

Contaminants of Emerging Concern

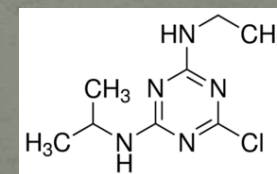
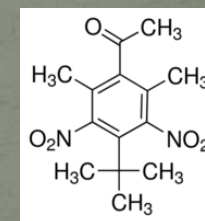
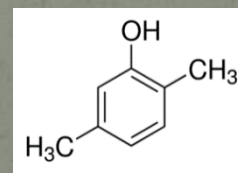
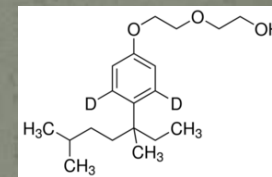
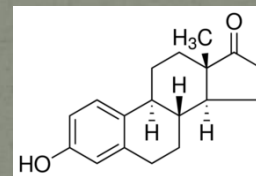
St. Clair/Detroit River System Initiative March 2, 2017
Mandy Annis, U.S. Fish & Wildlife Service





CECs

- Chemicals which are new, or for which there is limited regulations or limited knowledge of effects
- Diverse
 - Personnel Care Products
 - Agricultural Chemicals
 - Pharmaceuticals
 - Plasticizers/Flame Retardants
 - Surfactants
 - Others

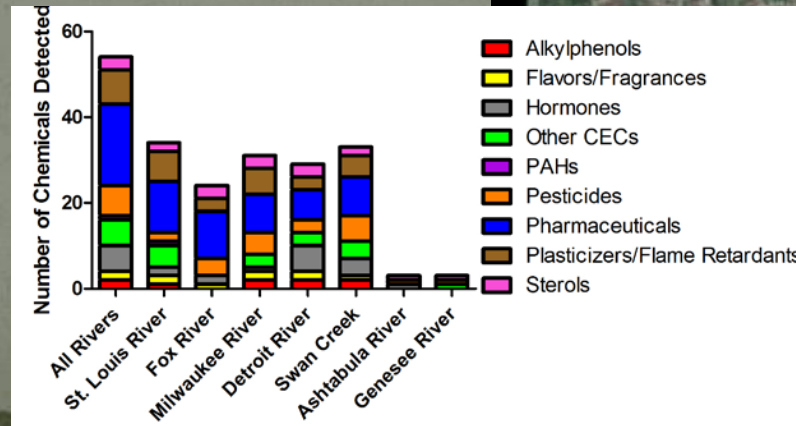
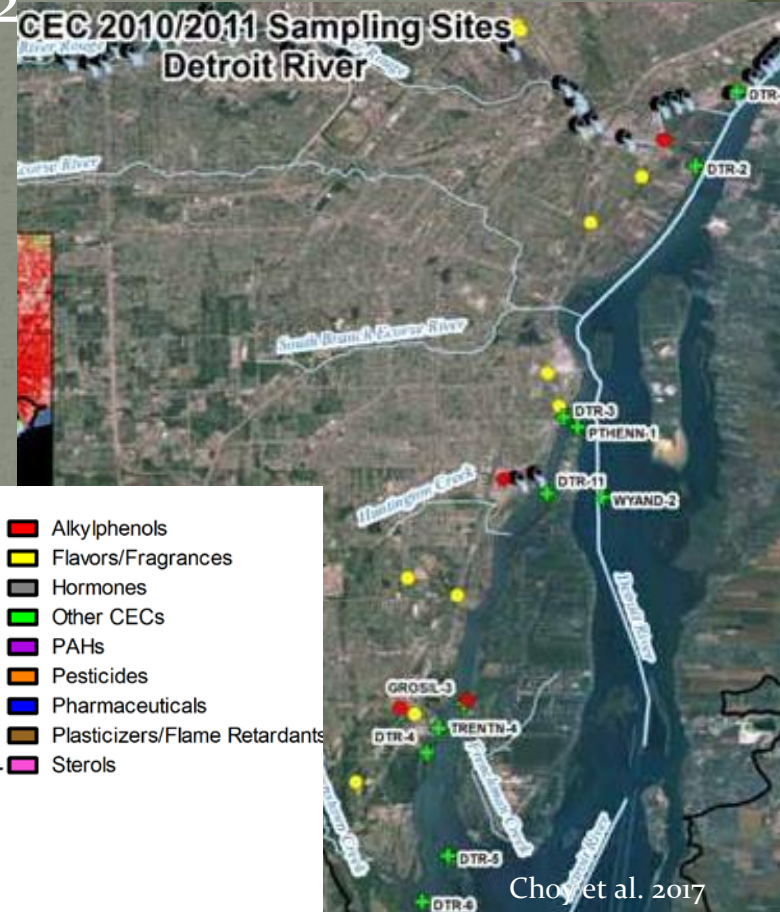


SigmaAldrich



CECs

- Widespread –Choy et al. 2017, “CECs in Great Lakes Basin: A Report of Sediment, Water & Fish Tissue Chemistry Collected in 2010-2012”
 - Found throughout the Basin
 - Detroit River-Urban Profile
 - Pharmaceuticals
 - Hormones
 - Plasticizers/Flame Retardants
 - Flavors/Fragrances
 - Sterols
 - Alklyphenols
 - Pesticides





CECs

- Contributions from Industry, Agriculture, & Municipalities
- Morning Routine- down the drain!
 - Soap/Shampoo/Lotions
 - Toothpaste
 - Vitamins/Other Medications
 - Etc.....
- Not always broken down by WWTP





CECs

- So what happens to animals who live, and eat from waters containing these chemicals?
- Limited Research
 - Endocrine Disruption
 - Altered Behaviors
 - Reduced Growth/Fitness
 - Altered Immune Responses
 - Molecular Alterations
 - Others?
- Such sub lethal effects may or may not have significant overall impacts.
- Currently we just don't know!
- Research & Monitoring Needed





SCDRS Indicators of CECs

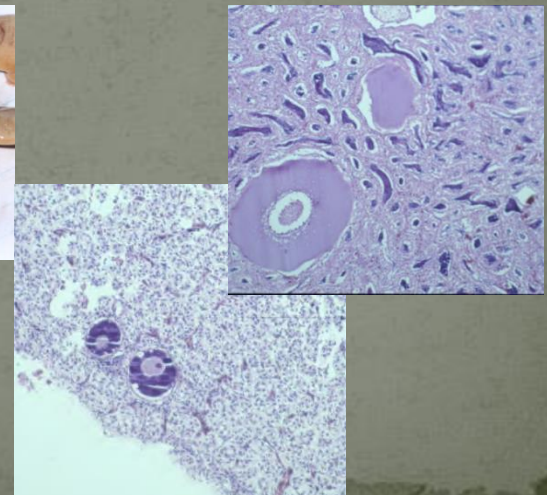
- Literature Rich-Field/Laboratory Research
- Classic Endocrine Disruption Indicators
 - Intersex
 - Altered Vitellogenin Levels
 - Altered Reproductive Hormones
 - Estrogenicity of Water





SCDRS Indicators of CECs

- Intersex
 - Fish with both male and female gametes
 - # & Degree in Sampled Population vs. Reference
 - Gonad Sampling
 - Gross or histological (microscopic) observations
 - Documented in areas of known EDCs
 - Increased occurrence in lab exposures with EDCs



SCDRS Indicators of CECs



- Altered Vitellogenin

- Yolk Protein Precursor

- Normal:

-  in Reproductive Females
 -  in All Males & Juveniles, Non-Repro Females



- Levels Sampled Population vs. Reference @ Same Time of Year

- Blood Test-Species Specific

- Documented in areas of known EDCs
 - Increased occurrence in lab exposures with EDCs



SCDRS Indicators of CECs

- Altered Reproductive Hormones Profiles
- Skewed Female (E) to Male (T or 11KT) Hormone Ratios
- Normal:
 - Females $E/T \geq 1$, Males $E/T < 1$
 - Levels Sampled Population vs. Reference @ Same Time of Year
 - Blood Test
 - Documented alterations in areas of known EDCs
 - Increased alterations in lab exposures with EDCs





SCDRS Indicators of CECs

- Estrogenicity of Water
 - Concentration & Strength of Chemicals Mimicking Female Hormones
 - Indicates Exposure to Estrogen-like Chemicals
 - Documented Effects Levels
 - Water Sample-Chemical Analyses
 - Relatability to EDC Endpoints in Literature
 - Known Metrics from the Literature





SCDRS Indicators of CECs

- Detroit River /Trenton Channel-2010-2011
- USGS-Blazer et al. 2014-Preliminary Report
 - Possible endocrine disruption from CECs?
 - Intersex (2 of 20 male largemouth bass, 0 of 6 male bullhead)
 - Vitellogenin present in males of both species
 - **Not a Smoking Gun!**
 - **Needs Careful Interpretation:**
 - Trenton Channel-high concentrations of other stressors/EDCs
 - Severity of Intersex? 1 egg or 1000?
 - Vitellogenin- Levels? Detectable , significantly different from others or at Female Levels?
 - **More Research is Needed to Verify!**





SCDRS Indicators of CECs

- Supported by Current Science
- Used in Many CEC Studies
- Opportunistic Data Collection
 - Expensive/Technical Expertise Needed
- Doesn't Address Non EDCs CECs
- Biological Responses can be Induced by Other Stressors
- Fish-centric
- Relevancy to Overall Population?
 - Suggests possible impairment
 - What degree impacts a population?





USFWS CEC Research

- U.S. Fish and Wildlife Service & Partners
 - GLRI Funded
 - Survey of Great Lakes Basin-including Detroit River
 - Population Impacts to Taxa Assessments:
 - Fish
 - Including Preliminary Detroit River Assessment-USGS Blazer
 - SCDRS Lake Sturgeon CEC Measurements-Pending.
 - Freshwater Native Mussels
 - Fish Eating Birds
 - Maumee, Milwaukee, and Lab Work



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USFWS Taxa Assessments

- Research, Research , Research!
 - Field-Fish & Mussels
 - Caged, Resident, Streamside Exposures
 - Lab-exposures to mixes similar to those of the Great Lakes
 - Generations of fish
 - Reproductive mussels & host fish
 - Lake Sturgeon Streamside Rearing Facilities
 - Evaluate CEC Concentrations in Fish Eating Birds





Future CEC Research

- What is out there?
 - Currently-a better understanding of the extent of CECs in the Great Lakes
- Why should we care?
 - At this level do they pose a threat to our fish and wildlife?
 - Research/Monitoring Needed!
 - Increase CEC Knowledge
 - Assess Effects to Taxa
 - Assess Population Impacts
 - Aid Resource Management
- Stay Tuned.....



Acknowledgements

Integrated Group Partners

EPA

Central Michigan University-Daelyn Woolnough's Lab-mussel assessments

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