I employ 35 years of data from 4 urban lakes in Sudbury, Canada, to explore whether the ecological recovery of lakes from massive historical acid and Cu and Ni contamination is controlled more by regional or local processes, i.e. by colonist arrival or by colonist establishment success and growth. Average zooplankton species richness has tripled in the lakes, a very promising trend, although it has not quite reached recovery targets. Somewhat surprisingly, average species richness increased more rapidly in the two more heavily metal-contaminated lakes, Middle and Hannah Lakes, than in the less heavily contaminated Clearwater and Lohi lakes. An examination of species accumulation curves suggests that Middle and Hannah lakes have not received more colonists, indicating that recovery is not controlled by this regional process: however, within-year persistence of these colonists is much higher in Middle and Hannah lakes than in Clearwater and Lohi lakes, suggesting a local, lake-scale process is regulating recovery. The more rapid recovery in Middle and Hannah lakes is consistent with the long-term trend of metal “toxic units” in the lakes, i.e. with the sum of the ratios of Cu, Ni and Zn LC50’s calculated with the Biotic Ligand Model, divided by metal levels in the lakes. This suggests that metal toxicity is the key factor regulating colonist establishment. Since 2007 we have been assessing the toxicity of Clearwater Lake in lab bioassays, and these results are consistent with the modelling results. After 8 decades of metal damage in Sudbury’s urban lakes, we are approaching a time when metal toxicity will no longer be the main determinant of zooplankton community composition. This will indeed be a welcome day, given that these lakes were among the most severely contaminated of Ontario’s quarter million lakes.