

Conflict of Interest Declaration: Nothing to Disclose

Presenter: Sherri A. Mason, PhD

Title of Presentation:
The Great Plasticized Lakes

I have no financial or personal relationships to disclose



Dr. Sherri "Sam" Mason
State University of New York at Fredonia
Chemistry & Environmental Sciences

The Great PLASTICIZED Lakes

I just want to say one word to you.

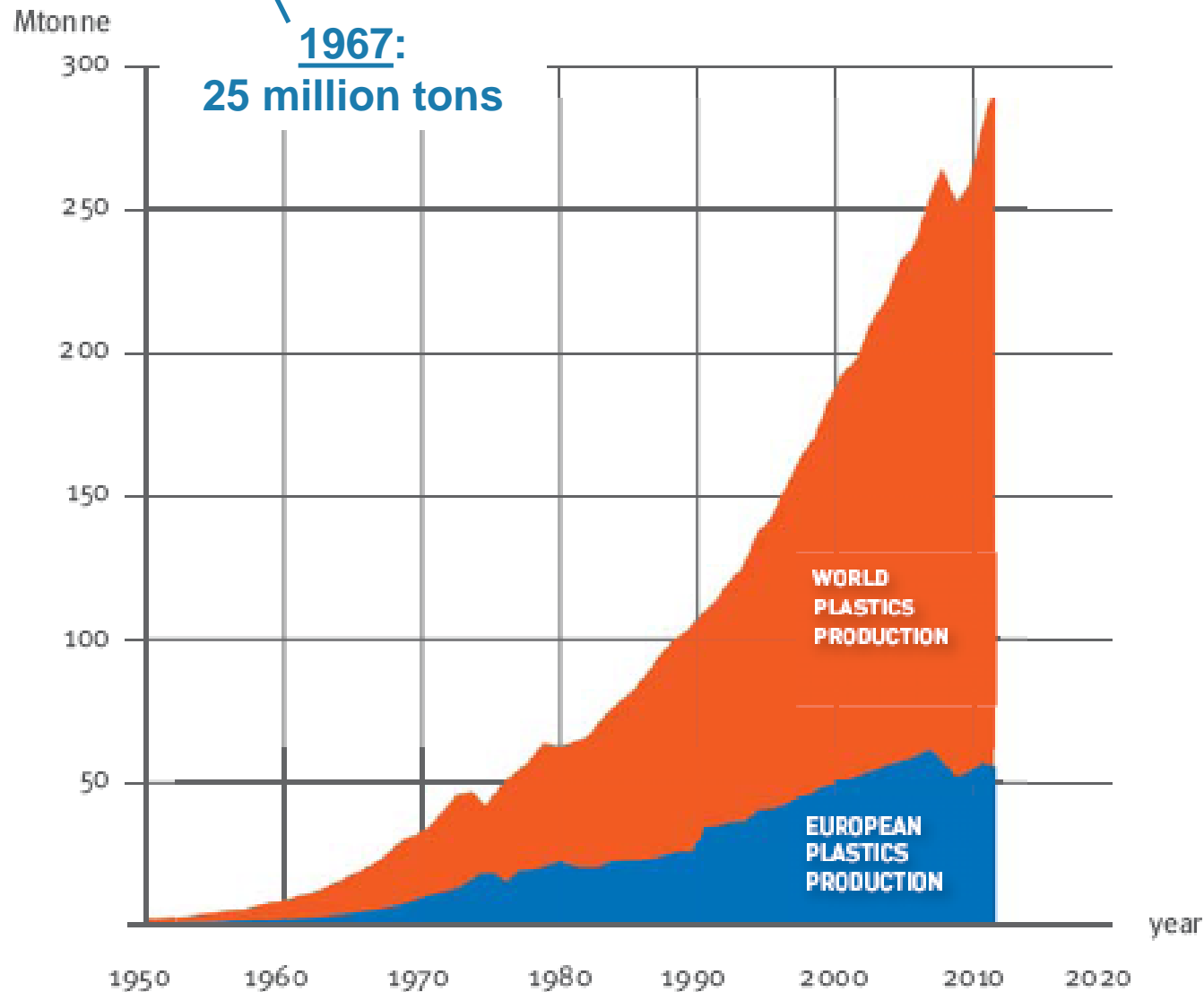


Just one word. PLASTICS.

- The Graduate, 1967

World plastics production grows

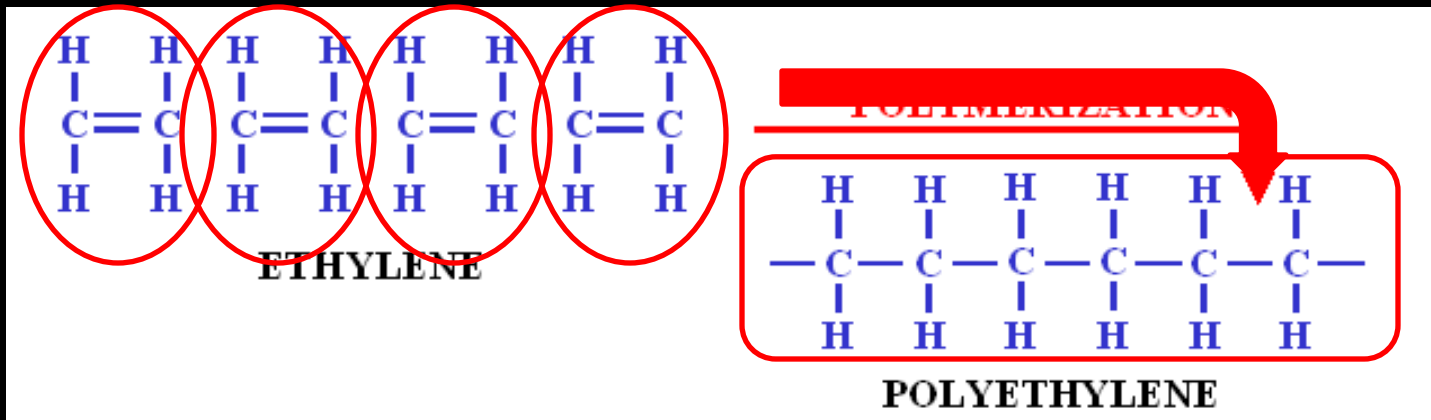
1950	1976	1989	2002	2009	2010	2011	2012
1,7	47	99	204	250	270	280	288



Source:
PlasticsEurope,
Plastics – The Facts 2013



❖ Synthetic polymers



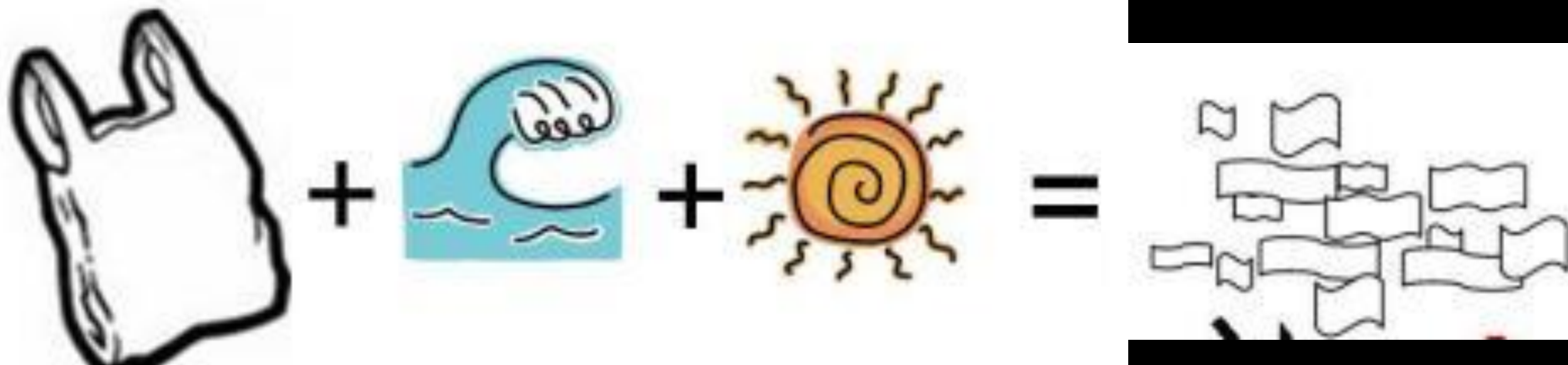
❖ Moldable, Light-weight, Durable

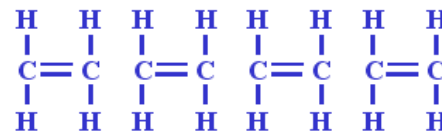




❖ Don't Biodegrade

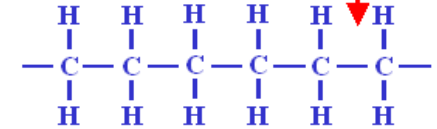
❖ Photodegrade





ETHYLENE

POLYMERIZATION



POLYETHYLENE

❖ Created to replace the (over)use of natural materials

❖ Birth

➤ Celluloid – 1862 (1870)

○ semi-synthetic

➤ Bakelite – December 7, 1909

○ first U.S. patent for a synthetic plastic

❖ WWII



1955
LIFE
Magazine
“Throwaway
Living”



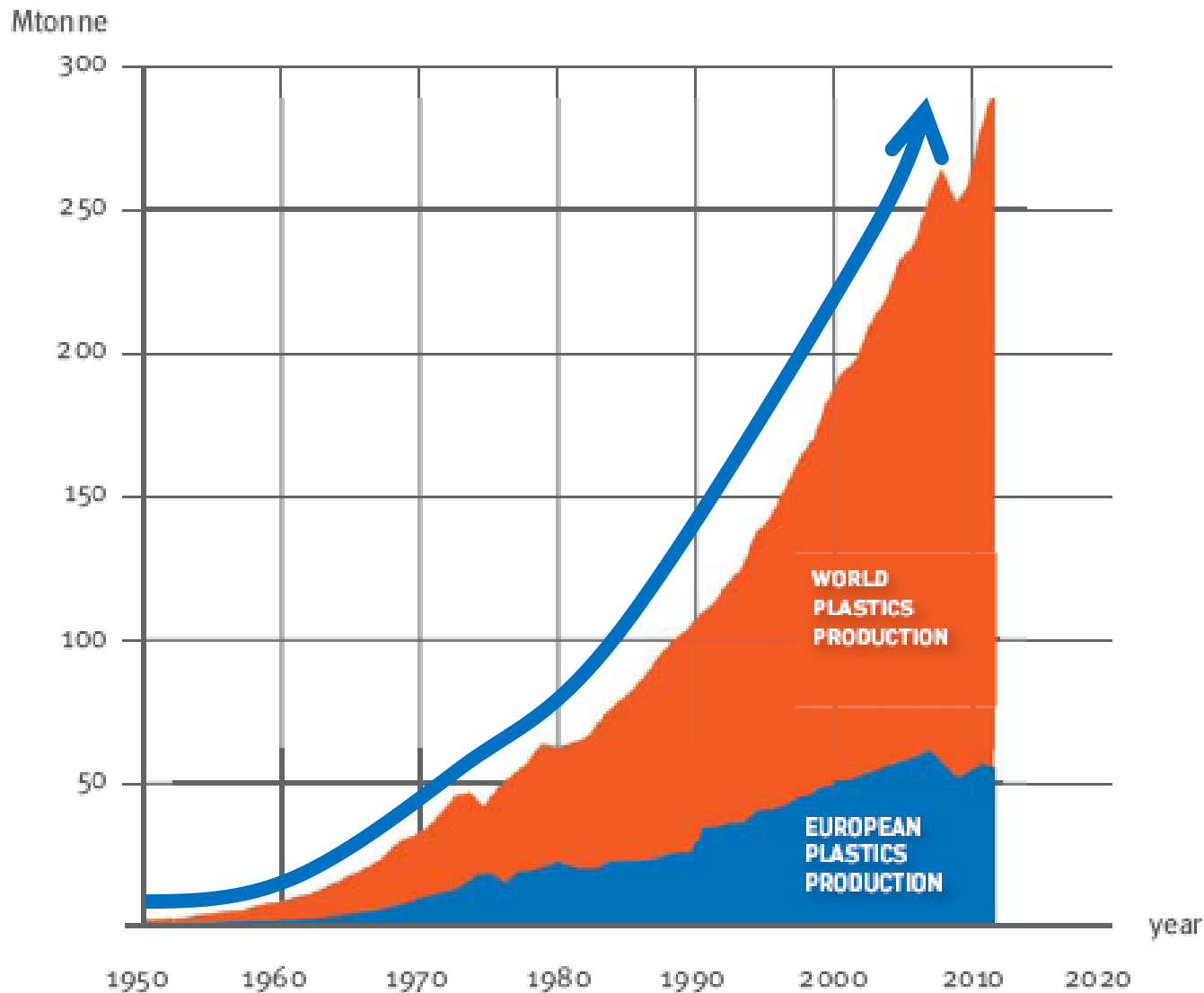
Throwaway Living

DISPOSABLE ITEMS CUT DOWN HOUSEHOLD CHORES

DISPOSABLE ITEMS CUT DOWN HOUSEHOLD CHORES

World plastics production grows

1950	1976	1989	2002	2009	2010	2011	2012
1,7	47	99	204	250	270	280	288



Where does it go?

- ~50% landfill
- <10% recycled
- “unaccounted for”

Source:
PlasticsEurope,
Plastics – The Facts 2013

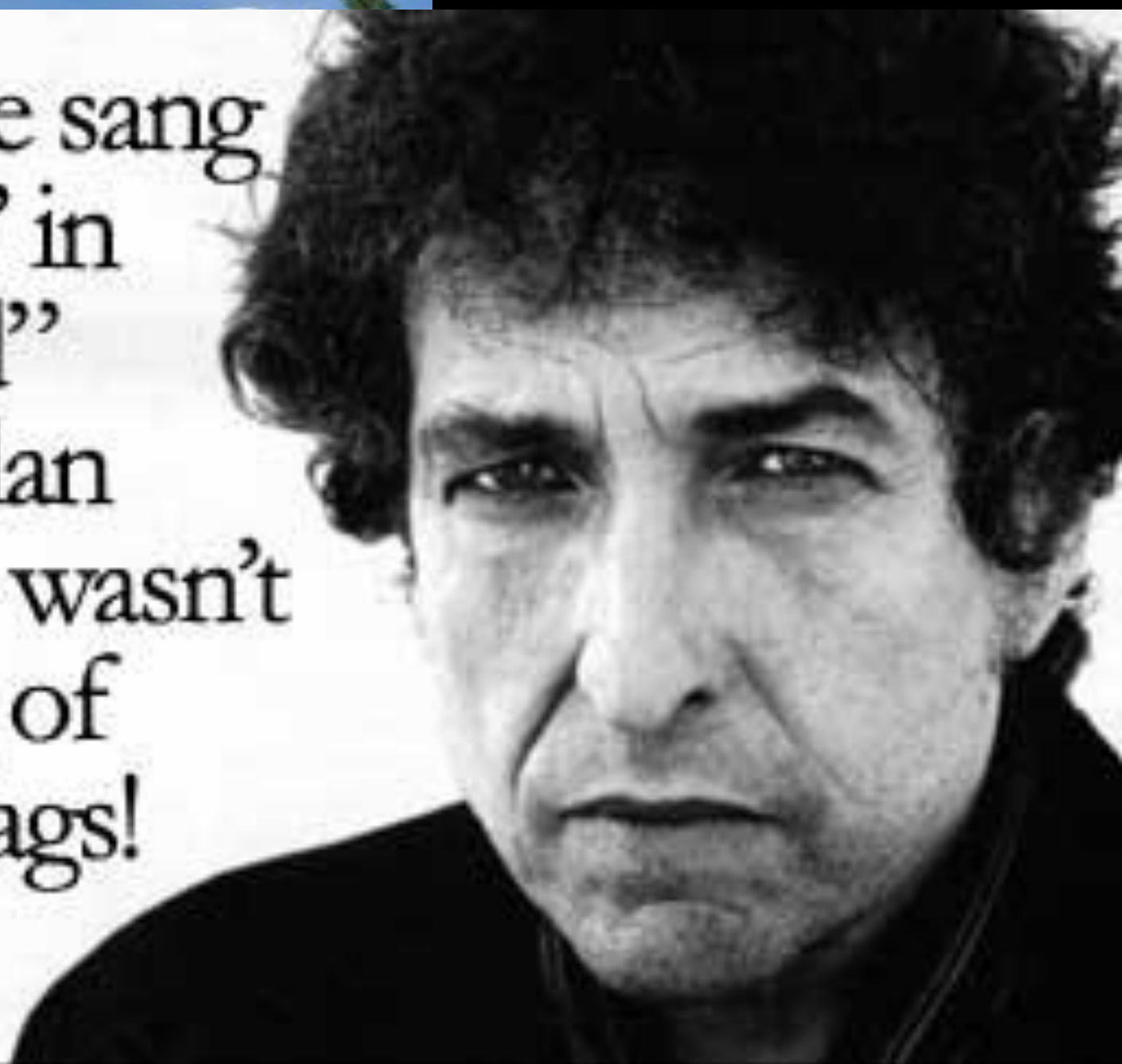


5GYRES



5 Subtropical Gyres

When he sang
“Blowin’ in
the wind”
Bob Dylan
certainly wasn’t
thinking of
plastic bags!





5GYRES



5 Laurentian Great Lakes



5GYRES



Manta Trawl



5GYRES



Lake Huron sample with plastic film

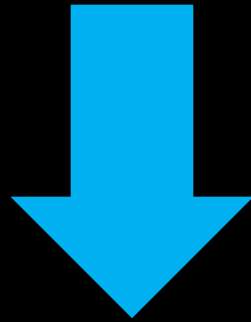


Photos courtesy of Brendan Bannon



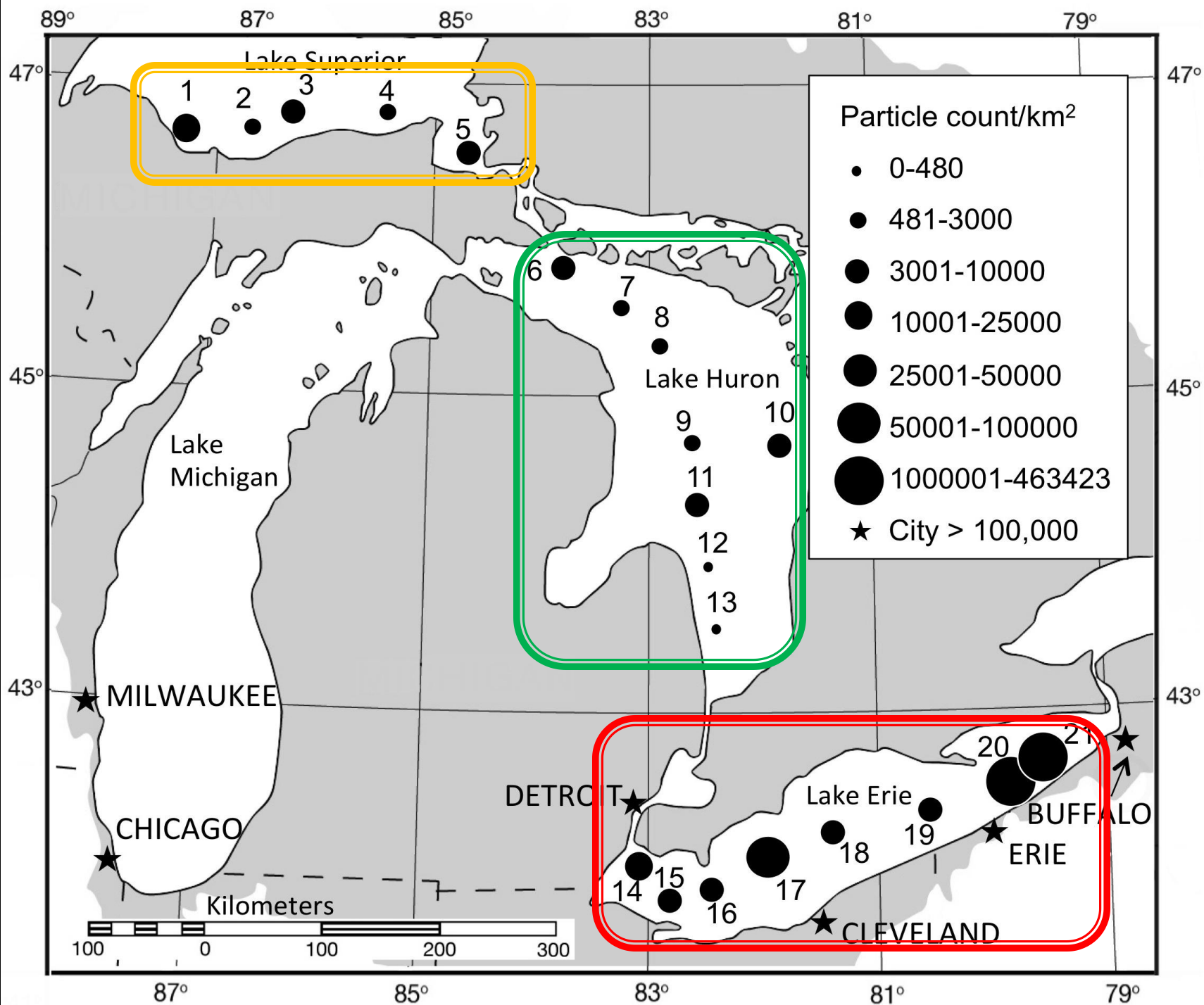
*Photos courtesy of
Tim Hoellein*

Extrapolate



Particles per Square Kilometer
(Plastic Abundance)

2012



Abundance of plastic pieces (count/km²) by type and size

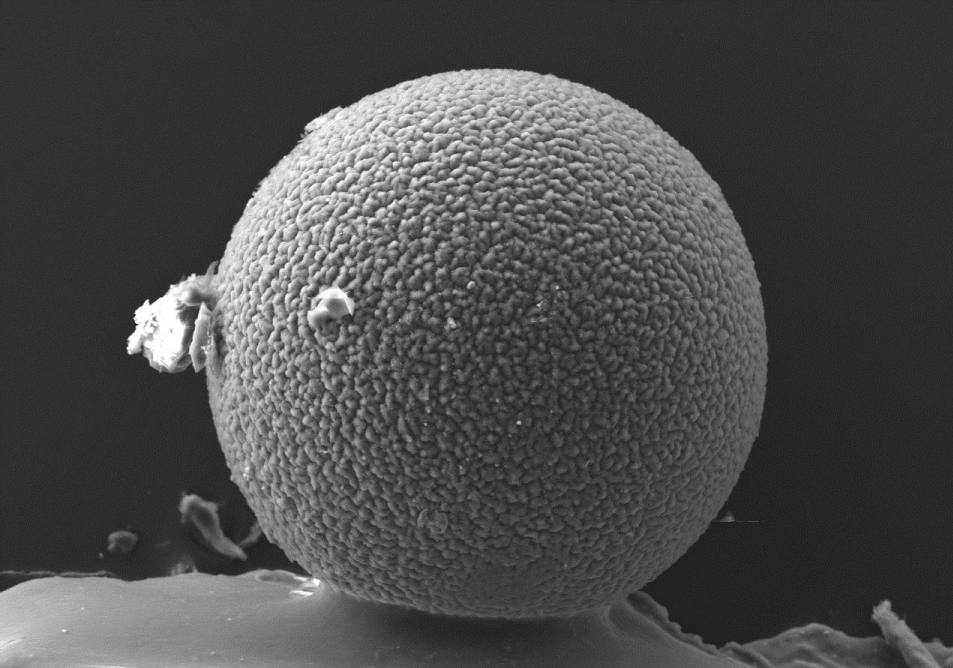
	0.355— 0.999mm	1.000— 4.749mm	> 4.75mm
Fragment	247,106.5	123,906.2	11,219.8
Pellet	430,029.8	5,614.1	420.9
Fiber/Line	1,328.9	2,571.9	449.0
Film	3,943.5	1,332.2	4,006.1
Foam	54,340.9	18,208.4	1,810.5
count/km ²	736,749.6	151,632.9	17,906.3
% of total	81%	17%	2%



MANTA #20 LAKE ERIE
- 355-1 mm

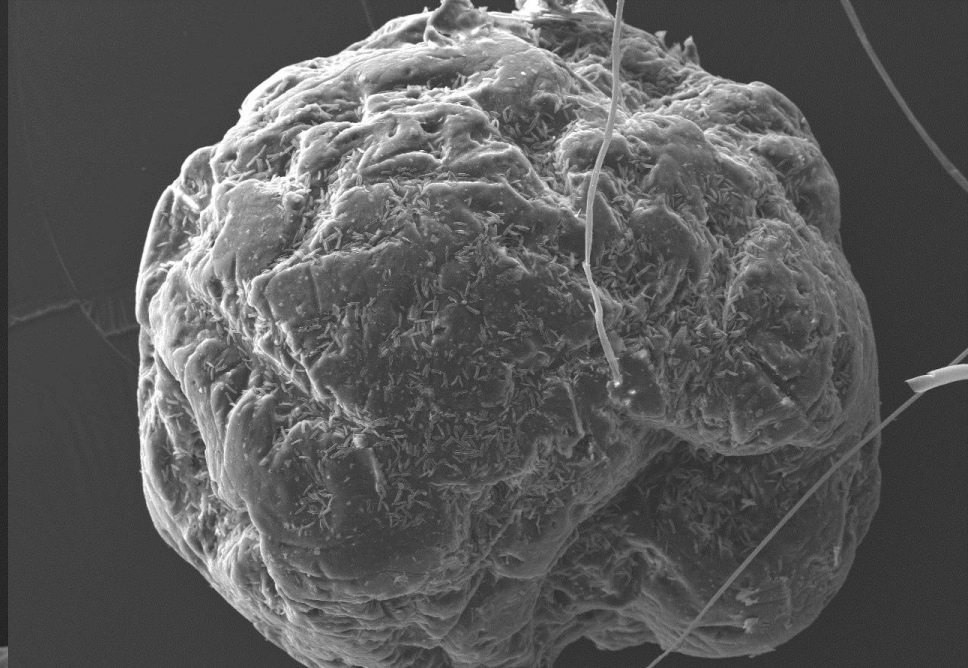






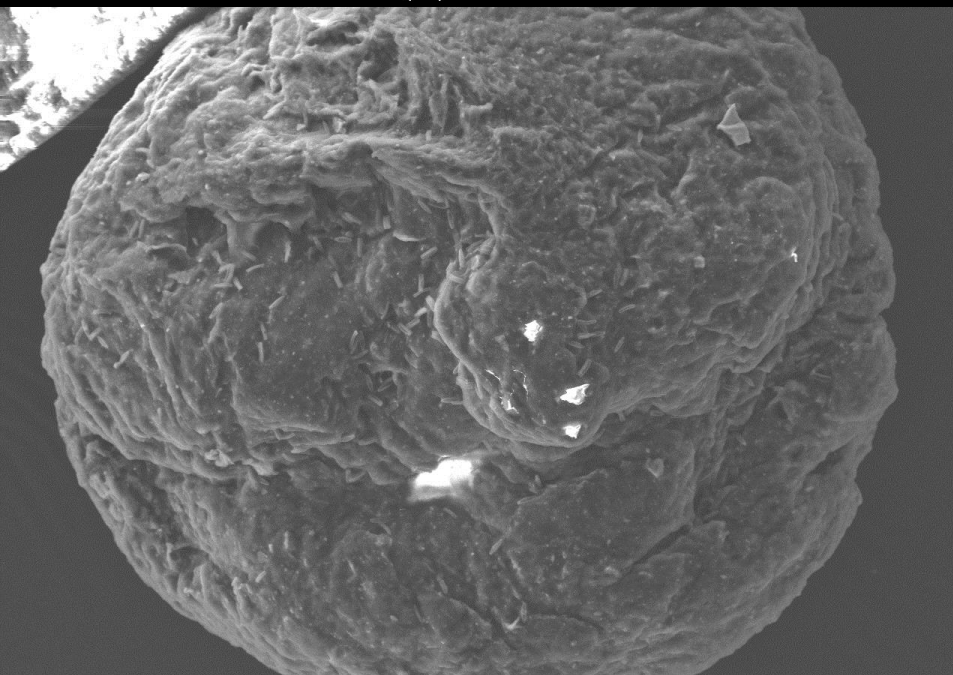
SU70 20.0kV 15.2mm x200 SE(M) 1/24/2013

200um



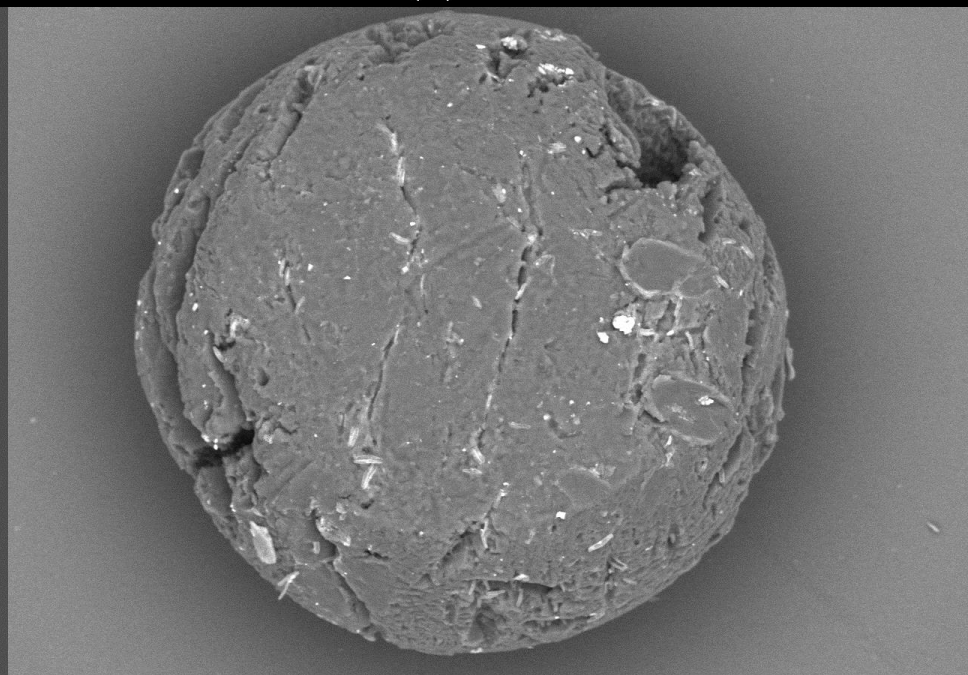
SU70 20.0kV 15.0mm x130 SE(M) 1/8/2013

400um



SU70 20.0kV 15.1mm x200 SE(M) 1/8/2013

200um



SU70 20.0kV 15.5mm x200 YAGBSE 3/19/2013

200um



5GYRES



POSSIBLE SOURCE OF MICROPLASTIC SPHERES

GENTLE

SCRUB

...the day.
...aurate, Polyethylene, Glycen
...aric Acid, Acrylates/C10

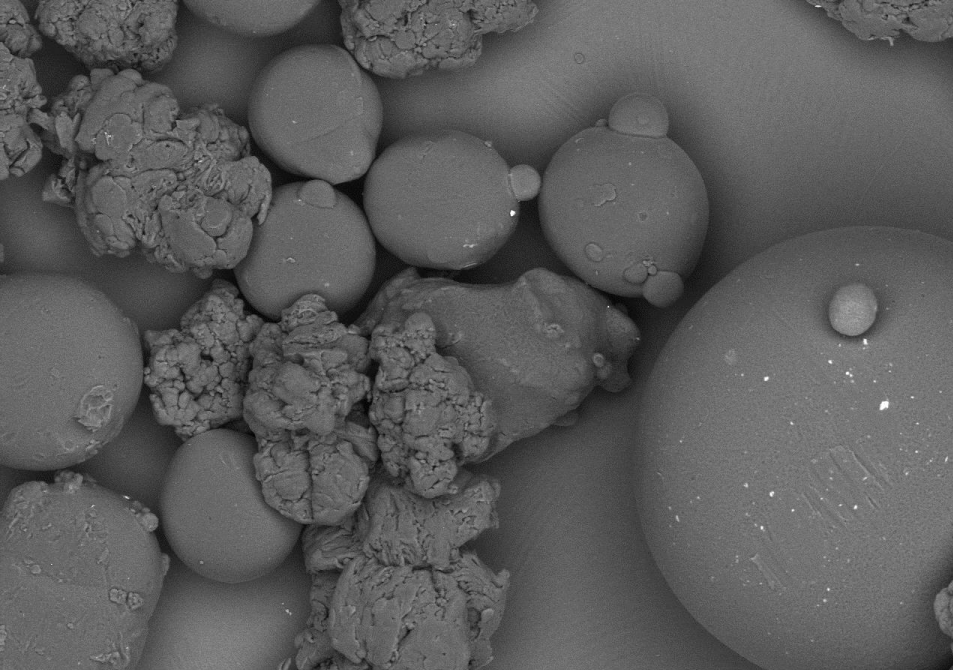
oil free

microbeads gently exfoliate,
Beta Hydroxy cleans deep into
pores for soft, smooth skin

Neutrogena®

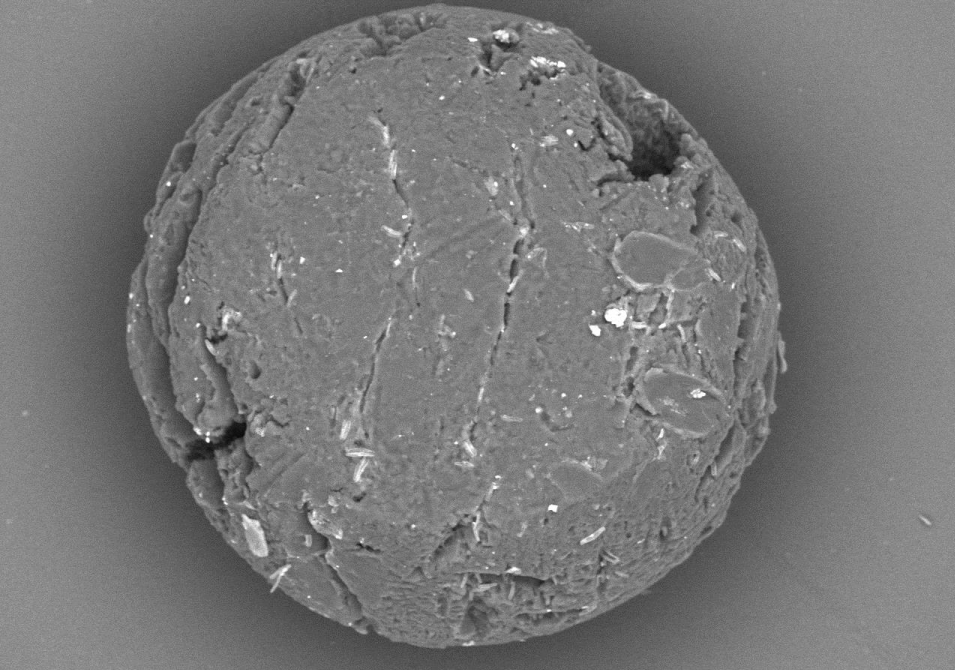






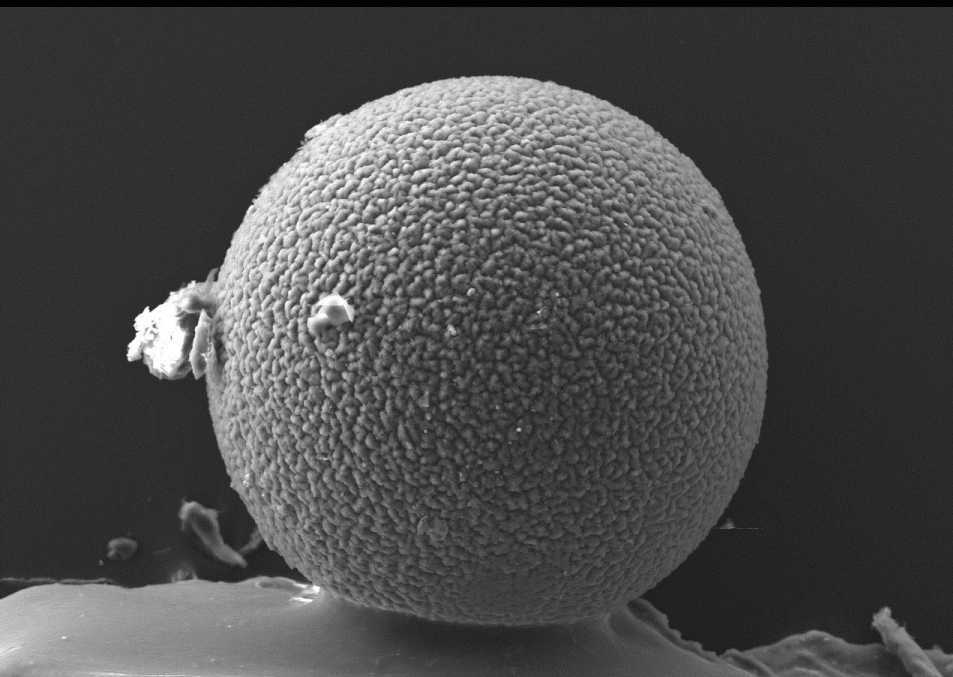
SU70 20.0kV 16.0mm x70 YAGBSE 1/8/2013

500um



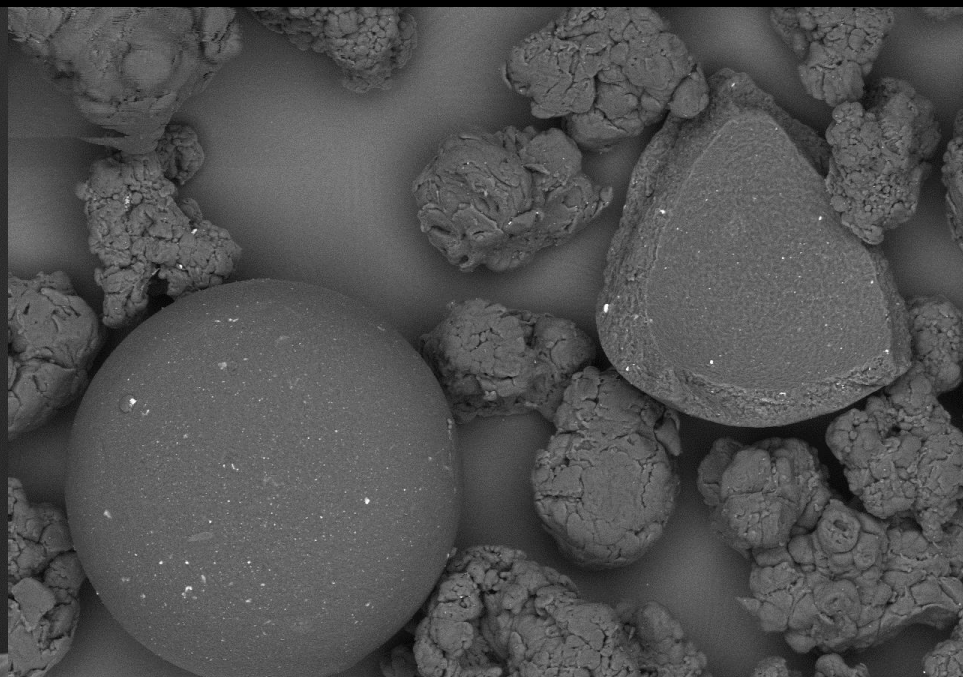
SU70 20.0kV 15.5mm x200 YAGBSE 3/19/2013

200um



SU70 20.0kV 15.2mm x200 SE(M) 1/24/2013

200um



SU70 20.0kV 15.9mm x80 YAGBSE 1/8/2013

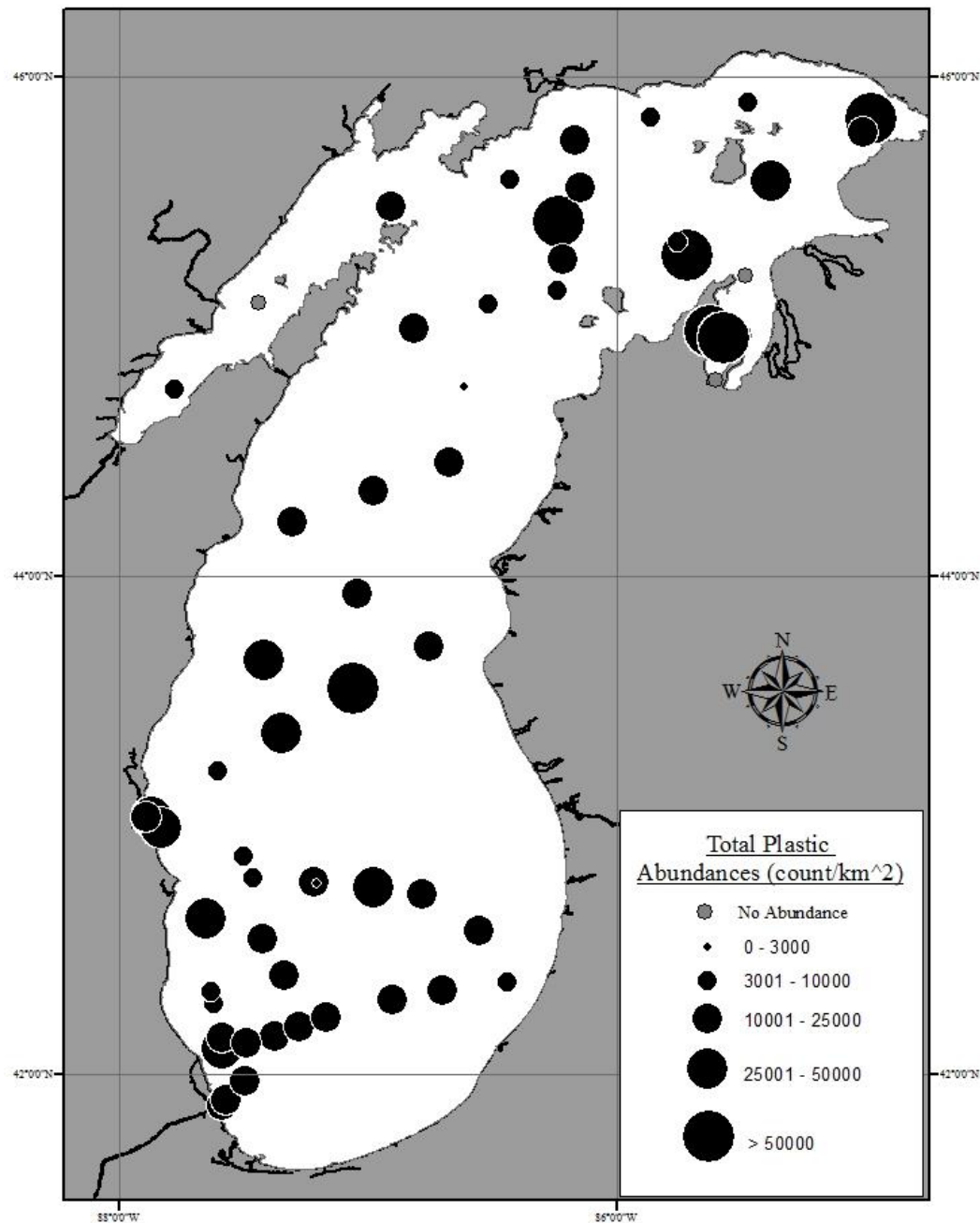
500um

2013



Photo courtesy of Brendan Bannon

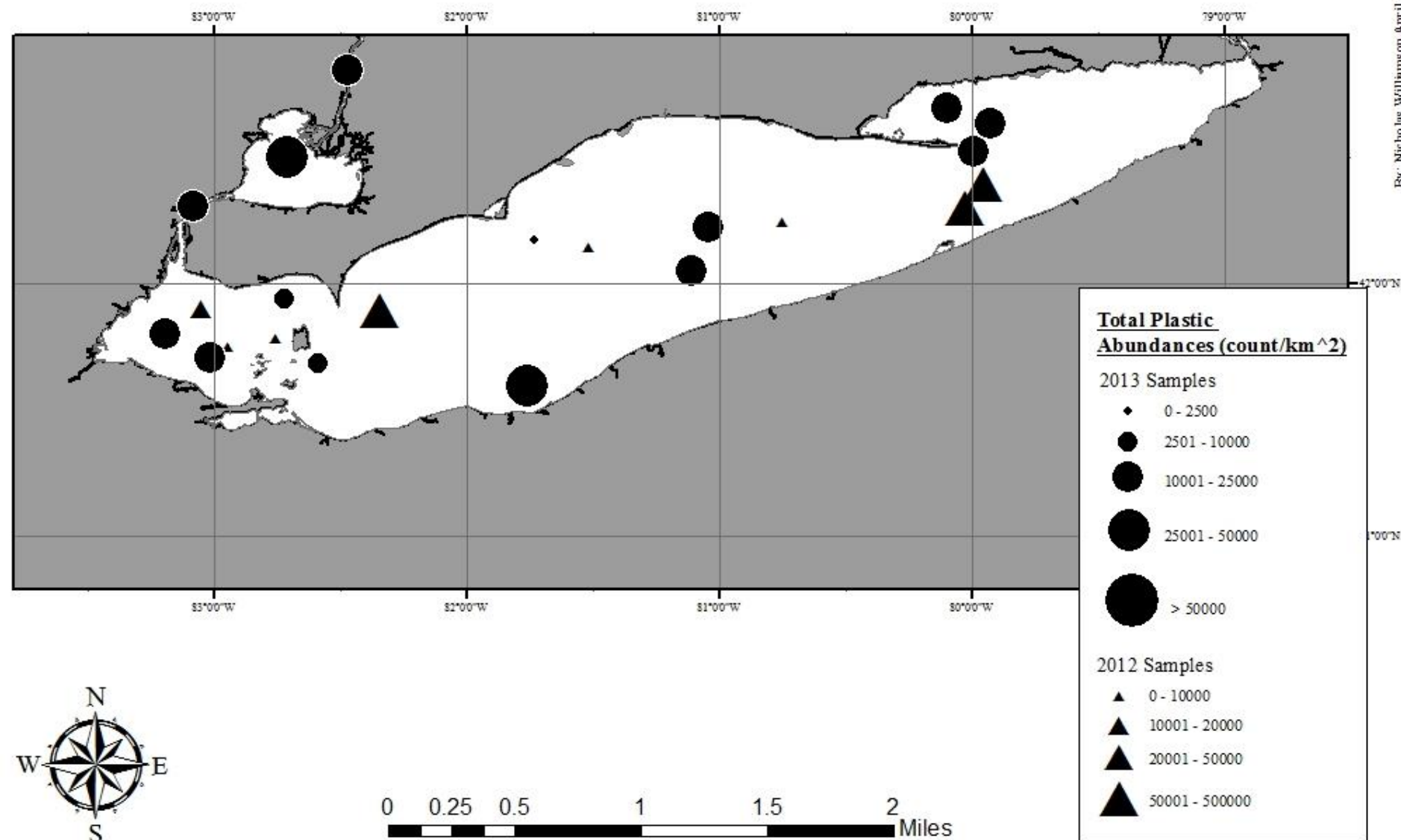
2013 Lake Michigan Open Water Samples



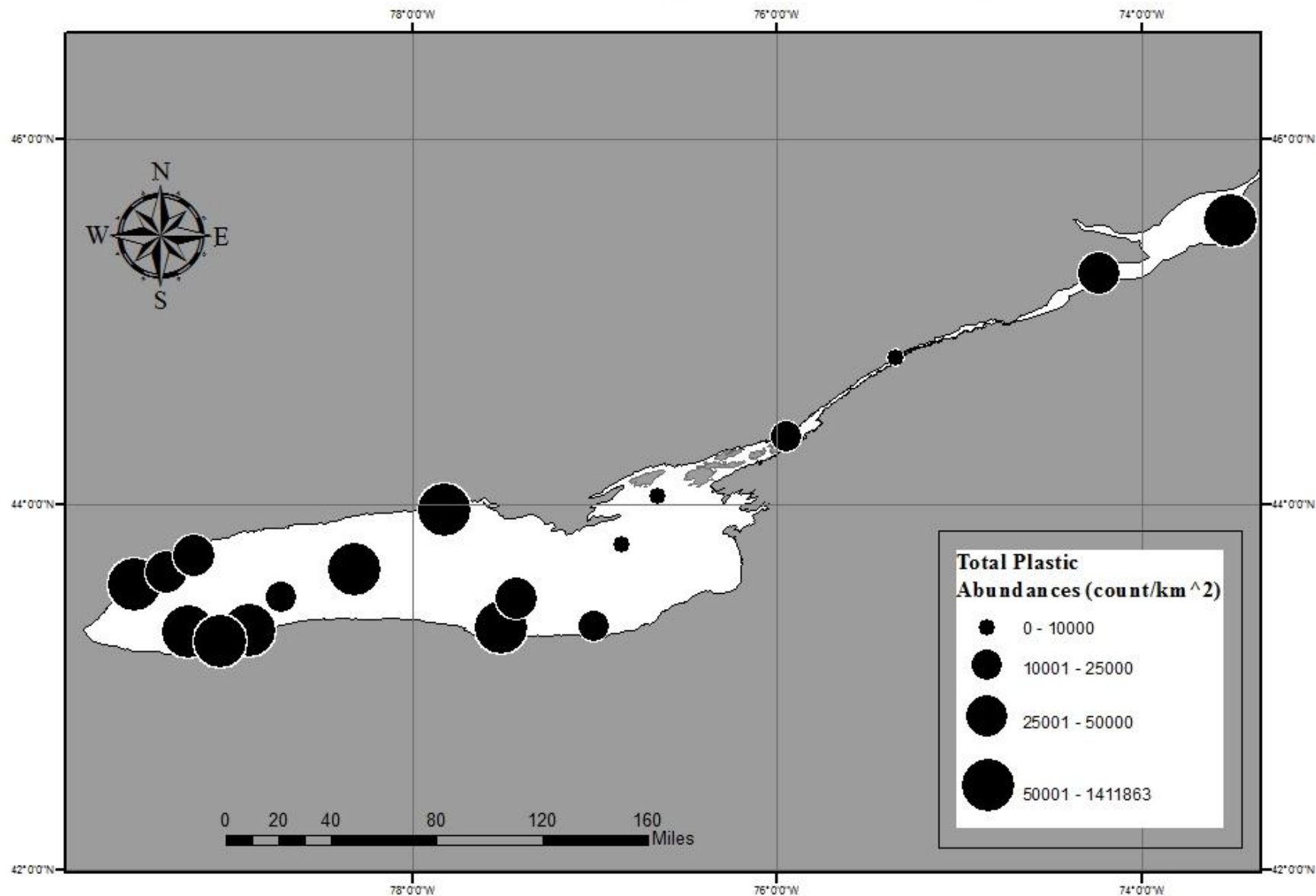
By: Nicholas Williamson April 23, 2014

Lake Erie 2012 & 2013 Open Water Samples

By: Nicholas Williams on April 23, 2014



Lake Ontario 2013 Open Water Samples



Combined Data – 2012 & 2013
Abundance of plastic pieces (count/km²)
by type and size

	0.355— 0.999mm	1.000— 4.749mm	> 4.75mm
Fragment	3,356,920.6	1,586,137.1	127,199.3
Pellet	920,457.4	78,815.0	4,999.6
Fiber/Line	119,116.3	94,004.7	67,245.2
Film	41,419.4	61,030.4	31,772.5
Foam	72,501.5	136,444.3	18,028.9
count/km ²	4,510,415.2	1,956,431.5	249,245.6
% of total	67%	29%	4%

Sources

- Consumer Products
 - Photodegradation of Larger Plastic Items



Sources

- Consumer Products
 - Photodegradation of Larger Plastic Items
 - Exfoliating Microbeads



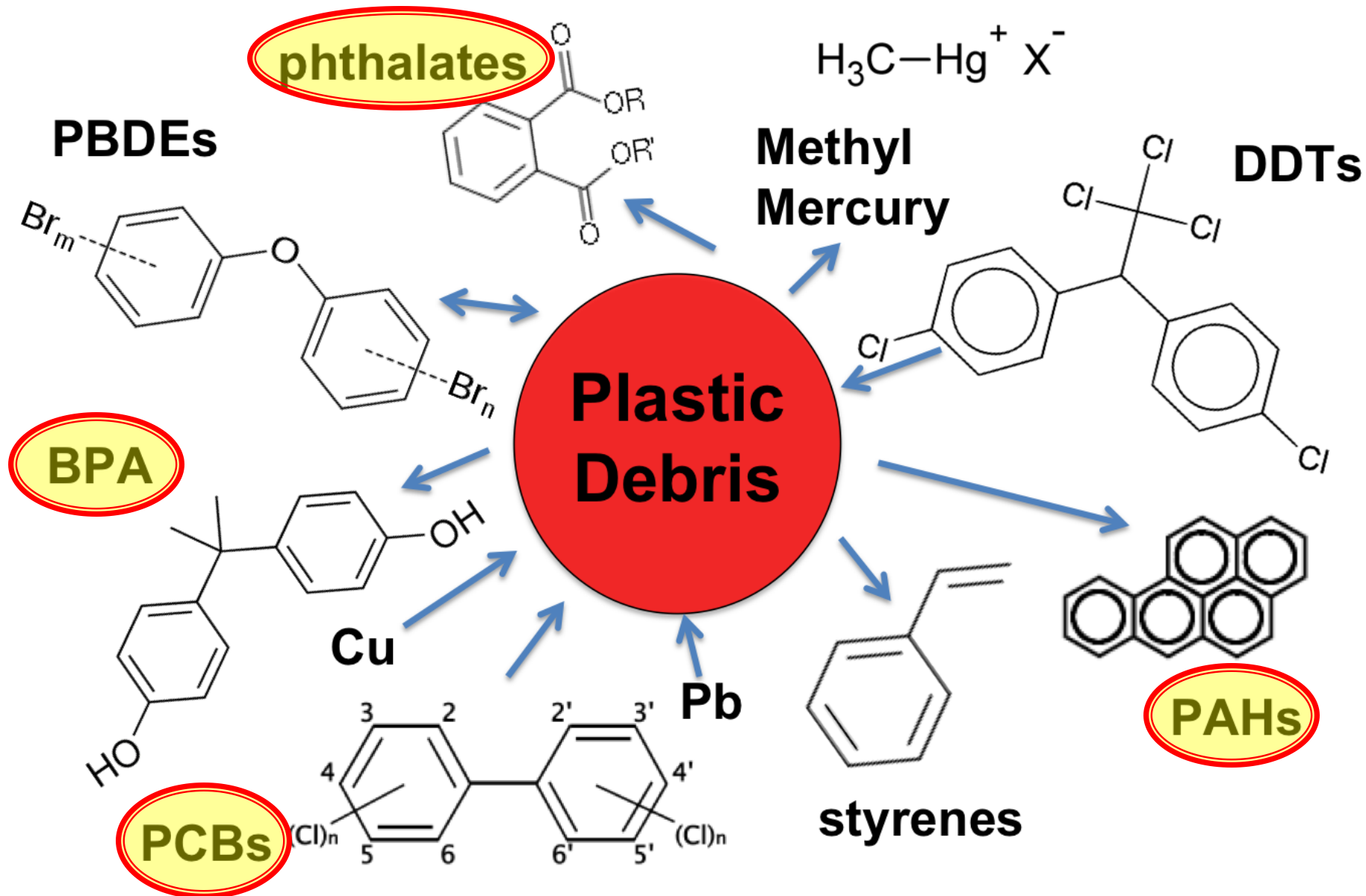
Sources

- Consumer Products
 - Photodegradation of Larger Plastic Items
 - Exfoliating Microbeads
 - Synthetic Fabrics

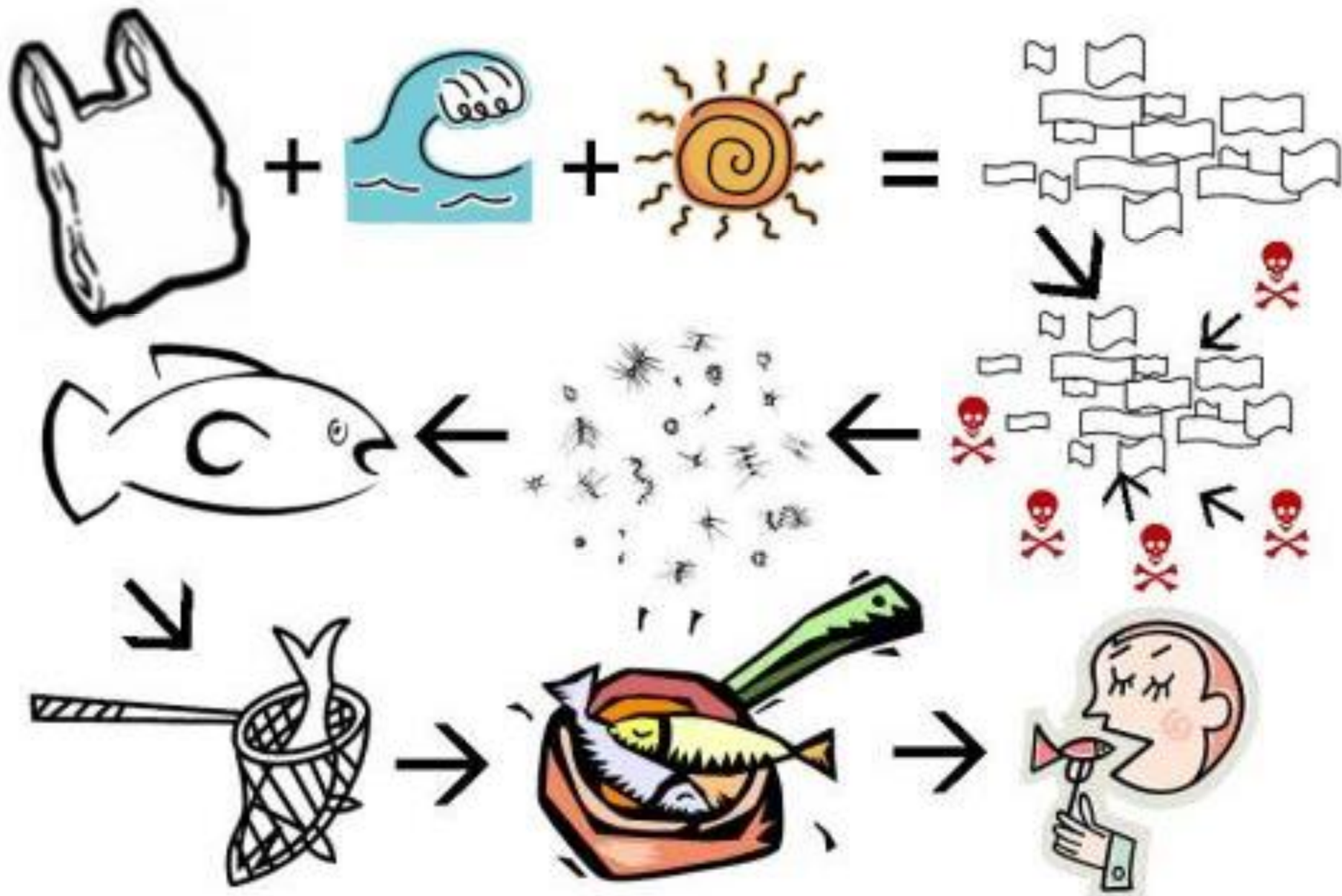


Why do we care?

“Cocktail” of Chemical Contaminants



Visual courtesy of Chelsea Rochman



Food Web Study

Preliminary Results

Species Analyzed to Date

Bloater

Brown Trout

Cisco

Common Shiner

Creek Chub

Double-crested Cormorant

Emerald Shiners

Golden Redhorse

Kiyi

Lake Trout

Logperch

Longnose Dace

Sand Shiner

Smelt

Spotfin Shiner

Walleye

White Bass

Yellow Perch

Total: 18

Species to Still Process

Burbot

Smallmouth bass

White Bass

Blue Gill

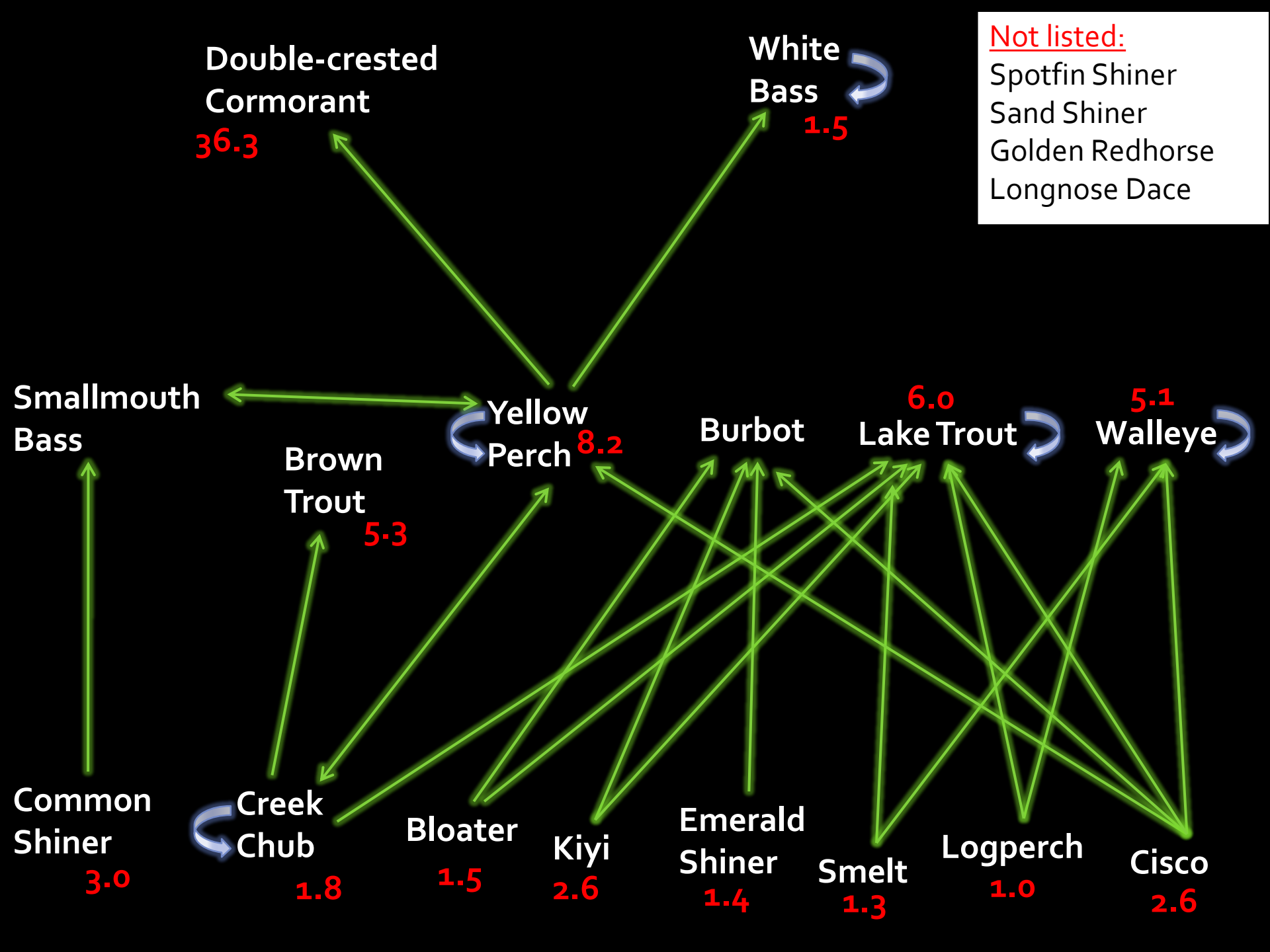
Gizzard Shad

Green Sunfish

Northern Pike

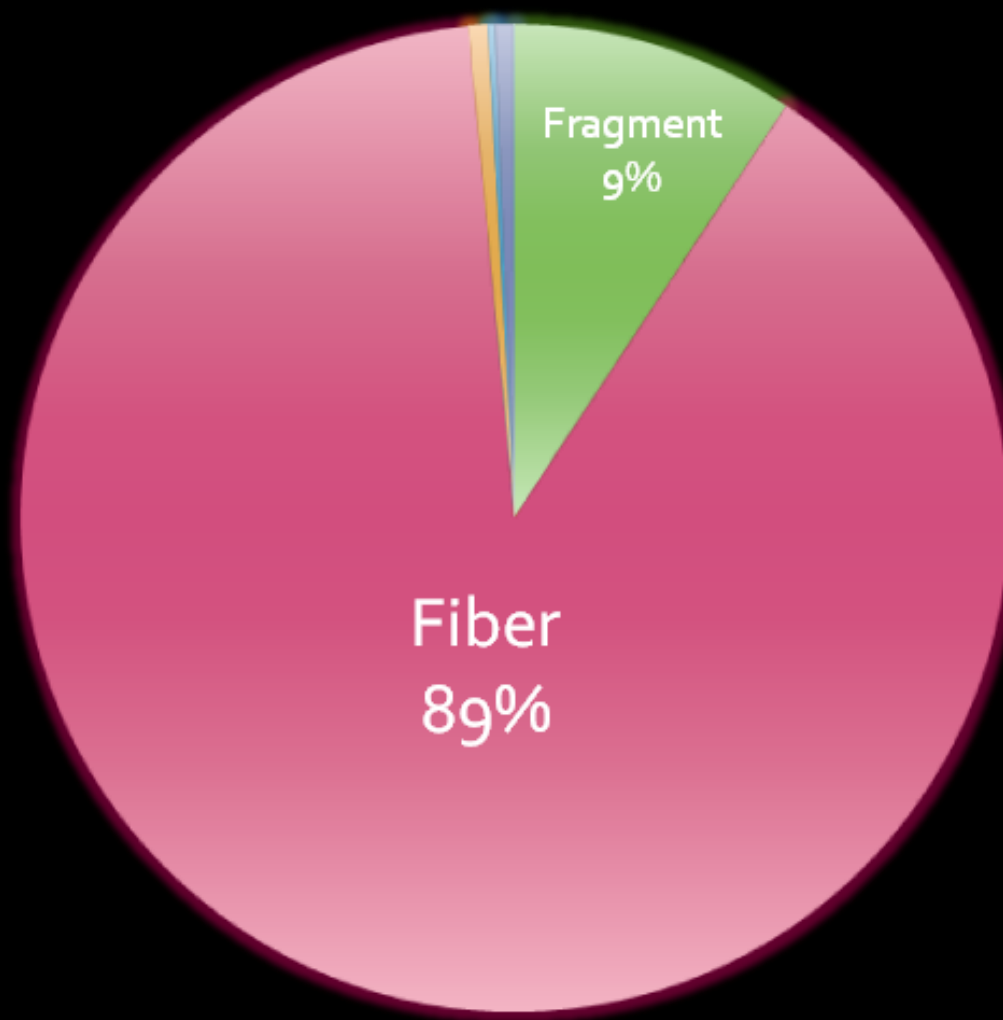
White Sucker

Total: 8





Overall Distribution



The background is an underwater scene. At the top, there are white and light blue bubbles rising towards the surface. Sunlight rays, or rays of light, penetrate the water from the top, creating a shimmering effect. The water itself is a deep blue color. The text 'We Are Water' is centered in the image. 'We Are' is in a white, cursive font with a green glow. 'Water' is in a large, blue, 3D font that looks like it's made of water or ice, with a white outline and a blue glow.

We Are
Water

IF IT'S IN
THE WATER,
IT'S IN US.

Questions?



Photo courtesy of Brendan Bannon



Thank You!

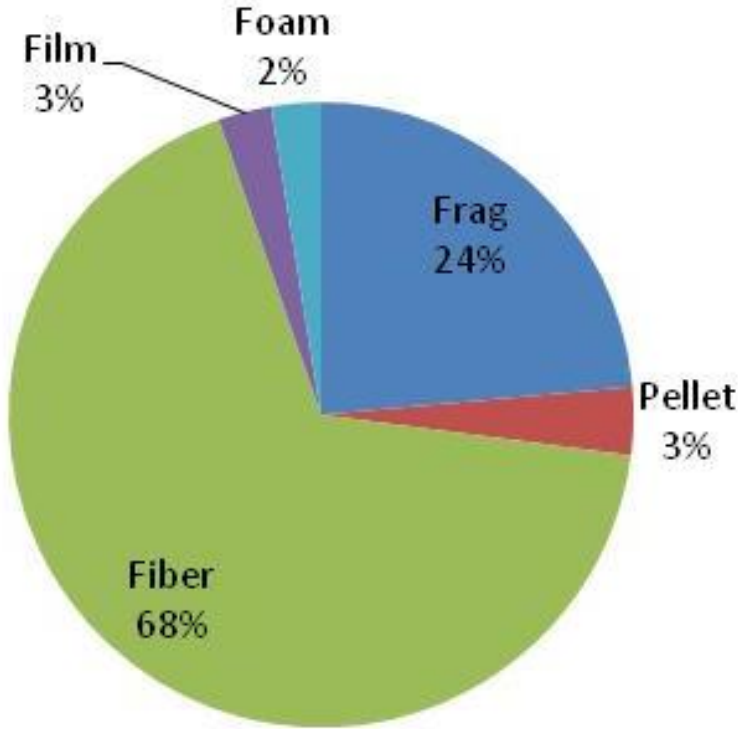


- Susan Gateley
- Ghadah Aleid
- Hannah Farley
- Nick Williamson
- Morgan Smith
- Rachel Ricotta
- Parker Fink
- Dan Papa

*Wastewater
Treatment Plant
Study*

Discharge Location	Average # Particles per Gallon	Average Facility Flow Rate (mgpd)	Plastic Particles per Day
Lake Erie #1	0.0328	2.5	81,911
Lake Ontario #1	0.0356	4	147,518
Lake Champlain	0.0155	5	77,325
Lake Erie #2	0.1770	6	1,061,953
Lake Erie #3			17,535,088
Lake Ontario #2			4,548,953

Wastewater Treatment Plant



Solutions

Polyethylene
Microbeads

Apricot
Shells

Cocoa
Beans



POSSIBLE SOURCE OF MICROPLASTIC SPHERES

Solutions

- Change what you buy
- Shake the Habit (of plastic bags)
- Ban the Bottle
- Bring your own utensils
- Don't Take it To-Go (or at least not in plastic)
- Don't Litter, Save the Critters
- Change the Laws
 - Bag/Bottle Fees
 - Extended Corporate Responsibility