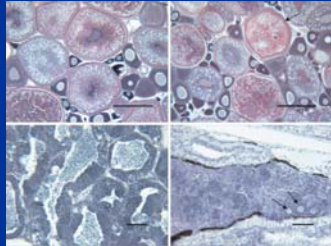


Wastewater-Borne Hormones & Their Threat To Fish

Josh Rogers
FWF 512
125 Ellington PSB
April 9, 2008
12:20 – 1:10 PM



Something's Fishy



Categories: U.S. news, World news, Politics, Business, Entertainment, Health, Sports, Tech & science, Travel, Weather, Local news, Browse

Male fish becoming female? Researchers worry about estrogen and pollutants in the water

By Tom Costello
NBC News
updated 2:54 a.m. ET, Tues., Nov. 9, 2004

FREE VIDEO

BOULDER, Colo. — Researchers in Colorado have made a startling discovery. Fish, apparently male, are developing female sexual organs. Scientists believe it's the result of too much estrogen in the water and they're finding estrogen in rivers across the country.

In Colorado's rivers and streams, scientists are waist-deep in ritual of the season, using electric currents to stun native fish to the surface where they're measured and checked.

<http://www.msnbc.msn.com/id/6436617/>

Outline

- Endocrine Disruption
 - Hormones as Contaminants
- History of EDCs
- Documented Effects on Fish
- Human Effects?
- Where do we go from here?



Endocrine Disruption

- Endocrine System
 - Regulation of immune, metabolic, morphogenic, neural, & reproductive functions
 - Glands → Hormones → Receptors → Response
- Endocrine Disrupter
 - Interferes in some way with the endocrine system

Synthesis, Secretion, Transport, Binding, Action, or Elimination of hormones from the body

Endocrine Disruption

- Types of Endocrine Disrupters
 - Natural
 - Phytoestrogens → substances naturally occurring in or derived from plants
 - Synthetic
 - Alkylphenols
 - Bisphenol A
 - TCDD & TCDF
 - Stable dioxin paper & wood preservatives
 - Pharmaceuticals
 - Birth Control Pills

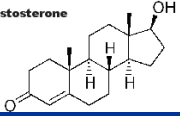
Herbicides
Fungicides
Insecticides
PCBs
Alkylphenols
TCDD & TCDF
Pharmaceuticals

History

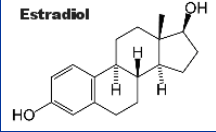
- 1930's - Endocrine Disrupting Chemicals were 1st manufactured
- 1938 - First signs of reproductive changes from EDC's
- ↓
- 1950's - Increased use of Diethylstilbestrol (DES) to help prevent miscarriages, but later shown to cause decreased fertility in offspring
- ↓
- 1960's - Negative effects of DDT documented after heavy use throughout the U.S.
- ↓
- 1970's - 1976 - The British Water Research Centre published a report called "Steroids as Water Pollutants"
- ↓
- 1990's - 1991 - The term "Endocrine Disrupter" was coined
- 1996 - EPA's Office of Development & Research identified endocrine disruption as one of it's 6 main priorities
- ↓
- 2000's - Over 500 studies on endocrine disruption in the last 10 years by EPA

Hormonal Contaminants

Testosterone



Estradiol



Hormonal Concerns

- Estrogen
 - 17 α -ethynylestradiol (EE2)
 - Active Form
 - Stable
 - LOEL
- Testosterone
- Persistence & Concentration

Hormonal Contaminants



Hormonal Concerns

- Sources
 - Point Source
 - WWTPs
 - Non-Point Source
 - Agricultural Runoff
 - Sewage Effluent Irrigation

What about us fish?!



Effects on Fish

- Masculinization
 - Early maturation of male juveniles
 - Smaller female body size
 - Smaller offspring
 - Less offspring
- Feminization
 - Delayed sperm/egg development
 - Smaller testes
 - Eggs on testes
 - Inc. production of the female protein vitellogenin



Why are fish more affected?
-No escape!
-Bioconcentration



Research

- *Rutilus rutilus* (roach fish)
 - Fresh/brackish water fish native to most of Europe & western Asia
 - 1985 → anglers began catching hermaphroditic fish downstream from London sewage treatment plants
 - Caged rainbows downstream
 - Findings:
 - Dose dependent vitellogenin production
 - Every sewage treatment plant investigated was releasing increased levels of estrogen



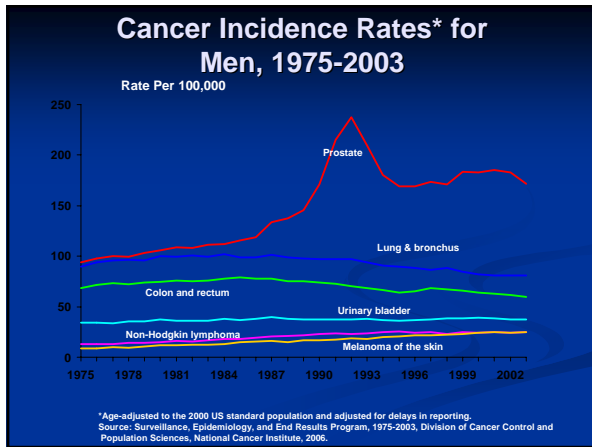
Research

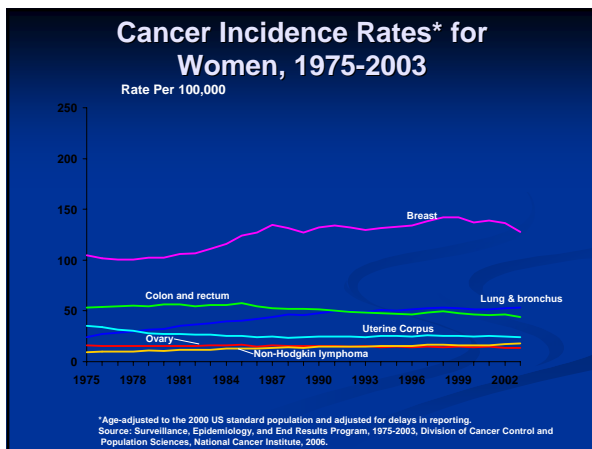
- Carp
 - 1996 → USGS study
 - 26 streams in 11 river basins throughout U.S.
 - Measured:
 - 17 β -estradiol
 - 11-ketotestosterone
 - Vitellogenin
 - Findings:
 - All river basins had carp showing signs of endocrine disruption → Estrogen / Testosterone Ratios



Human Effects?

- Endocrine disruption from sewage effluent theorized to be linked to:
 - Supposed decline in sperm counts of adult males
 - Younger age for onset of puberty
 - Increased incidence of prostate & breast cancer





Human Effects?

- Don't risk it!
 - Estroblaster



What Next?



- Wastewater Treatment
 - Removal Methods
 - Membrane Biological Reactors
 - Activated Sludge Process With Nutrient Removal
 - Trickling Filtration
 - Untreated

40 - 90% Removal

What Next?



- Wastewater Treatment
- Problems
 - Non-active → Active
 - Mixtures more potent
 - Pharmaceuticals
 - Increased Usage
 - Naturally Derived
 - No requirements
 - Updates cost \$

What Next?



- Wastewater Treatment
- Problems
- Future Work
 - Better treatment methods
 - Updated EDC list
 - Study of population level effects on longer lived species
 - Understanding the mechanism of interactive chemical effects

What Next?



- Wastewater Treatment
- Problems
- Future Work
- “Precautionary Principle”

“Where there are threats of serious or irreversible damage, scientific uncertainty shall not be used to postpone cost-effective measures to prevent environmental degradation.”

Questions?

Buy it today!