1 Introduction

The accumulation of sediments in off-channel areas (i.e., backwaters) of the Upper Mississippi River (UMR) is a major concern of river resource managers (Great River Environmental Action Team (GREAT) 1980; Fremling and Claflin 1984; Nielsen, Rada, and Smart 1984) because it can result in significant losses in water volume and habitat for fishes and waterfowl. Rates of net sediment accumulation of 1 to 2 cm/year and greater have been found using isotopic dating techniques in a few UMR backwaters with known high rates of sediment accumulation (McHenry et al. 1984, Eckblad et al. 1977). Similar rates have been found by comparing bed elevation changes over time (Claflin 1977, McHenry et al. 1984), although lower rates were found by Korschgen et al. (1987). However, because backwaters have diverse morphometric features and varying connections to the main river channel, there is a need to evaluate net sediment accumulation in differing backwater types over an entire navigation pool.

Different methods used for measuring sedimentation can provide different types of information on changes in an aquatic system. Bed elevation change provides the best overall estimate of net deposition and erosion. However, the historical elevation surveys of the UMR that are needed to detect changes are limited in spatial and temporal extent. In addition, these elevation survey comparisons provide no information on the type of sediment that is accumulating. In contrast, rates determined by isotopic dating can provide in most cases only estimates of net accumulation of fine sediment because the methods rely on markers adsorbed to fine sediments. However, these estimates of fine sediment accumulation provide unique information on the type of sediment that has accumulated in the UMR.

Isotopic dating techniques (i.e., cesium-137 or lead-210) are often used to estimate rates of fine sediment accumulation (Evans and Rigler 1980, McHenry et al. 1984) but are very expensive, and this expense limits the number of sites that can be evaluated. This technique can be inaccurate and, in some cases, inappropriate in dynamic systems such as the UMR because isotope-marked sediments can be resuspended and mixed with other sediments, making rate estimates biased. However, in impoundments/backwaters on the UMR and many reservoirs, sediment accumulation can be estimated by determining the depth of sediment

overlying preimpoundment soil in a sediment core sample (James and Barko 1990). Although this method is subjective and limited to measuring fine sediment accumulation, it can greatly increase the sample size at relatively low expense as compared with isotopic dating.

Rates of net fine sediment accumulation were estimated over a wide range of backwater types in Pool 8 of the UMR using the depth to preimpoundment soil as a method for estimating sediment accumulation. Rates of net fine sediment accumulation were determined for 147 sediment cores collected from 25 backwater regions in this UMR pool. Correlations between these rates and backwater morphometric and sediment characteristics were determined to investigate the possibility of extrapolating the results from this study. In addition, comparisons of rates during the 58 years since impoundment estimated in this study to rates estimated during a 7-year period from 1989 to 1996 were made in selected backwaters to begin to investigate changes in rates through time.

Results from this study of rates of accumulation since impoundment are important in evaluating past accumulation of fine sediment and the variability of rates within and among backwaters. This information can be combined with studies of coarse sediment accumulation, studies of erosion, and studies of sedimentation in the other backwater types and channels to estimate total loss of water volume due to sedimentation in Pool 8. The rates determined in Pool 8 may not represent rates in other reaches of the UMR because of differences in sediment loading rates, source sediment characteristics, and hydraulic conditions.