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Pamela J. Boppel
Route 2, Box 721
L'Anse, MI 49946
(906) 524-6334

University of Alberta
Department of Biological Sciences
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Terrestrial Gastropods (Stylommatophora: Pulmonata) of Isle Royale:
A Pilot Study

ABSTRACT

I conducted a three day study, 06 September through 08 September 1995, to identify common species of gastropods present on Isle Royale. I placed sixteen total cardboard pieces in four areas alongside Three Mile hiking trail to attract gastropods. This method was very effective even in a short time. Leaf litter, logs, sticks and rocks were also searched at random, by hand. A total 114 snails and four slugs were collected representing 9 species and 2 species respectively. Ten snails were artificially digested and examined for presence of nematode larvae. None were found but this finding is not a true representation of infectivity because of the small sample size. I recommend a long term study be completed to better assess the gastropod population on Isle Royale.

INTRODUCTION

Microfauna play an important although subtle role in the cycling of an ecosystem. Gastropods break down organic waste material, carcasses, leaf litter, and consume soil microbes (Burch 1962). Gastropods also act as intermediate hosts to parasitic nematodes that often infect ungulate hosts such as moose (*Alces alces*) (Anderson and Prestwood 1981). Isle Royal is a unique island ecosystem in that the only ungulate present is moose. To date, nematode parasites that require gastropod intermediate hosts are not reported on Isle Royale (Peterson 1977). For example, the brain worm (*Parelaphostrongylus tenuis*), muscle worm (*Parelaphostrongylus andersoni*), and lung worm (*Varestrongylus alpenae*) are not present in the moose population, but suitable intermediate hosts are available if these parasites are ever introduced.

I conducted a study to collect and identify common species of gastropods present on Isle Royale. Two methods of collection were used: permanent plot transects using moist corrugated cardboard to attract snails and slugs, and random searching of the environment by hand. Overall, a very small area was searched due to limited time and a more thorough study is recommended.

METHODS

Moist corrugated cardboard pieces (60 x 30 cm), were placed 4 apiece in 4 areas (16 total) along Three Mile trail and weighted down with sticks and rocks. Locations were selected according to suitability for gastropods such as adequate litter layer (minimum 5 cm), and shade to slow desiccation. The cardboards were soaked in lake water before placement along the trail. It rained frequently so watering them prior to collection was not a concern. Collections from cardboards were completed once each morning for two days. Throughout the afternoons, random areas alongside the trail were searched by hand, looking under logs, bark, leaf litter, and rocks.

All snails found were placed in plastic multi-compartment boxes lined on one side with moist cheesecloth; they were later transferred to larger, lined plastic containers and refrigerated until identifications could be made. Only four slugs were collected for representative identification because of difficulties keeping them alive in captivity. Snails and slugs were identified with the aid of a dissecting microscope at 15X magnification and keyed using Burch (1962) and Burch and Jung (1988).

Most cardboards were placed in mature aspen-birch-fir-spruce habitat along Three Mile trail. One cardboard collection area was on the edge of an open grassy site, on a South facing slope. Random searches by hand were scattered and included some area previously burned from 1956 and 1948, and some sugar maple - yellow birch area. I made no effort to keep the gastropods separated according to collection site because very numerous stops were made along the way.

Six days following collection, 5 *Discus crankhueti* and 5 *Zonitoides arboreus*, were crushed and artificially digested in a pepsin solution to examine for nematode larvae. Following eight hours of incubation at 37° C, the digesting solutions were examined using a dissecting microscope at 25X magnification.

RESULTS

A total 114 snails representing 9 species and 4 slugs of 2 species were collected (Table 1). Three snails representing two genera have not been identified to species and are pending confirmation. No larvae were found in ten snails examined for nematodes.

DISCUSSION:

Nine species of snails are now identified from Isle Royale but some species were probably missed because of the limited collection area and limited time. I recommend that a study be done to describe gastropod populations according to moose density areas and/or by different habitat types. Collection should be done May through October because different species are more active at certain times of the year and to address fluctuating weather.

Gastropod populations probably differ according to moose density. Higher moose densities result in more heavily browsed areas; this creates more open, even-aged stands, richer in low ground vegetation (Snyder and Janke 1976). Browsed, open stands result in two situations detrimental to gastropods; these are, decreased litter quantity and altered litter composition (McInnes et al. 1992, Pastor et al. 1988). Gastropod numbers appear to reflect litter depth (Locasciulli and Boag 1987) with a majority found in the top 5 cm during hospitable conditions (Boag 1985). A deep, noncompacted litter layer offers a relatively stable microclimate, with optimal living space that is richer in food (Locasciulli and Boag 1987). Therefore, I expect that browsing associated with high moose density would ultimately compact a decreasing litter layer making it less suitable for gastropods.

The greatest proportion of the organic litter layer of soil is made up of tree leaves (Lutz and Chandler 1946). Therefore, differences in tree species regardless of browsing, may also affect gastropod distributions. Snails and slugs appear to prefer areas with tree species rich in calcium (Beyer and Saari 1977). Calcium indirectly influences many soil characteristics in such a way that even worms and other arthropods tend to be more abundant in calcareous soils (Boycott

1934). Successional changes of tree species to those with higher or lower calcium content would ultimately alter soil characteristics over time. I believe this change in composition of litter and soil would eventually make the area more or less suitable for gastropods according to tree species.

Gastropod distributions vary greatly among and between habitats and sampling techniques are limited. Limitations include time constraints, weather, vegetation, and expansiveness of the area to be searched. Searching by hand is exceptionally time consuming and is only as effective as the collector's knowledge, persistence, and eyesight. It does allow certain areas to be searched such as under logs, rocks, and bark that other methods do not allow. Sifting leaf litter is also time consuming and disruptive of the habitat in that layers of it are removed. The cardboard method of collection is more efficient and does attract an adequate number of species to compare statistically (Boag 1982). Some species, however, may be underestimated because they spend a majority of time below the surface of the litter (Boag 1982, Strayer et al. 1986).

The cardboard collection method has associated difficulties. It requires repeated visits that may not always be possible, and works best under moist conditions that may require watering by hand. Placement of cardboards is also very important because snail numbers tend to have clumped distributions both horizontally and vertically throughout the environment (Boag 1985). Placement is best determined by recognizing general requirements of snails such as depth of litter, shade, and moisture (Boycott 1934). Overall, "no sampling method is without bias" in quantifying terrestrial gastropods (Bishop 1977).

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	Species	Number Collected
Snails	<i>Zonitoides arboreus</i>	46
	<i>Discus cronkhui</i>	31
	<i>Zoongenetes harpa</i>	19
	<i>Euconulus fulvus</i>	09
	<i>Virina limpida</i>	03
	<i>Verugo gouldi</i> <i>modesta</i>	02
	<i>Retinella</i> spp. (unconfirmed)	02
	<i>Triodopsis albolabris</i>	01
	<i>Striatura</i> spp. (unconfirmed)	01
Total		114
Slugs	<i>Pallifera dorsalis</i>	02
	<i>Deroceras laeve</i>	02
Total		04

Table 1. Numbers and species of gastropods (Stylommatophora: Pulmonata) collected from Isle Royale, 06 Sept. through 08 Sept. 1995.

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