



Emerging Contaminants in our Water Resources: *Research-Assessment-Monitoring*

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Emerging Contaminants?

EDC's

HAA's

PPCP's

- Human Drugs
- Vet. Drugs
- Antibiotics
- Hormones
- Steroids
- Detergents
- Plastics

- Antioxidants
- Fire retardants
- Disinfectants
- Fumigants
- Fragrances
- Insecticides/ Repellants

OWC's

PhAC's

New and understudied contaminants!

How do we decide which chemicals to look for?

- Quantities produced/used.
- Pathways for chemical release.
- Anticipated environ'tal behavior.
- Health significance.
- Potential as indicators/tracers.
- Ability to measure.
- Stakeholder priorities.



Human Waste Pathways

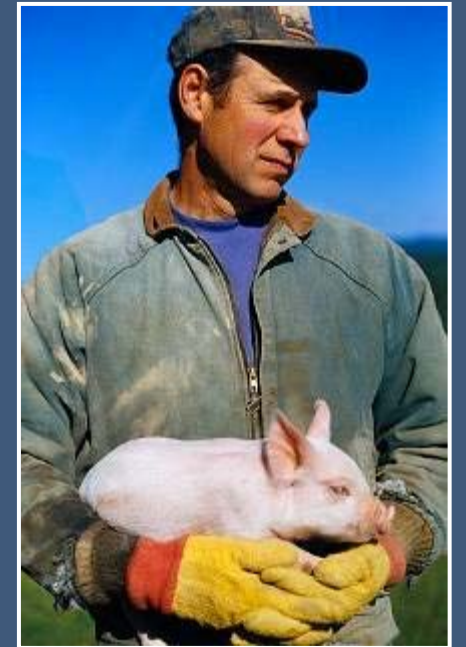
- WWTF
- CSOs
- ISDS
- Industrial Disch.
- Landfills
- Water Reuse.



Animal Waste Pathways

Animal Agriculture

- Waste lagoons
- Land application
- Processing
- Aquaculture



The Important Questions

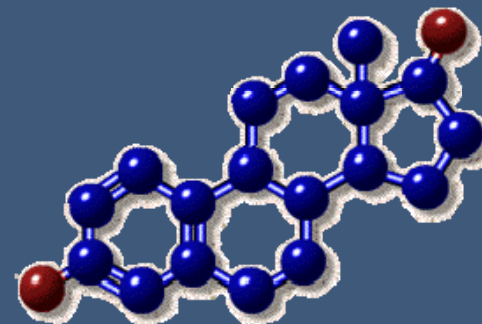
- What compounds enter the environment and from what sources?
- At what levels are they found?
- In what mixtures?
- In what media (water, sediment, tissue)?
- Do they persist and accumulate?
- Do they transform and to what?
- Do they pose an ecological health risk?
- Do they pose a human health risk?

USGS Priorities

- Methods Development.
- Occurrence and Source Pathways.
- Transport & Fate.
- Ecological Effects.



• Methods Development



158 Compounds in Water

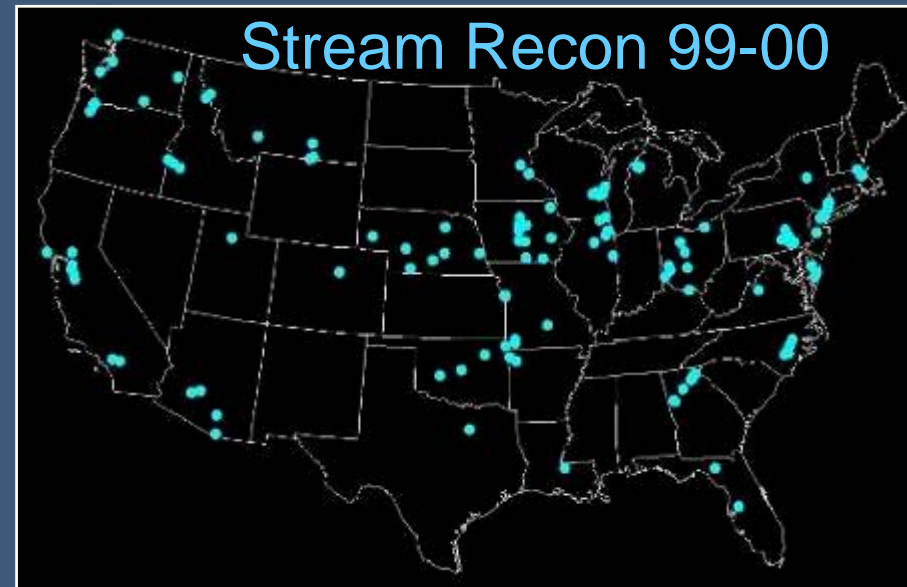
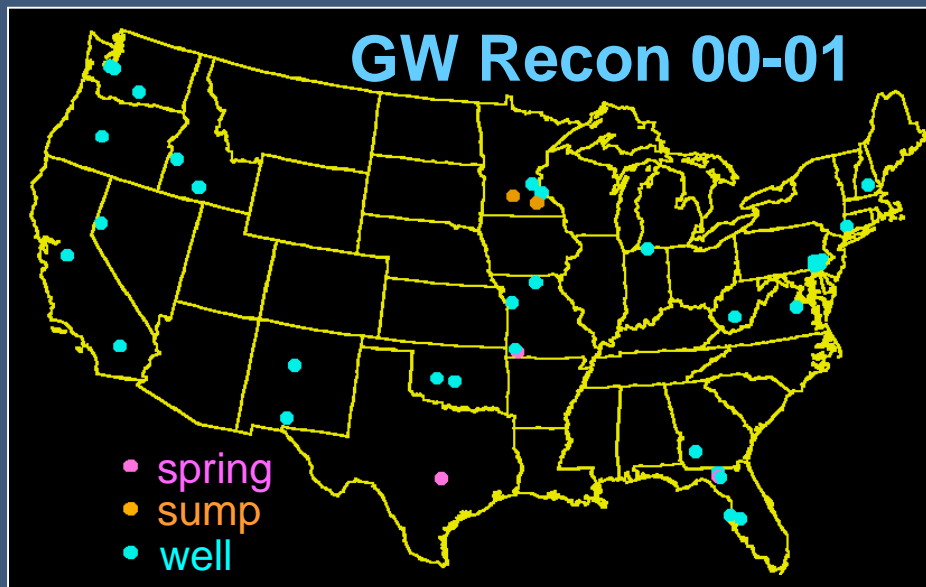
- 45 Antibiotics
- 20 Human Drugs
- 14 Hormones and Steroids
- 79 Household and Industrial Compounds

83 Compounds in Sediment

- 3 Antibiotics
- 19 Human Drugs
- 61 Household and Industrial Compounds

New Methods Priorities

- SSRI's
- Fluorochemicals
- Hormones
- Antibiotics
- Statins
- Benzodiazepenes
- Cox II inhibitors
- Algal Toxins
- Additional Environmental Media
- Lower Reporting Levels



II. Occurrence & Source Pathways

What have we learned?

- Present at low concentrations in water.
- Present as mixtures (up to 38 in 1 sample).
- A wide range of compounds and classes reflect a range of human activities & inputs.
- The compounds and concentrations detected depend on the media sampled.

Source Characterization Studies

Human: septic tanks, municipal biosolids, municipal effluents, municipal holding ponds, hospital waste.

Animal Agric: poultry, swine, dairy, beef cow operations, food processing plants, aquaculture.

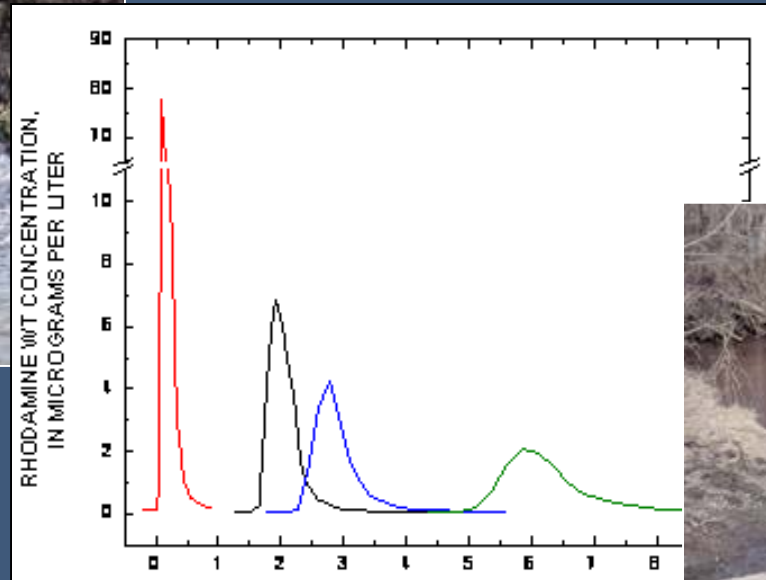


III. Transport & Fate

- Transport processes
- Environmental media
- Degradation byproducts
- Persistence



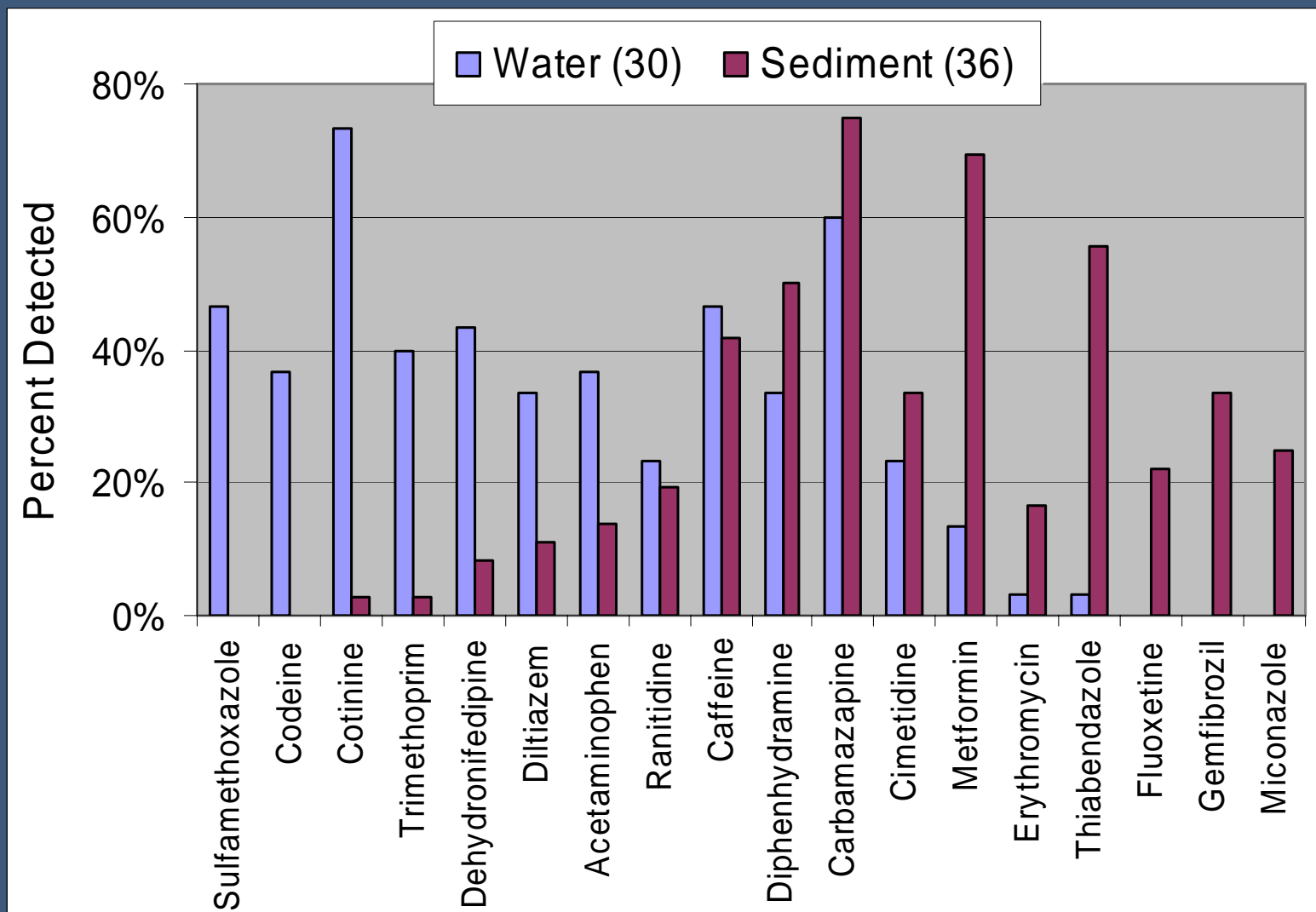
Tracer
Tests



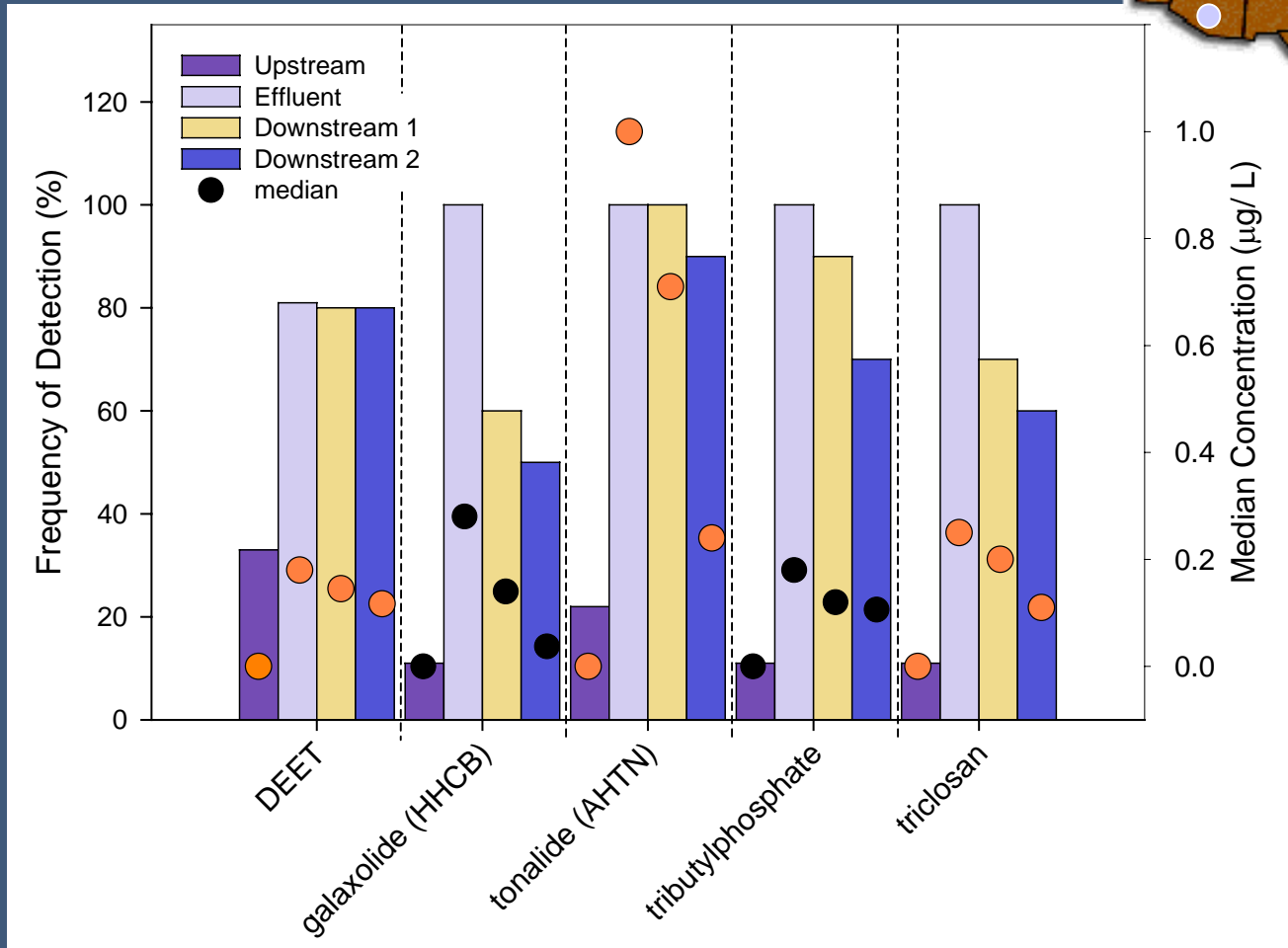
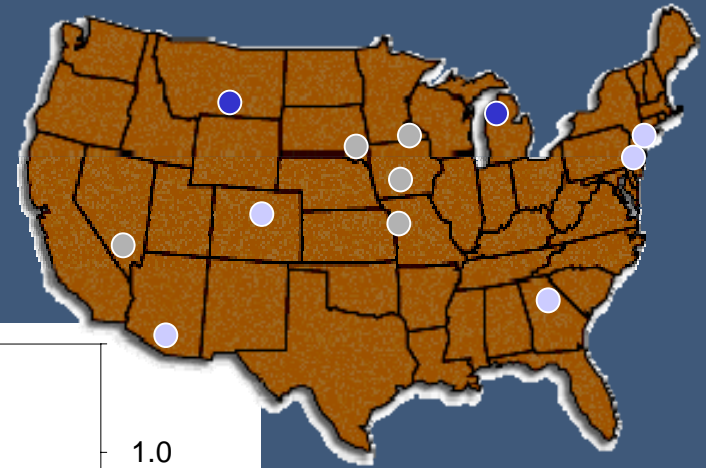
Fourmile Creek, IA



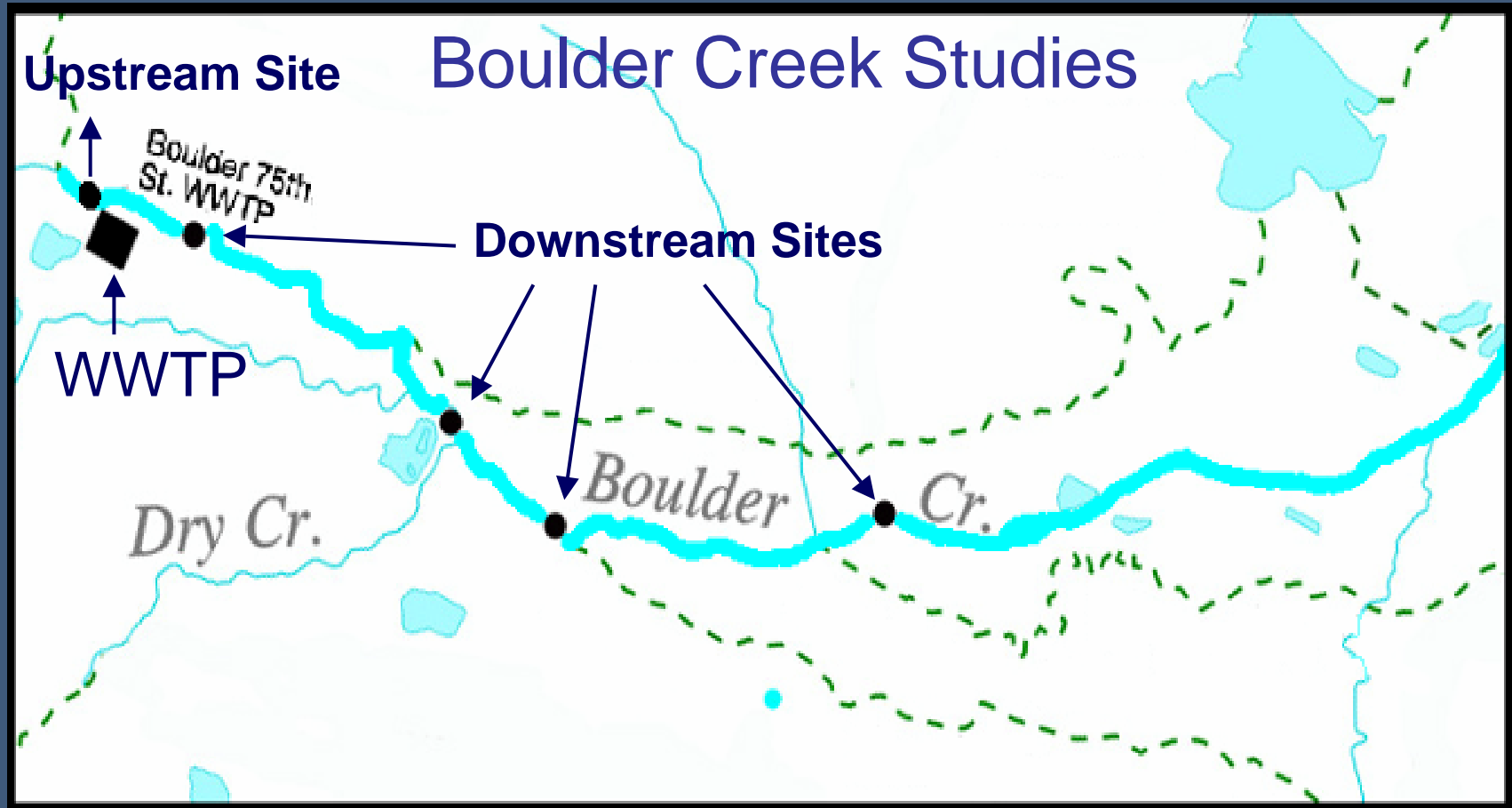
Are they in the water or sediments?



WWTP Study: 10 Plants, US/DS

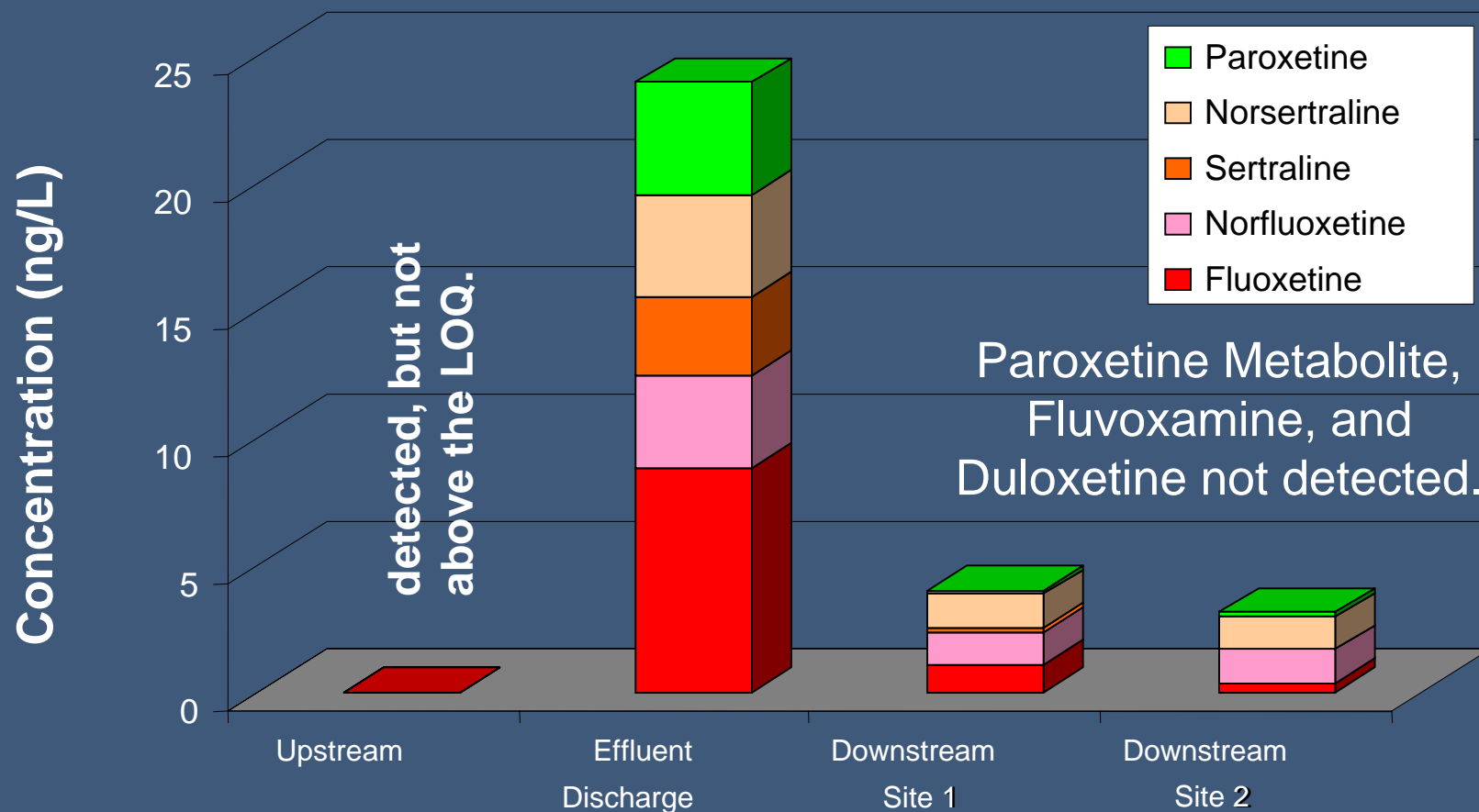


Transport and Fate Study in Boulder Creek CO



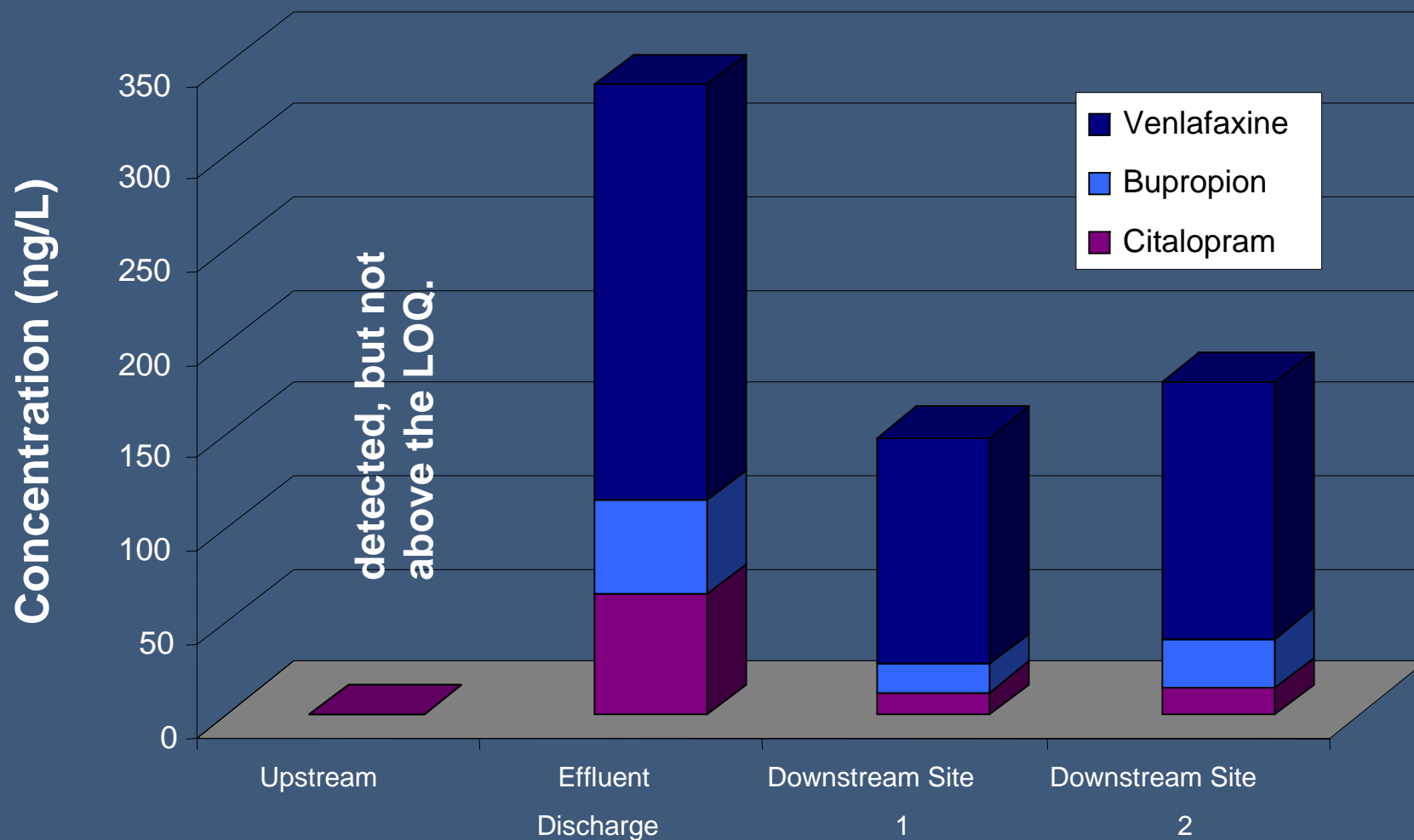
Antidepressants in Boulder Creek

“Minor Players”



Antidepressants in Boulder Creek

“Major Players”

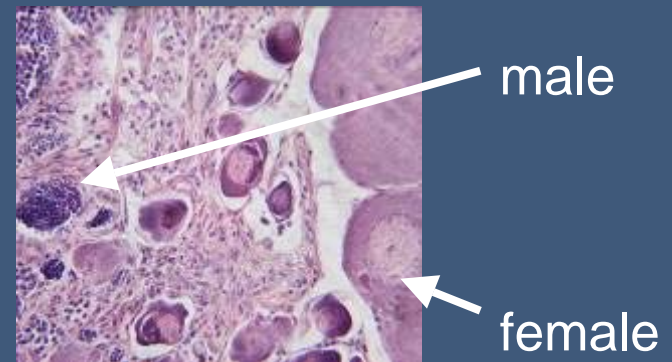


IV. Health Effects

- Endocrine Disruption
- Antibiotic Resistance
- Chemical Mixtures
- Pathogens
- Other Ecological Effects

Intersex

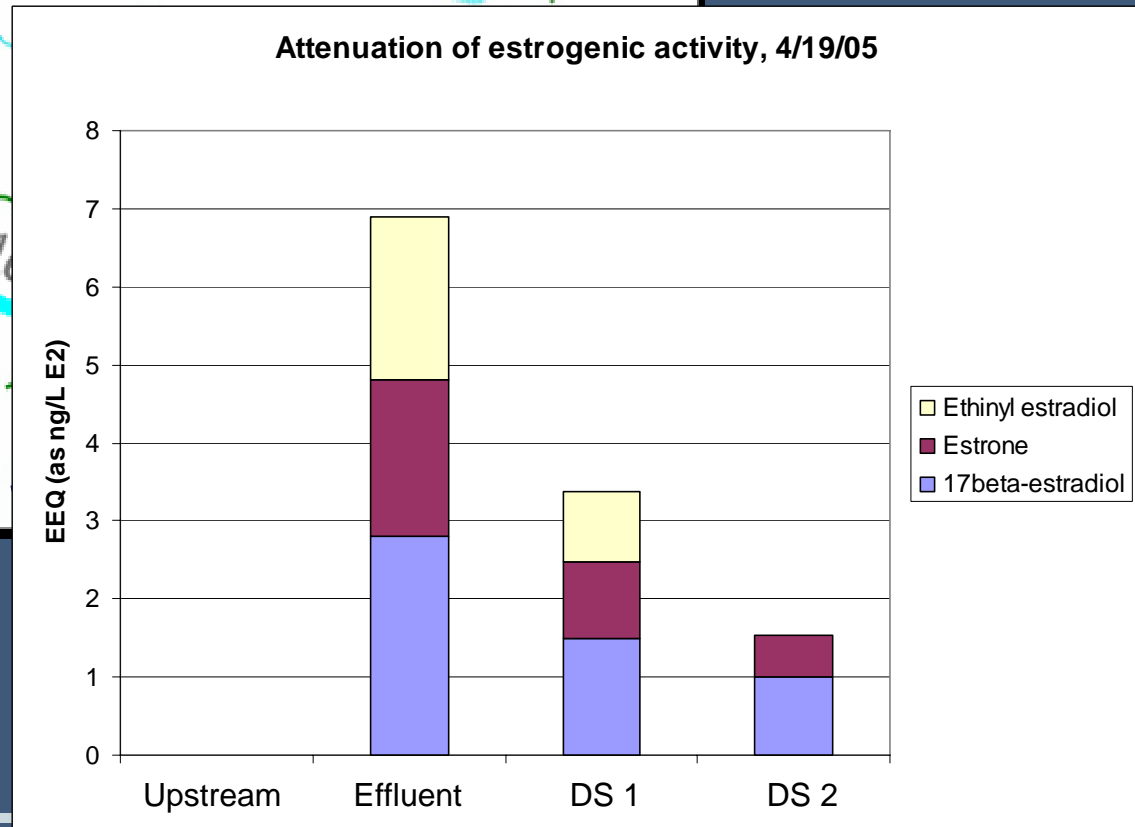
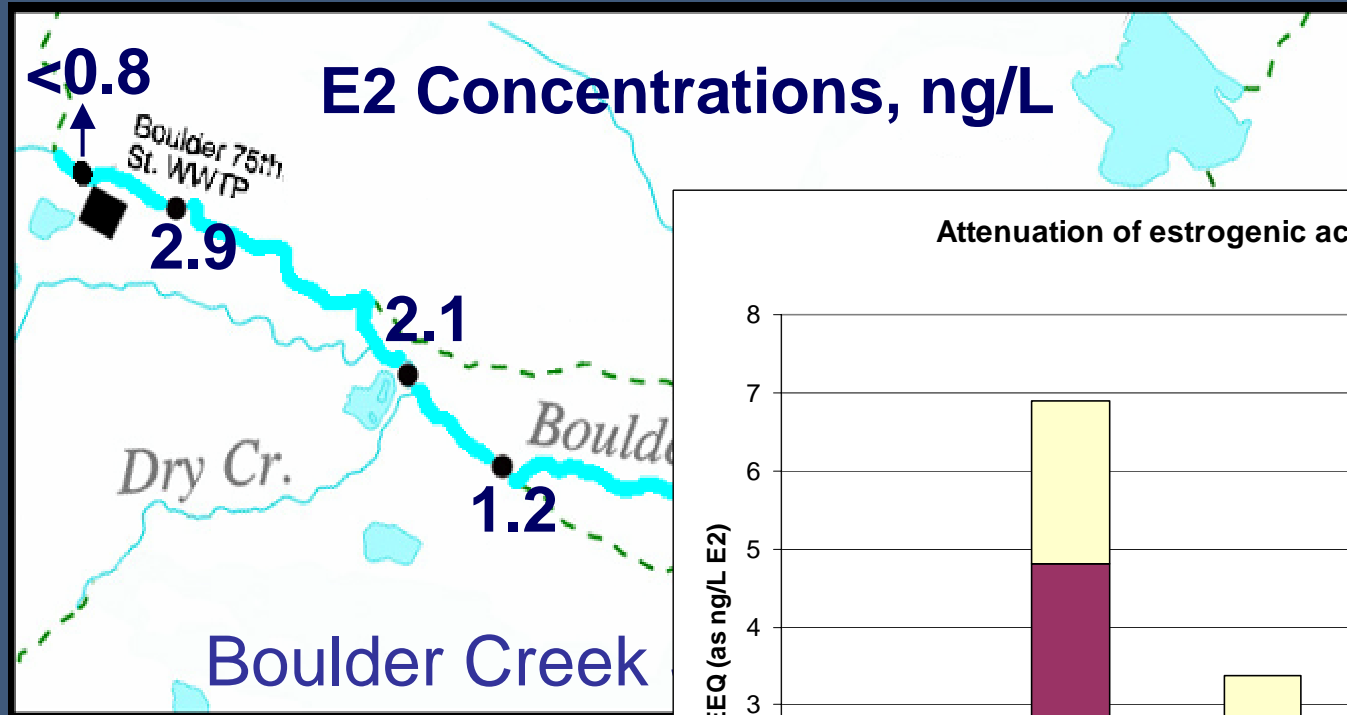
Cellular Abnormalities



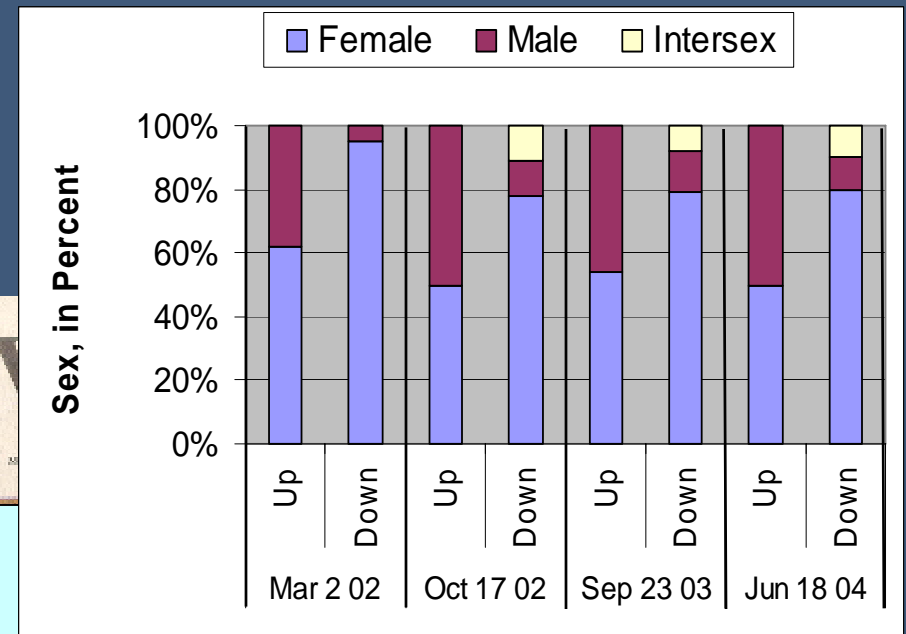
External Deformities



Boulder Creek Transport Fate and Effects Studies



WWTP Effluent and Endocrine Disruption



THE SUNDAY DENVER POST

DENVERPOST.COM | THE DENVER POST | Rocky Mountain News | \$1.00

Mutant fish prompt concern

Study focuses on sewage plants

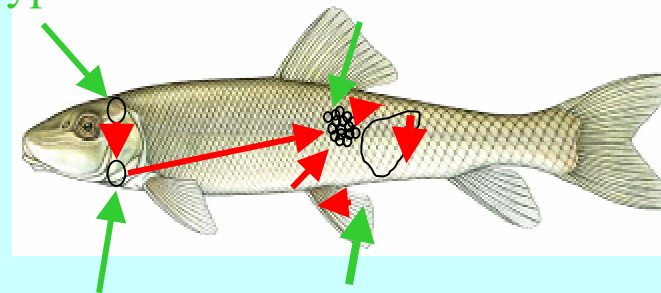
CU researchers are trying to determine if chemicals in area wastewater are causing deformities.

By Theo Stein and Miles Moffelt
Denver Post Staff Writers

When Colorado biologist John Woodling and a team of researchers pulled fish from the South Platte River and Boulder Creek two years ago, they found deformities they'd never



Hypothalamus Gonads



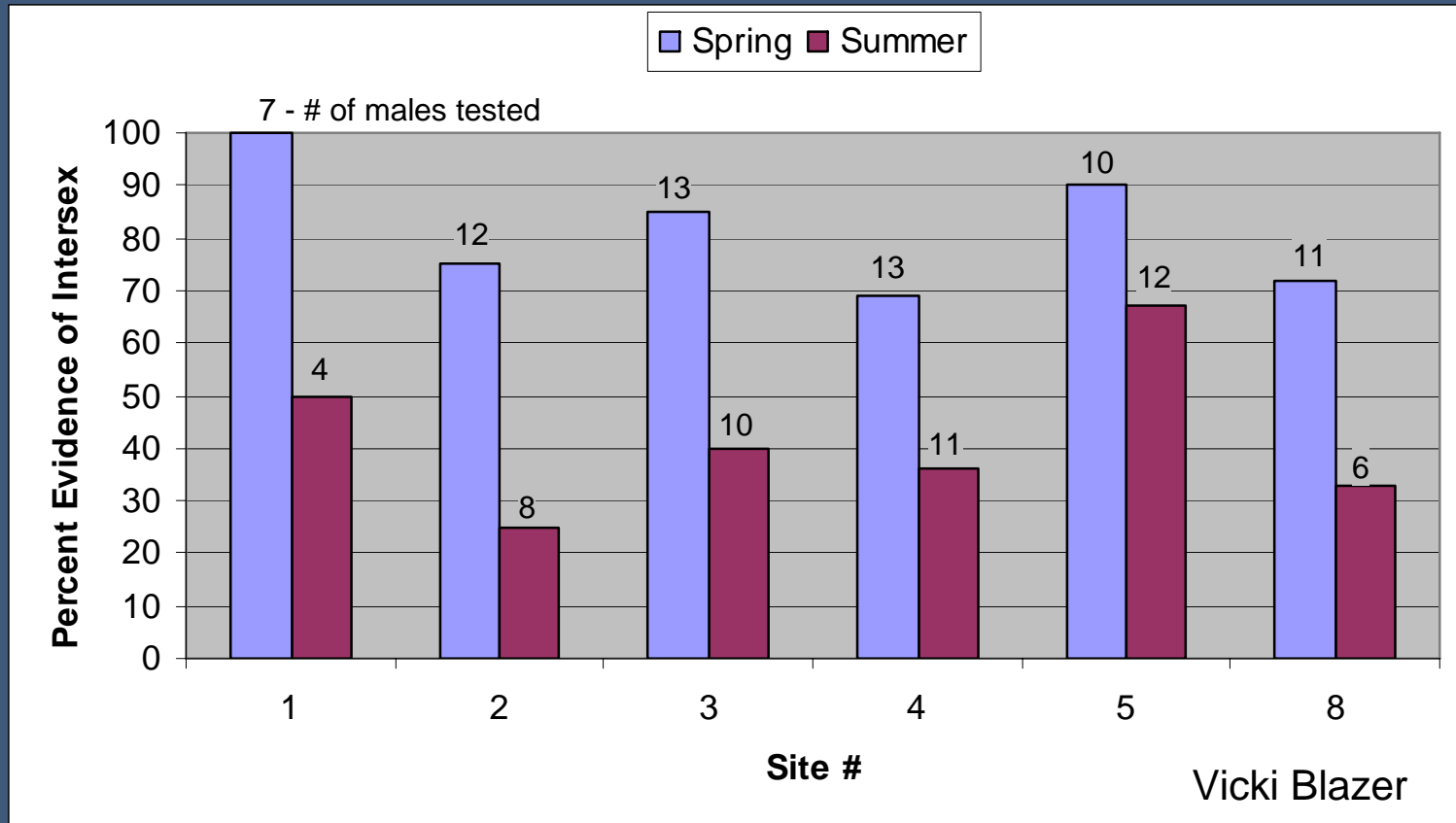
Pituitary

Liver

White sucker

(*Catostomus commersoni*)

Intersex: S. Branch Potomac, 2004



Antibiotic Resistance

- Resistance develops in organisms.
- Environmental Transfer of Genetic Determinants.
- Development of Multiple Resistance.
- Resistance from non antibiotics.
- Is resistance facilitated by chronic low-level exposure?



Acknowledgements

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The Research Team

Field expertise in 50 District (state) Offices.

The USGS Toxics Program:

toxics.usgs.gov

Emerging Water Quality Issues:

toxics.usgs.gov/regional/emc.html

Bibliography with over 100 publications