

Microplastics and Our Lakes

Jill Emerson, Water Quality Coordinator

Support from: NH State Conservation Commission

The Moose Plate Grant Award



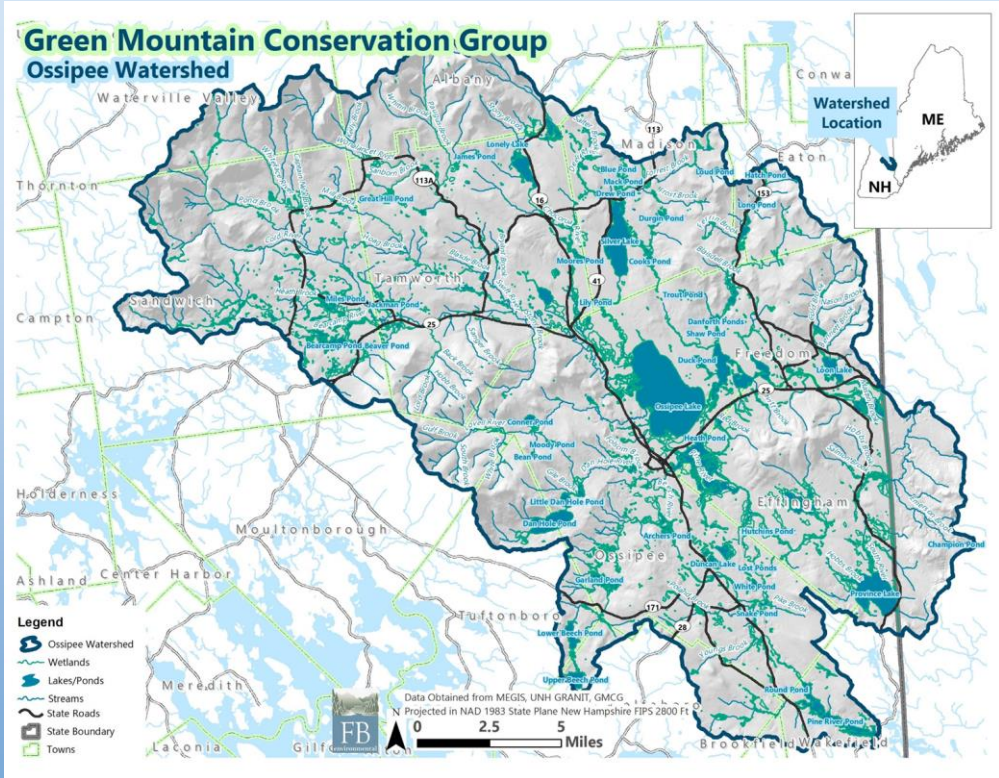
Green Mountain Conservation Group is a watershed organization committed to the conservation of shared natural resources in the Ossipee Watershed through research, education, advocacy and land conservation. The primary towns include Eaton, Effingham, Freedom, Ossipee, Madison, Sandwich and Tamworth. GMCG also partners with the Saco River Corridor Commission in Maine.



Healthy Water, Healthy Community



Saco River Basin Location Map

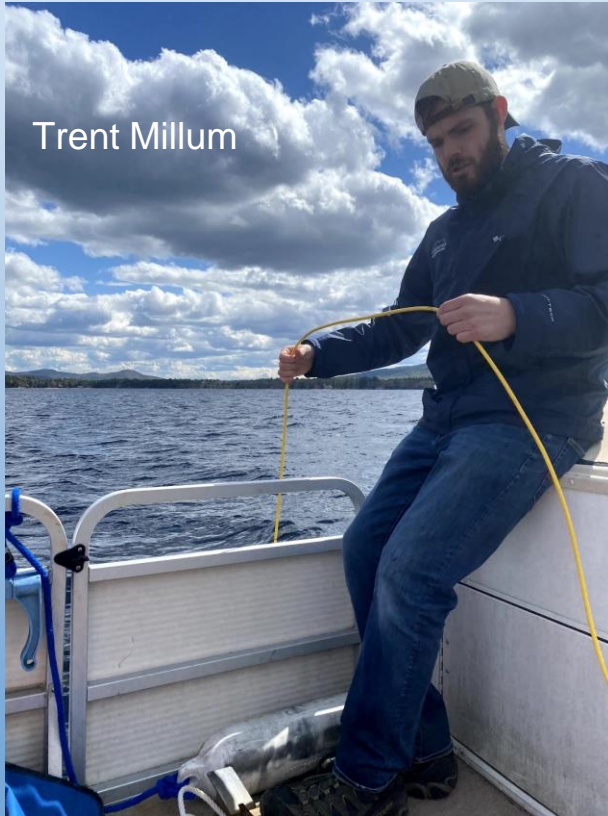


Special thanks to the AmeriCorps program



AmeriCorps


LAKES REGION
CONSERVATION CORPS



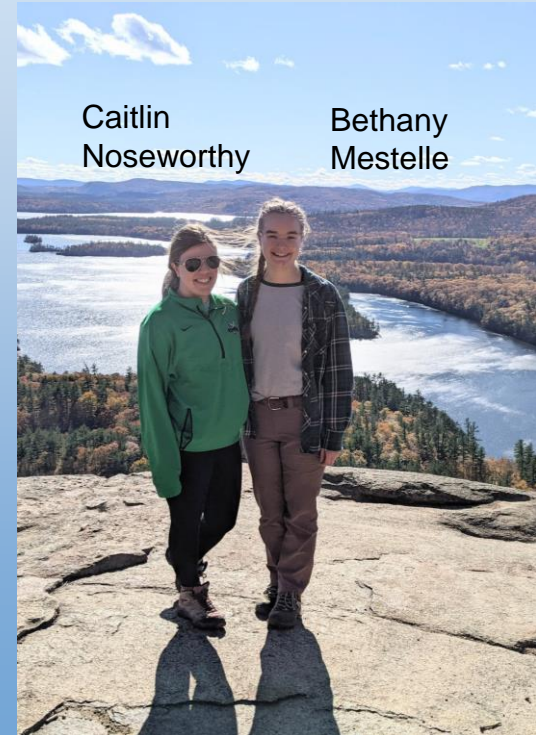
Trent Millum



Emma "EB" Brandt



Spencer Wilson



Caitlin
Noseworthy

Bethany
Mestelle

What are plastics and where do they come from?

- “Plastics” means pliable and easy to shape
- Natural plastics used 3,500+ years ago
- 1869 – first synthetic polymer developed to replace ivory
 - Humans could now make materials instead of harvesting them
- 1907 Bakelite became the first synthetic plastic
 - Originally used for electrical insulation
- 1930’s came polyethylene nylon, PVC, silicone...WWII in grenades, radar cables, etc.

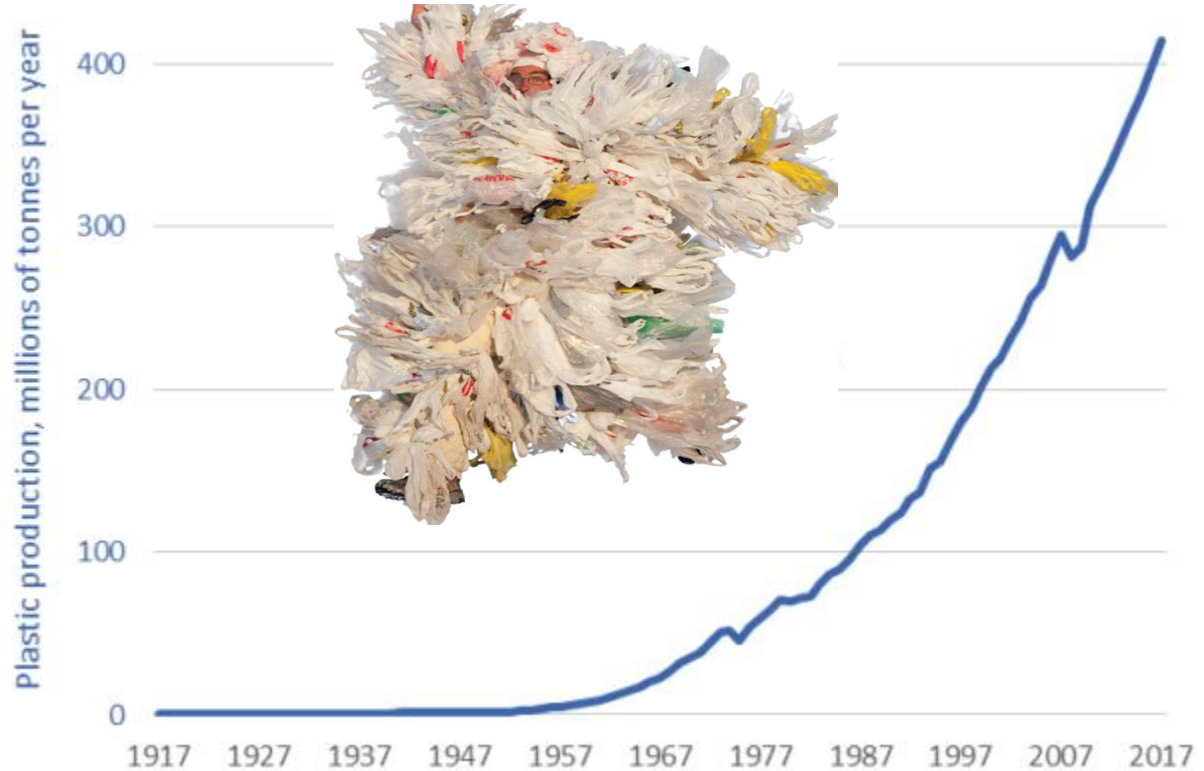


<https://www.nationalgeographic.com/animals/article/frankincense-trees-declining-overtapping>

<https://www.nationalgeographic.com/science/article/100628-science-ancient-maya-aztec-rubber-balls-beheaded>

















Global plastic production 1917-2017

- 0 to 400+ million tons in 2017
- US generates more plastic waste than any other country in the world
- By 2050, it is estimated that there will be more plastic in the ocean by weight than fish



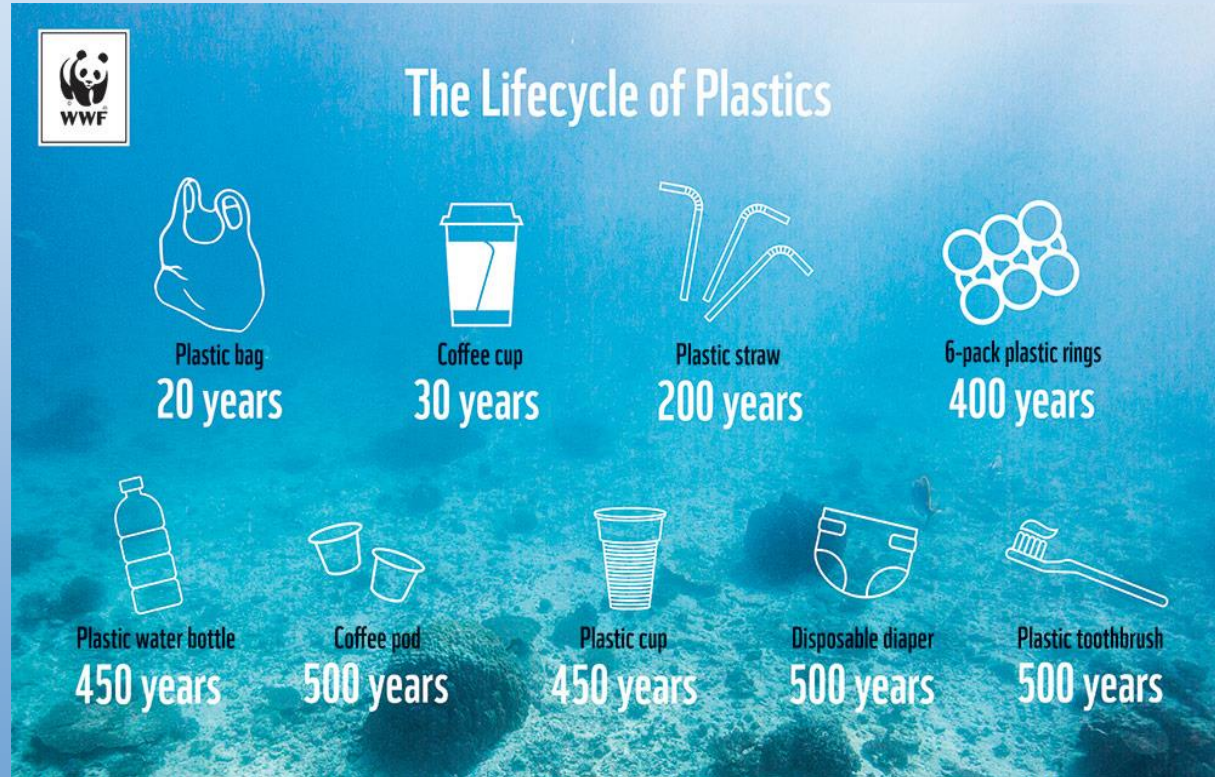
The Recycling Myth

Plastic Resin Identification Codes

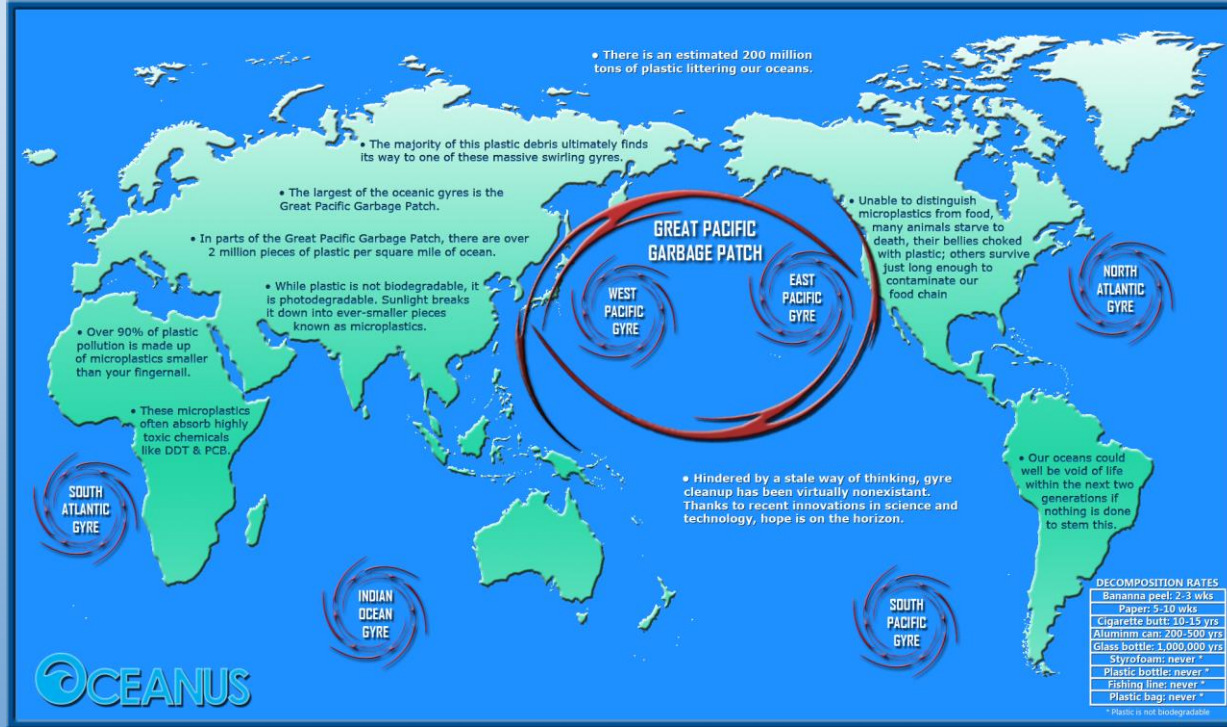
 PETE	 HDPE	 PVC	 LDPE	 PP	 PS	 OTHER
Polyethylene Terephthalate	High-Density Polyethylene	Polyvinyl Chloride	Low-Density Polyethylene	Polypropylene	Polystyrene	Other
Common products: soda & water bottles; cups, jars, trays, clamshells	Common products: milk jugs, detergent & shampoo bottles, flower pots, grocery bags	Common products: cleaning supply jugs, pool liners, twine, sheeting, automotive product bottles, sheeting	Common products: bread bags, paper towels & tissue overwrap, squeeze bottles, trash bags, six-pack rings	Common products: yogurt tubs, cups, juice bottles, straws, hangers, sand & chipping	Common products: to-go containers & flatware, hot cups, razors, CD cases, shipping cushion, cartons, trays	Common types & products: polycarbonate, nylon, ABS, acrylic, PLA; bottles, safety glasses, CDs, headlight lenses
				 	 	

Harmful effects of plastics on the environment

- Plastic persists
- 260+ species Impacted
- 8 million tons of plastic enters the ocean each year
- Plastic has been found in 90% of the guts of sea birds
- By 2050, plastic in the oceans will outweigh fish



Oceanic Garbage Patches



Plastics are everywhere!



Basically if you.....



.....you have plastics in you.

What are microplastics?

- Coined in 2004 by a UK marine biologist
- Frequently defined as being 5mm (1/5") or less in length
 - Nanoplastics are less than 1 μ M
- Two classifications of microplastics
 - 1) Primary microplastics - purposely produced to be small
 - 2) Secondary microplastics - broken down from larger plastic sources

Microbeads



Microfibers



Microfragments



How much plastic do you consume in a week?

- A) None! Plastic is not a part of my diet
- B) The weight of a paperclip (~1g)
- C) The weight of a penny (~2.5g)
- D) The weight of a credit card (~5g)
- E) I very much do not want to know please
do not flip to the next slide and completely
gross me out you're going to tell me on
the next slide aren't you?



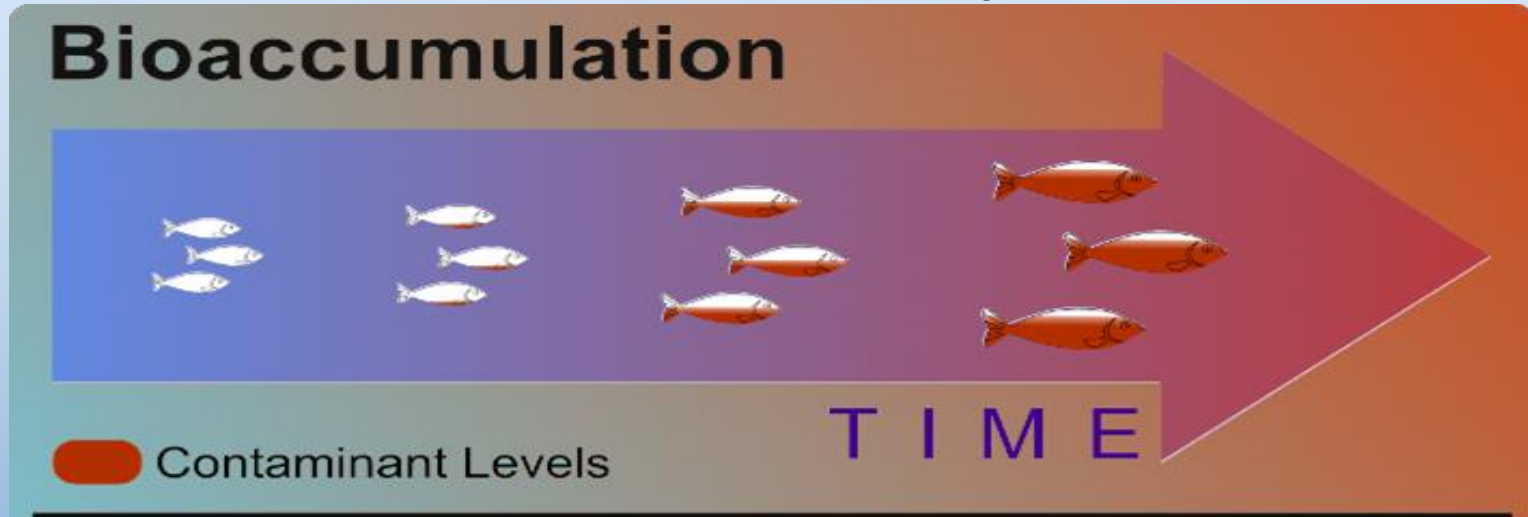
Ingesting Microplastics

A Study from the University of Newcastle says that we ingest 5 grams of plastic each week.

- Still largely unknown
- Some studies show impacts to smaller animals
- Some studies show that compounds in plastics have altered human hormones in the body



Problems with Microplastics



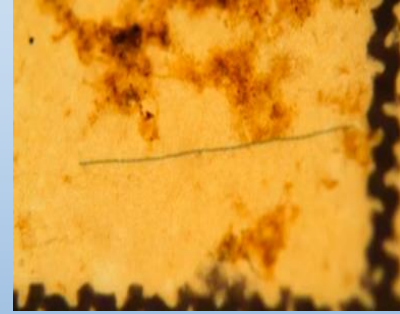
<https://static1.squarespace.com/static/53e8ee02e4b09aec917742e6/t/54ae94f2e4b0342c02bd216b/1413554775702/3-bioaccumulation-vs-biomagnification+small.png>



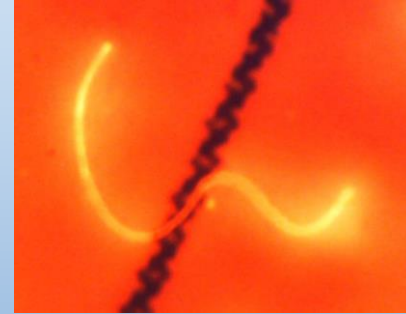
GMCG is a 2021 Recipient of Moose Plate Grant Award “Microplastics in the Ossipee Lake System”



Commercial Water



Freshwater lake



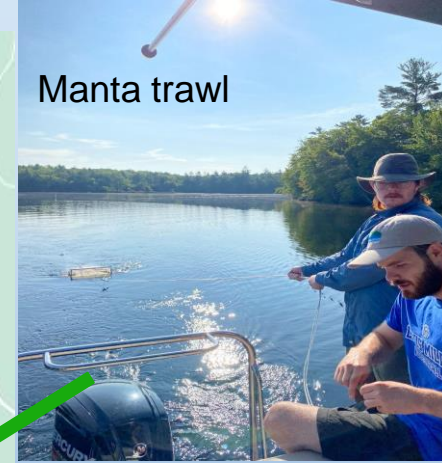
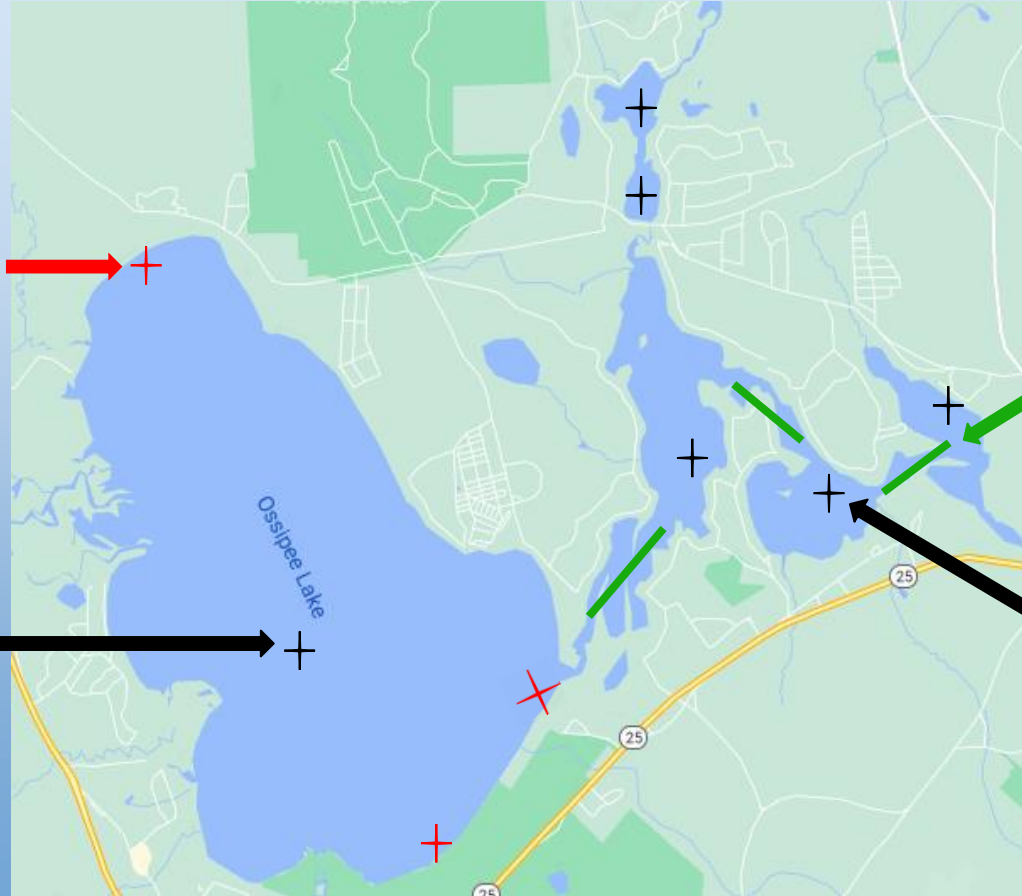
Fresh Snow

Knowledge gaps in freshwater



- Much of what is known about microplastics comes from marine environments and controlled laboratory experiments
- Adventure Scientists compiles microplastics data submitted in a singular location
 - Not an exhaustive list
- Microplastic effects in surface and drinking water are not widely known

GMCG's Research...Ossipee Lake System



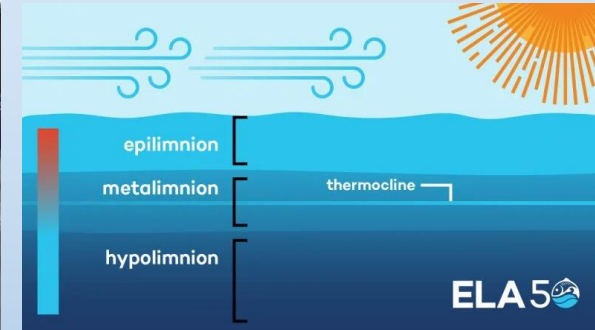
Water collection

Deep spot sampling

- May-September
- Deep spot identified by GPS and depth finder
- Layer determination by DO and temperature
- Integrated tube sample taken to thermocline

Manta Trawl sampling

- In channels in between Lake Ossipee bays, the manta trawl was deployed



What is a manta trawl?

A manta trawl is a net system used for sampling surface waters. It is towed behind the wake of a boat travelling at low speeds and filters water based on the net pore size (ours is 100uM).



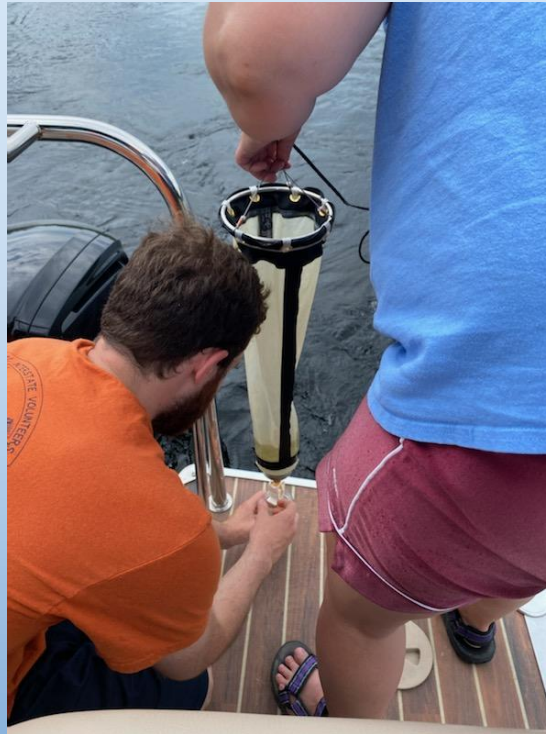
Sediment collection

- Sediment was collected from various places around Lake Ossipee
- A 0.5M x 0.5M was selected at the wrack line
- Natural debris like sticks, leaves, or pine needles were removed from the collection site
- Collected sand was sifted through a sifter to remove any large rocks or bits of plastic
- After drying, sediment was mixed with a high molar salt solution and the solution was allowed to settle



Plankton collection

- At the deep spot
- Net lowered down to the thermocline
- 1-2 collections per deep spot
- Samples were filtered to collect the plankton
- Plankton were dried o/n
- Mechanical grinding
- Alkaline digestion & neutralization
- Treated as a water sample



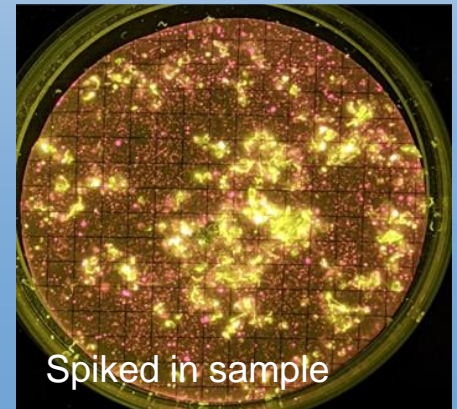
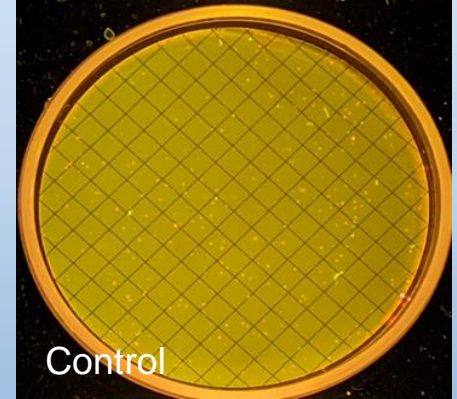
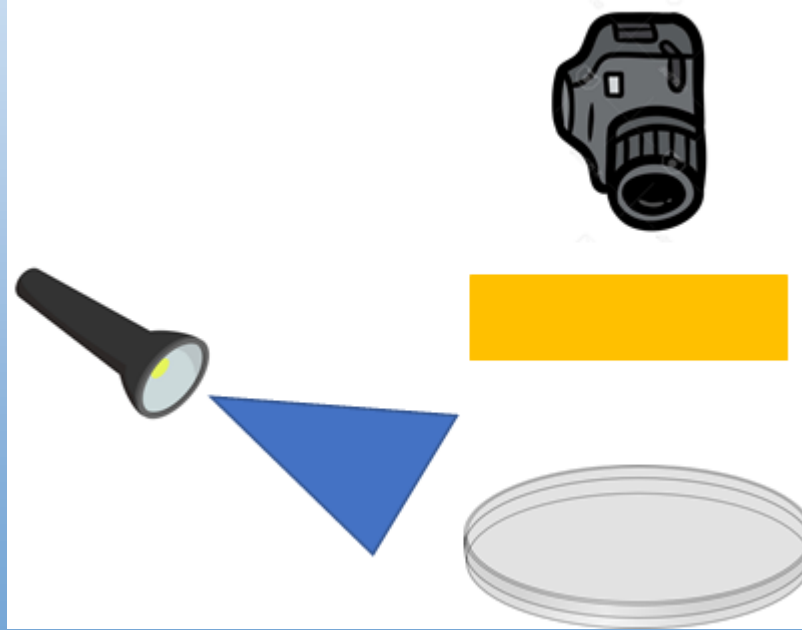
Cladocera
UNH CFB



Rotifer
UNH CFB

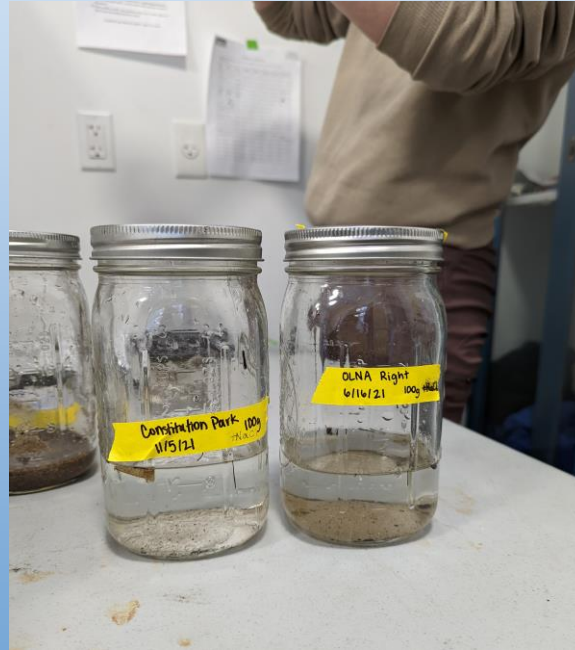
How does Nile Red (NR) work in identifying microplastics?

- Nile Red (NR) is a commercial dye originally used to stain lipids
- Has been shown to adhere to many different types of plastics, most likely through hydrophobic interactions
 - Essentially, water is polar, plastic is not – dye wants to play with other non polar things
- Excitation via blue light
- Observe through orange filter

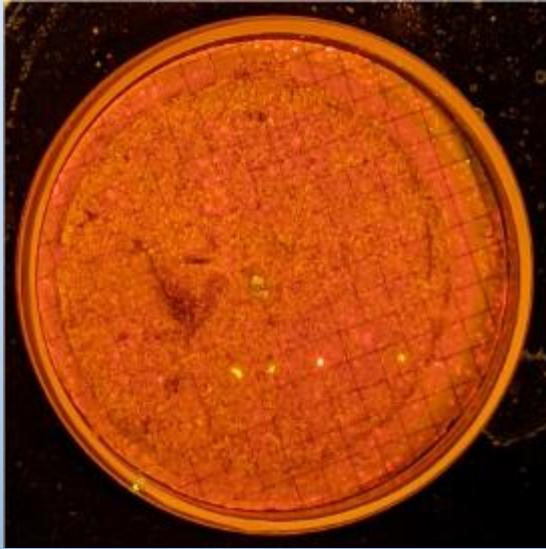


Science research in a plastic world

- At each step of this research, we were trying to come up with workarounds
- Sample collection was done in Mason jars
- Glass, ceramic, and metal alternatives were identified for many different steps
- Calculated risks when a good alternative didn't present itself



Initial findings from Ossipee Lake System - Water

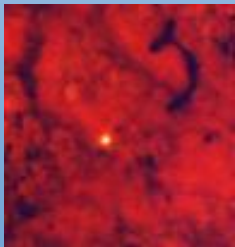
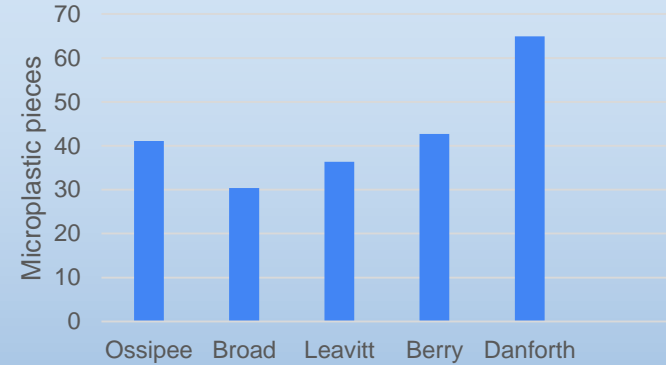


Deep water sample (average):

- Ossipee – 41.12 pieces
- Broad – 30.39 pieces
- Leavitt – 36.33 pieces
- Berry – 42.73 pieces
- Danforth – 64.93 pieces

Manta trawl (average):

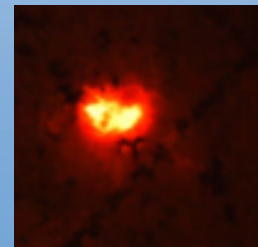
- 80.7 pieces



Microbeads



Microfibers



Microfragments

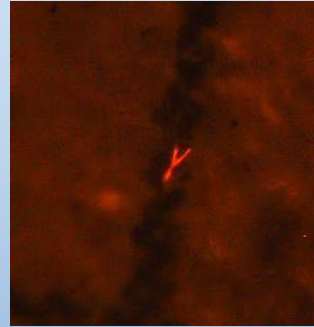
Initial findings from Ossipee Lake System - Plankton

In total, 57 pieces of microplastics were found in plankton, with an average of 19 being found per sampling event.

Areas of improvement:

- 1) Gathering more plankton per trawl trip
- 2) Better filtration step
- 3) Maybe a rinsing step
- 4) Work on digestion step (ended up with a lot of debris to sort through).

Future work: mollusk population



Microplastics in sediment – initial work underway



Troubleshooting endeavors

- Working on how to reduce/eliminate salt residue from filters to adequately see particles stained with Nile red
- Working on how to keep the most sediment away from our liquid sample
- Determining best solution to float plastics in
- Determining a reasonable ratio of solution to sediment

Nile Red as a tool for microplastic determination

Pros

- Pretty cheap to run samples compared to other methods
- Pretty easy to use
 - Protocols are very forgiving
- Great educational tool for both adults and kids
 - Students have enjoyed seeing the Nile red in action
 - It makes for some pretty impressive pictures!
- An accepted protocol with plenty of literature supporting it

Cons

- Probably only binds to non polar plastic types, and some plastic is polar (basically, some plastic has charge)
- Will bind to some organics
 - We use other cues about phenotypes, what it looks like under white light, etc.
 - Tends to be a difference in fluorescence levels in plastic vs. organic

Education & Outreach about Microplastics

- Summer Camp programs at Camp Calumet in Freedom & Effingham Elementary School
- Coffee Hour Talks
- Online presentation of research to the public
- Farmer's Market in Tamworth
- Earth Day Less Plastic Challenge & Online Programs
- Integrating microplastic research into schools
- Less Plastic Guide – educational programming



LESS PLASTIC CHALLENGE

Will you take on the challenge of up-cycling single-use plastics?

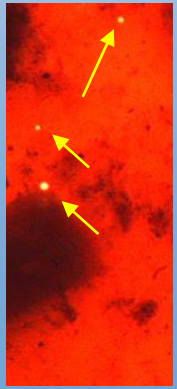
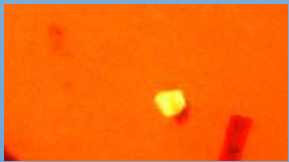
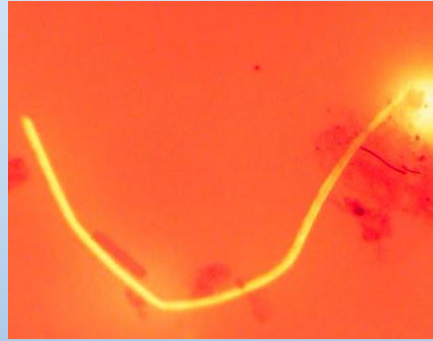
What: Transform single-use plastics into something new!

Where: Submit your name, town, and a photo of your project with a written or video explanation to education2@gmcg.org

When: Submissions will be accepted through April 15th. Winners will be announced on Earth Day (April 22nd)
For more submission information visit gmcg.org



GMCG's Research...rivers & streams with schools



Taking *action!*

- Break Free From Plastic Pollution Act of 2021 (BFFPPA) (H.R. 2238, S.984)
- Extended Producer Responsibility for Packaging Act
 - Passed by State of ME 2021
- 4 R's: Refuse, Reduce, Reuse, Recycle –
“Let’s look for ways for us to create less trash...there is no away.”
~ Jeb Berrier, “Bag It” filmmaker
- Community science endeavors like Nat Geo’s “Debris Tracker” and plastic audits

What **The Break Free From Plastic Pollution Act** Will Accomplish:



Huge “Thank You” to: NH State Conservation Commission The Moose Plate Grant Award

The New Hampshire State Conservation Committee (SCC) is the state government agency responsible for managing the Conservation Grant Program. Competitive grants are awarded annually to physical and tangible environmental projects that foster stewardship and the sustainability of New Hampshire's natural environment.

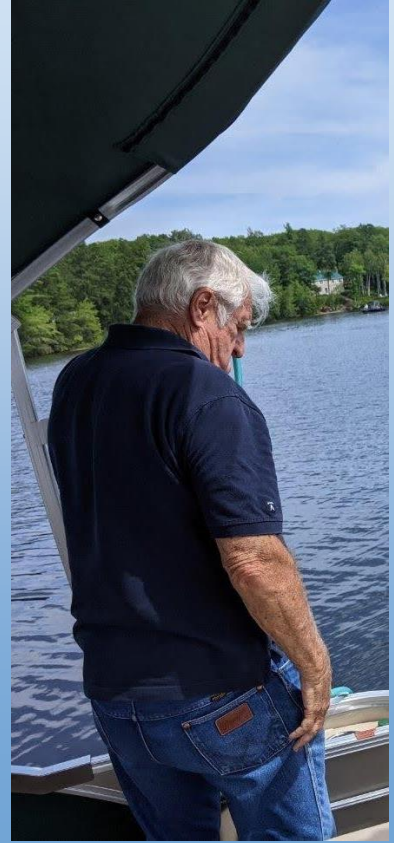


Thank you to partners & collaborators in research & education

- The Dorr Foundation
- AmeriCorps program
- Tamworth Recycling Project
- Chocorua Lake Conservancy
- Cook Memorial Library
- Conway Public Library
- Effingham Public Library
- Effingham, Freedom, Ossipee & Sandwich Elementary Schools
- Northeast Woodland Charter School
- Camp Calumet
- Kingswood High School
- Sacopee Valley Middle School
- Kennett High School
- Jeb Berrier of "Bag It"
- Lauren Moreira of Italy's "More Clay, Less Plastic"
- Tru Earth



Extra Special thanks to all the GMCG volunteers!



Want to know more about
our research projects or
other programs?

water@gmcg.org
info@gmcg.org
603-539-1859
gmcg.org

