



Emerging Contaminants in the Environment Project



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Toxic Substances
Hydrology Program

Emerging Contaminants?

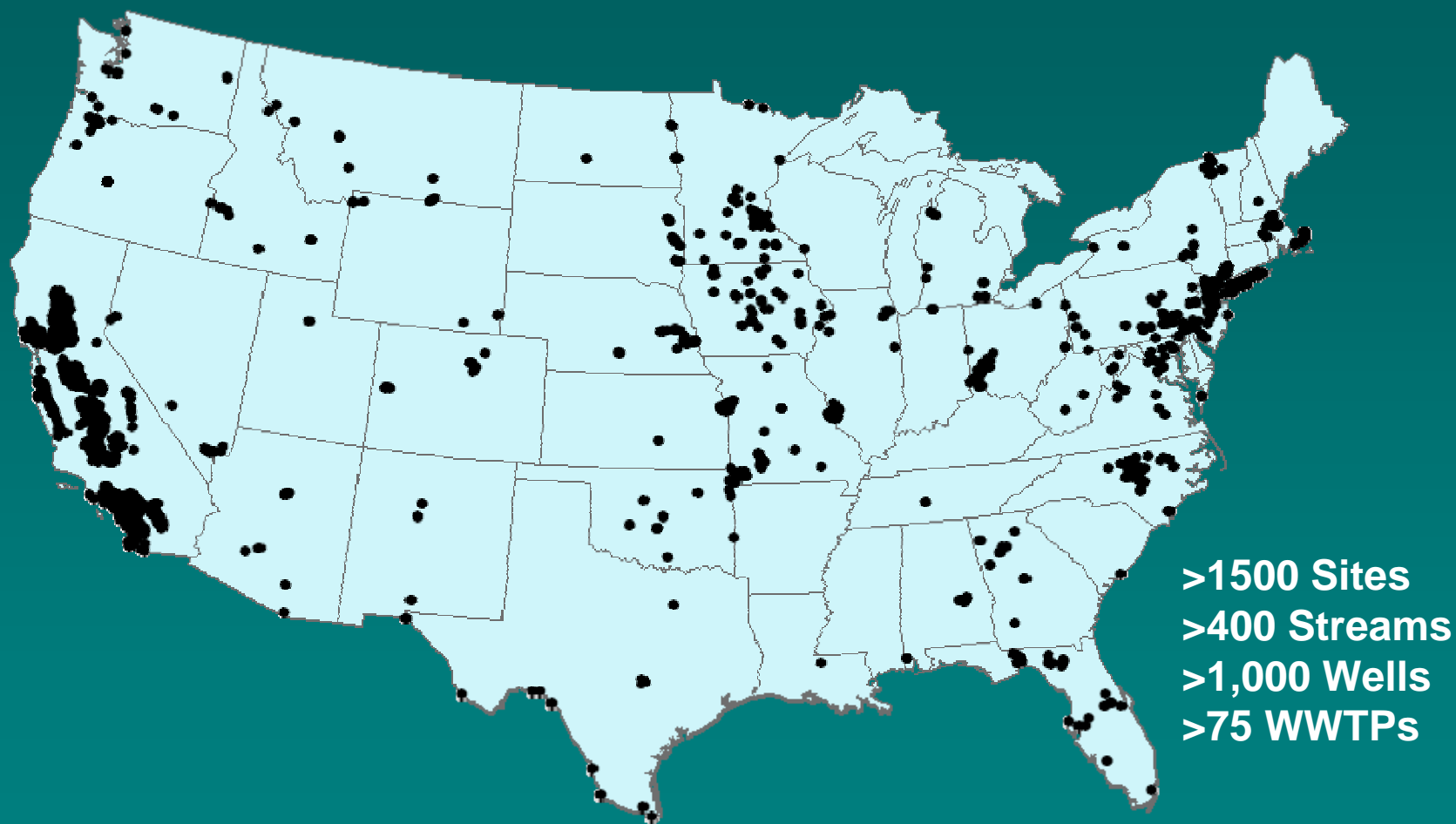


EC Project “Source-to-Receptor” Research

<http://toxics.usgs.gov/regional/emc/>



Chemicals of Emerging Environmental Concern Sample Locations



Preliminary, in preparation

0 145 290 580 Miles
|-----|-----|-----|

USGS National Reconnaissance Studies

- Streams (1999-2000)
- Ground Water (2000)
- Sources of Drinking Water (2001)
- Streambed Sediment (2002)
- Biosolids (2003-2005)

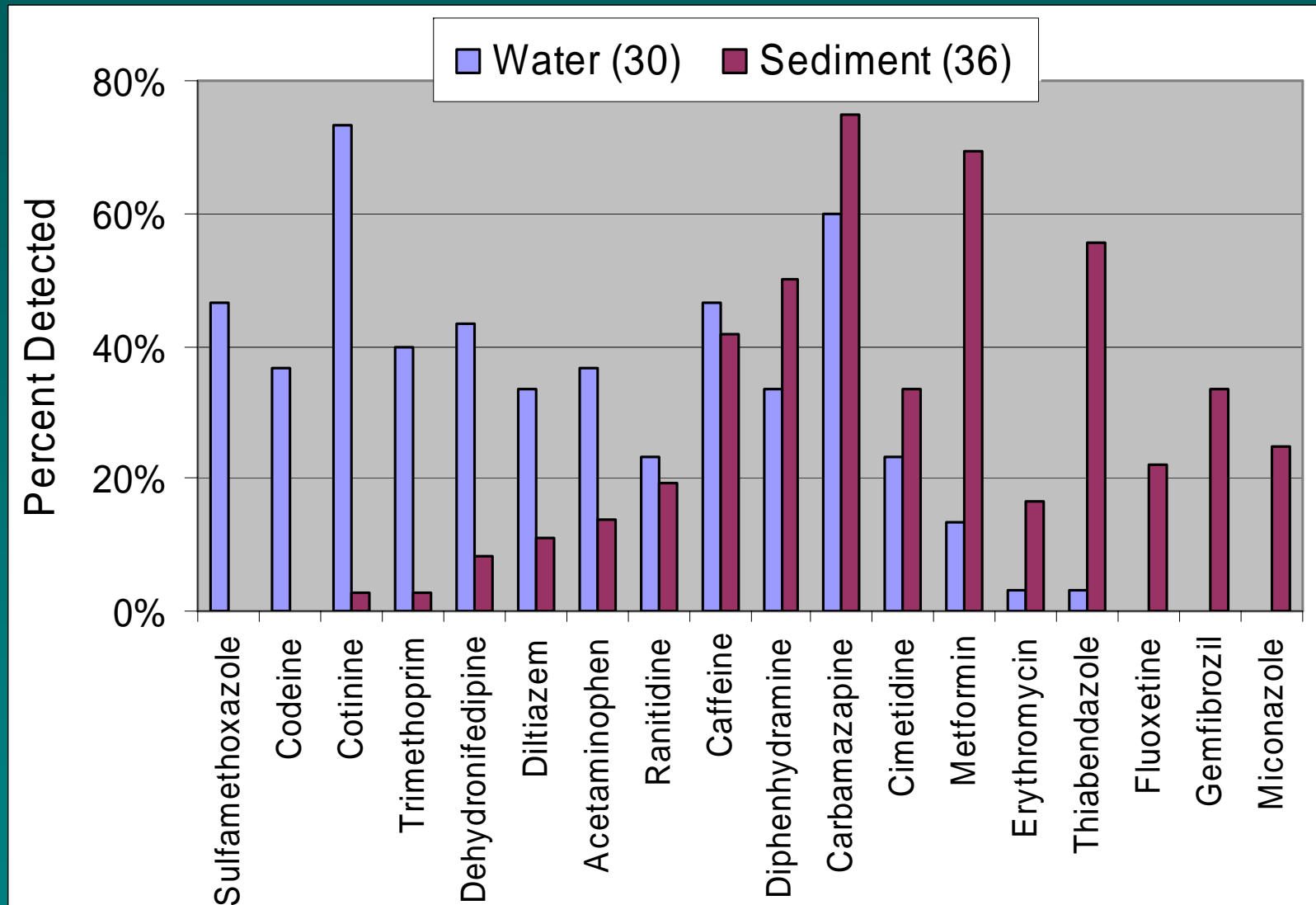


What have we learned?

- 1) OWCs are present at low concentrations in water (ppb or lower)
- 2) OWCs are present as mixtures (up to 38 compounds in 1 sample)
- 3) A wide range of compounds and compound classes may be found; they reflect the range of human activities in, and inputs to, our watersheds
- 4) The compounds and concentrations detected depend on the media sampled

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Don't look just in the water!



In-stream Study of ECs

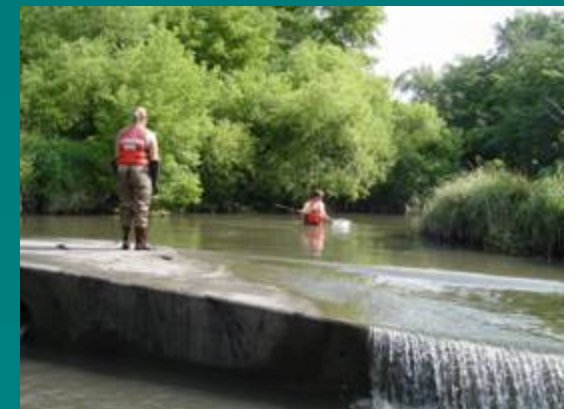
Fourmile Creek (IA)



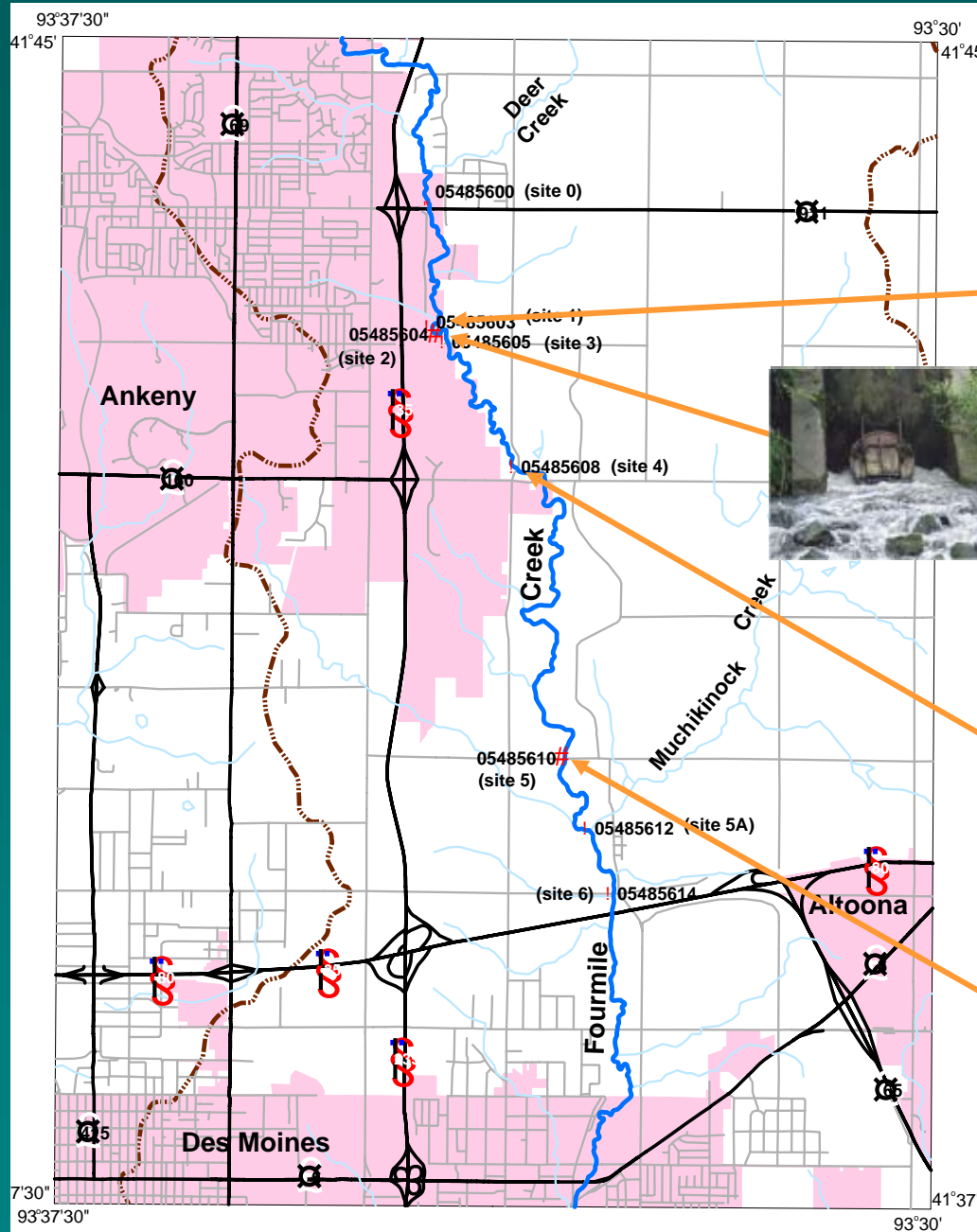
Boulder Creek (CO)



- Effluent dominated systems (WWTP discharge)
- Background data denote multiple ECs present
- Relatively small basin sizes
- Basic understanding of the flow system
- Controls present above WWTPs
- WWTPs undergoing major changes

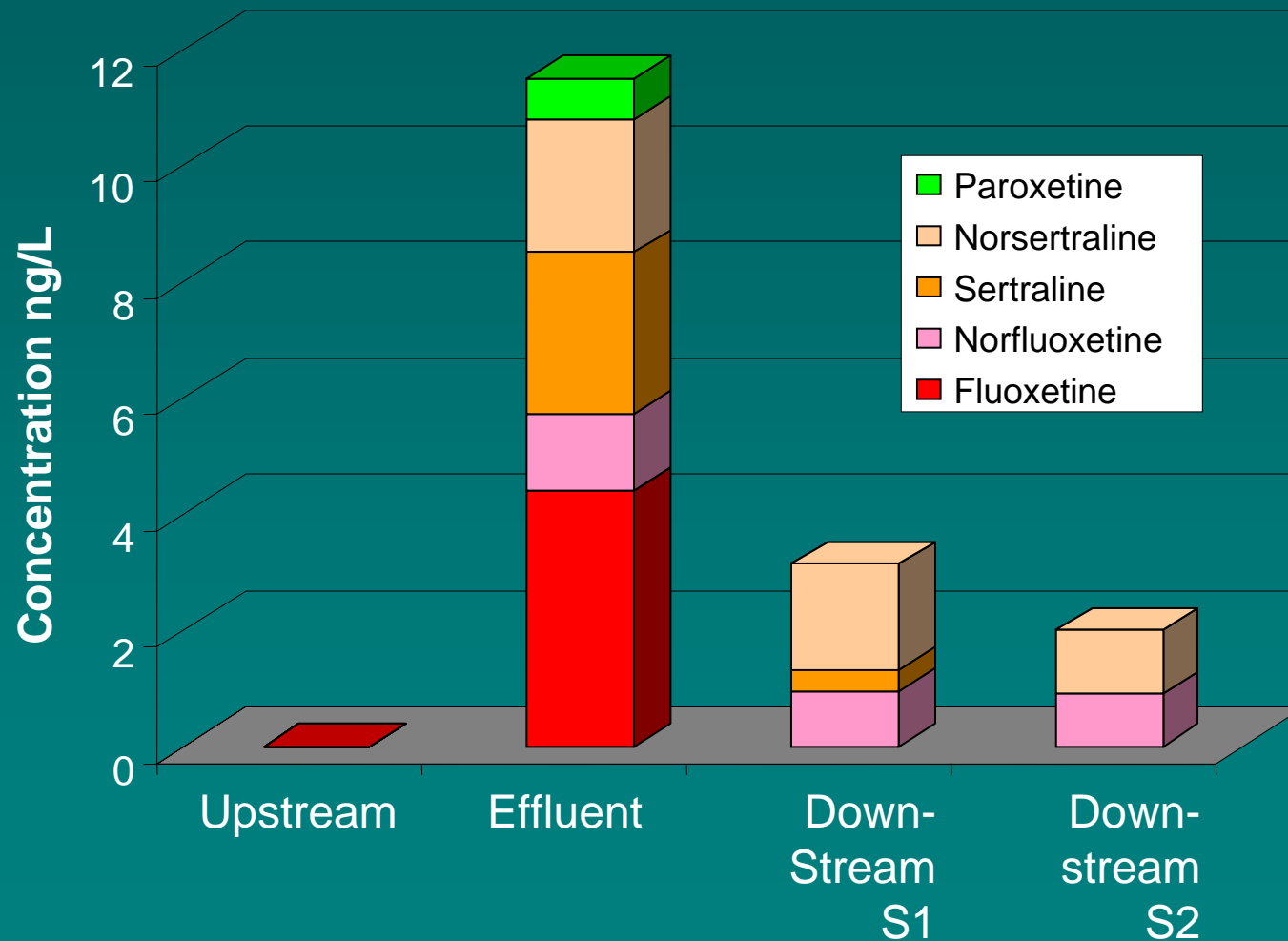


Galaxolide in Fourmile Creek



	Water ($\mu\text{g/L}$)	Sediment ($\mu\text{g/kg}$)
Site 1 (-0.1 km)	0.021	<25
Site 2 (0 km)	3.1	2000
Site 4 (2.9 km)	0.7	580
Site 5 (8.4 km)	0.4	200

Antidepressants in Fourmile Creek



Antidepressants in fish neural tissue at downstream site ONLY



all units ng/g	mean, <i>n</i> =6	range
Fluoxetine	0.63	0.29 – 1.6
Norfluoxetine	0.87	0.22 – 2.4
Sertraline	1.5	0.99 – 2.1
Norsertraline	2.47	1.4 – 3.2
Citalopram	0.072	0.024 – 0.21
Bupropion	0.049	0.005 – 0.14

Paroxetine, Fluvoxamine, Duloxetine, & VENLAFAXINE not detected.

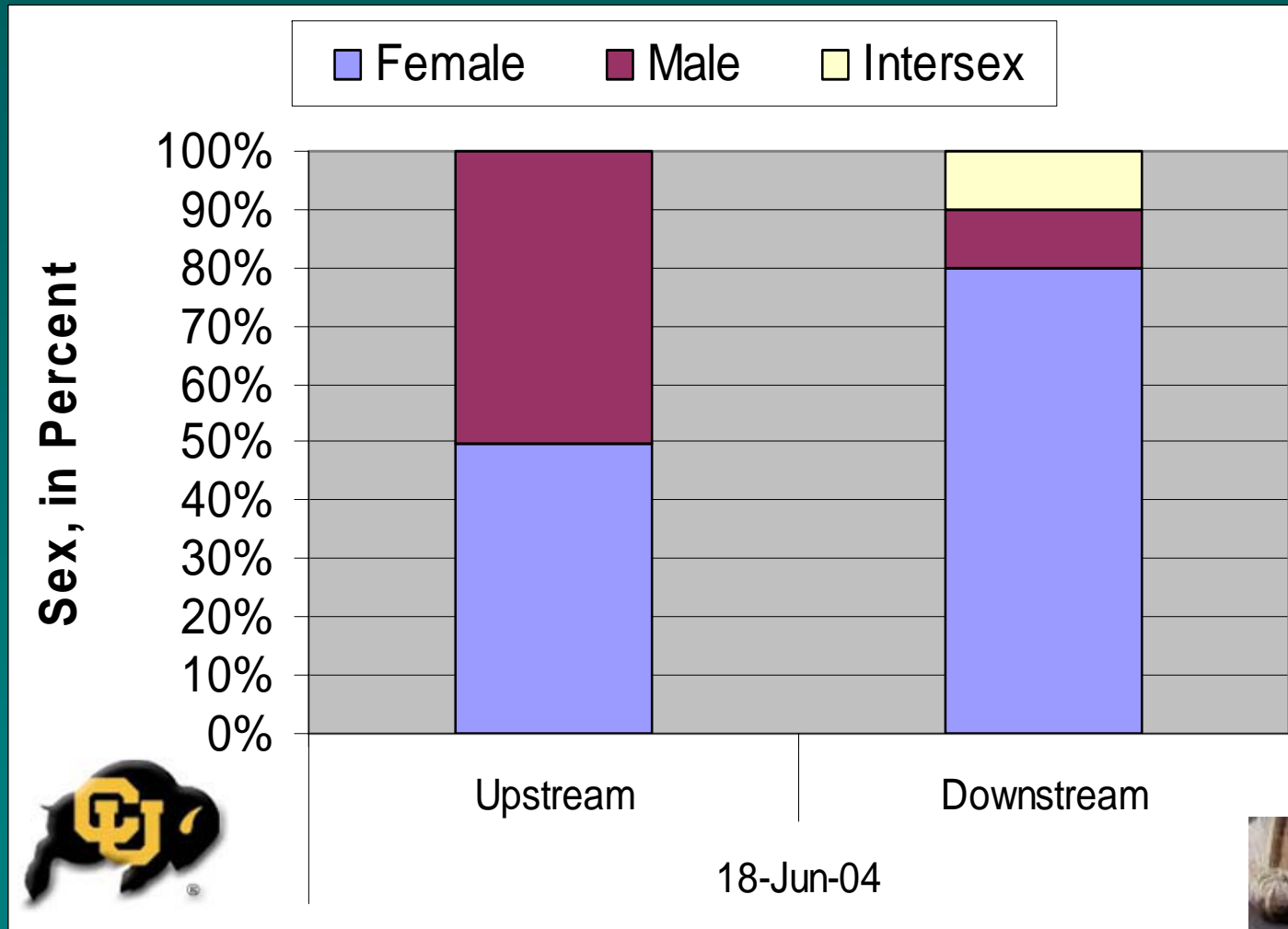
Linking Environmental Contamination and Effects



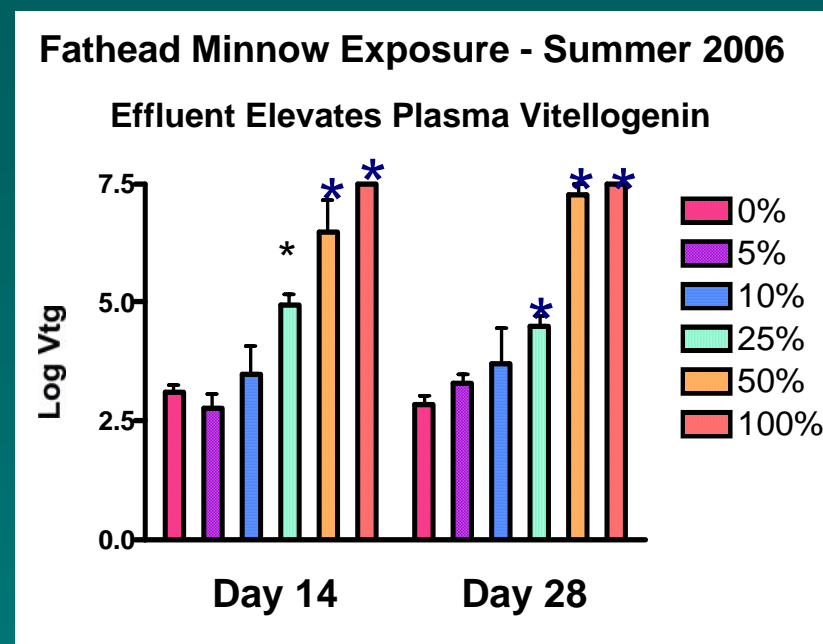
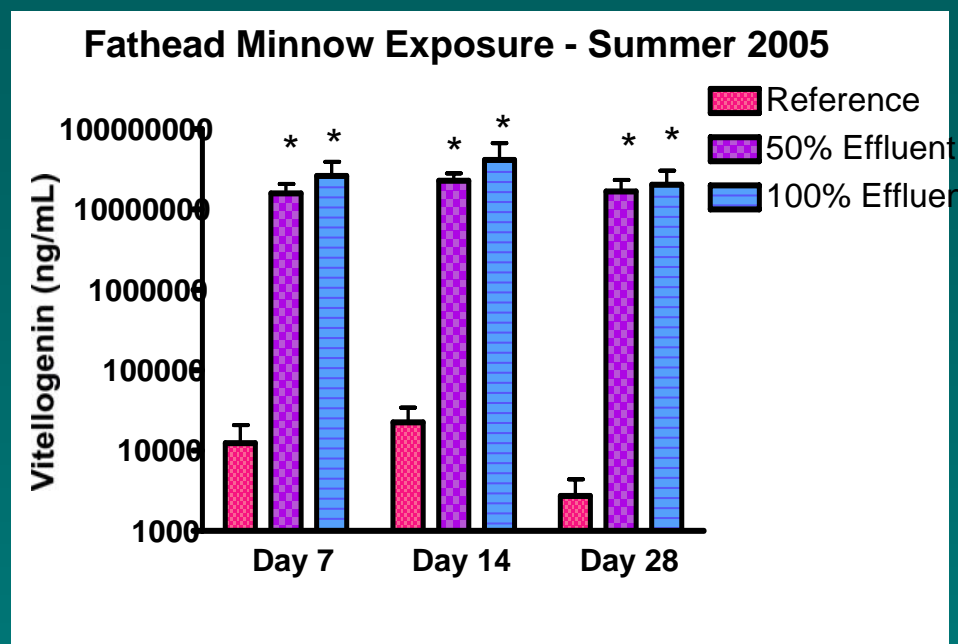
On Site - uses actual stream waters with controlled photo-period and temperature.



Evidence of Reproductive Disruption in Boulder Creek



Effluent Elevates Plasma Vitellogenin



Significant main effect of exposure ($P < 0.0001$)

Worm Field Study



- Worms and soil collected twice (early and late growing season) at 3 field sites
- worms depurated before analysis



1) Municipal biosolid amendment



2) Hog slurry Amendment



3) No organic waste Amendments



Worm Conclusions

- Land application of waste can transfer ECs to earthworms
 - ECs were detected at low ug/kg to high mg/kg in earthworms
 - Earthworms may represent a route for ECs into food web
- Similar EC profiles in biosolids/soil/earthworms
- Select ECs detected in earthworms but not in soil
 - biomagnification
- Exposure to biosolid can be lethal and interfere with earthworm reproduction



Future Research Priorities

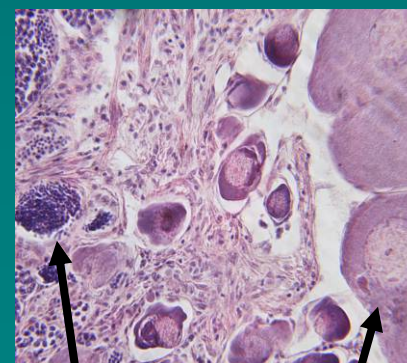
CAFOs



- Developing regional proposal to examine the occurrence, fate, and effects of CAFO-derived contaminants (e.g. hormones, vet medicines, antibiotic resistance genes, etc.)
- Phase I characterize CAFO contributions in 20-25 small watersheds (varying animal types)

Endocrine Disruption

- Intersex fish in the Potomac Basin
 - 2007 Spawning Study



male

female