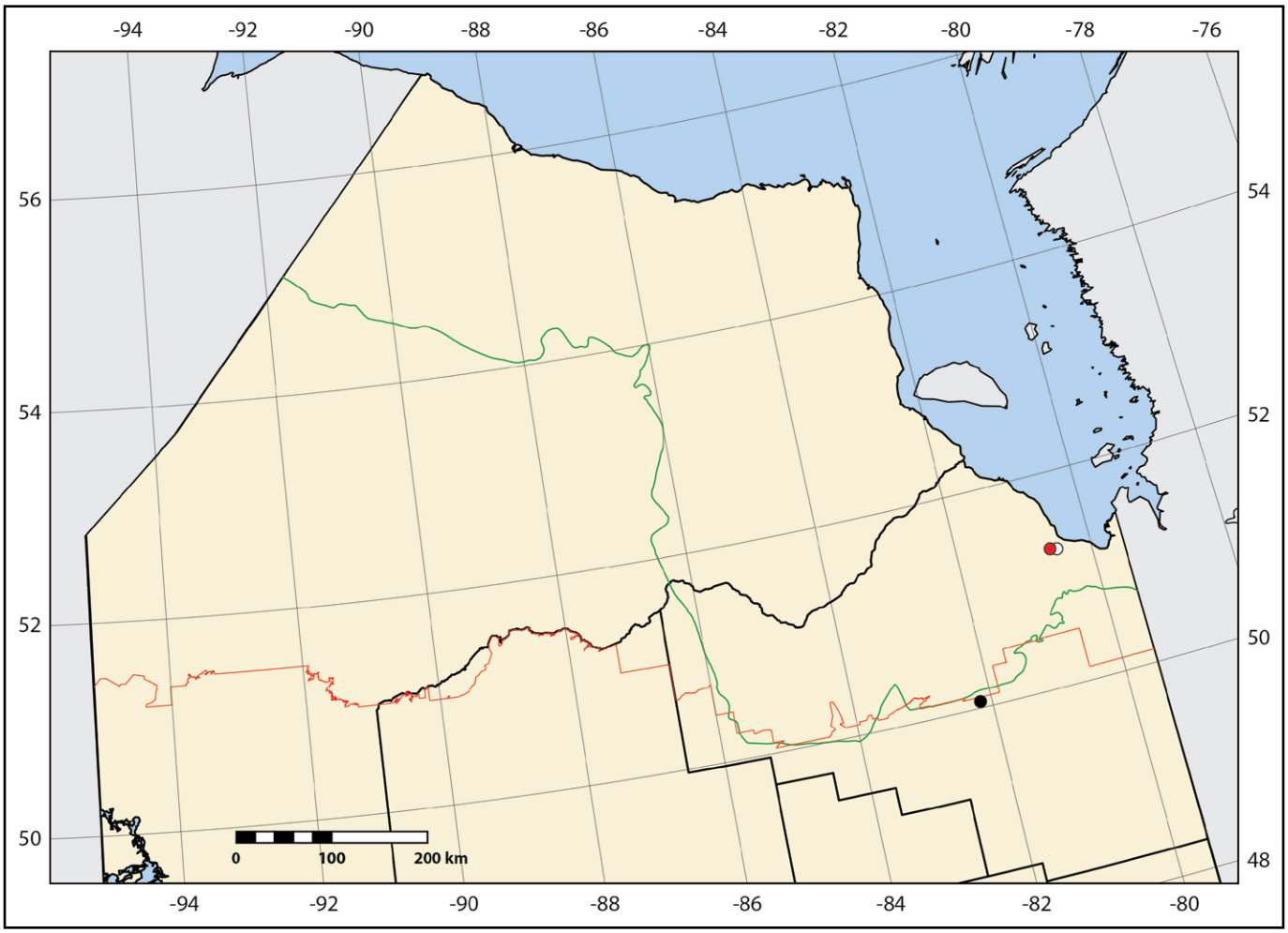

Figure 70. Records of *Deroceras reticulatum* in Kenora and Cochrane districts, Ontario. Black circle: data from Oughton (1948); white circle: Moose Factory record from Goodrich (1933); red circle: new record.

60.8247° N, 115.7783° W, is the northernmost known to the authors; RGF unpublished data).

Habitat — This species was found under debris at Moosonee by MJO and previously reported under loose boards at Moose Factory by Goodrich (1933).

Family Vitrinidae
Genus *Vitrina* Draparnaud, 1801

Vitrina angelicae Beck, 1837; Eastern Glass-snail; S4
Figures 71 and 72
Vitrina angelicae Beck (1837): 1.
Vitrina limpida Gould (1850): 243 — Dall (1905): 37. Whiteaves (1905): 4. W. G. Binney (1861): 330. Whelan and Oughton (1939): 100. Oughton (1948): 30. Pilsbry (1946): 501.
Vitrina angelicae angelicae — Forcart (1955): 161.
Vitrina angelicae limpida — Forcart (1955): 162.

Identification — The very thin, translucent, colourless, and depressed-globose shell with few and rapidly enlarging whorls is unlike that of any other land snail in Ontario.

For many years, the populations of eastern North American *Vitrina* species were known as *V. limpida*. However, Forcart (1955) found that North American *V. limpida* is conspecific with Greenlandic *V. angelicae*. Although he recognized subspecies, *V. angelicae angelicae* and *V. angelicae limpida*, little evidence was given to support these as distinct subspecies. He wrote that the genital anatomy of both purported taxa is identical and that shells with the same number of whorls were slightly larger in *angelicae* than in *limpida*. This difference in size could well be environmental, and division of *V. angelicae* into subspecies by this character and geography is probably not defensible. Turgeon et al. (1998) have used *V. angelicae* for the eastern North American species of *Vitrina*.

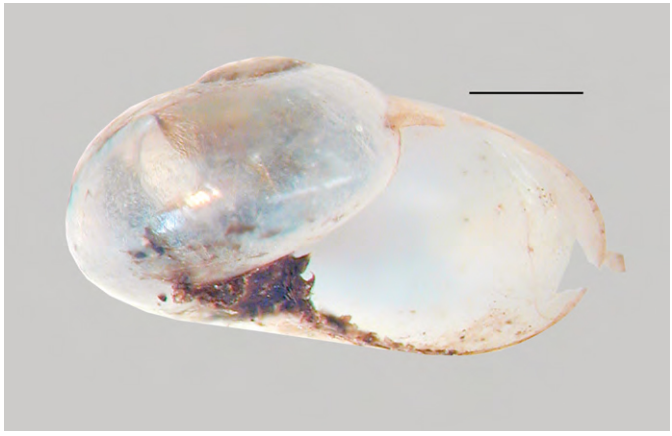

Figure 71. *Vitrina angelicae*, Site 23, ROMIZ M11641. Scale bar = 1 mm.

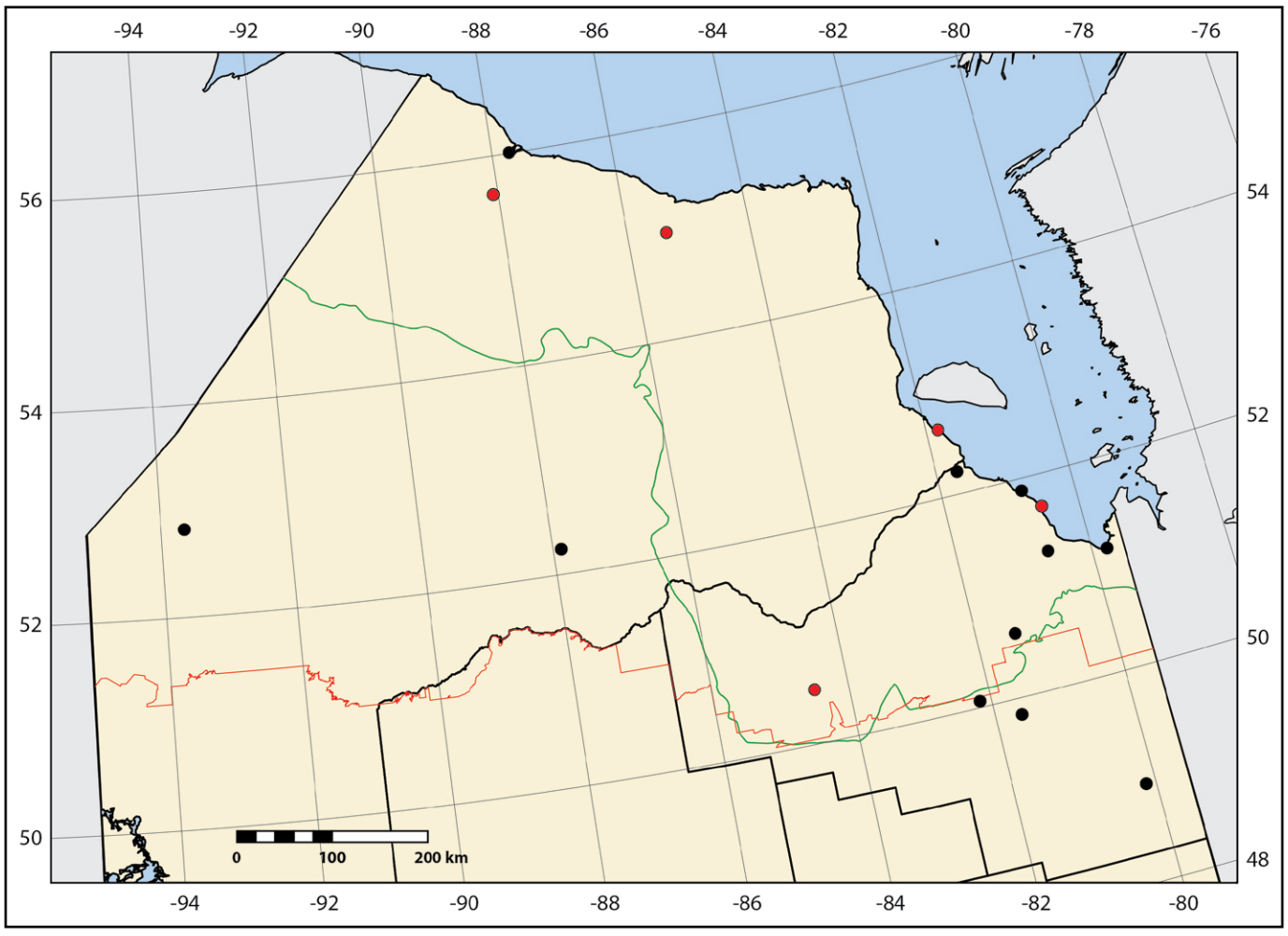

Figure 72. Records of *Vitrina angelicae* in Kenora and Cochrane districts, Ontario. Black circles: data from Oughton (1948); red circles: new records.

Material examined — Cochrane District: **Site 4**: ROMIZ M11552, 4 specimens, dry shells. **Site 11**: ROMIZ M11607, 1 specimen, dry shell. *Kenora District:* **Site 23**: ROMIZ M11641, 1 specimen, dry shell. **Site 29**: ROMIZ M10970, 3 specimens, 70% EtOH. **Site 39**: ROMIZ M11703, 1 specimen, dry shell.

Range in Ontario — Oughton (1948) considered this a widespread species in Ontario, apparently only absent in the Algonquin Park–Lake Nipissing region. We suspect that this absence may be an artefact of insufficient collecting in that area. According to Oughton (1948), this species is most common in the north, where although less surveyed for terrestrial molluscs, the majority of collections derive from. The four new records do not add significantly to the known range in Ontario of *Vitrina angelicae*.

Habitat — All but one of our samples were collected in stream drift. One sample was found under logs on an open, gravel river floodplain. *Vitrina angelicae* is often in open habitats, but may also occur in forests (Oughton 1948; Hubricht 1985; RGF unpublished data).

DISCUSSION

Thirty-four species of terrestrial molluscs were identified from the recent collections in the Ontario Far North. Of these, most have been previously found (31 species), although publications by Oughton (1948) and others may have used a different name. One of only two slugs, *Deroceras reticulatum* is the only exotic species. Its possible occurrence at Moose Factory in the 1930s is now confirmed by a recently collected specimen from nearby Moosonee. Three species — *Vertigo* cf. *genesii, Vallonia pulchella,* and *Gastrocopta similis* — are newly recorded from the Far North.

Besides being newly reported from the Far North, *Vertigo* cf. *genesii* is also new for Ontario. This species and five others are only known from arctic Ontario or have the majority of occurrences from this part of the Far North. *Vertigo hannai, V. oughtoni* and *Discus shimekii* are only known in Ontario from (and may possibly be restricted to) the arctic coast of Hudson Bay. *Pupilla hudsonianum* and *Columella columella* have been found further south. *Pupilla hudsonianum* is a species, recently recognized as distinct from *P. muscorum,* with a huge range across boreal North America (Newfoundland to Alberta; Nekola et al. 2015) but most Ontario *Pupilla* specimens have yet to be re-examined.

The relatively southern occurrence of *Columella columella* from an area along the north shore of Lake Superior (Nekola and Coles 2010) — an area known to have disjunct populations of arctic-alpine species (Griven and Soper 1981; Crins et al. 2009) — is interesting as it could signify either a continuous distribution south from the arctic coast for this species or, just as likely, a disjunct relict population. (As an area of future fieldwork, the north shore of Lake Superior may be worthwhile.)

A xerothermic calciphile (Grimm 1996), *Gastrocopta similis* was not expected to occur outside the limestone terrain of the Mixedwood Plains ecozone of southern Ontario.

Three of the species found (*Discus shimekii, Vertigo hannai,* and *V. oughtoni*), were only ever found once before in Ontario, from drift of the Severn River. The recent Far North collections have confirmed the continued presence of all three species in Ontario, although for the first two species, they remain known only from river drift. Although Oughton (1948) thought that his collections of *Discus shimekii* from Severn River drift could be washed out Pleistocene fossils, it is just as likely that living populations of this species are extant in Ontario, although we cannot prove this. The best preserved shells largely still had their periostracum (a membrane-like covering consisting of conchiolin over the largely calcium carbonate shell), and association with other land snail species still found in that part of Ontario today offer support for an extant population. However, Pleistocene fossils may retain periostracum (David Campbell, pers. comm.).

Disregarding changes in name and taxonomic rank (subspecies to species), only four species reported by Oughton (1948) from the Far North were not found in this study. These are:

- *Planogyra asteriscus* (Morse, 1857): reported in the north from three locations in Cochrane District, with Onakawana the farthest north (Oughton 1948).
- *Vertigo nylanderi* Sterki, 1909: reported north to Onakawana (Oughton 1948), accepted by Nekola and Coles (2010).
- *Vertigo ovata* (Say, 1822): reported in Ontario north and west to Borthwick Lake (Oughton 1948), accepted by Nekola and Coles (2010).
- *Vertigo pygmaea* (Draparnaud, 1801): originally reported from Moose Factory by Goodrich (1933), record accepted by Oughton (1948), overlooked or not accepted by Nekola and Coles (2010).

It is probable that targeted searches in suitable habitats would have found the first three of these species. For example, *Vertigo ovata* is not uncommon in marshes and other wetland habitats. Leaf litter samples may have found these species as well as living material of other microsnails, including *Strobilops labyrinthicus, Punctum minutissimum,* and *Striatura exigua* (found in this study, but not in great numbers), as well as *Striatura milium* (Morse, 1859), a species reported from Fraserdale, Cochrane District (Oughton 1948), just outside of the study area.

The identification of *Vertigo pygmaea* from Moose

Factory is probably incorrect. Courtesy of Dr. T. Lee at the University of Michigan Museum of Zoology (UMMZ), a photograph of Goodrich's material, a single shell, was studied (UMMZ 55956; Figure 73). It is unlikely *V. pygmaea,* and seems closest to *V. hannai*.

Figure 73. The specimen from Moose Factory, Ontario (UMMZ 55956) , originally identified as *Vertigo pygmaea* by Goodrich (1933). Photograph by Dr. T. Lee (UMMZ). Scale bar = 0.5 mm.

Subnational conservation ranks

Recently, subnational conservation status ranks have been reviewed and updated for terrestrial molluscs in Ontario as part of the General Status of Wild Species in Canada project (CESCC 2011). Conservation status ranks are assigned at three levels, global (G-ranks), national (N-ranks), and subnational (S-ranks) by NatureServe and its member programs such as the Ontario Natural Heritage Information Centre (see Faber-Langendoen et al. 2012 for methodology and rank definitions). These conservation status ranks are used to guide conservation actions and help to prioritize species for more detailed status assessments such as those undertaken by COSSARO (Committee on the Status of Species at Risk in Ontario) and COSEWIC (Committee on the Status of Endangered Wildlife in Canada).

In general, most species encountered in the Far North have broad Nearctic ranges. This is exemplified by such species as *Discus whitneyi, Pupilla hudsonianum,* and *Vertigo arthuri*. A pattern common to many minute land snail species is near-continental distributions (Nekola 2009), and some species are Holarctic (e.g., *Euconulus fulvus* and *Columella columella*).

By definition, there is not much difference between the subnational conservation ranks of S4 (common and apparently secure in Ontario, usually with more than 100 occurrences in the province) and S5 (very common and demonstrably secure in Ontario). Although we introduced this paper with the premise that the Ontario terrestrial mollusc fauna is better known than most provinces and territories of Canada, as a group of organisms, these molluscs have been largely neglected in recent decades. We think that for the majority of terrestrial mollusc species in northern Ontario, many more than 100 occurrences within the province could be found with minimal effort in relatively intact habitats, if the fieldwork could be done. It is likely that most Far North species currently ranked as S4 may more appropriately be ranked S5 with additional fieldwork documenting their widespread occurrence.

Three of the four Far North terrestrial mollusc species with conservation ranks higher than S4 are more-or-less restricted to areas along the arctic coast (*Discus shimekii, Vertigo* cf. *genesii,* and *V. oughtoni*). It is probable that these species are not all that uncommon in tundra habitats and would rank lower if more and targeted fieldwork were conducted.

It is notable that two Ontario Far North terrestrial mollusc species are currently ranked as being of global conservation concern by NatureServe. *Vertigo hannai* is ranked G2 globally by NatureServe (2015) and is mapped by Nekola and Coles (2010) as occurring in eastern Canada only in the Churchill area, Manitoba, and at Fort Severn, Ontario; it also occurs in northern Alaska. *Vertigo oughtoni* is ranked as G2G3 globally by NatureServe (2015) and mapped in eastern North America only from the Churchill area, Manitoba, southern Baffin Island, Nunavut, Anticosti Island, Quebec, and Fort Severn, Ontario (Nekola and Coles 2010). Ontario populations of both these snails are important to the global conservation of the species though further fieldwork within their ranges may alter the global conservation ranks.

Application of conservation ranks to most succineids probably would be inadvisable given the taxonomic difficulties of the group. A rank of SU (unrankable, often because of low search effort or *cryptic nature of the species* [emphasis added], there is insufficient information available to assign a more accurate rank; more data is needed) for the majority of succineid species in Ontario is appropriate at this time.

Conclusions

Although the collections of terrestrial molluscs made between 2009 and 2014 in Ontario's Far North were incidental to other fieldwork performed during other field activities, these collections nevertheless add important new data towards understanding the terrestrial mollusc fauna of northern Ontario. We strongly encourage that even incidental collections be made when possible, especially in remote and infrequently visited areas of the province (and country).

ACKNOWLEDGEMENTS

This study was conducted as part of the broader Far North Biodiversity Project implemented by the Ontario Ministry of Natural Resources and Forestry (OMNRF) for the purpose of providing a foundation of biodiversity information across Ontario's Far North in support of community-based land use planning. Funding for the Far North Biodiversity Project (FNBP) was provided by the OMNRF's Far North Branch. The authors would like to extend a special thanks to Jane Toppozini, Paul Sampson, and Jim Mackenzie for making this project possible; our steering committee of Dean Phoenix, Ken Abraham, Bill Crins, Bob Watt, Dennis Donovan, Don Sutherland, and Chris Davies; and the communities of Peawanuck, Marten Falls, Webequie, Weenusk, Summer Beaver (Nibinamik), Kitchenuhmaykoosib Inninuwug, Keewaywin, Fort Albany, and Fort Severn for their hospitality and support in working within their traditional lands. Julie Belliveau, Eric Snyder, and Mary Ann Young assisted with collecting some of the terrestrial mollusc specimens reported on here, and Sam Brinker, Bill Crins, Colin Jones, Alex Howard, Zaid Jumean, Rachelle Lalonde, Charles Latremouille, Mike McMurtry, Shannon Page, John Riley, Don Sutherland, Peter Uhlig, and Stan Vasiliauskas also assisted with fieldwork.

RGF thanks Dr. Taehwan Lee, University of Michigan, Museum of Zoology, for kindly providing the photograph of "*Vertigo pygmaea*" from Moose Factory, Dr. David Campbell, Garner-Webb University, for help with a question about periostracum in Pleistocene fossils, and Maureen Zubowski, Royal Ontario Museum, for assistance and patience with depositing our voucher specimens.

We also thank two anonymous reviewers for their valuable comments on the manuscript.

LITERATURE CITED

Abraham, K.F. and C.J. Keddy. 2005. The Hudson Bay lowland; pp. 118–148, in: Fraser, L.H. and P.A. Keddy (eds.). The world's largest wetlands: ecology and conservation. New York: Cambridge University Press.

Adams, C.B. 1841. Description of a new species of *Pupa*. Middlebury College, Vermont: Adams. [1] p.

Adams, C.B. 1842. Fresh-water and land shells of Vermont; pp. 151–169, in: Z. Thompson (ed.), History of Vermont, natural, civil, and statistical, in three parts, with a new map of the state, and 200 engravings. Part 1, Natural history of Vermont. Burlington: Chauncey Goodrich. http://biodiversitylibrary.org/page/25466529

Anthony, J.G. 1840. Descriptions of three new species of shells. Boston Journal of Natural History 3(1–2): 278–279, pl. 3 [part]. http://biodiversitylibrary.org/page/32416015

Baker, F.C. 1939. Land and freshwater Mollusca from western Ontario. Canadian Journal of Research, Section D 17(4): 87–102. doi: 10.1139/cjr39d-011

Beck, H. 1837. Index Molluscorum præsentis ævi Musei principis augustissimi Christiani Frederici. Mollusca Gastræopoda Pulmonata. Fasciculus secundus: 1–100. Hafniæ: Beck. http://biodiversitylibrary.org/page/43577314

Bequaert, J.C. and W.B. Miller. 1973. The mollusks of the arid southwest with an Arizona checklist. Tucson: University of Arizona Press. xiv + 271 pp.

Binney, A. 1842. [Dr. Binney also read a paper, "on some of the species of naked pneumonobranchus Mollusca of the United States" ...]. Proceedings of the Boston Society of Natural History 1: 51–52. http://biodiversitylibrary.org/page/9490479

Binney, W.G. (ed.). 1858. The complete writings of Thomas Say on the conchology of United States. New York: H. Baillière. viii + 252 pp., 75 pls. doi: 10.5962/bhl.title.9158

Binney, W.G. 1861. Catalogue of land and freshwater univalve mollusks collected in British America by Messrs. Ross, Kennicott, and Drexler, and deposited in the Smithsonian Collection. Proceedings of the Academy of Natural Sciences of Philadelphia for 1861 [=13]: 330. http://biodiversitylibrary.org/page/26313036 http://www.jstor.org/stable/4059562

Binney, W.G. 1863. Bibliography of North American Conchology previous to the year 1860, prepared for the Smithsonian Institution. Part I. American authors. Washington, D.C.: Smithsonian Institution. viii + 650 pp.

Bouchet, P., J. Frýda, B. Hausdorf, W. Ponder, Á. Valdés and A. Warén. 2005. Working classification of the Gastropoda; pp. 239–283, in: P. Bouchet and J.-P. Rocroi. Classification and nomenclator of gastropod families. Malacologia 47(1–2). http://biodiversitylibrary.org/page/25127200

CESCC (Canadian Endangered Species Conservation Council). 2011. Wild Species 2010: The General Status of Species in Canada. National General Status Working Group. Accessed at http://publications.gc.ca/collections/collection_2011/ec/CW70-7-2010-eng.pdf, 15 March 2015.

CGNDB (Canadian Geographical Names Data Base). 2015. Geographical names. Accessed at http://www4.rncan.gc.ca/search-place-names/search?lang=en, 1 March 2015.

Clapp, G.H. 1906. Notes on *Carychium* and description of a new variety. The Nautilus 19(12): 138–140, pl. 138. http://biodiversitylibrary.org/page/1755719

Crins, W.J., P.A. Gray, P.W.C. Uhlig and M.C. Wester. 2009. The ecosystems of Ontario, part I: ecozones and ecoregions. Technical report SIB TER IMA TR-01. Peterborough: Ontario Ministry of Natural Resources, Inventory, Monitoring and Assessment. 71 pp. Accessed at http://www.ontario.ca/document/ecosystems-ontario-part-1-ecozones-and-ecoregions, 10 March 2015.

Dall, W.H. 1905. Land and fresh water mollusks; pp.xi–xii, 1–171, pl. 1–2, in: C.H. Merriam. Alaska. Harriman Alaska Series. Volume XIII. New York: Doubleday, Page & Company. http://biodiversitylibrary.org/page/21676465

Draparnaud, J.-P.-R. [1805]. Histoire naturelle des Mollusques terrestres et fluviatiles de France, ouvrage posthume. Paris: Louis Colas. viii + 164 pp., 13 pl. doi: 10.5962/bhl.title.12856

Faber-Langendoen, D., J. Nichols, L. Master, K. Snow, A. Tomaino, R. Bittman, G. Hammerson, B. Heidel, L. Ramsay, A. Teucher, and B. Young. 2012. NatureServe conservation status assessments: methodology for assigning ranks. Arlington, VA: NatureServe. Accessed at http://www.natureserve.org//biodiversity-science/publications/natureserve-conservation-status-assessments-methodology-assigning, 15 March 2015.

Falkner, G., T.E.J. Ripken and M. Falkner. 2002. Mollusques continentaux de France. Liste de référence annotée et bibliographie. Patrimoines Naturels 52: 350 pp.

Forcart, L. 1955. Die nordischen Arten der Gattung *Vitrina*. Archiv für Molluskenkunde 85(4/6): 155–166, pl. 12.

Forcart, L. 1959. Die palaearktischen Arten des Genus *Columella* (Moll., Styll., Pupillidae). Verhandlungen der Naturforschenden Gesellschaft in Basel 70(1): 7–18.

Forsyth, R.G. 2004. Land snails of British Columbia. (Royal BC Museum Handbook). Victoria: Royal British Columbia Museum.

188 + [8] pp.
Forsyth, R.G. 2005. Terrestrial gastropods of the Peace River – northern Rockies of British Columbia (Living Landscapes). Victoria: Royal British Columbia Museum. 23 pp. Accessed at http://142.36.5.21/prnr/prnr_snails/PRNR-Snails.pdf, 2 March 2015.
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(2): 397–401. doi: 10.15560/10.2.397
Gerber, J. 1996. Revision der Gattung *Vallonia* Risso 1826 (Mollusca: Gastropoda: Valloniidae). Schriften zur Malakozoologie aus dem Haus der Natur–Cismar 8: 1–227.
Given, D.R. and J.H. Soper. 1981. The arctic-alpine element of the vascular flora at Lake Superior. National Museums of Canada, Publications in Botany No. 10: 70 pp.
Goodrich, C. 1933. Mollusks of Moose Factory. The Nautilus 47(1): 7–9. http://biodiversitylibrary.org/page/8522570
Gould, A.A. 1841. Report on the Invertebrata of Massachusetts, comprising the Mollusca, Crustacea, Annelida, and Radiata. Cambridge, Mass.: Folsom, Wells and Thurston. xiii + 373 pp., [15] pls. doi: 10.5962/bhl.title.31922
Gould, A.A. 1850. Catalogue of shells with descriptions of new species; pp. 243–245, in: Agassiz, L. (ed.). Lake Superior: its physical condition, vegetation, and animals, compared with those of other and similar regions with a narrative of the tour [by] J.E. Cabot and contributions by other scientific gentlemen. Elegantly illustrated. Boston: Gould, Kendall and Lincoln. http://biodiversitylibrary.org/page/22208521
Gredler, V. 1856. Tirol's Land- und Süsswasser-Conchylien. Verhandlungen des Zoologisch-Botanischen Vereins Wien 6: 25–162, pl. 2. http://biodiversitylibrary.org/page/11712787
Grimm, F.W. 1996. Terrestrial molluscs; 9 unpaginated PDF files, in: I.M. Smith (ed.). Assessment of species diversity in the Mixedwood Plains Ecozone. Ecological Monitoring and Assessment Network (EMAN). CD-ROM.
Grimm, F.W., R.G. Forsyth, F.W. Schueler and A. Karstad. "2009" [2010]. Identifying land snails and slugs in Canada: introduced species and native genera. Canadian Food Inspection Agency, Ottawa. iv + 168 pp.
Hanna, G D. and E.C. Johnston. 1913. A Pleistocene molluscan fauna from Phillips County, Kansas. The Kansas University Science Bulletin 7(3): 111–121, pl. 18. http://biodiversitylibrary.org/page/4404143
Hawkins, J.W., M.W. Lankester, R.A. Lautenschlager and F.W. Bell. 1997. Effects of alternative conifer release treatments on terrestrial gastropods of northwestern Ontario. The Forestry Chronicle 73(1): 91–98. doi: 10.5558/tfc73091-1
Hawkins, J.W., M.W. Lankester and R.R.A. Nelson. 1998. Sampling terrestrial gastropods using cardboard sheets. Malacologia 39(1–2): 1–9. http://biodiversitylibrary.org/page/13106710
Hoagland, K.E. and G.M. Davis. 1987. The succineid snail fauna of Chittenango Falls, New York: taxonomic status with comparisons to other relevant taxa. Proceedings of the Academy of Natural Sciences of Philadelphia 139: 465–526. http://www.jstor.org/stable/4064906
Horsák, M., L. Juřičková and J. Picka. 2013. Měkkýši České a Slovenské republiky. Molluscs of the Czech and Slovak Republics. Zlín, Czech Republic: Nakladatelství Kabourek. 264 pp.
Hubricht, L. 1972. *Gastrocopta armifera* (Say). The Nautilus 85(3): 73–78. http://biodiversitylibrary.org/page/8516177
Hubricht, L. 1985. The distributions of the native land mollusks of the eastern United States. Fieldiana, Zoology 24: i–viii + 1–191. doi: 10.5962/bhl.title.3329
Ingersoll, E. 1875. Report on the natural history of the United States Geological and Geographical Survey of the Territories, 1874. Special report on the Mollusca, pp. 125–142, in: F.V. Hayden. Bulletin of the United States Geological and Geographical Survey of the Territories. 1874 and 1875. Volume 1. Bulletin No. 2, Second Series. http://biodiversitylibrary.org/page/31822490
Lea, H.C. 1842. Description of eight new species of shells, native to the United States. The American Journal of Science and Arts 42(1): 106–112, pl. 1. http://biodiversitylibrary.org/page/15948730
Lea, I. 1834. Observations of the naïades, and descriptions of new species of that, and other families. Transactions of the American Philosophical Society (new series) 5: 63–121, pl. 3–18. http://www.jstor.org/stable/1004831
Lea, I. 1841. Continuation of Mr. Lea's paper on fresh water and land shells. Transactions of the American Philosophical Society (new series) 9: 1–31. http://biodiversitylibrary.org/page/28873168
Martens, E. von. 1882. [... einige Conchylien vor, welche Dr. Aurel und Arthur Krause während ihrer Rückreise von den Küsten des stillen Oceans durch Amerika gesammelt haben]. Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin 1882(9): 138–143. http://biodiversitylibrary.org/page/7796100
Martens, G. von. 1830. Natur- und Vaterlandskunde. Über Würtembergs Fauna. Correspondenzblatt des Württembergischen Landwirthschaftlichen Vereins 17(3): 123–186.
Morse, E.S. 1864. Observations on the terrestrial Pulmonifera of Maine, including a catalogue of all the species of terrestrial and fluviatile Mollusca known to inhabit the state. Journal of the Portland Society of Natural History 1(1): 1–63, pl. 61–10. http://biodiversitylibrary.org/page/16070837
Müller, O.F. 1774. Vermium terrestrium et fluviatilium, seu animalium Infusorium, Helminthicorum, et Testaceorum, non marinorum, succincta historia. Volumen alterum: Testacea. Havniæ and Lipsia: Heineck and Faber. xxxvi + 214 + [x] pp. http://biodiversitylibrary.org/page/32096858
NatureServe. 2015. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.1. Arlington, VA: NatureServe. Accessed at http://explorer.natureserve.org, 17 March 2015.
Nekola, J.C. 2004. Terrestrial gastropod fauna of northeastern Wisconsin and the southern Upper Peninsula of Michigan. American Malacological Bulletin 18(1/2): 21–44. http://biodiversitylibrary.org/page/45999981
Nekola, J.C. 2009. Big ranges from small packages: North American vertiginids more widespread than thought. Tentacle 17: 26–27. http://www.hawaii.edu/cowielab/Tentacle/Tentacle_23.pdf
Nekola, J.C. and M. Barthel. 2002. Morphometric analysis of *Carychium exile* and *Carychium exiguum* in the Great Lakes region of North America. Journal of Conchology 37(5): 515–531.
Nekola, J.C. and B.F. Coles. 2010. Pupillid land snails of eastern North America. American Malacological Bulletin 28(1/2): 29–57. doi: 10.4003/006.028.0221
Nekola, J.C. and B.F. Coles. 2016. Supraspecific taxonomy in the Vertiginidae (Gastropoda: Stylommatophora). Journal of Molluscan Studies 82(1):208–212. doi: 10.1093/mollus/eyv034
Nekola, J.C., B.F. Coles and U. Bergthorsson. 2009. Evolutionary pattern and process within the *Vertigo gouldii* (Mollusca: Pulmonata, Pupillidae) group of minute North American land snails. Molecular Phylogenetics and Evolution 53: 1010–1024. doi: 10.1016/j.ympev.2009.09.012
Nekola, J.C., B.F. Coles and M. Horsák. 2015. Species assignment in *Pupilla* (Gastropoda: Pulmonata: Pupillidae): integration of DNA-sequence data and conchology. Journal of Molluscan Studies 81(2): 196–216. doi: 10.1093/mollus/eyu083
Newcomb, W. 1864. Descriptions of nine new species of *Helix* inhabiting California. Proceedings of the California Academy of Sciences (series 1) 3: 115–119. http://biodiversitylibrary.org/page/3148153
Newcomb, W. 1865. Descriptions of new species of land shells. Proceedings of the California Academy of Sciences (series 1)3:179–183. http://biodiversitylibrary.org/page/3147794

Nylanderi, O.O. 1900. A list of shells from northeastern Maine. The Nautilus 13(9): 102–106. http://biodiversitylibrary.org/page/3758312

Oughton, J. 1948. A zoogeographical study of the land snails of Ontario. University of Toronto Studies, Biological Series 57: xi + 126 pp., frontispiece, 1 map, 3 tables.

Pearce, T.A., M.C. Fields and K. Kurita. 2007. Discriminating shells of *Gastrocopta pentodon* (Say, 1822) and *G. tappaniana* (C B. Adams, 1842) (Gastrocopta: Pulmonata) with an example from the Delmarva Peninsula, eastern USA. The Nautilus 121(2): 66–75.

Pilsbry, H. A. 1890. Two new species of U.S. land snails. The Nautilus 4(1): 3–4. http://biodiversitylibrary.org/page/12596631

Pilsbry, H.A. 1919. Pupillidæ (Gastrocoptinæ, Vertiginæ). Manual of conchology, structural and systematic with illustrations of the species. Second series: Pulmonata 25(98): 65–144, pl. 6–10. http://biodiversitylibrary.org/page/23703909

Pilsbry, H.A. 1931. Geographic distribution of Pupillidae; Strobilopsidae, Valloniidae and Pleurodiscidae [etc.]. Manual of conchology, structural and systematic, with illustrations of the species. Second series, Pulmonata 28(110): 49–96, pl. 9–12. http://biodiversitylibrary.org/page/5936040

Pilsbry, H.A. 1934. Geographic distribution of Pupillidae; Strobilopsidae, Valloniidae and Pleurodiscidae [etc.]. Manual of conchology, structural and systematic, with illustrations of the species. Second series, Pulmonata 28(111): 97–160, pl. 13–23. http://biodiversitylibrary.org/page/5936102

Pilsbry, H.A. 1946. Land Mollusca of North America (north of Mexico), Volume II, Part 1. The Academy of Natural Sciences of Philadelphia, Monographs 3: i–vii + 1–520. http://hdl.handle.net/2027/mdp.39015035488819

Pilsbry, H.A. 1948. Land Mollusca of North America (north of Mexico), Volume II, Part 2. The Academy of Natural Sciences of Philadelphia, Monographs 3: frontis., i–xlvii + 521–1113. http://hdl.handle.net/2027/mdp.39015035488801

Pilsbry, H.A. and J.H. Ferriss. 1906. Mollusca of the southwestern states, II. Proceedings of the Academy of Natural Sciences of Philadelphia 58: 123–175, pls. 125–129. http://biodiversitylibrary.org/page/24706972

Pokryszko, B.M. 1990. The Vertiginidae of Poland (Gastropoda: Pulmonata: Pupilloidea) — a systematic monograph. Annales Zoologii 43(8): 133–257.

Prozorova, L.A., M.O. Zasypkina and K.V. Kavun. 2007. Vidy roda *Columella* Westerlund, 1878 (Gastropoda: Pulmonata: Truncatellidae) v Siberi i na Dal'nem Vostoke Rossii. [Species of the genus *Columella* Westerlund, 1878 (Gastropoda: Pulmonata: Truncatellinidae) in Siberia and the Russian Far East.] The Bulletin of the Russian Far East Malacological Society 11: 75–81. [In Russian]. http://rfems.dvo.ru/index.php/en/component/attachments/download/245

Rackett, T. 1821. Descriptions of some shells found in Canada. Transactions of the Linnean Society 13: 42–43. http://biodiversitylibrary.org/page/754769

Rafinesque, C.S. 1820. Annals of nature or annual synopsis of new genera and species of animals, plants, etc. discovered in North America. First annual number, for 1820. Lexington: Smith. 16 pp. doi: 10.5962/bhl.title.54755

Reinhardt, O. 1883. [Über die von den Herren Gebrüder Krause auf ihrer Reise gesammelten *Pupa*-, *Hyalina*- und *Vallonia*-Arten]. Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin 1883(3): 37–43. http://biodiversitylibrary.org/page/8789329

Richards, H.G. 1936. Land and freshwater mollusks collected on a trip to James Bay. The Canadian Field-Naturalist 50(4): 58–60. http://biodiversitylibrary.org/page/28103458

Riley, J.L. 2003. Flora of the Hudson Bay Lowland and its postglacial origins. Ottawa: NRC Press. 236 pp.

Roth, B. "1987" [1988]. Identities of two Californian land mollusks described by Wesley Newcomb. Malacological Review 20(1–2): 129–130.

Say, T. 1817a. Conchology; unpaginated [4 plates], in: Nicholson, W. (ed.). American edition of the British encyclopedia or dictionary of arts and sciences, comprising an accurate and popular view of the present improved state of human knowledge, 1st ed. Philadelphia: Mitchell, Ames and White. [Not seen; reprinted in W.G. Binney (1858)].

Say, T. 1817b. Description of seven species of American fresh water and land shells, not noticed in the systems. Journal of the Academy of Natural Sciences of Philadelphia 1(1): 13–16. http://biodiversitylibrary.org/page/24680209

Say, T. 1817c. Descriptions of new species of land and fresh water shells of the United States. Journal of the Academy of Natural Sciences of Philadelphia 1(6): 123–126. http://biodiversitylibrary.org/page/24680373

Say, T. 1822. Description of univalve terrestrial and fluviatile shells of the United States. Journal of the Academy of Natural Sciences of Philadelphia 2(2): 370–381. http://biodiversitylibrary.org/page/36831560

Say, T. 1824. Appendix. Part I — Natural history. §1, pp. 253–378, in: Keating, W.H. (ed.). Narrative of an expedition to the Source of St Peter's River, Lake Winnepeek, Lake of the Woods, &c. &c. performed in the year 1823, by order of the Hon. J.C. Calhoun, Secretary of War, under the command of Stephen H. Long, Major U.S.T.E. Compiled from the notes of Major Long, Messrs Say, Keating, and Calhoun. Vol. 2. Philadelphia: H.C. Carey and I. Lea. http://biodiversitylibrary.org/page/13640684

Say, T. 1829. Descriptions of some new terrestrial and fluviatile shells of North America. The Disseminator of Useful Knowledge; containing hints to the youth of the U. States, from the School of Industry 2(15): 229–230 [29 July 1829]. [Original not seen. Bibliographic data after W. G. Binney (1863)].

Schileyko, A.A. 1998. Treatise on Recent Terrestrial pulmonate Molluscs. Part 2. Gastrocoptidae, Hypselostomatidae, Vertiginidae, Truncatellinidae, Pachnodidae, Enidae, Sagdidae. Ruthenica, Supplement 2: 129-261.

Schileyko, A.A. 2007. Treatise on Recent terrestrial pulmonate molluscs, part 15. Oopeltidae, Anadenidae, Arionidae, Philomycidae, Succineidae, Athoracophoridae. Ruthenica Supplement 2: 2049–2210.

Schileyko, A.A. and I.M. Likharev. 1986. Nazemnye mollyski semeistva yantarok (Succineidae) fauny SSSR [Terrestrial molluscs of the ambersnail family (Succineidae) of the fauna of the U.S.S.R.]. Sbornik Trudov Zoologischeskogo Muzeya MGU 24: 197–239. [In Russian].

Sterki, V. 1893. Observations on *Vallonia*. Proceedings of the Academy of Natural Sciences of Philadelphia, 1893 [=45](2): 234–279, pl. 238. http://biodiversitylibrary.org/page/1633465

Sterki, V. 1894. The land and fresh-water molluscs in the vicinity of New Philadelphia, a contribution to the natural history of Tuscarawas County, Ohio. New Philadelphia, Ohio: Beobachter Press. 14 pp. doi: 10.5962/bhl.title.13905

Sterki, V. 1909. *Bifidaria armifera* Say, and its varieties. The Nautilus 23(4): 52–54. http://biodiversitylibrary.org/page/5314489

Stimpson, W. 1850. [Mr. Simpson presented a description of a new species of *Helix*]. Proceedings of the Boston Society of Natural History 3: 175. http://biodiversitylibrary.org/page/8870477

Turgeon, D.D., J.F.J. Quinn, 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, 2nd edition. American Fisheries Society, Special Publication 26: ix + 526 pp.

Waldén, H.W. 1966. Einige Bemerkungen zum Ergänzungsband zu Ehrmann's "Mollusca" in "Die Tierwelt Mitteleuropas". Archiv für Molluskenkunde 95(1/2): 49–68.

Whelan, R.V. and J. Oughton. 1939. Land mollusks of Smoky Falls, Cochrane District, Ontario. The Canadian Field-Naturalist 53(7): 99–101. http://biodiversitylibrary.org/page/28111259

Whiteaves, J.F. 1905. Lists of a few species of land and fresh-water shells from the immediate vicinity of James Bay, Hudson Bay. The Nautilus 19(1): 4. http://biodiversitylibrary.org/page/1755644

Wiktor, A. 2000. Agriolimacidae (Gastropoda: Pulmonata) — a systematic monograph. Annales Zoologici 49(3): 347–590.

Winslow, M.L. 1922. Notes on the internal lamellae of *Carychium*. Occasional Papers of the Museum of Zoology 128: 1–17 pp. http://hdl.handle.net/2027.42/56567

Author contributions: MJO collected the specimens and RGF identified them. RGF and MJO wrote the text. The maps and photographs were prepared by RGF.

Submitted: 28 October 2015
Accepted: 7 April 2016
Academic editor: Rodrigo B. Salvador