Water Quality Monitoring for the Effects of Road Salt and Suspended Sediment on Yellow Perch (*Perca flavescens*) in Three Tributaries of the Chesapeake Bay

A. C. Whiting[1], A.E. Pinkney[2], R. E. Casey[1] and D.R. Ownby[1]

[1]Urban Environmental Biogeochemistry Laboratory, Towson University, Towson, MD [2]Chesapeake Bay Field Office, U.S. Fish and Wildlife Service, Annapolis, MD

INTRODUCTION

- The goal of this study is to analyze the impacts of road salt and suspended sediment on the survival of yellow perch eggs and larvae.
- Yellow perch populations are increasing in the Choptank River, however, they are experiencing declines in the Mattawoman Creek, and they are doing poorly in the Severn River.
- One possible cause of the decline is decreasing water quality in the spawning habitat due to stormwater runoff. In particular, road salt and suspended sediment impacted stormwater is believed to be causing water quality degradation.

METHODS

- Sample locations were identified in Yellow Perch spawning grounds in each tributary (Severn River, Mattawoman Creek, and Choptank River) (Figure 1).
- At each site, starting in February 2010, a YSI 600LS temperature and conductivity logger and an ISCO sampler were deployed (Figure 2).

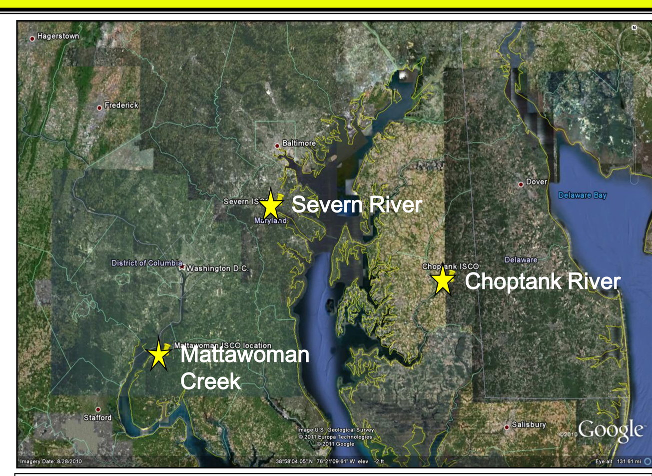


Figure 1. Map of the three sampling locations (Severn River, Mattawoman Creek, and Choptank River).

Figure 2. Photographs of the sampling equipment at each site (left to right: Mattawoman, Severn, Choptank).

- The ISCO samplers were triggered prior to rain events and collected water samples every 4 h for 4 d so that each sampling period included samples prior, during, and after the rain event.
- All three watersheds were sampled during spawning (Feb/Mar), summer (May/June) and fall (Oct) 2010, and prior and during spawning (Feb/Mar) 2011.
- Water samples were analyzed for major cations and anions using a Dionex IC-320 Ion Chromatograph (IC) (Table 1).
- Dissolved metals were quantified after 0.45 µm PTFE syringe filtration using a ThermoElemental PQExCell ICP-MS.
- Total suspended solids (TSS) were analyzed using ESS method 340.2 (Fig 3).

Table 1. List of all cation, anion, and dissolved metals that were analyzed.

Cations	Ca^{2+}, K^+, Mg^+, and Na^+
Anions	F^-, Cl^-, Br^-, NO_2^-, NO_3^-, PO_4^{3-}, and SO_4^{2-}
Metals	Cr, Mn, Co, Ni, Cu, Zn, Cd, and Pb

Figure 3. TSS filters from the Choptank river.

Figure 4. Beaver damage at the Mattawoman site in Jan. 2011.

RESULTS

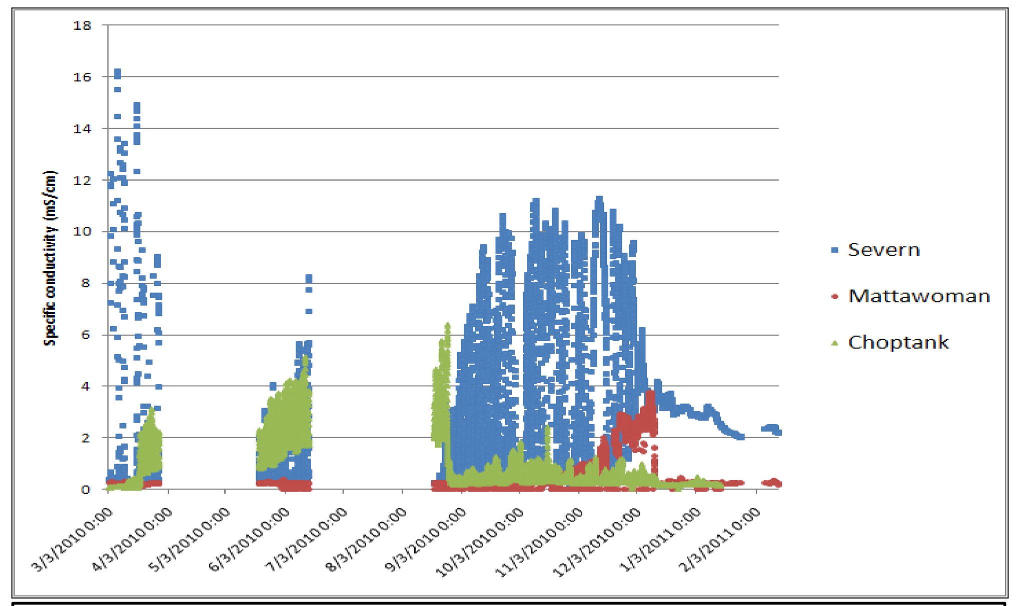


Figure 5. Conductivity readings at each sampling location starting in Feb 2010 and ending in Feb 2011. No data was collected from April-May 2010 and June-August 2010.

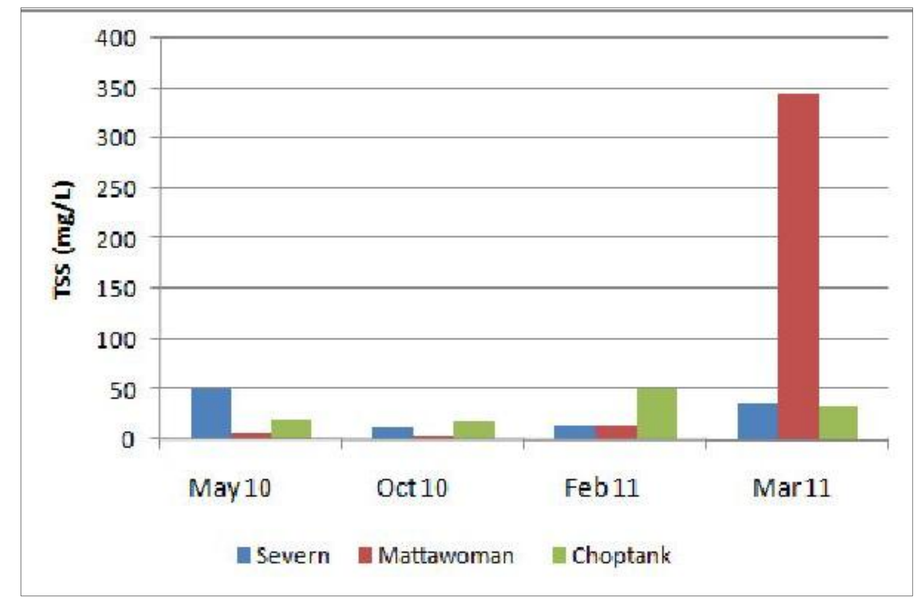
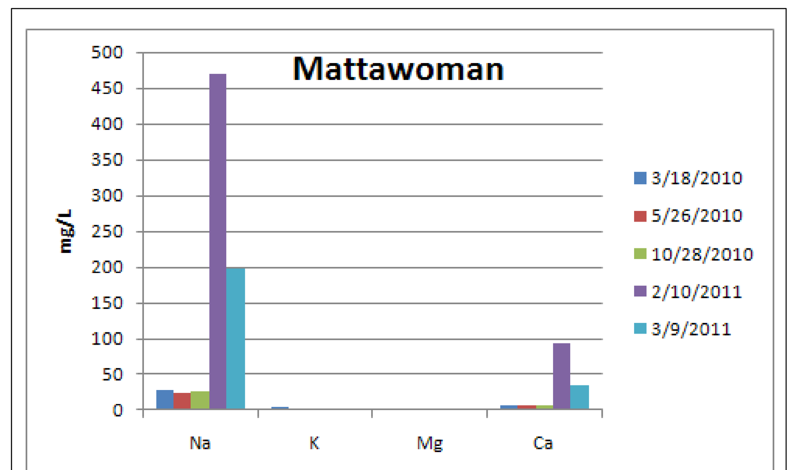
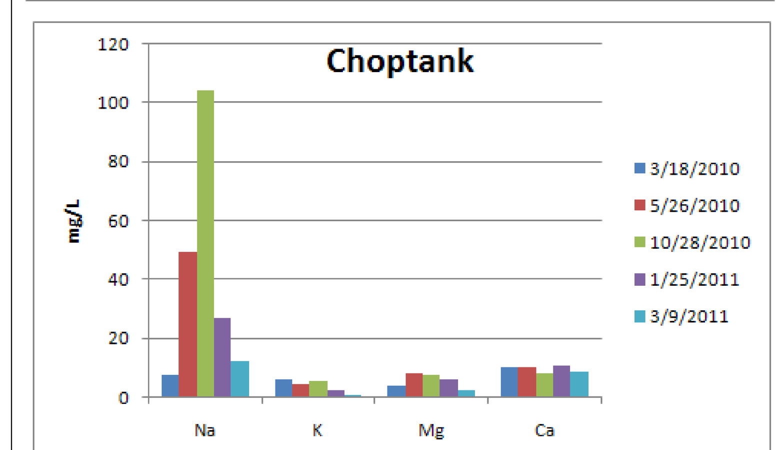


Figure 6. Total suspended solids (TSS) results for select sampling events at all locations. Values used are averages of each sampling event by river.





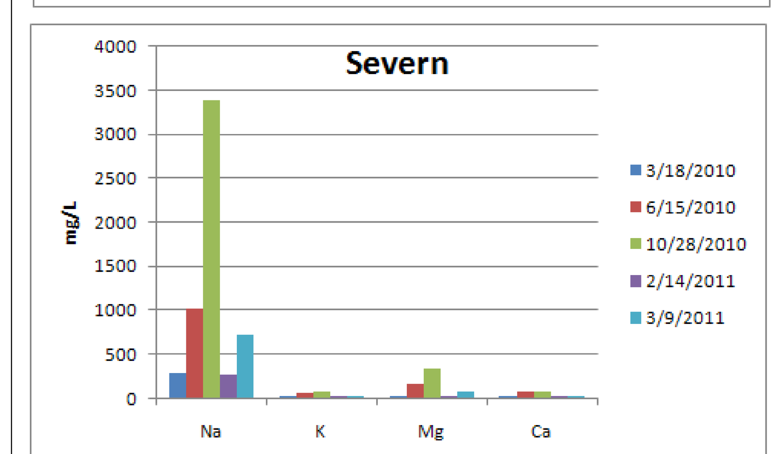


Figure 7. Cation data by river and date. Values used are averages of each sampling event by river.

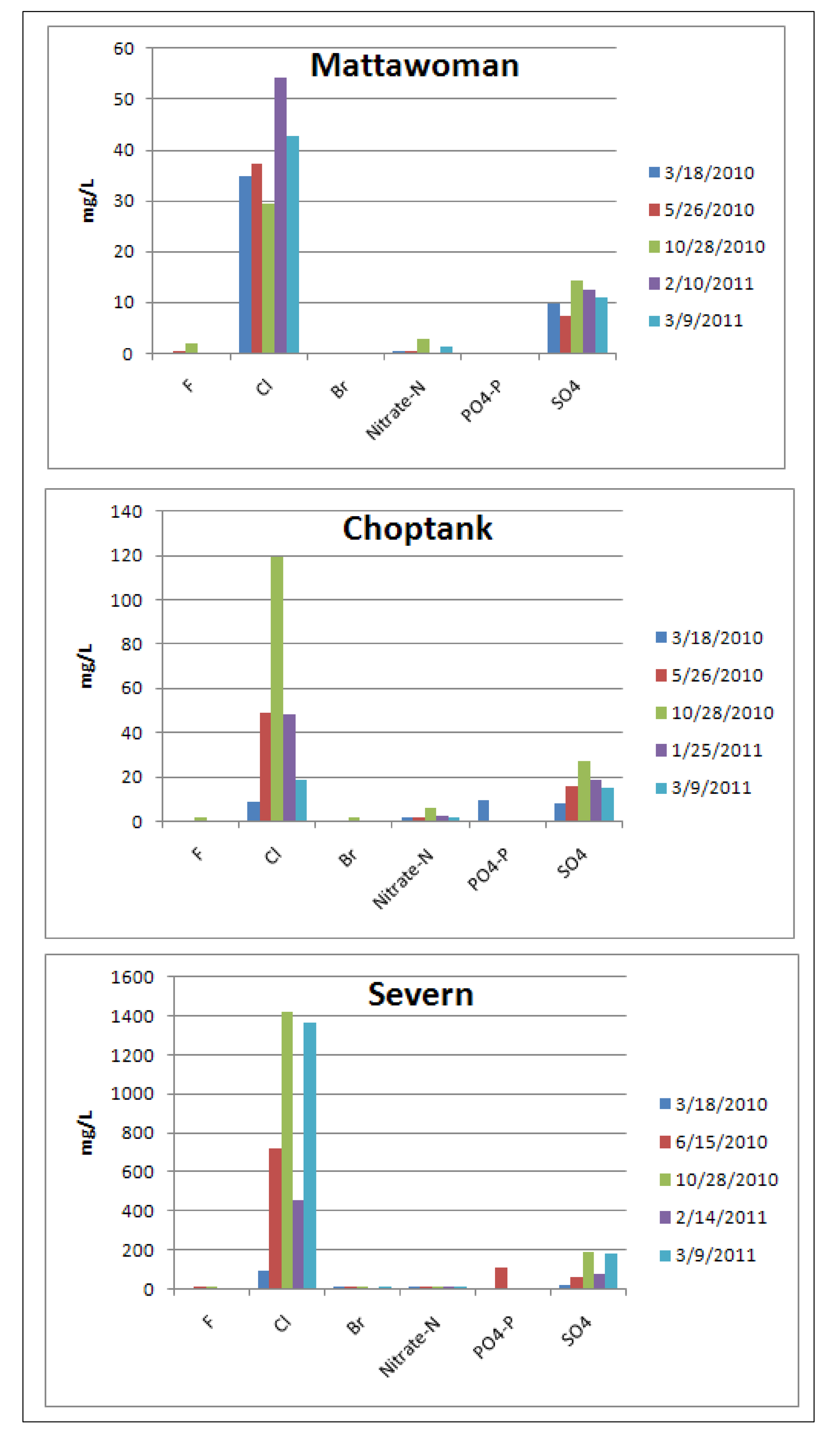


Figure 8. Anion data by river and date. Values used are averages of each sampling event by river.

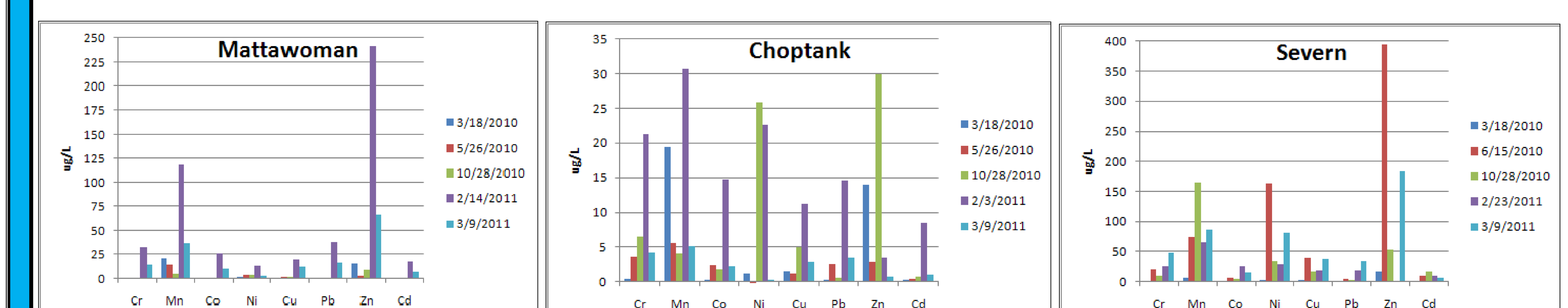


Figure 9. ICP-MS metals results by river and date. Values used are averages of each sampling event by river.

DISCUSSION AND CONCLUSIONS

- Mean conductivity increased from spring to summer and from summer to fall for all of the watersheds in 2010. Conductivity data from the Severn and Choptank Rivers shows the tidal influence at those sites (Figure 5).
- TSS values from the summer 2010 sampling date showed large variability (7-50 mg/L) between watersheds. The fall 2010 sampling values were generally smaller (4-18 mg/L), but this would be expected since the rain event that occurred during the dates the samplers were triggered had less rainfall. The Mattawoman March 2011 TSS values were very high due to very fine sediment in the water samples (Figure 6).
- The highest ion values (1009 mg/L Na) in the Severn River samples appear to be cyclical, matching up with tidal cycles. For Mattawoman Creek, Na and Cl values were consistent over the three 2010 sampling events. For the Choptank and Severn Rivers Na and Cl values (104 mg/L Na and 295 mg/L Cl for the Choptank, and 3387 mg/L Na and 6076 mg/L Cl for the Severn) were an order of magnitude greater during the summer and fall events, suggesting greater tidal influence at these locations during those sampling events (Figures 7 & 8).
- A brief comparison of metal concentrations to the EPA's National Recommended Water Quality Criteria suggests that there are some exceedences of the freshwater acute criteria (CMC) for Cu, Zn, and Cd. Cadmium concentrations exceeded the CMC value (2.0 µg/L acute) in all rivers in Feb. 2011, in the Severn during the Summer and Fall 2010 as well as March 2011, and in the Mattawoman in March 2011. Zinc concentrations exceeded CMC values (120 µg/L acute and chronic) in the Severn in Summer 2010, and Mattawoman in March 2011 (Figure 9).

FUTURE WORK

- This is a two year study.
- Water quality monitoring and toxicity testing for 2011 is in progress.
- A full project report is expected in 2012.

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