

Report for 2003MD30B: Response of Macroinvertebrates to Road Salt Runoff in Headwater Streams

- unclassified:
 - No publications have been submitted for this project.

Report Follows

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2003-2004 USGS Annual Report for Project Number 2003MD30B
Response of Macroinvertebrates to Road Salt Runoff in Headwater Streams
Principal Investigators: William Lamp and Sandra Crane

PROBLEM AND RESEARCH OBJECTIVES:

As stated in the project proposal, little research has been conducted on the effects of salt toxicity and salinity to aquatic biota in running water systems in the mid-Atlantic region of the United States. Increasing suburbanization in the Piedmont physiogeographic region of Virginia and Maryland heightens the risk of loss and adverse impacts to headwater streams. These streams provide habitat for benthic invertebrate organisms which are key components of trophic food webs in aquatic systems. Both acute and chronic effects on aquatic biota may occur from road salt inputs into small streams.

Research Objectives:

1. To quantify the stormflow loading of road salt in a gradient of rural – urban streams subsequent to a snowstorm event.
2. Measure the macroinvertebrate response (mortality and drift) to salt loading of an unimpacted headwater stream.
3. Measure mortality response of macroinvertebrate species to acute levels of high salt concentrations

The final objective, to compare mortality of macroinvertebrate species to different cation sources of salt, was dropped from the study because of cost constraints and lack of access to appropriate equipment.

METHODOLOGY

Objective 1: Fifteen streams representing unimpacted to highly urbanized conditions were selected. Four are located in Loudoun County, VA, 1 in Great Falls National Park, VA (Fairfax County), 4 in Montgomery County, 1 in Prince Georges County (on the University of Maryland College Park campus), and 5 in Howard County, MD. Baseline conditions were measured by taking monthly samples from each stream beginning

August 2003. pH, temp, DO (through December 2003), Conductivity and Specific Conductivity measurements were taken using an YSI probe. Chloride levels (mg/l) were measured using Hach silver nitrate titration kit. Because chloride is inert and does not dissipate over time, 2/3 of the samples still require processing.

Access to streams during snow events proved more difficult than expected so select sites were monitored daily (or multiple times/day) during and following snow events. The Fairfax County and 2 Loudoun County sites were monitored in January 2004 during a snow event that for 10 days until the snow melted. Surge Creek on the UMD campus was also monitored for a week following the snow event. For other short term snow events (November 2003, February 2004), measurements and water samples were taken at a subset of sites. In addition, measurements were taken during two rain storm events in 2003 to compare the dilution effect of snow versus rain discharge.

To obtain a baseline inventory of the invertebrate population in the stream sites, three moss packs were placed at each site for approximately 4 weeks in February 2004 and then collected. At seven of the sites, 1 -3 packs were either lost or desiccated at the time of retrieval, making an assessment of invertebrate community. Sampling is planned for late Fall 2005 to reassess the invertebrate community.

Objective 2: In March 2004, an experiment was conducted at the Central Maryland Research and Education Center (CMREC), Clarksville, Howard County, MD. Drift nets were stationed above the salt input site and 125 feet below the input site in a stream designated Field Stream. A 1280 mg/l chloride solution was pumped into the stream at a constant rate for 5.5 hours. Conductivity readings just below the pumping station monitored the amount of solution entering the stream. Drift net samples were collected prior to the initiation of pumping, beginning at 3:30pm and then every two hours for a total of six samples and then again at sunrise the next morning. A control stream also had two drift net collection sites; samples were collected from 3:30pm until 6pm and at 6:30m the following morning. Samples were noted for mortality or unresponsiveness prior to preserving the invertebrates in alcohol. The invertebrate samples are still being identified and analyses comparing within and across stream sites is not yet complete.

Objective 3: Two laboratory experiments were run to determine acute effects to high NaCl concentrations. The initial experiment was performed primarily to test the technique and used *Gammarus spp.* NaCl concentrations of 0mg/l, 50mg/l, 500mg/l and 5000mg/l were used with 3 organisms per flask and 6 replicates per concentration. Mortality was low and could not be attributed to NaCl concentrations. A second experiment was run in January 2004 using *Tuplidae spp.* Using NaCl concentrations of 0, 50, 500, and 5000mg/l, 3 individuals were placed in a tray in their own mesh containers and provided with leached maple leaves for refugia (to reduce stress). The trays were aerated and stream water was used from the site where the *Tuplidae spp.* were collected. The stream, Fishing Creek in Frederick County, MD, has a low conductivity reading for ions and meets the criteria for this study designation of "unimpacted."

There were four replicates of each NaCl concentration. Every 24 hours the invertebrates were assessed for mortality and degree of responsiveness (e.g. response to gentle prodding). The experiment was run for 96 hours. While the data has not been statistically analyzed as of June 2004, mortality was extremely low at all NaCl levels.

FINDINGS

There are no findings to date for this study. Completion of water sample analyses is expected by August 2004 and statistical analysis of the experimental data by November 2004. Additional data will be collected from a subset of streams during Fall 2004 and if possible, another snowstorm event will be monitored. Data from additional snow events will be added to the findings in Spring 2005.