Emerging Contaminants in our Waterways

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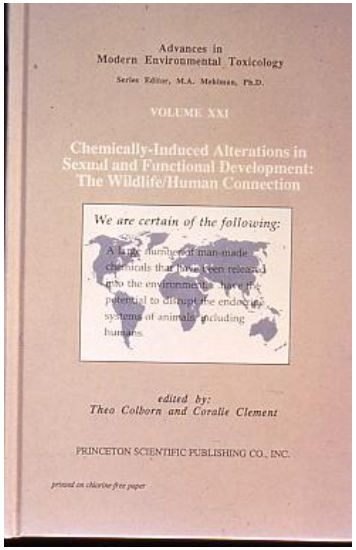
Presentation to
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Long ago in lands far away

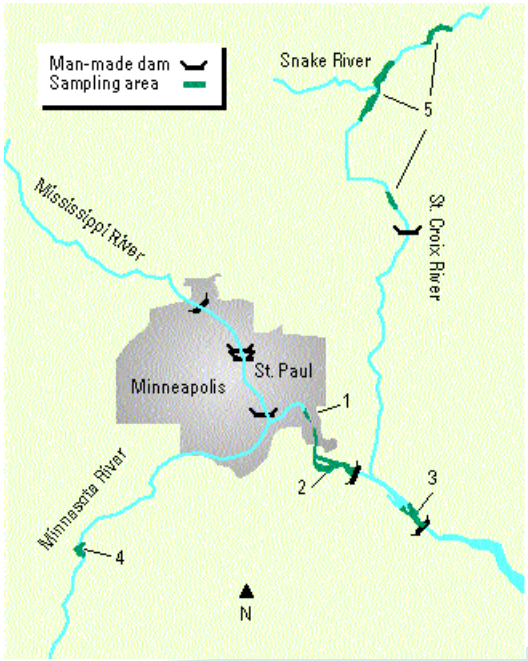


1992



1994





Enter the US Geological Survey

Fish Sex Change

- First reported in Florida in 1970's
- Male Goby fish showed female characteristics
- Downstream from pulp mill effluent
- Sitosterol was active chemical from trees
- Reported in other rivers with pulp effluent
- Resurfaced in England in 1994-5

USGS investigation – Kolpin et al. 2002

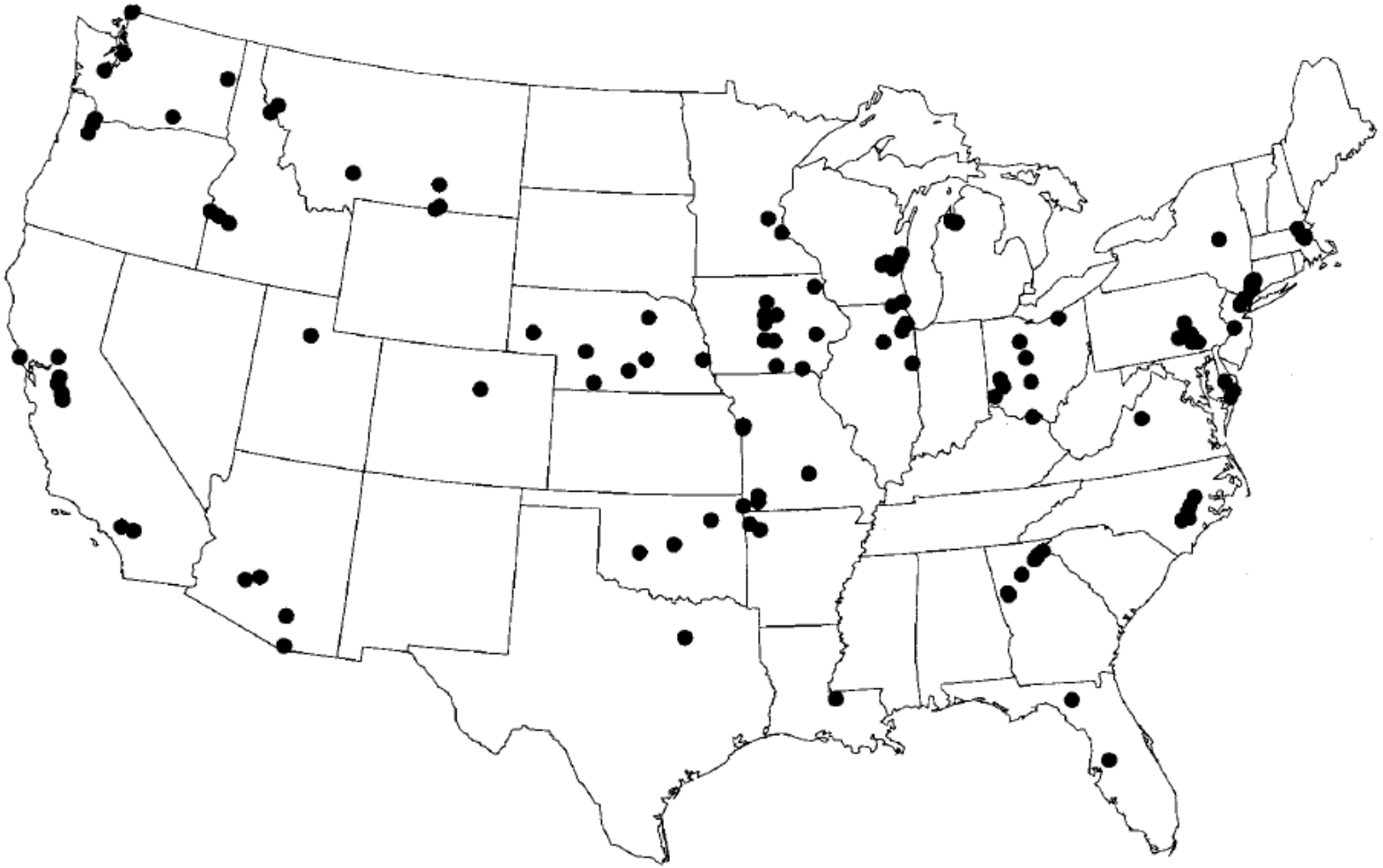


FIGURE 1. Location of 139 stream sampling sites.

USGS Survey





- 1999–2000
- 139 rivers
- One time water samples
- Measured hundreds of pharmaceuticals, industrials, pesticides, hormones













Findings

- 17 antibiotics
- 15 prescription drugs
- 7 non-prescription drugs
- 39 other chemicals
- 18 hormones, including several different steroids
- What's the harm?





Reproduction

IQ



Behavior







2008

- Congress weighs in- hearings Sept 18, 2009
- USGS to continue
- Agricultural run-off
- Drinking water and groundwater

What is going on elsewhere?

- Columbia River
- Ohio River
- California
- Minnesota
- Potomac River
- US Geological Survey
- Individual scientific research

The Bottom Line

- Many chemicals into the water
- Effects on fish downstream from WWTP
- Effects from animal feedlots
- Sediment as sinks

Questions ?

Estewards.com

Compounds in USGS survey

Pharmaceuticals
17*a*-Ethynylestradiol (ovulation inhibitor)
Mestranol (ovulation inhibitor)
19-Norethisterone (ovulation inhibitor)
Equilenin (hormone replacement therapy)
Equilin (hormone replacement therapy)

Sterols
Cholesterol (fecal indicator)
3*b*-Coprostanol (carnivore fecal indicator)
Stigmastanol (plant sterol)

Biogenics
17*b*-Estradiol
17*a*-Estradiol
Estrone
Estriol
Testosterone
Progesterone
cis-Androsterone

More USGS target chemicals

- **Prescription**
- Metformin (antidiabetic agent)
  Cimetidine (antacid)
  Ranitidine (antacid)
  Enalaprilat (antihypertensive)
  Digoxin
  Diltiazem (antihypertensive)
  Fluoxetine (antidepressant)
  Paroxetine (antidepressant, antianxiety)
  Warfarin (anticoagulant)
  Salbutamol (antiasthmatic)
  Gemfibrozil (antihyperlipidemic)
  Dehydronifedipine (antianginal metabolite)
  Digoxigenin (digoxin metabolite)

- **Non-Prescription** Acetaminophen (analgesic)
  Ibuprofen (anti-inflammatory, analgesic)
  Codeine (analgesic)
  Caffeine (stimulant)
  1,7-Dimethylxanthine (caffeine metabolite)
  Cotinine (nicotine metabolite)

More USGS target chemicals

Tetracyclines

- Chlortetracycline
  Doxycycline
  Oxytetracycline
  Tetracycline

Fluoroquinolones

- Ciprofloxacin
- Enrofloxacin
- Norfloxacin
- Sarafloxacin

Macrolides

- Erythromycin-H2O (metabolite)
- Tylosin
- Roxithromycin

Sulfonamides

- Sulfachlorpyridazine
- Sulfamerazine
- Sulfamethazine
- Sulfathiazole
- Sulfadimethoxine
- Sulfamethiazole
- Sulfamethoxazole

Others

- Lincomycin
- Trimethoprim
- Carbadox
- Virginiamycin

More USGS target chemicals

Insecticides

- Diazinon
- Carbaryl
- Chlorpyrifos
- *cis*-Chlordane
- N,N-diethyltoluamide (DEET)
- Lindane
- Methyl parathion
- Dieldrin

Polycyclic aromatic hydrocarbons (fossil fuel and fuel combusion indicators)

- Naphthalene
- Phenanthrene
- Anthracene
- Fluoranthene
- Pyrene
- Benzo(*a*)pyrene

More USGS target chemicals

- **Antioxidants**
- 2,6-di-tert-Butylphenol
- 5-Methyl-1H-benzotriazole
- Butylatedhydroxyanisole (BHA)
- Butylatedhydroxytoluene (BHT)
- 2,6-di-tert-Butyl-p-benzoquinone

- **Others**
- Tetrachloroethylene (solvent)
  Phenol (disinfectant)
  1,4-Dichlorobenzene (fumigant)
  Acetophenone (fragrance)
  p-Cresol (wood preservative)
  Phthalic anhydride (used in plastics)
  Bisphenol A (used in polymers)
  Triclosan (antimicrobial disinfectant)