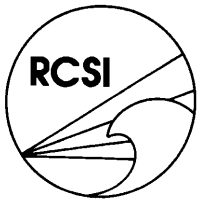

Rochester Committee
for Scientific Information
Rochester, NY

RCSI Bulletin 125
Run-off of Deicing Salt: Effect on Irondequoit Bay,
Rochester, New York

By: R. C. Bubeck, W. H. Diment, B. L. Deck, A. L. Baldwin, S. D. Lipton
July 1971

THE ROCHESTER COMMITTEE FOR SCIENTIFIC INFORMATION
P. O. Box 5236, River Campus Station
Rochester, New York 14627

Bulletin #125(W)
Water Pollution Summary Bulletin July 1971

Run-Off of Deicing Salt: Effect on Irondequoit Bay, Rochester, New York

by
R. C. Bubeck, W. H. Diment, B. L. Deck, A. L. Baldwin, S. D. Lipton

Summary:

Salt used for deicing the streets near Rochester, New York has increased the chloride concentration in Irondequoit Bay at least five fold during the past two decades. During the winter of 1969-1970, the quantity and salinity of the dense run-off that accumulated on the bottom of the Bay was sufficient to prevent complete vertical mixing of the Bay during the spring. Comparison with 1939 conditions indicates that the period of summer stratification has been prolonged a month by the density gradient imposed by the salt run-off.

History of Salt Use for Deicing

Use of salt for deicing has increased very sharply in recent years. Sodium chloride ("table salt") is by far the most common material but some calcium chloride is used. Before 1941 some salt was added to the sand spread at critical road locations such as hills, intersections, and curves. Pure salt was applied in a few localities before 1950, but in the next twenty years the amount grew very rapidly with the expansion of a "bare pavement" policy into most northern localities. The amount applied has doubled and redoubled every five years.

Application in Monroe County and the Irondequoit Creek Basin

The local use of salt exceeds national averages. In the winter of 1969-70, 2½ per cent of all salt used for deicing in the United States went on Monroe County. Irondequoit Basin, about one-quarter of the county, received 1 per cent of all the salt applied in the country. There is no obvious reason why the disproportionate amount should be applied, but part of the area is densely surburbanized, and the snowfall pattern may promote frequent applications.

Increased Salt in Water of Irondequoit Watershed

Since a few old records do exist, it is possible to calculate that the concentration of chloride (one of the two ions of common salt) has risen ten fold since 1910 in Irondequoit Creek and Bay. The rise was particularly rapid since the mid-

NOTE: The full report with references cited appeared in Science (1). Reprints will be available from the author, Department of Geological Sciences, University of Rochester and from the RCSI. The senior author is indepted to RCSI for a grant with which this study was initiated. Subsequent support was received from the National Sea Grant Program, GH-106.

1950's, but the rate of increase has slackened somewhat after 1965, probably because the "bare pavement" policy had been fully implemented.

Salt enters the Bay not only from Irondequoit Creek, but from smaller creeks which enter the Bay directly. The concentration is striking because the Bay is relatively small in area and volume, and because it is essentially a sink, with only a small shallow opening at the lip, as an overflow into Lake Ontario. Nevertheless, there was little net accumulation between November 1969 and November 1970.

About 77,000 metric tons of salt are applied to the watershed in a year. More than half is stored in the ground water and soil, but 32,000 metric tons enters the Bay, and in the course of a year flushes into Lake Ontario. Two thirds of the total entering the Bay came during the winter (December-March), but the contribution is continued from soil and groundwater all summer.

Interference by Salt of Lake Dynamics

Ordinarily, deeper lakes in the climate of northern United States mix once or twice a year when the surface water becomes denser than the deeper waters (spring and fall turnover). Mixing may be continuous during the winter in ice-free lakes such as Cayuga. Irondequoit Bay mixed completely in early October, 1939 when the surface temperature had reached 12°C (63°F). In 1970 mixing was delayed until November and a colder surface temperature (8.5°C or 46°F) was required to bring the density above that of the salty deeper water.

Significance of Changes

The aforementioned changes are not viewed with alarm. The point is that the salt run-off has significantly changed the physical characteristics of the Bay and that similar conditions might be expected elsewhere, particularly in heavily salted areas that provide natural traps. Very small and relatively deep lakes are particularly susceptible to such conditions. Indeed, one tiny lake in Michigan has been prevented from completely mixing in the spring by salt run-off. More should be known about such lakes as it is likely that salt run-off will produce more of them.

The chloride levels are not presently critical. Although they exceed the U. S. Public Health Service recommended limit for human consumption of 250 mg/l chloride during parts of the year and are unsuitable for certain industrial processes, waters of much higher chloride content are utilized without processing in various regions. However, the fact that the chloride levels are rising rapidly suggests that they should be monitored carefully, and that serious attention should be given to the fraction of deicing salt that is being stored in the ground water. The need for more detailed statistics as to the local distribution of deicing salt is also evident.

Reference

(1) Bubeck, R. C., W. H. Diment, B. L. Deck, A. L. Baldwin, and S. D. Lipton, "Runoff of Deicing Salt: Effect on Irondequoit Bay, Rochester, New York", Science, 172(3988), 1128-1132. June 11, 1971.