CRUSTACEAN PLANKTON IN NORTHEASTERN ONTARIO LAKES SUBJECTED TO ACIDIC DEPOSITION

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Abstract. During the summer of 1981, crustacean plankton was sampled in 249 northeastern Ontario lakes, including a large proportion of acidic lakes. Species cluster analysis showed that a major species group containing B. longirostris, D. minutus, H. gibberum, and M. edax was common to most lakes. Two species subgroups most associated with more productive waters (D. retrocurva, D. oregonensis, T. p. mexicanus, and Diaphanosoma sp.) and less productive waters (D. longiremis, C. scutifer, D. g. mendotae, C. b. thomasi, E. longispina, and E. lacustris) in the study area were identified. Acidic lakes were characterized by reduced numbers of species related to declines in the importance of cyclopoids, Daphnidae, L. kindtii and E. lacustris and high relative abundance of D. minutus. Stepwise multiple linear regression of physico-chemical lake characteristics against percent composition of individual species failed to explain much of the variation in species proportions. However, variables related to lake thermal structure were most frequently the primary correlates with species proportions in near-neutral lakes while in acidic lakes the best statistical predictors of species percent composition were most often variables directly related to lake acidity.

1. Introduction

Although on a broad geographical scale glacial history may influence lentic zooplankton communities (Carter et al., 1980; Roff et al., 1981), regional studies in Ontario (Carter, 1971; Patalas, 1971; Sprules, 1975, 1977) have demonstrated general relationships between lake chemistry and/or morphometry and crustacean species assemblages.

H+ has long been recognized as a factor influencing the structure and diversity of crustacean plankton communities (Lowndes, 1952). Restricted crustacean faunas have been found in naturally acidic freshwater bodies (Fryer, 1980) as well as in manmade impoundments acidified by acid inputs from coal mining activity (Janicki and DeCosta, 1979). Reductions in zooplankton community diversity in lakes acidified due to acidic precipitation have been identified in Norway (Leivestad et al., 1976), Sweden (Almer et al., 1974), the USA (Confer et al., 1983) and Ontario (Sprules, 1975; Roff and Kwiatkowski, 1977).

For decades, aquatic environments in the Sudbury, Ontario area have been subjected to atmospheric inputs of contaminants associated with large-scale, local smelting activity. Investigations in the greater Sudbury area (Beamish and Harvey, 1972; Conroy et al., 1978) have documented a large zone of acidified lakes extending northeast-southwest of Sudbury. Many Sudbury area lakes also exhibit elevations in trace metal concentra-
tions related to smelting activity (Cu, Ni) or to increased metal dissolution and mobilization from watersheds under acidic conditions (Al, Mn).

This paper examines associations between lake water quality and crustacean plankton communities in 249 lakes, including a large proportion of acidic lakes, within a 250 km radius of Sudbury (Figure 1).

2. The Study Lakes

Although predominantly on the Precambrian Shield, the lakes studied vary in chemistry, morphometry and surficial geological setting, spanning a cross-section of lake types occurring in northeastern Ontario. Pitblado et al. (1980) have divided northeastern