

# DEFINING AWAY METAL CONTAMINATION IN GEORGIA STREAMS

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**Abstract.** Currently the State of Georgia regulates only metals in the dissolved form, based on the recommendations of the US EPA. This change was made in 1998 and has ramifications for Georgia water quality. 943 stream miles that were listed as having metals violations in the 1998 305 B list were no longer listed as having metals violations in the 2000 305 B list. In addition 43% of these streams were removed entirely from the list. This implies that these streams no longer suffer from metal contamination. We have also conducted research on the Chattahoochee River which indicates that the concentrations of dissolved arsenic, copper, cadmium and lead are well below the new criteria. However, data on biota from this river indicate that the food web remains contaminated and that arsenic concentrations in fishes exceed consumption guidelines. These findings suggest that the new criteria do not adequately protect Georgia streams.

## INTRODUCTION

In 1998, the Georgia DNR approved a change to the Georgia Rules and Regulations for Water Quality Control which altered metals criteria from values based on total recoverable concentrations to values based on dissolved concentrations. The ability of states to make this change was initially promulgated by the US Environmental Protection Agency in 1995. The reason for this change is to reflect scientific research which suggested that in toxicity tests, the metals that were causing measurable toxicity were those in the dissolved form.

Dissolved concentrations are obtained by filtering river water through a 0.45 µm filter and then acidifying and measuring the metal concentrations in the filtrate. This is contrasted to the total recoverable concentrations which are measured by acidifying an unfiltered water sample and then measuring the metals in the total sample. In surface waters with high concentrations of suspended particles, such as clays and organic material, the portion of metals in a water

sample that is removed through filtration can be significant. In addition, metals in surface waters readily sorb to fine particles. However concentrations for the new criteria are similar to the concentrations for the previous criteria (Table 1). This means that the new criteria will permit much higher concentrations of total recoverable metals and are less stringent than previous criteria.

When this change was made in 1998, we hypothesized that the change would have ramifications for Georgia water quality (Rosi 1999). We predicted that the number of stream miles that were partially or not supporting their designated uses due to metals would decrease. We also predicted that within the Chattahoochee River, where we are conducting research, the concentrations of metals would be within the new criteria without any change in water quality or extent of metal contamination in the food web. To test these predictions, we now examine the 1998 and proposed 2000 305B lists to determine the effect of this change in metals criteria.

**Table 1. The previous total recoverable criteria concentrations and the new 1998 dissolved criteria.**

Metal	Previous Total Recoverable criteria (µg/l)	Current Dissolved Criteria (µg/l)
Arsenic	50	50
Cadmium	0.7	0.62
Chromium VI	11	11
Copper	6.5	6.2
Lead	1.3	1.2
Nickel	88	88
Selenium	5.0	5.0
Zinc	60	60

**Table 2. Changes in the listing of streams, by river basin, from 1998 to 2000. Number of stream miles that were listed as violating metals criteria in 1998 and were not listed in 2000 and the number of streams that were completely removed from the list are given for Stream Partially and Not Supporting Designated Uses.**

Basin	Partially Supporting Designated Uses		Not Supporting Designated Uses	
	Number of stream miles no longer listed for metals	Number of stream miles delisted	Number of stream miles no longer listed for metals	Number of stream miles delisted
Altamaha	23	0	0	0
Chattahoochee	97	94	192	108
Coosa	3	0	64	1
Flint	0	0	55	0
Ochlockonee	0	0	5	0
Ocmulgee	17	2	105	64
Oconee	0	0	14	10
Ogeechee	61	2	1	0
Satilla	43	43	23	0
Savannah	142	40	9	2
Suwanee	12	5	77	40
Total	398	184 (46%)	545	225 (42%)

## RESULTS

Numerous rivers throughout the state were affected by the change in metals criteria (Table 2). For streams partially meeting designated uses in 1998, 398 stream miles are no longer listed for violation of metals and 46% of these stream miles were removed entirely from the list. For streams not meeting designated uses in 1998, 545 stream miles are no longer listed as for violation of metal criteria and 42% of these stream miles were removed entirely from the list. In a matter of two years 943 miles of Georgia streams are now defined as free of metal contamination.

### The Chattahoochee River below Atlanta

In research which we are conducting on the Chattahoochee River below Atlanta, we have found a similar trend. We sampled four sites on the Chattahoochee River mainstem within and below metropolitan Atlanta. We measured the dissolved and total recoverable concentrations of metals during four seasons in 1998-1999. The dissolved concentrations of copper (Cu), cadmium (Cd), arsenic (As), and lead (Pb) were consistently much lower than the new criteria limit in the Chattahoochee River, (Neumann

and Lyons, unpublished data). The total recoverable concentrations for Cu, Cd, and Pb were consistently higher than the dissolved concentrations. While these results may seem surprising, the mechanism is well understood. In surface waters with high total suspended solids, especially those high in clays, as in the Chattahoochee, metals readily sorb to fine particles and are rarely found in the dissolved fraction of the water column.

In addition, the concentration of metals in net-spinning caddisflies, Hydropsychidae, inhabiting the river are high (Figure 1). Hydropsychid caddisflies are filter-feeding insects which feed primarily on suspended fine particles. The concentrations of Pb, Cu and Cd in caddisflies in the Chattahoochee River are similar to concentrations in a similar caddisfly species inhabiting the Clark Fork River, Montana at a site draining a severely contaminated Superfund site (Axtmann et al. 1997).

We also measured the concentration of metals in muscle tissues of carp, catfish, large mouth bass and shad in the Chattahoochee River. Muscle tissue is most often consumed by people. The concentration of cadmium was below the concentration which the EPA suggests fish consumption guidelines. However, the concentration of arsenic in all fish species is high

enough to warrant concern for the general population. At the concentrations detected, the EPA recommends consuming only from six fish meals per year to one meal per month (USEPA 2000).

### CONCLUSIONS

In conclusion, it appears that the metals standards adopted in 1998, may not be effective for protecting Georgia surface waters. The dramatic change in the number of stream miles listed in the 305B list implies that a large number of streams in Georgia are now free of metal contamination, as compared to 2 years ago. However this was due only to a change in the criteria and should not be viewed as a dramatic increase in water quality in Georgia streams.

The case study of the Chattahoochee River suggests that in this Georgia river system the biota are contaminated with metals even though the measured dissolved metal concentrations are well below the dissolved criteria. The concentration of Pb, Cu and Cd in the tissues of hydropsychid caddisflies are similar to those found in a site contaminated by a Superfund site. Recently a number of papers have shown that the tissue metal concentrations in biota are most related to the concentration of metals associated with their food

particles, not with dissolved metals (Roditi and Fisher 1999, Schlekot et al. 1999, Lee et al. 2000). This suggests that the portion of metals that are most influencing the biota are currently not regulated. These findings indicate that the new criteria are not protective of biota.

Furthermore, our findings indicate that the fish in the Chattahoochee River are contaminated with high enough levels of arsenic to be of concern for human consumption. Although the dissolved concentrations of arsenic were lower than the dissolved criteria limits, the fishes are contaminated with arsenic. These findings indicate that the new criteria limits may not be protective enough to maintain safely edible fishes in Georgia rivers.

These results lead us to conclude that the new standards may not be adequate to detect problems of metal contamination in riverine food webs. Regulating dissolved concentrations may be protective, if used in combination with sediment metals criteria, which at this point are not in place. However, without sediment criteria and with no regard for suspended sediments, a majority of the metals in a surface water body may not be regulated in Georgia. These new criteria have simply defined away a statewide problem of metal contamination.

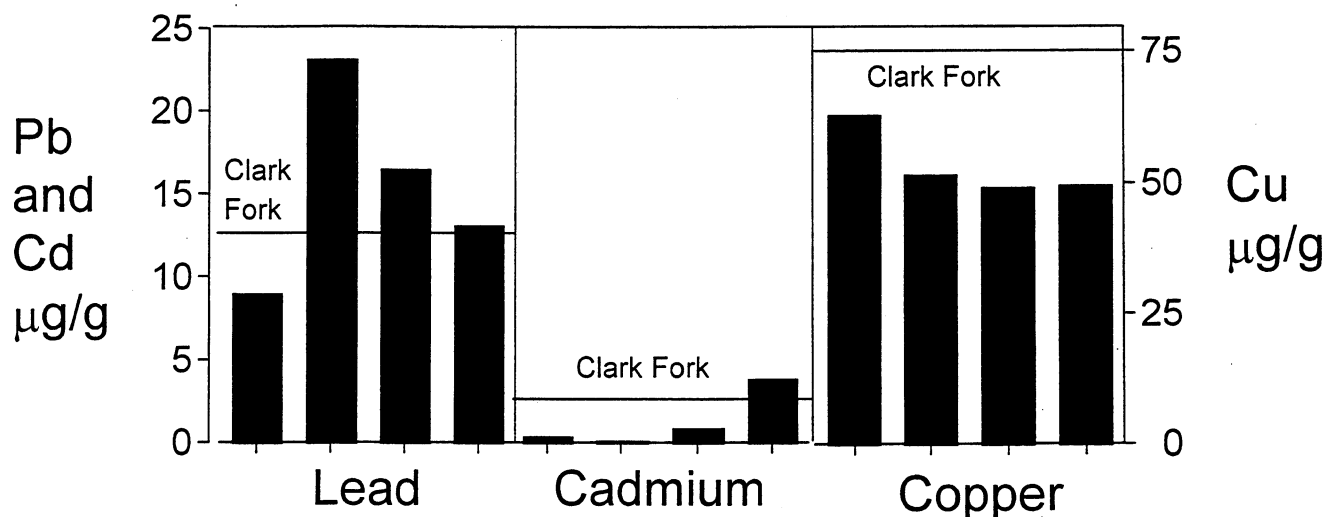


Figure 1. The seasonal maximum concentration of lead, cadmium, and copper measured in the tissues of net-spinning caddisflies, Hydropsychidae at each site on the Chattahoochee River. Samples were collected and pooled at each site and a single concentration determined for each site and season. Concentrations plotted here are the maximum seasonal value for each site. The highest concentrations which were detected in the Clark Fork river, Montana are represented as a line. Lead and cadmium concentrations are given on the left axis and copper concentrations are given on the right axis.

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