Interstate Commission on the Potomac River Basin – Nov. 14, 2012 meeting

ANALYSIS OF EDC'S IN AQUATIC SYSTEMS

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Points to discuss

- My background and experience.
- Approach for study

Recent Analytical Experience.

- "Occurrence of antibiotics and hormones in a major agricultural watershed" Journal article, 2008.
- "Steroid hormones in biosolids and poultry litter: A comparison of potential environmental inputs" – Journal article, 2011.
- "Fate of triclosan in agricultural soils after biosolid application" – analyses in biosolids and field soils." Journal article, 2010.
- Several publications on alkylphenol and alkylethoxylates in WWTPs, airports and waterways – Jorge Loyo-Rosales 1998 to 2005.

EDC/Fish-Related Research

- 1998 to 2010 - **Alkylphenols and Alkylphenol-ethoxylates (APEs) as Potential Endocrine Disrupters in Fish.**
- **2001 to 2003 -** Alkylphenol and Alkylphenol-Ethoxylates in Carp, Water, and Sediment from the Cuyahoga River, Ohio, ES&T 2003 and their effects Sci. Tot Env. 2006
- 2005 to 2010 - Concentration of Organic Contaminants in Fish and their Biological Effects in a Wastewater-Dominated Urban Stream – Sci. Tot. Env. 2012.

WWTP outfall vary seasonably for APEs

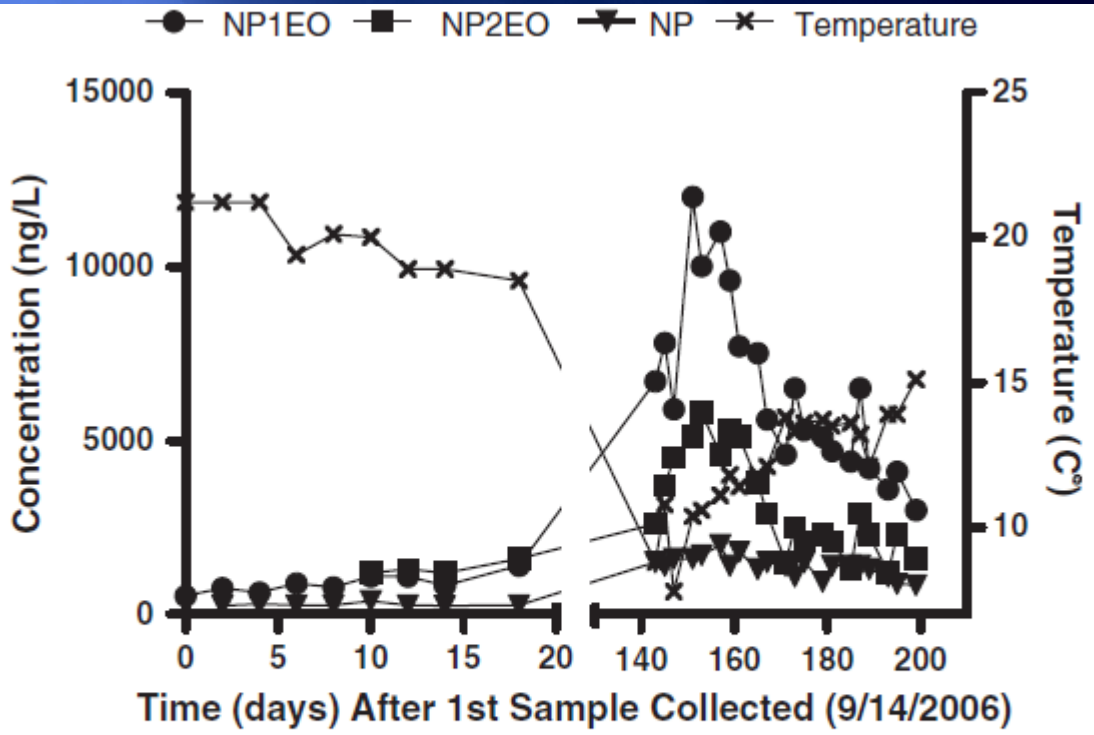

Fig. 3. Effluent concentrations of nonylphenol (NP) and nonylphenol 1 to 2 ethoxylate (NP1–2 EO), and temperature in effluent versus days after 1st sample collection at the North Side Water Reclamation Plant inclusive of a fall 2006 collection interval (0 to 20 days) followed by a spring 2007 collection (140 to 200 days).

Fish Tissue Concentration Also vary seasonally

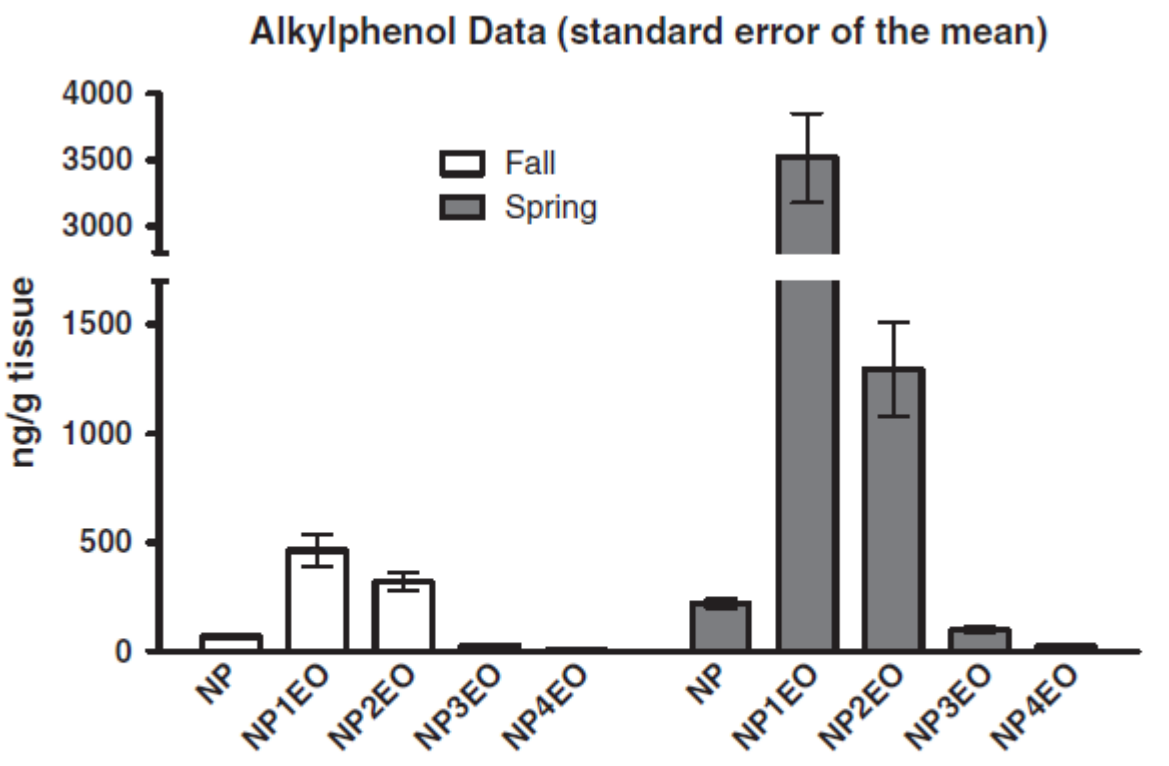

Fig. 2. Nonylphenol (NP) and nonylphenol 1 to 4 ethoxylate (NP(1–4)EO) concentrations found in fish collected in the Fall of 2006 and Spring of 2007. Concentrations represent mean ± standard error of the mean of all fish captured for each season.

Biological Effects also tested on these fish.

- Vitellogenin levels in males positively correlated with concentrations of NPEs in these same fish.
- There were, however, no observable histological differences in fall versus spring fish samples.

Acknowledge

- Alba Torrents, U of MD, provided talented staff.
  - Dr. Jorge Loyo Rosales – PhD 2004
  - Dr. Nuria Lozano – Visiting Scientist
  - Isabelle Schmitz-Afonso - 2002
  - Christine (Bevacqua) Heines - 2011
- Dr. Osman Arikin – Visiting Scientist -2006
- Dr. Seema Datta – Post. Doc -1999

Chemicals proposed for monitoring

- EDC's as proposed in UCMR3, e.g. 6 natural estrogens plus equiline and EE2 throughout.
- Marker compounds for WWTP (nonylphenol, altenolol, TCS, TCEP (tris(2-chloroethyl) phosphate), Sucralose, etc.
- Marker compounds for Urban sources (bisphenol A, PAH's, …)
- Marker compounds for Agricultural sources (sulfamethazine or sulfathiazole, ionophores and herbicides, etc.).

Approach For this study

- Chemistry is critical, but not central to the goal of this study.
- Central is its bioassay directed focus.
  - Attempt to use common media for chemical and biotic impact assessments.
  - Correlation across water parameters to emphasize
    - Bioavailability
    - Exposure duration (may use POCIS samplers).
  - Many unknown stressors besides obvious EDCs
    - Metals
    - Man-made pollutants
      - Pharmaceuticals
      - Pesticides
    - Interactive effects (mixtures).
- Utilize DOM measured using EEMs to combine and correlate with:
  - Biological effects (fish bioassays)
  - Chemical measurements (water and fish?) .

Conclusions

- One needs a team approach to better understand problems of this complexity.
- We need to better manage this river system to protect the fisheries, but also to gain insight into potential effects on drinking water, as an early sentinel for possible human effects.
- Hopefully we should be able to apply knowledge to similar river systems in other impacted urban areas.