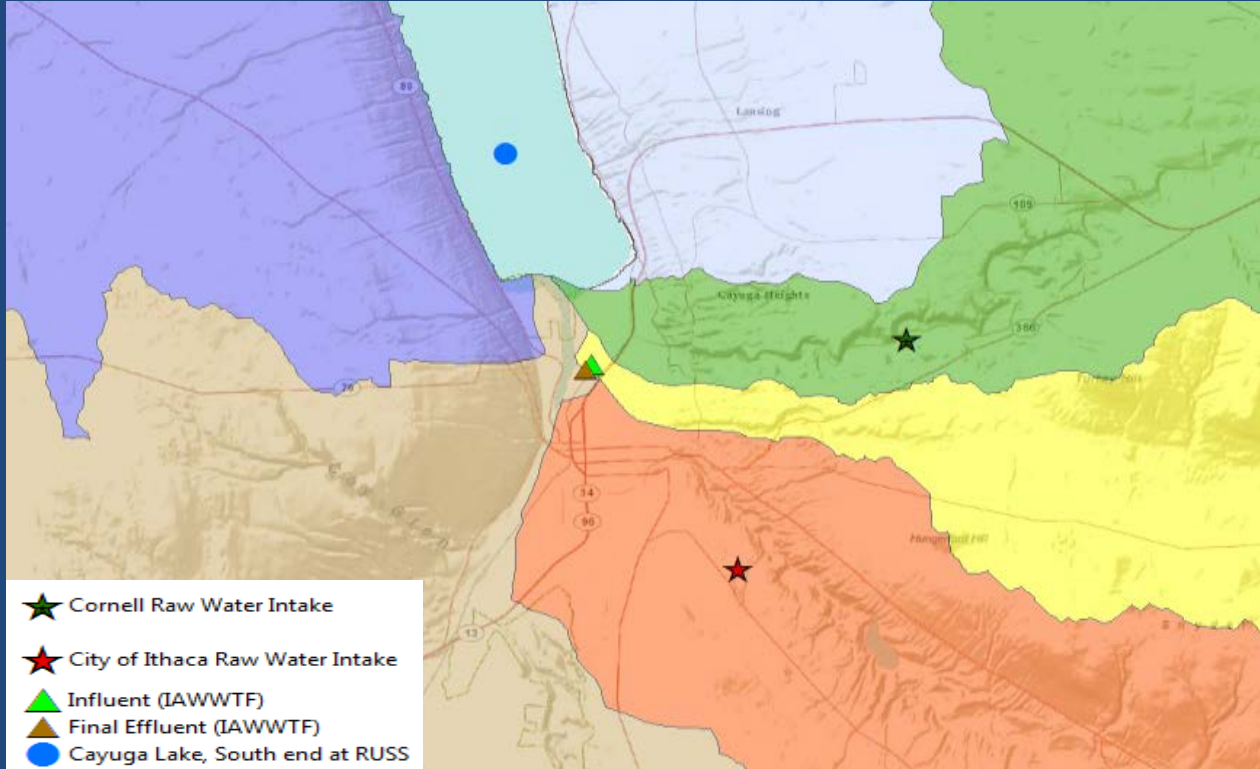


Assessment of Emerging Contaminants in the Ithaca NY Area, 2014-2015

**A look into the pharmaceuticals, consumer products and
microplastics in the southern Cayuga Lake watershed**

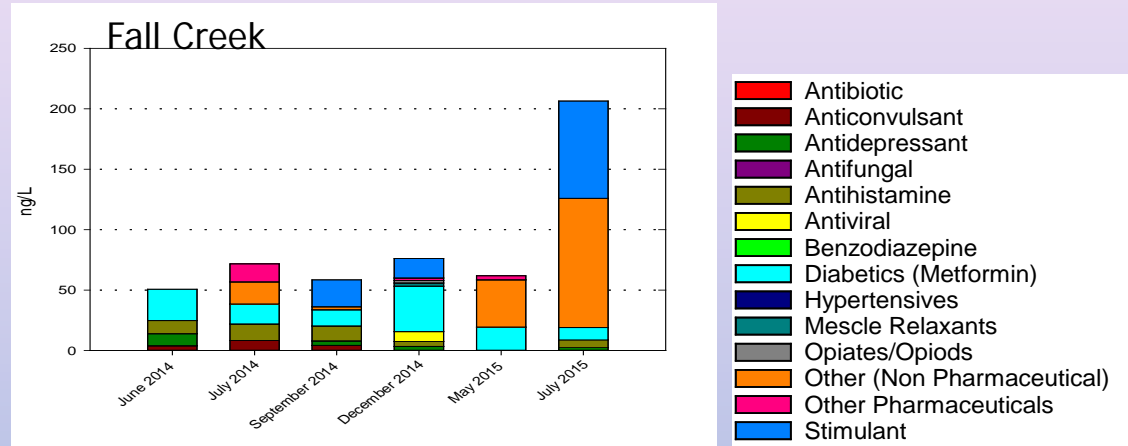
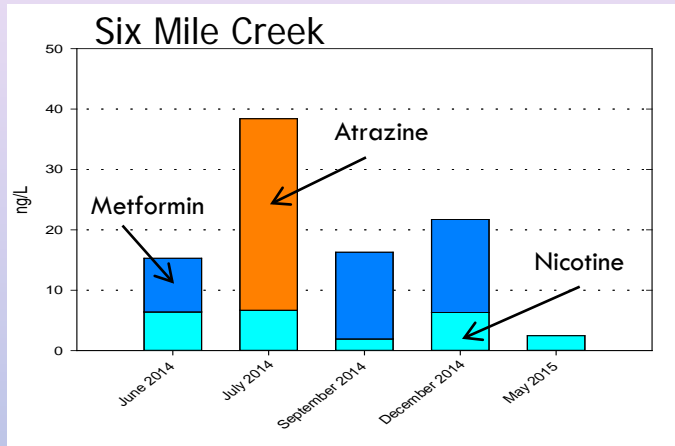
Jose Lozano and Susan Allen-Gil*
Ithaca Area Wastewater Treatment Facility
* Ithaca College



One of the most comprehensive assessments in US

- 9 sampling events
- 7 sites
- ~ 200 compounds
- 24-hour composite samples
 - Raw water at 2 intake locations
 - time proportional
 - Influent, Effluent
 - flow proportional
- Grab samples
 - Biosolids
 - Cayuga Lake
- Analysis
 - USGS –CO
 - 4 different methods

THE STARTING POINT: DRINKING WATER INTAKE



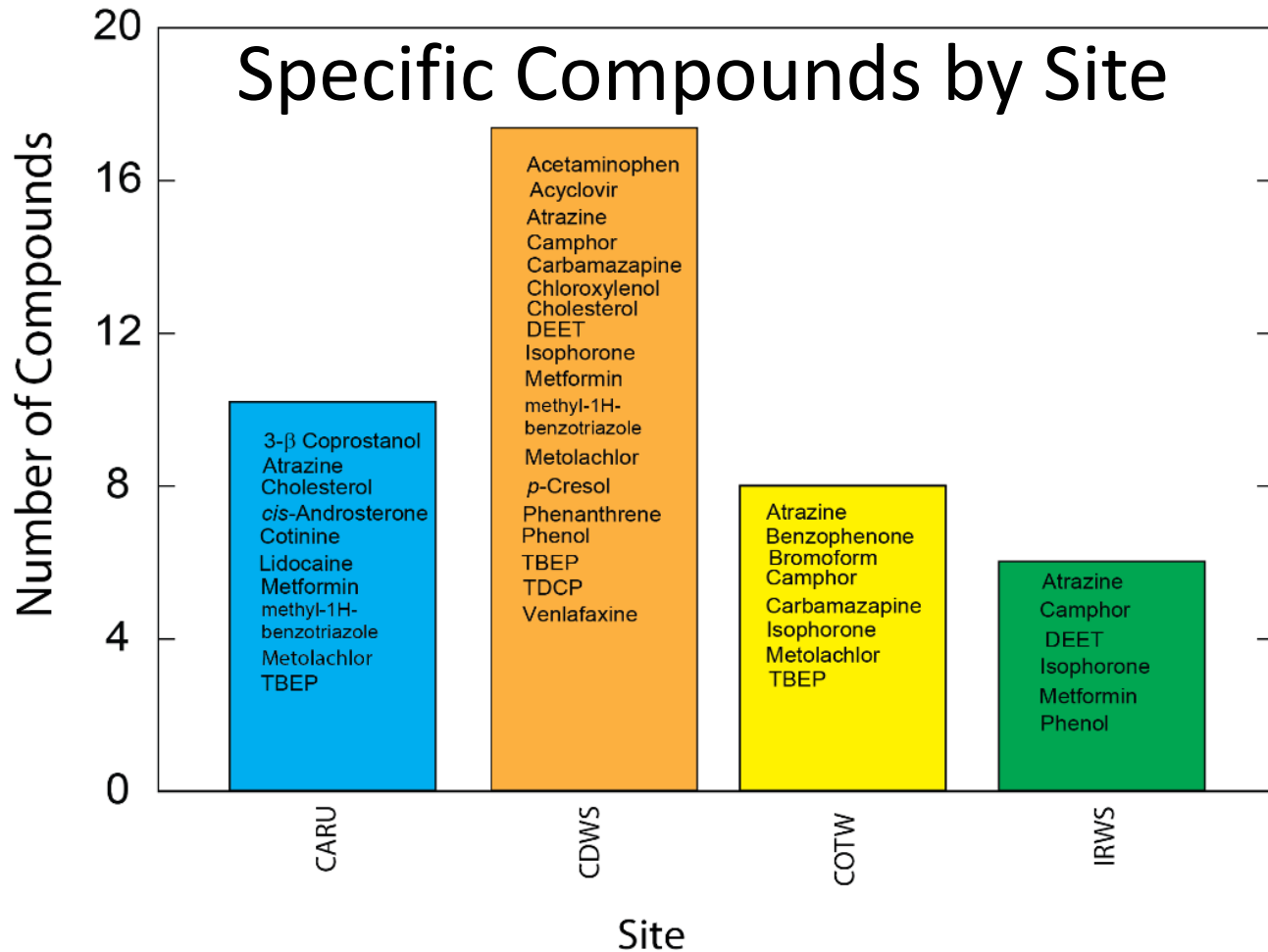
- Six Mile Creek water is cleaner than Fall Creek Water (note scales differ)
- Metformin, atrazine, nicotine, and acetaminophen found most often and at highest concentrations
- Detectable, reportable, but less than 1 pinch of salt on 10 tons of potato chips
- Doesn't mean that is what comes out of your sink! (just atrazine! 35 nanograms/L)

Raw vs Treated Drinking Water

Compound	7/15/2015	9/15/2015	12/15/2015
Atrazine	56% decrease from raw to treated → -56.0	na	na
Benzophenone	na	na	na
Bromoform	na	na	Only in treated water
Camphor	-3.3	na	-4.2
Carbamazepine	na	-17.7	Only in treated water
Chloroxylenol	na	na	Only in raw water
Isophorone	-13.8	na	na
Metolachlor	-56.7	na	na
methyl-1H-benzotriazole	na	na	na
Metformin	Only in raw water	na	Only in treated water
Tris(2-butoxyethyl) phosphate (TBEP)	Only in treated water	Only in raw water	na
Venlafaxine	na	Only in treated water	na

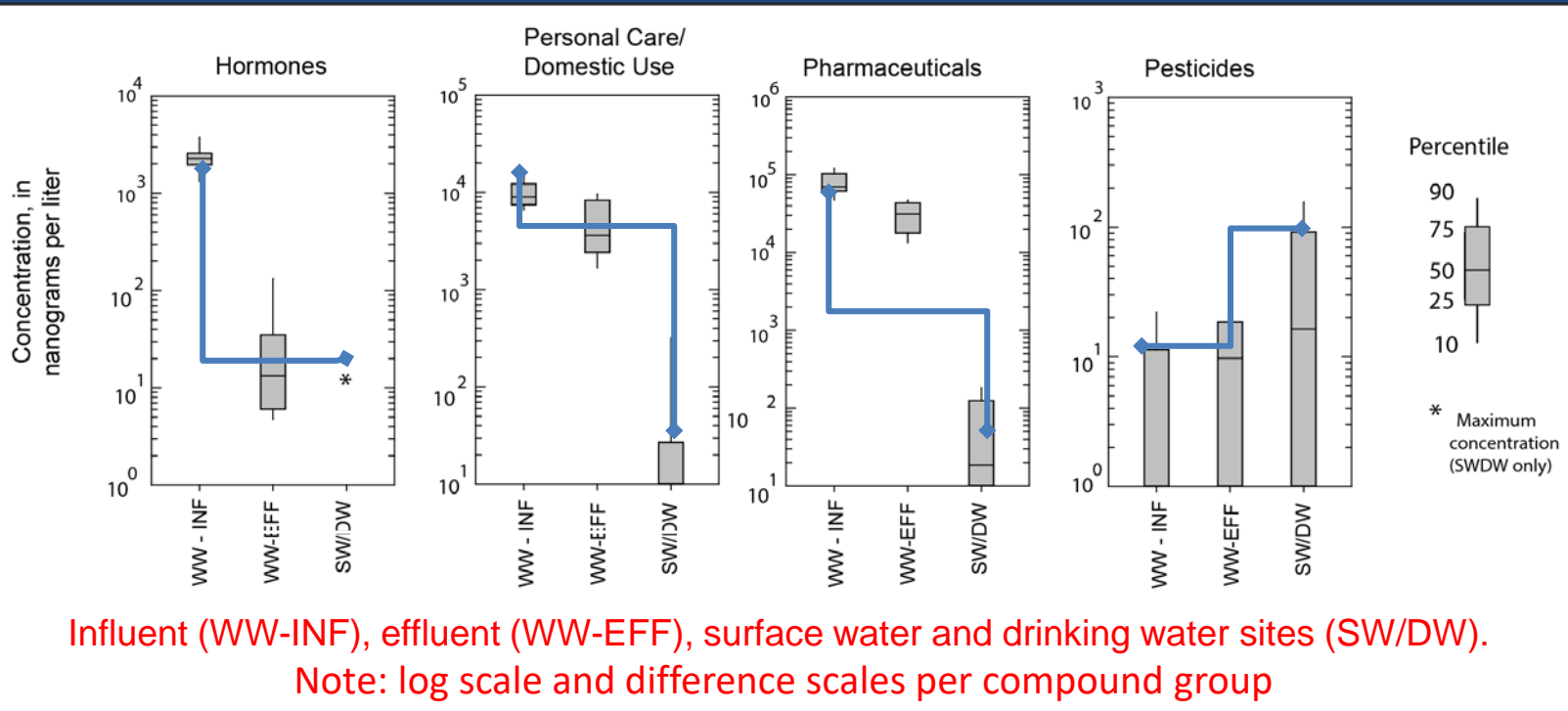
Median 17% decrease in conc. from raw to treated water, but limited data.

Specific Compounds by Site



- CARU= 10
- CDWS = 18
- CDTW = 8
- IRWS=7

Total concentrations by major compound group



Influent (WW-INF), effluent (WW-EFF), surface water and drinking water sites (SW/DW).
Note: log scale and difference scales per compound group

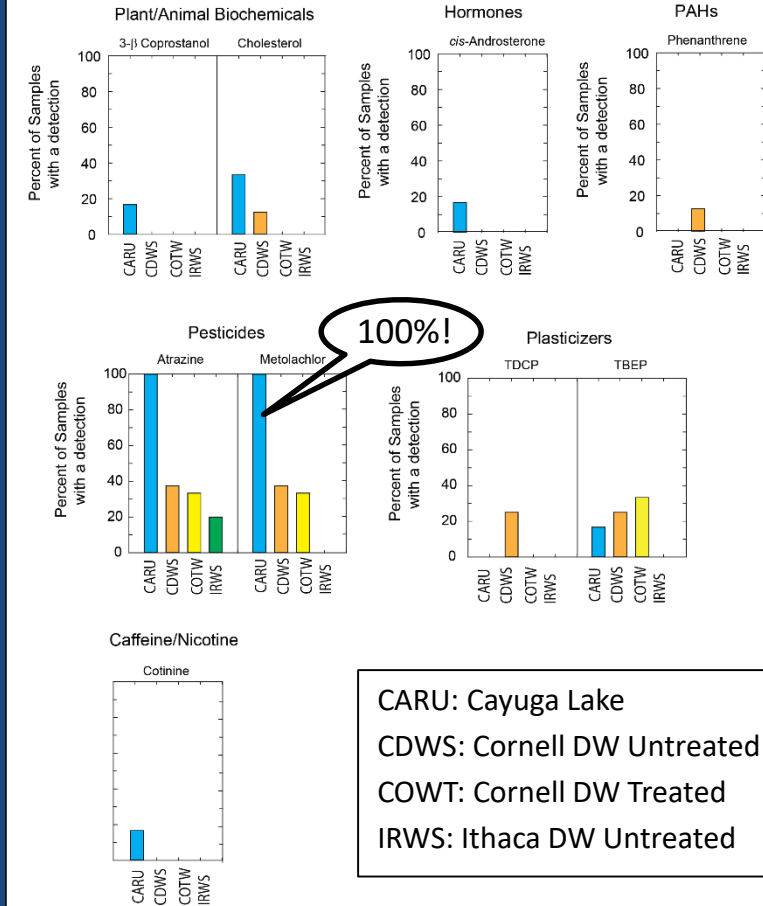
Hormones: two orders of magnitude higher in WI than in WE samples

PCDU compounds and pharmaceuticals were an order of magnitude higher in INF than EFF samples

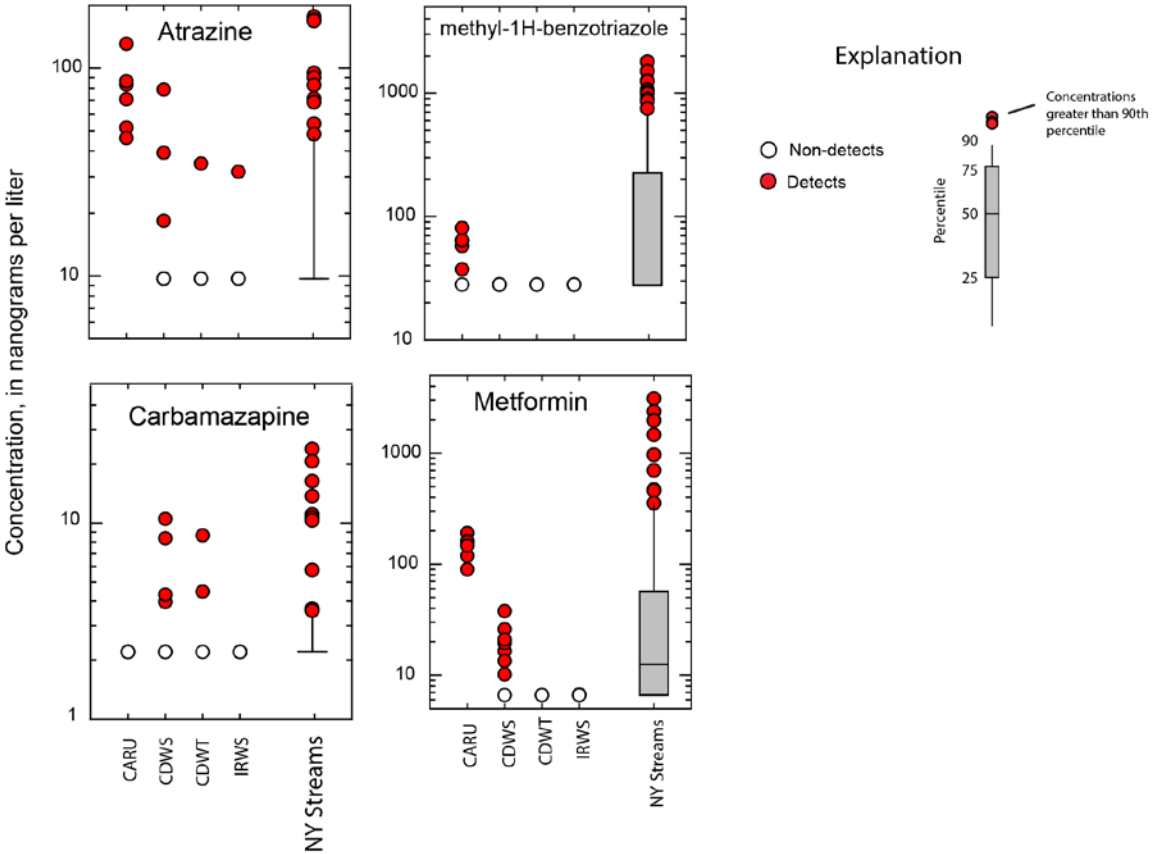
Pesticides were only compound group found in higher concentrations in SW/DW than INF or EFF

Surface Water Samples

- 24 compounds were detected in one or more of the samples
- Seven compounds were commonly detected in more than 25% of these samples
 - 2 pesticides (atrazine and metolachlor)
 - 2 pharmaceuticals (metformin and carbamazepine)
 - 1 PCDU compound (camphor)
 - 2 other compounds (isophorone and methyl-1H-benzotriazole)



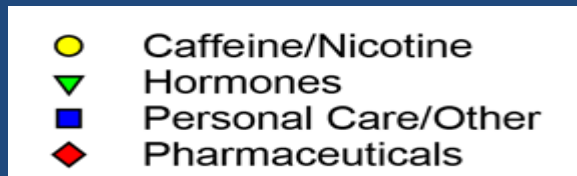
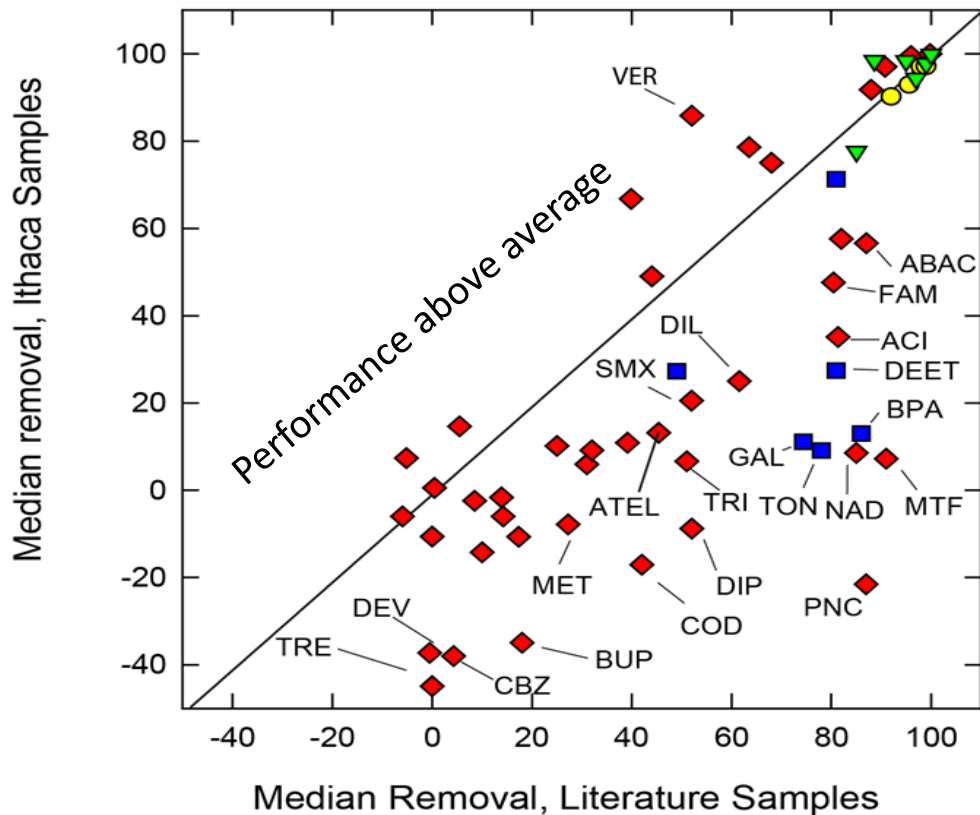
Comparison to NY Streams



Cayuga Lake: atrazine and metformin in 90th percentile

SW/DW samples are similar to (and in many cases, less than) those found in New York State streams (45 sites).

IAWWTF performance at removing ECs





Homer NY 2014

Fate of ECs

INF Loading [Lb/day]	Hormones	Pharma	P/A Biochems	PC/DU	Plasticizers	Other	PAH
Overall mean	109.9	2,889.1	7,945.4	1,706.1	1,472.4	1,449.5	5.8
% Removal Efficiency	97.3	79.0	98.0	66.1	44.6	48.9	90.9
Expected load to biosolids	107.0	2,281.3	7,784.1	1,128.6	656.4	709.2	5.3

INF Loading [Lb/day]	Metformin	Caffeine
Overall mean	1,145.3	3,728.8
% Removal Efficiency	15.3	95.6
Expected load to biosolids	175.2	3,563.9

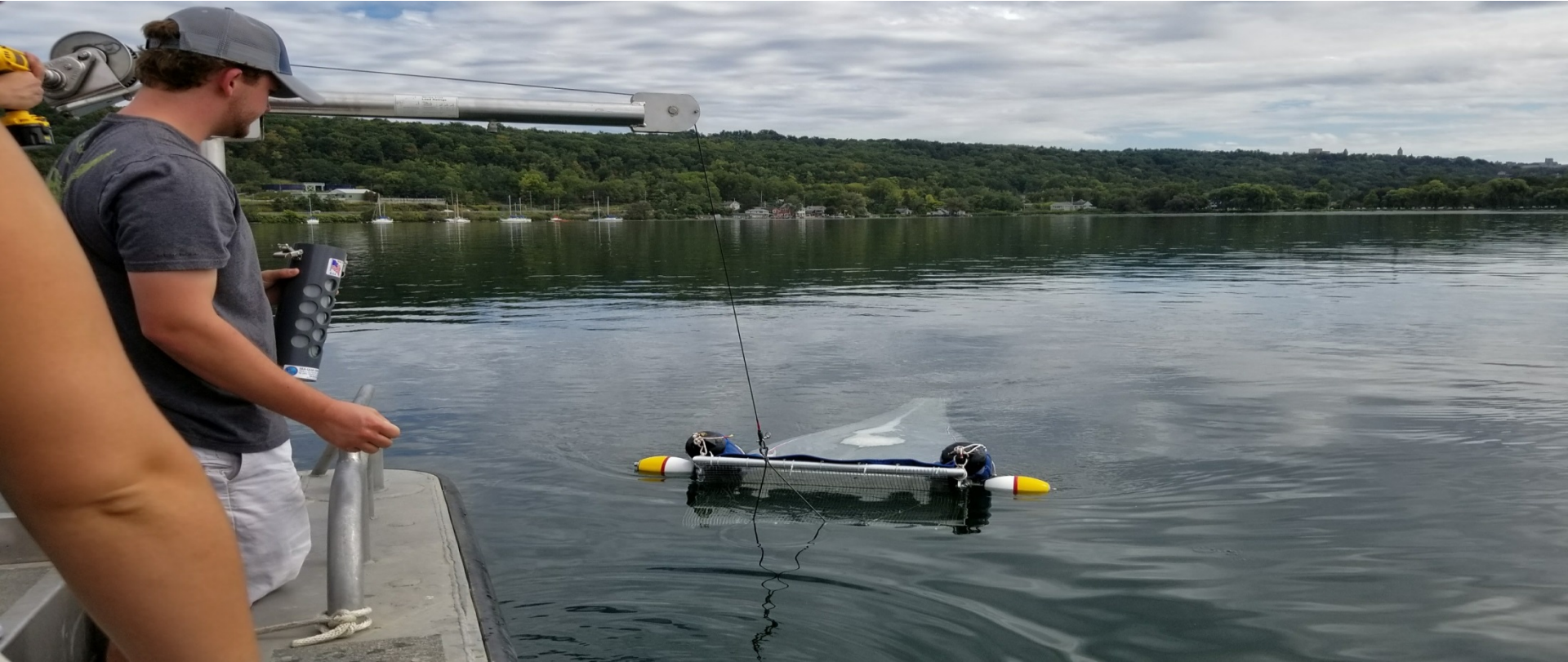


Fate of ECs

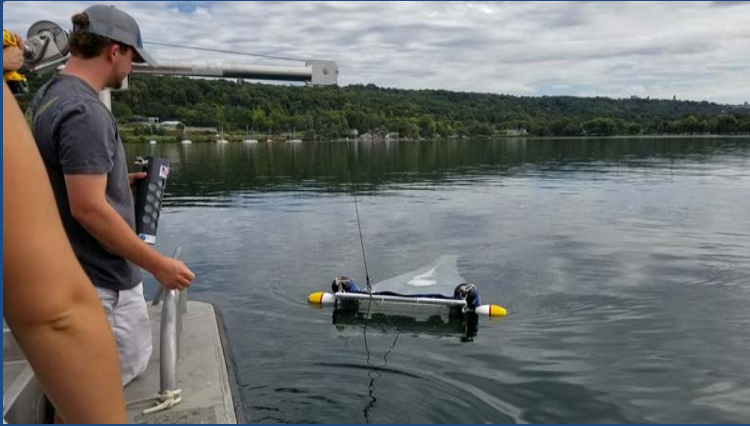


Compound	Amount Removed [Lb/day]	Biosolids Content [Lb/day]	Difference [Lb/day]
Hormones	107.0	1.77E-06	107.0
PC/DU	1,128.0	2.43	1,125.6
P/A Biochem	7,748.1	0.68	7,747.4
Plasticizers	656.4	0.03	656.4
PAH	5.3	0.04	5.3
Other	709.2	0.04	709.2

Selected compounds mass balance between amounts removed from the effluent and present in biosolids. The difference between these is the amount destroyed, lost, or chemically modified.



Current Microplastics Research



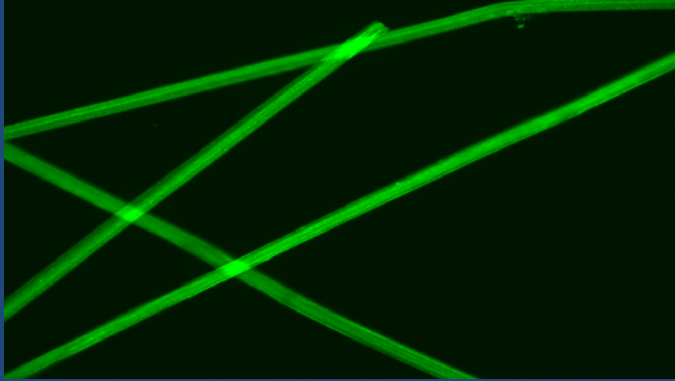
- Process:
 - Sampling 4 lake sites for last 2 years plus effluent
 - 50 um net
 - Density separation, hydrogen peroxide digestion, staining
 - Grid counting, epifluorescence microscopy
 - Raman spectroscopy
- Discover Cayuga Informational Boat Tour!
 - June 19 (rain date of June 26, ~6-8 pm)
 - By Invitation only, targeted audience

Link to CCE Video:

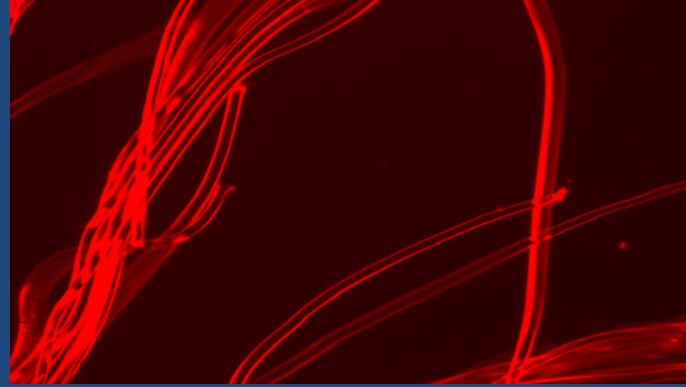
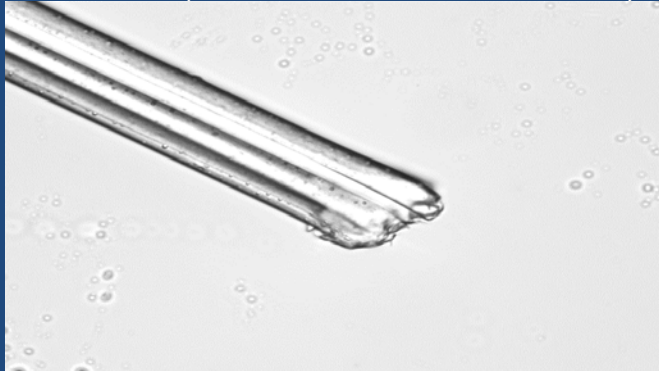
<http://cctompkins.org/environment/water-conservation-quality/microplastics>



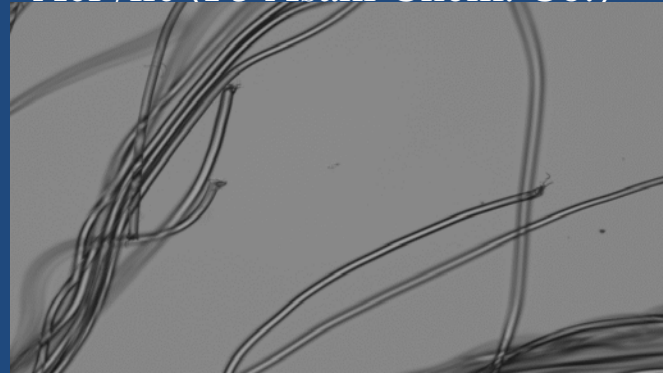
Intrinsic fluorescence

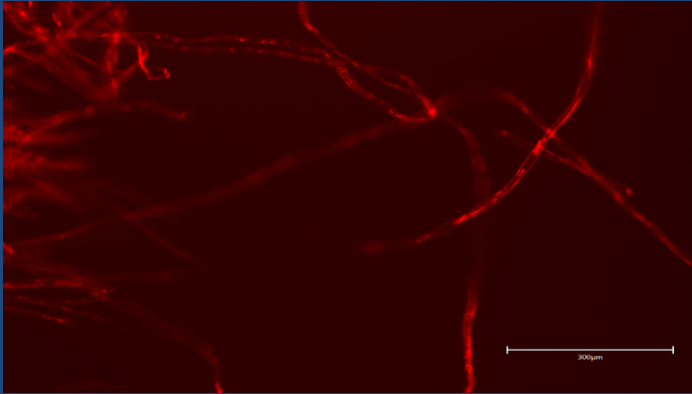


Acetate (F1 Canadian Celanese)

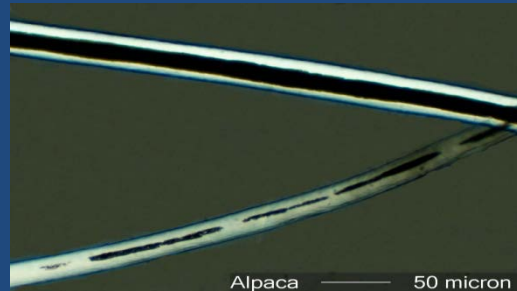
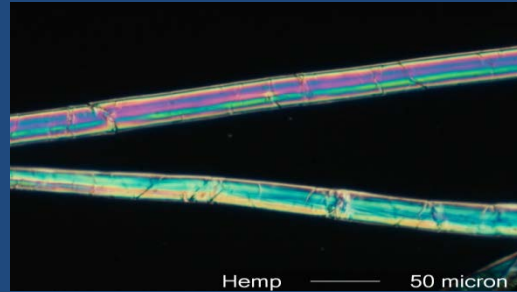
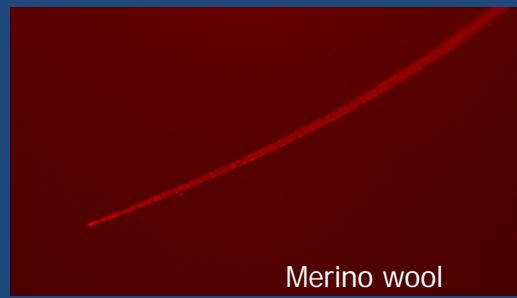


Acrylic (F5 Asahi Chem. Co.)





Cotton (cheese cloth)

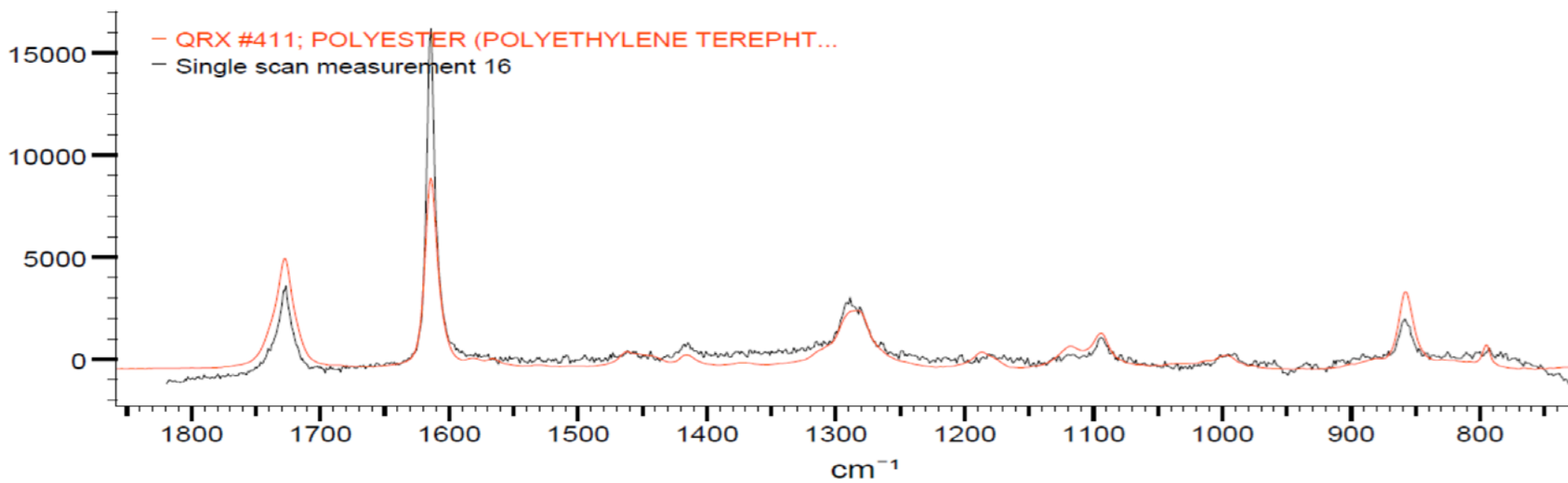


	Million	
	MP/day	MF/day
Mean =	325	457
s =	404	278
n =	13	13
95% CI =	220	151

IAWWTF Effluent MicroPlastics, MP, and MicroFibers, MF.
Average flow during sampling period was 7.608 MGD
24hr Flow-proportional composite samples



CCMR





A multi-year collaborative project between
IAWWTF, Ithaca College, Cornell
University, USGS, and Cornell Cooperative
Extension

PLEASE JOIN US FOR A FRIENDLY AND INFORMATIVE BOAT TOUR ON THE CAYUGA LAKE FLOATING CLASSROOM

Emerging water quality concerns:
pharmaceuticals & microplastics

June 19 to 7:00 to 9:00 PM
(rain date: June 26)

Snacks and beverages included

Leaving from Treman Marina.

Limited space, please **RSVP** at your earliest
convenience: floatingclassroom@gmail.com



THANK YOU!