

Terrestrial Molluscs of the Kawartha Lakes Region: Land Snails and Slugs (An Independent Research Study)

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Abstract

Terrestrial molluscs are one of the world's most endangered phyla, yet, research surrounding this unique invertebrate group is scarce, especially in Ontario, Canada where this research project was carried out. This project coordinated with a specimen collection consisting of various native and invasive mollusc species from the Kawartha Lakes region in Ontario, Canada. The purpose of the collection was to validate the existence of certain species and to gain a clearer understanding of the proportion of invasive species, compared to native, that live in specific preferred habitats. The results of this project is consistent with other experiments, demonstrating that invasive species of slugs and snails often outnumber native species, depending on the habitat.

Keywords

Snails — Slugs — Invertebrates — Molluscs — Mollusks — Kawartha Lakes, Ontario Canada — Invasive Species — Native Species — Habitat

1. Introduction

The phylum Mollusca makes up a significant proportion of marine, aquatic, and terrestrial invertebrates, and are broken into two groups: Cephalopods (consists of squids, octopuses, and cuttlefish) and Gastropods (consists of snails, slugs, and limpets) (Lydeard, et al., 2004). Globally, there are about 40,000-150,000 recognized species of molluscs that continue to exist, however thousands more have yet to be recognized (Lydeard, et al., 2004; Sysoev, et al., 1989), and hundreds have become extinct (Régner, et al., 2009). As of 2003, there were 1222 terrestrial mollusc species included in the "IUCN Red List of Threatened Species" (Lydeard, et al., 2004). While the phylum consists of highly diverse species, different species have similar defining anatomical features: the presence of the radula (a tongue-like organ present in all molluscs with the exception of bivalves), the mantle organ, and the ventricular foot, which is modified in Cephalopods (Sysoev, et al., 1989). Although they have basic open circulatory systems, they are often considered the most neurologically advanced invertebrate group (Sysoev, et al., 1989).

This article focuses solely on terrestrial Gastropods, specifically snails and slugs, of the Kawartha Lakes region of Central Ontario, Canada. There is limited information available about the molluscan species that inhabit the Kawartha Lakes area, therefore this collection of species was aimed at gaining a more complete understanding of which species currently reside in the area, which are most populous, and which habitats and conditions each species prefer. This type of collective data is important for gaining insight about native

and invasive species, and their habitat preferences.

2. Methods

To collect a variety of specimens, several different sites of the Kawartha Lakes region of Ontario were sampled for slugs and snails based on scientific literature describing where these molluscs are likely to be found. Areas sampled included residential gardens (Downie Street, Peterborough; Figure 6), forested area near Silent Lake (Bancroft; Figure 7), forested and grassed areas near Pigeon Lake (Bobcaygeon; Figure 8), forested area in Jackson Park (Peterborough; Figure 9), and forested area and gardens at the Greenup Ecology Garden (Peterborough; Figure 10). Sampling lasted from late-September to mid-October, and was completed with solely the use of visual-location of the specimen (i.e. no bait or traps were used). At the time of capture, notes were taken on time, date, weather, location, habitat, and native plants and animals common to the area.

The captured specimens were photographed and numbered when alive in order to identify the species as accurately as possible, and were then killed in boiling water before being preserved in an isopropyl alcohol solution. Glass vials were used to hold the preserved specimen, which were then numbered and labelled accordingly. Species were identified using the Terrestrial Mollusc Species Key by the University of Florida and U.S Department of Agriculture (USDA) (White-McLean, 2011).



Figure 1. *Deroceras agreste*, milky field slugs, identified by their white-brown colour and dark head. Photo by Roy Anderson.



Figure 2. *Arion circumscriptus*, the brown-banded slug, identified by the brown lateral band on its body. Photo by Roy Anderson.

3. Results

The results varied greatly depending on the site, the weather, the time of day, and the temperature. Colder days often resulted in zero specimens found, and the days in which many specimens were captured were usually warmer and rainy or damp. Species were caught fairly equally during the day and at night. The first sampling occurred in a residential garden at Downie Street, Peterborough, during a rainy afternoon on a warm day on September 29. The garden had a high abundance of slugs and few live snails, however many empty shells were discovered which could be explained by nearby predators, specifically racoons. The slugs and snails were mostly found under garbage cans and recycling bins that had grown damp from the rain, but some were found in the garden itself which consisted of a mixture of sunflowers, grasses, a maple tree sapling, and a cucumber vine. The species that were found consisted of brown-lipped grove snails (*Cepea nemoralis*), one white-lipped grove snail (*Cepea hortensis*), and a high concentration of milky field slugs (*Deroceras agreste*).

On October 2nd, the second sampling period occurred at Silent Lake in Bancroft, during a day that was dry and warm. Few specimens were found during the daytime, likely due to the dryness, but a small amount of slugs were located at dusk in the forested areas. There was no evidence of live snails, and the slugs were small and well-hidden under rocks and logs. The sampling area was a diverse forest with oak trees, maple trees, ash trees, eastern white pine trees, grasses, and a high richness of fern plants. The species collected consisted of a dead orchid snail (*Zonitoides arboreus*) and a dead slippery moss snail (*Cochlicopa lubrica*). The few slugs that were collected were not preserved correctly and were therefore not included in the collection.

Pigeon Lake in Bobcaygeon was the third sampling site that occurred on October 5th during the evening. The weather was clear, the temperature was about 10°C, and the ground

was dewy and damp, which is ideal conditions for finding snails and slugs. Surprisingly, no snails were found, with the exception of one empty shell. Nonetheless, there was a very high richness and diversity of slug species. This site was very close to the lakefront and was a mixture of forest (mostly maples and other deciduous trees) and grass. The findings at this location consisted of grey field slugs (*Deroceras reticulatum*), marsh slugs (*Deroceras laeve*), brown field slugs (*Deroceras panormitanum*), brown-banded Arion slugs (*Arion circumscriptus*), and silver slugs (*Arion silvaticus*), all of which were found in abundance. The only snail found was the amber snail (*Succinea campestris*), which was found dead.

On October 17, another sampling was conducted at Downie Street in Peterborough during a dry afternoon, in which only one specimen was collected from the garden: a *Monacha* spp. that was difficult to identify to the specific species. Because the specimen was found dead with no body in its deteriorated shell, it would not have been an accurate identification to species. On the same day, Jackson Park in Peterborough was sampled, where another *Monacha* spp. was found in similar condition. Other specimens collected were marsh slugs (*Deroceras laeve*), grey field slugs (*Deroceras reticulatum*), silver slugs (*Arion silvaticus*), cellar glass snails (*Oxychilus cellarius*), and hive snails (*Euconulus fulvus*). Jackson Park contained roughly an equal amount of snails and slugs, however most snails were found dead, and all were found in forested areas.

The final sampling occurred on October 18 at the Greenup Ecology Garden in Peterborough in which a large deposit of snails was discovered in a grassy area near the river. Snail species collected included the hive snail (*Euconulus fulvus*), various amber snails (*Succinea campestris*, *Oxyloma elegans*), glass snails (*Oxychilus cellarius*), and pillar snails (*Cochlicopa lubrica*). Slugs were also discovered in the gardens and grasses, including brown-banded Arion slugs (*Arion circumscriptus*), silver slugs (*Arion silvaticus*), marsh slugs (*Deroceras laeve*), and grey field slugs (*Deroceras reticulatum*). Most of the snails collected were dead, however many were alive and found in the same place as the deceased ones.

Altogether, fifteen different species were collected consisting of nine snail species and six slug species (Table 1). Of

Table 1. *Snail and slug names organized according to native or invasive status, including their region of origin.*

	Native	Invasive (and native region)
Snails	Z. arboneus	C. nemoralis (W. Europe)
	C. lubrica	C. hortensis (Europe)
	O. elegans	Monacha spp. (Europe)
	S. campestris	O. cellarius (W Europe)
	E. fulvus	
Slugs	D. laeve	D. agreste (Asia)
		D. reticulatum (Europe)
		A. silvaticus (Europe)
		D. panormitanum (SW Europe)
		A. circumscriptus (Europe)



Figure 3. *Oxychilus cellarius*, cellar glass snail, identified by its clear, flat shell and blue-black body. Photo by Roy Anderson.



Figure 4. *Cepea nemoralis*, the brown-lipped grove snail, identified by the brown and white shell with brown lip near the opening. Photo by Roy Anderson.

these fifteen species, nine of them were invasive and only six were native to Canada or the Holarctic region (White-McLean, 2011).

4. Discussion

There are a few variables that should be considered when interpreting these results, such as why certain species were found and others, known to exist in the area, were not found. One important variable is the time of year: this collection was started in late September when temperatures were already low and many species of terrestrial gastropod were already hibernating. Another possible limitation was the similarity of the sampling sites: most were forested areas and some were grassed or garden, however there were no wetlands or farmed areas that were sampled due to lack of time. This type of sampling could result in some species being left out of the collection. It should also be noted that because specimens were collected by the naked eye and without any sampling equipment, it is possible that smaller or more camouflaged specimens were overlooked. Some specimens were collected in the dark with the aid of headlamps and flashlights, making

it easy to miss smaller species which were well hidden in the debris of the forest.

The findings included a significant ratio of invasive species compared to native species, especially in the case of slug species in which only one of the six species was native (Figure 5).

These findings are consistent with similar studies of Ontario species. Hutchinson, et al. (2014) found that most slugs found in Ontario disturbed habitats are in fact invasive species such as *Deroceras* and *Arion* species. Perhaps these species of slug are more resilient than Ontario's native species, which would also explain why they were found in the colder weather while the native species were less abundant.

This collection showed a significant number of invasive slugs, but also a significant number of native snails, most of which were found dead, likely because live snails were already hibernating beneath the soil. Collections of specimens are an important aspect of discovering which species are present in which areas, which habitats and niches they thrive in, and which species decline or increase with time. This article

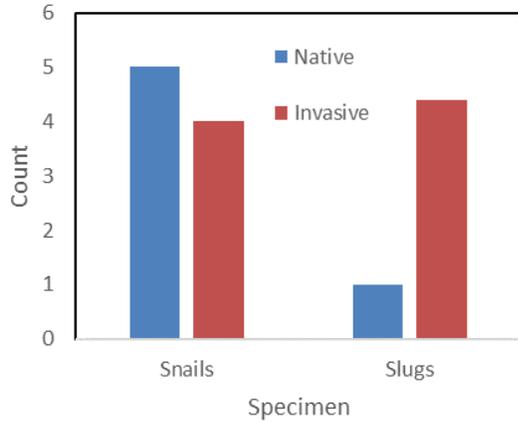


Figure 5. Invasive snail and slug species compared to native species through the findings of the attached specimen collection.

provides a stepping stone for further research to take place regarding the species of molluscs that exist in the Kawartha Lakes region and to protect the native species of Ontario.

5. References

Hutchinson, J., Reise, H., & Robinson, D. (2014). A bio-

graphy of an invasive terrestrial slug: the spread, distribution and habitat of *Deroceras invadens*. *NeoBiota*, 23, 17.

Lydeard, C., Cowie, R. H., Ponder, W. F., Bogan, A. E., Bouchet, P., Clark, S. A., et al. (2004). The Global Decline of Non-Marine Mollusks. *BioScience*, 54(4), 321-330.

Régnier, C., Fontaine, B., & Bouchet, P. (2009). Not knowing, not recording, not listing: numerous unnoticed mollusk extinctions. *Conservation Biology*, 23(5), 1214-1221.

Sysoev, A. V., & Kantor, Y. I. (1989). Anatomy of molluscs of genus *Splendrillia* (Gastropoda: Toxoglossa: Turridae) with descriptions of two new bathyal species of the genus from New Zealand. *New Zealand Journal of Zoology*, 16(2), 205-214.

White-McLean, J.A. (September, 2011). Terrestrial Mollusc Tool. USDA/APHIS/PPQ Center for Plant Health Science and Technology and the University of Florida. [28 Oct, 2017] - <http://idtools.org/id/mollusc>

6. Appendices

See trentu.ca/just for additional materials related to this paper.