DISTRIBUTION OF MICROPLASTICS WITHIN NH LAKES

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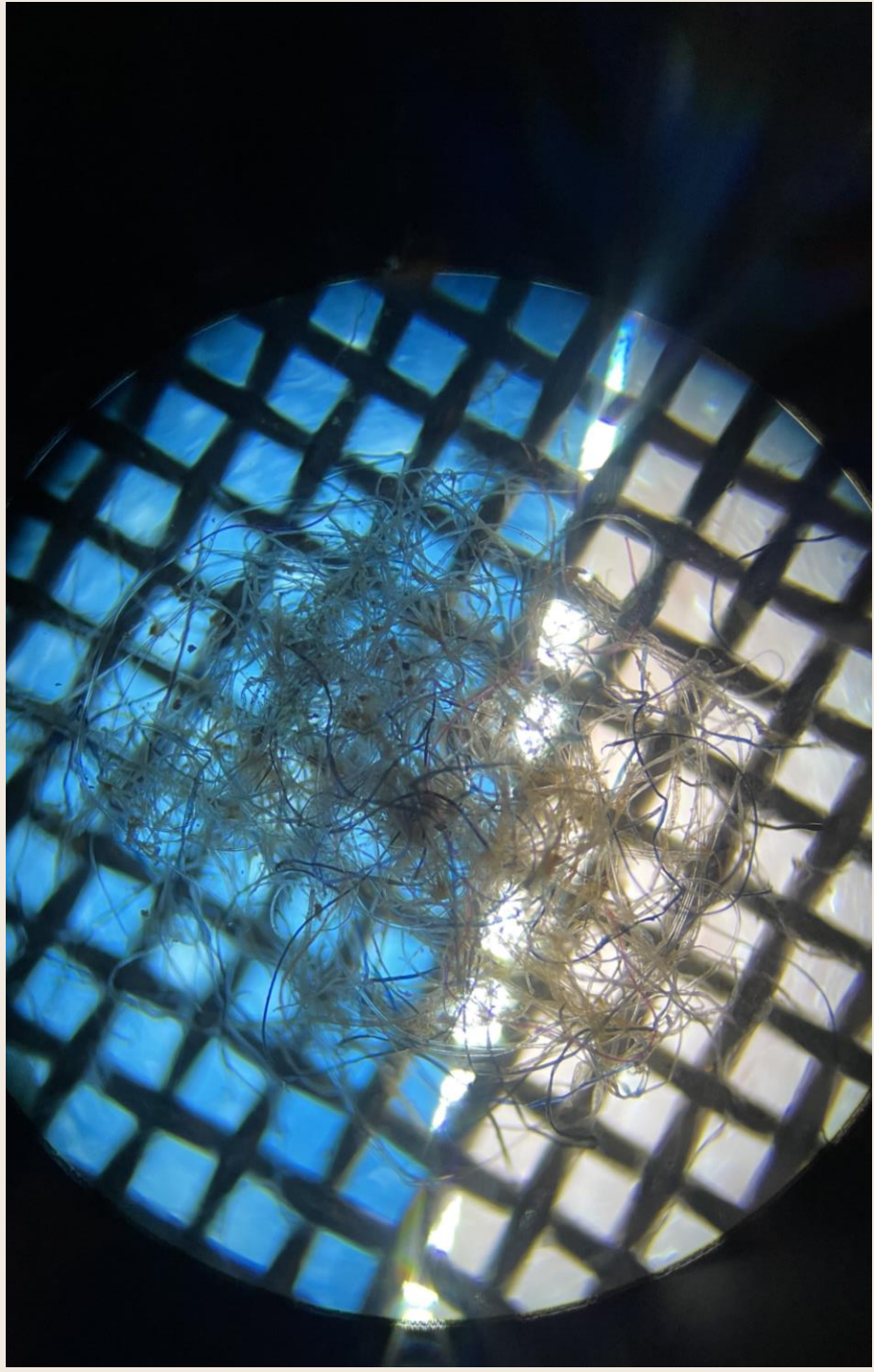
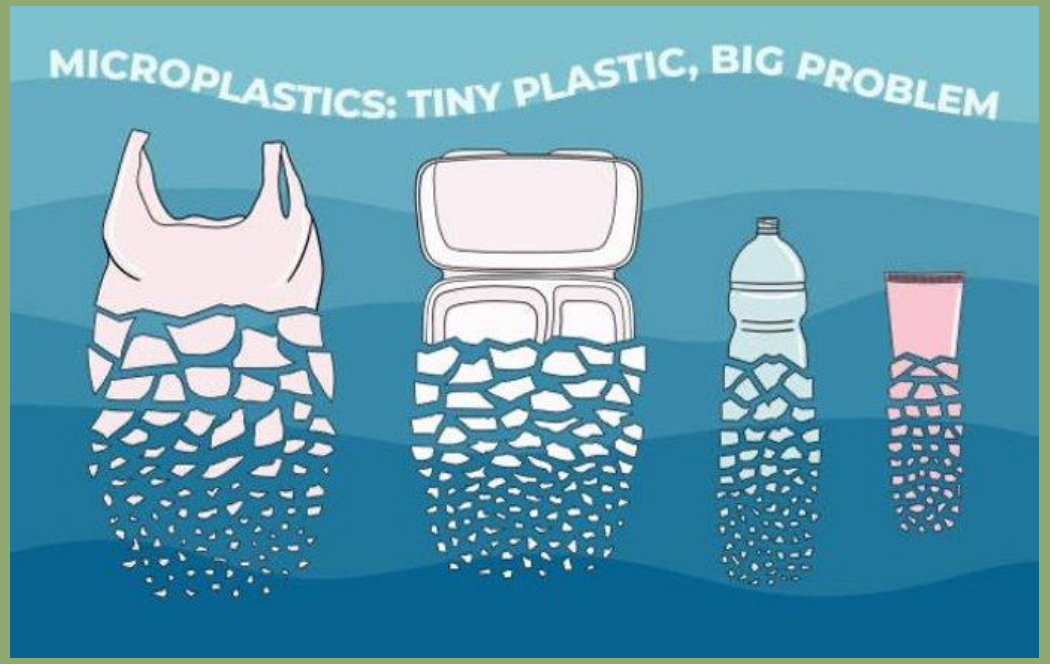
Colby·Sawyer College

LSPA
Devoted to the Environmental Quality of the Lake Sunapee Watershed



Background | Microplastics



- Small particles of plastic between the sizes of 300 µm and 5 mm [1,2]
- Worldwide, plastic levels:
  - 230 million tons in 2009
  - 335 million tons in 2016 [3,4]
- 70,000 - 270,000 tons of these plastic levels account for 51 trillion pieces of microplastics [1,2]

Importance of Study

Why We Care. What We Hope to Do.

Raise Awareness

Controlling & Minimizing Distribution

Provide Context of Human & Wildlife Health Risk

Lend Controlled Way to Continue Monitoring

Why are We Studying Micro-Plastics?

01

MICROPLASTICS CAUSE HARMFUL PHYSICAL EFFECTS

02

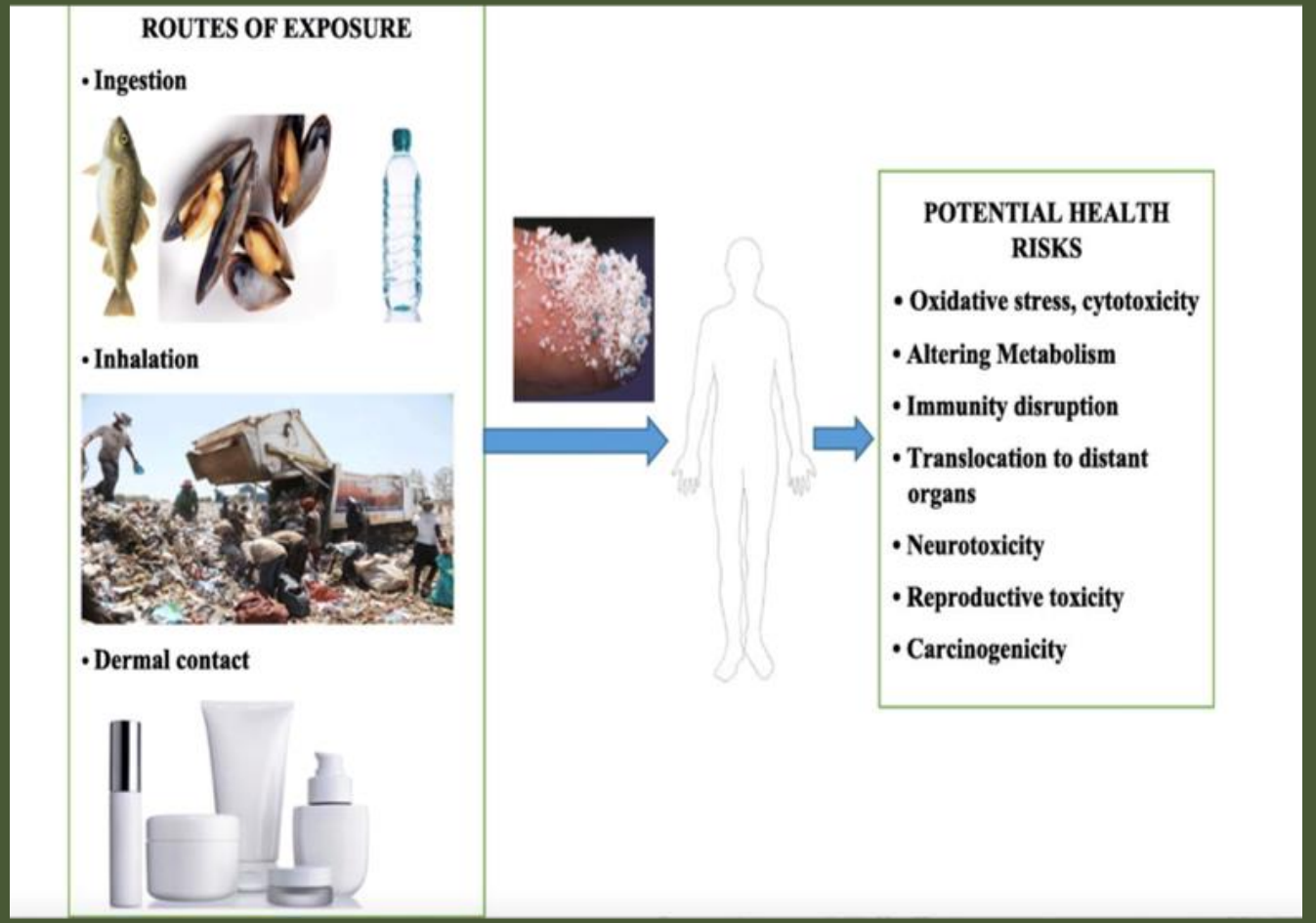
Microplastics are becoming a worldwide issue in all ecosystems

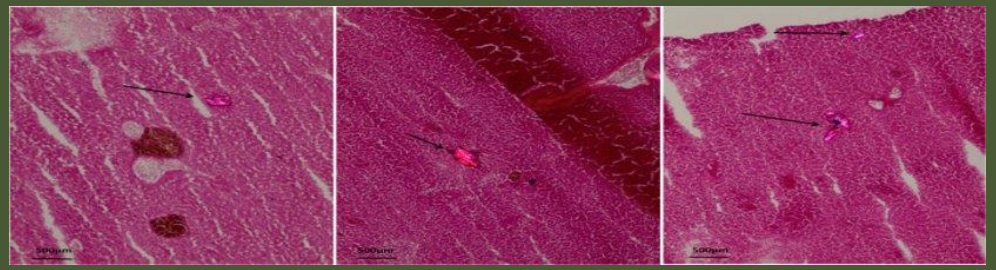
03

LESS THAN 4% OF MICROPLASTIC RELATED STUDIES ARE PERFORMED WITH FRESHWATER.

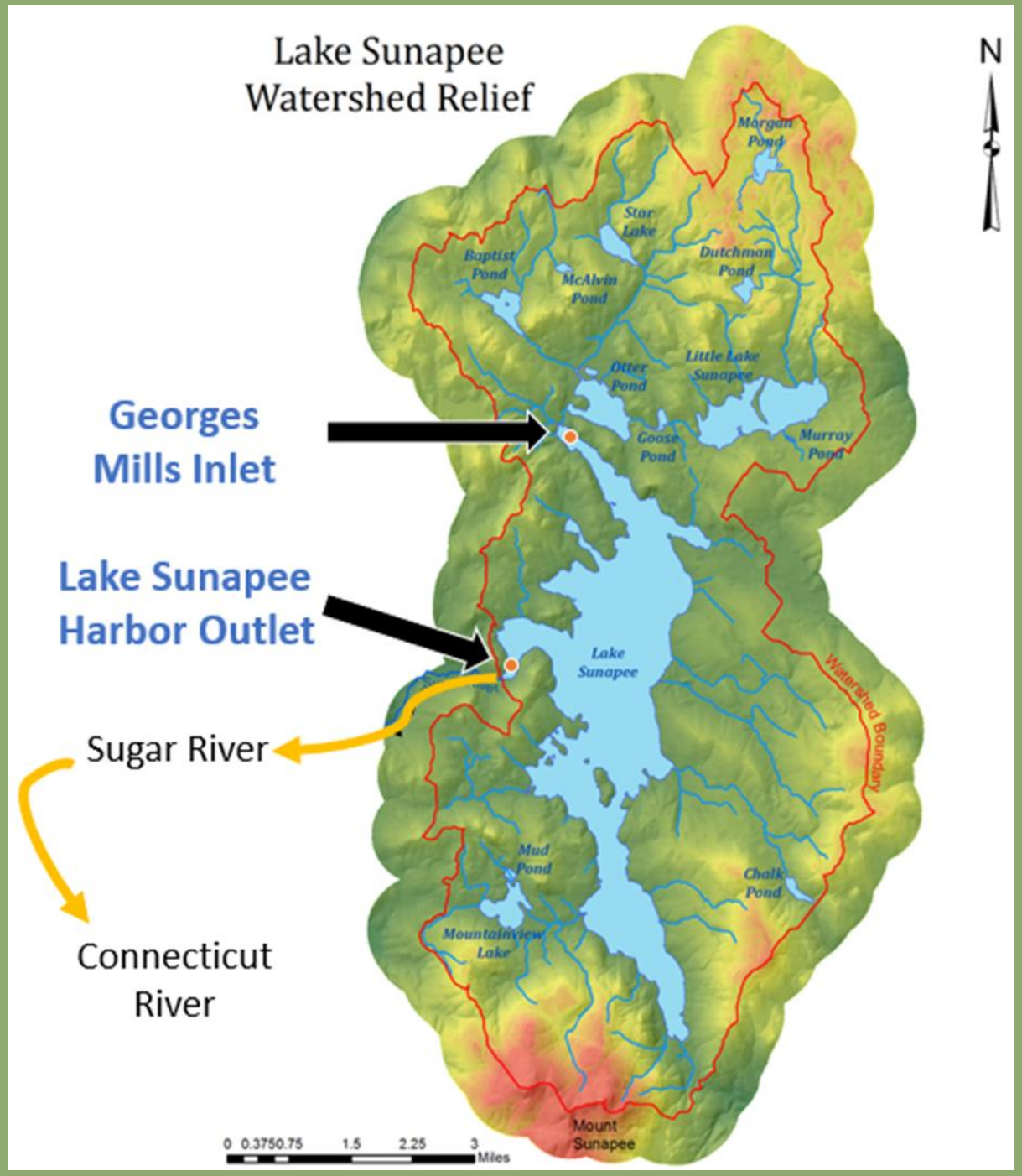
Ecological Impact

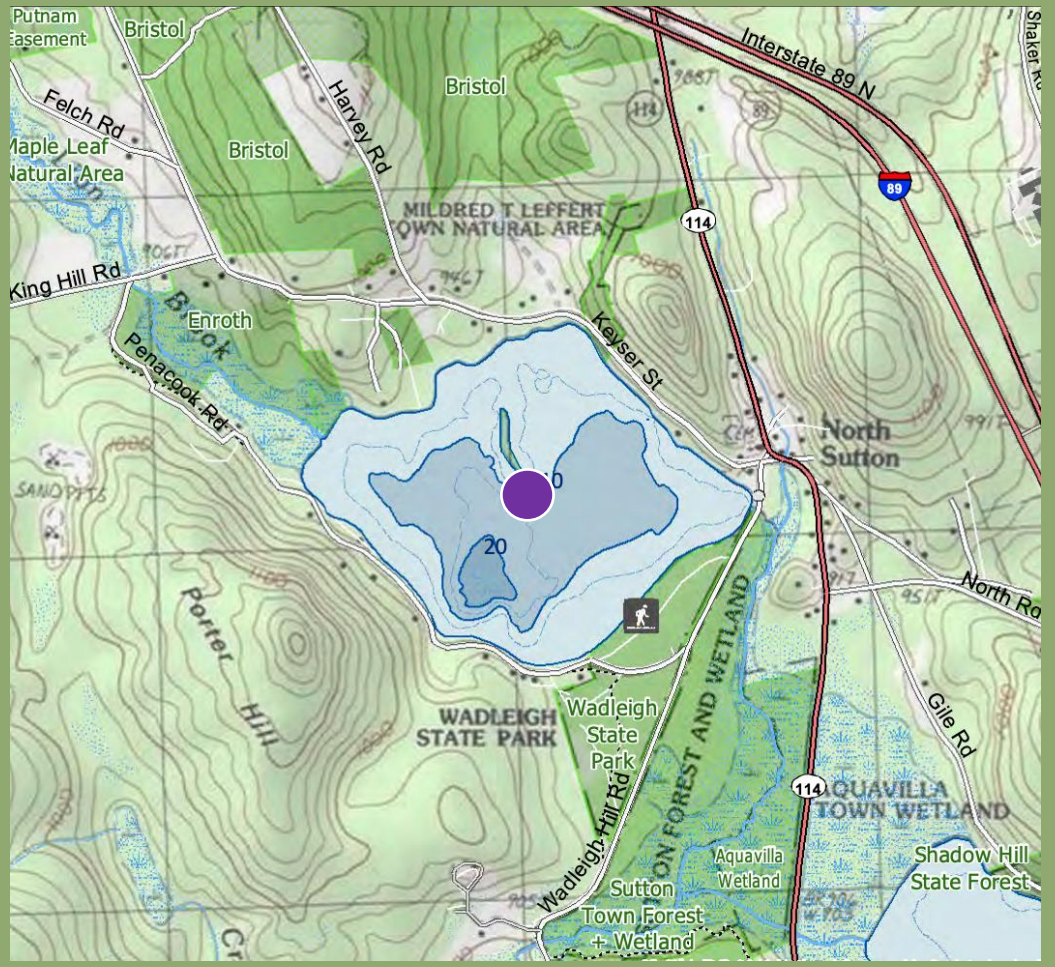
- There is an increase in scientific evidence of microplastic particles entering the marine systems and food chain [11].
- Microplastic presence has been reported in different taxa including planktonic species, invertebrates, and fish [12].
- Human Food safety needs to be re-evaluated due to possible health impacts eating seafood could cause [11].





Lake Sunapee | Kezar Lake





Objective of Research

Questions Proposed:

Will there be a difference in the distribution of microplastics within **deep** cores versus **shallow** cores?

Hypotheses:

Shallow cores will have **more random distribution** of microplastics whereas **deep** cores will have **more stratified layers** of microplastics with more microplastics present in the upper layers.

Objective of Research

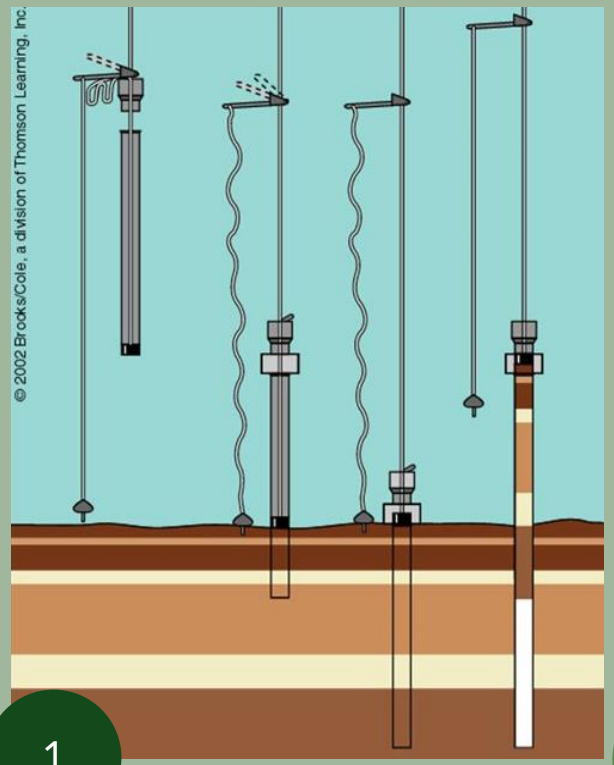
Questions Proposed:

Will there be a difference in the total number of microplastics in sediment collected at the **inlet** versus the **outlet**?

Hypotheses:

There will be a **higher** number of microplastics found in sediment from the **outlet** compared to the **inlet** coring sites.

Collection Methods | Coring



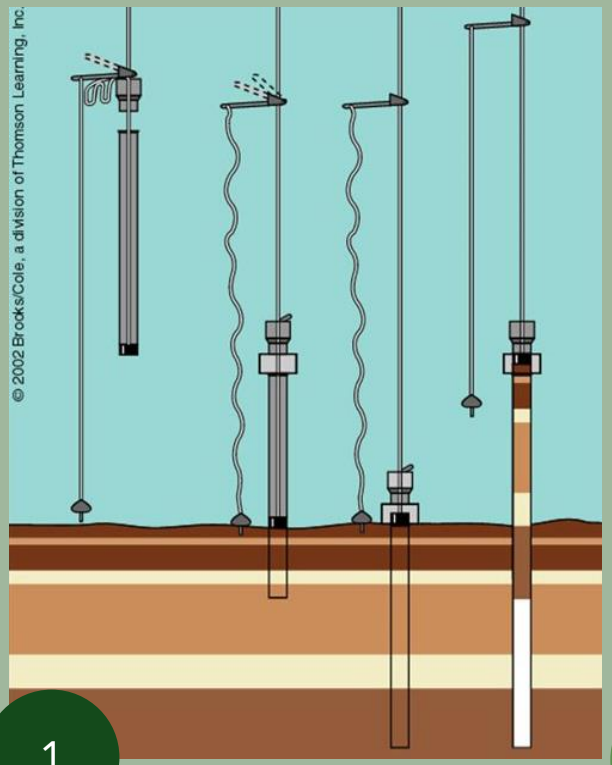
1

2

3

4

Collection Methods | Coring



1

2

3

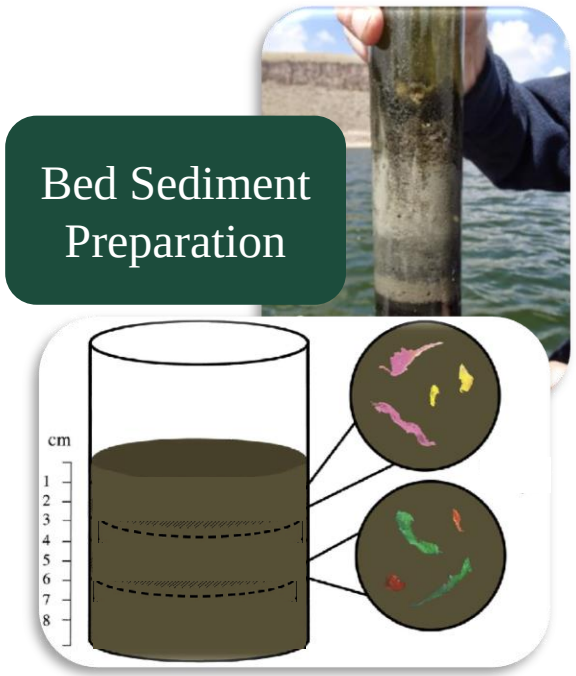
4

Adjustments Made Along the Way

1. Sediment proved gritty and difficult to push through – had to use docks to gain leverage and distance.
2. Removing the sediment from the core tube – had to create a tool to push sediment out after heating tube with warm water.
3. Concentrating sample onto sieve as to save as much as possible – devised funneling system using a tin can.
4. Density filtration system did not allow sample through due to sand – solved by decanting top layer containing microplastics.
5. Catching dish did not allow for visualization on microscope & had salt accumulation– filtered and washed using DI onto pieces of sieve.

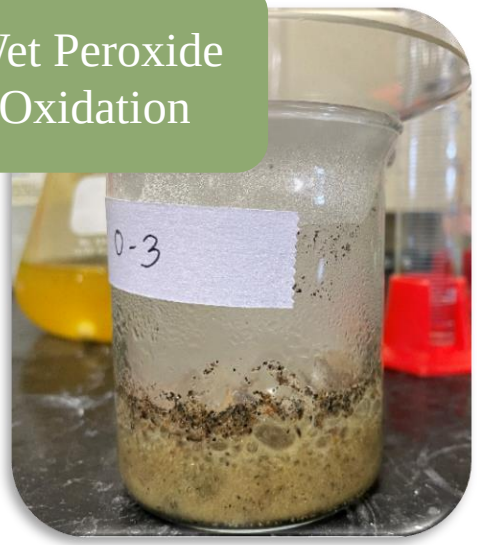
Analysis Methods | Sediment

Bed Sediment Preparation



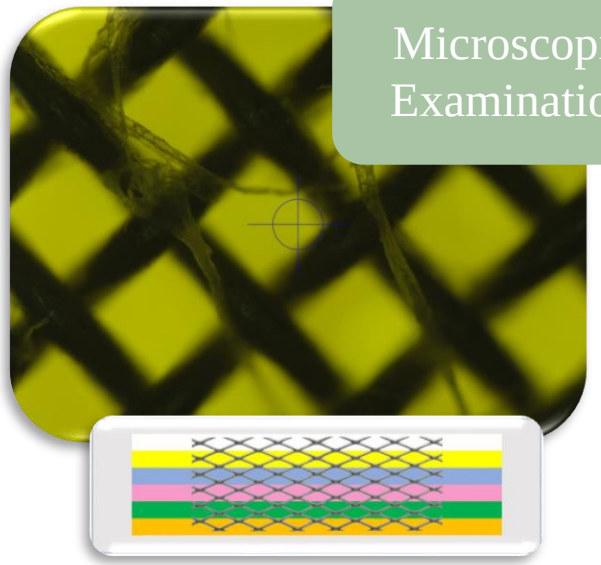
Wet Sieve & Transfer of Solids

Wet Peroxide Oxidation

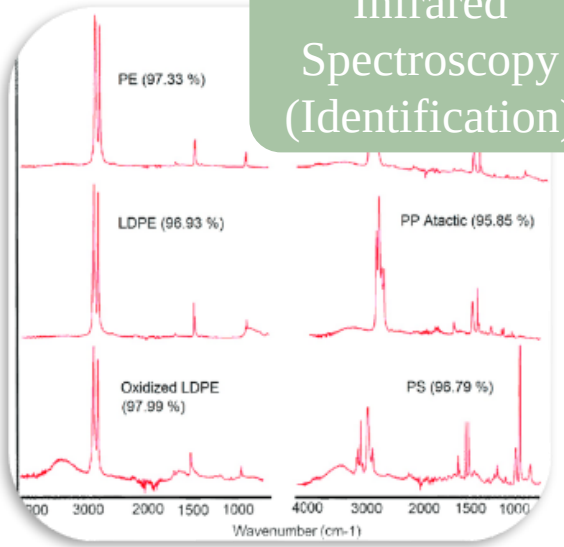


Density Separation

Microscopic Examination



Infrared Spectroscopy (Identification)



Distinguishing Microplastics

Campanale, C., Massarelli, C., Bagnuolo, G., Savino, I., & Uricchio, V. F. (2019). The Problem of Microplastics and Regulatory Strategies in Italy. The Handbook of Environmental Chemistry, 255–276. https://doi.org/10.1007/698_2019_419

Our Categorization

Pellets	Fibers/Lines	Pieces

Previous Study Findings

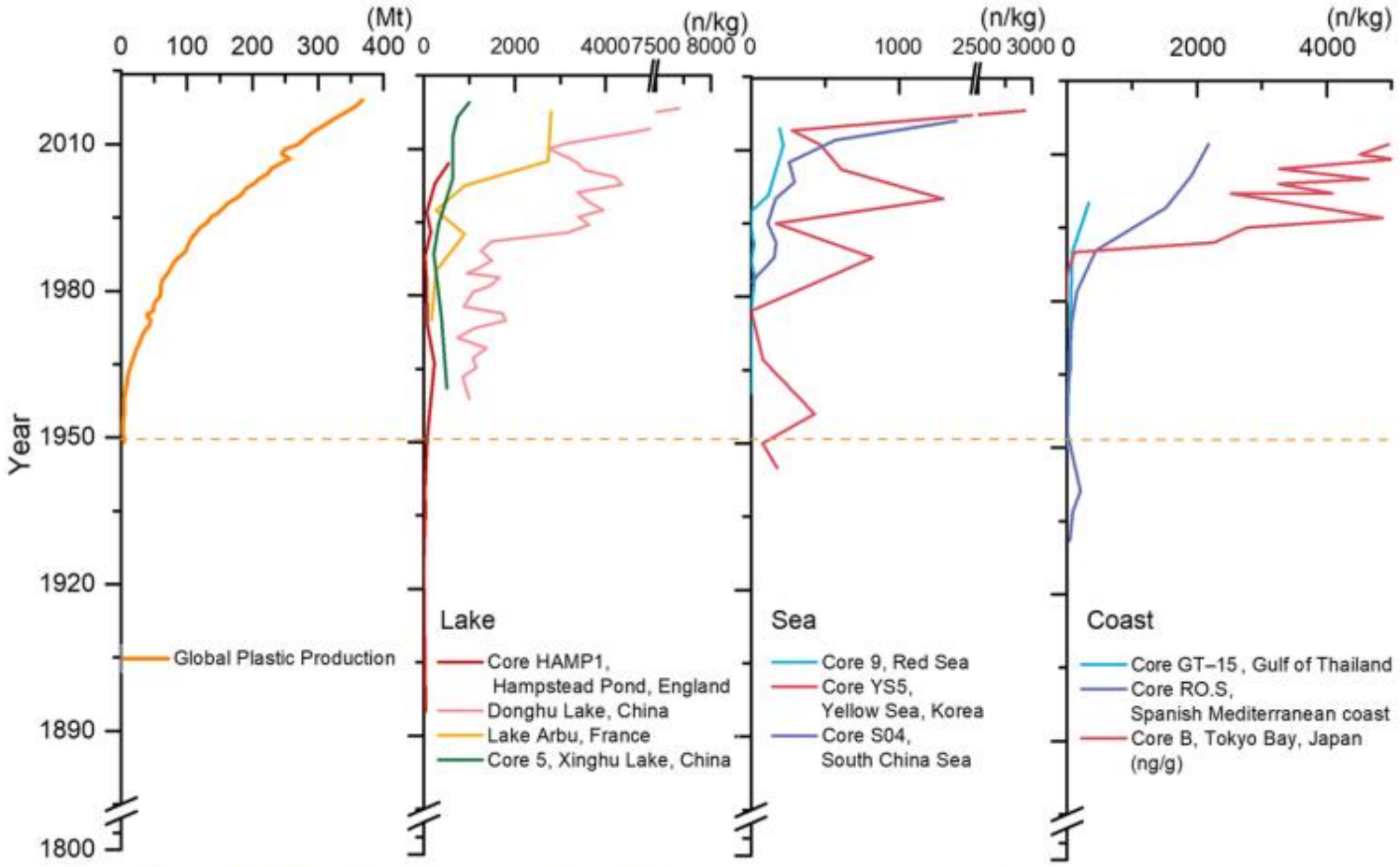
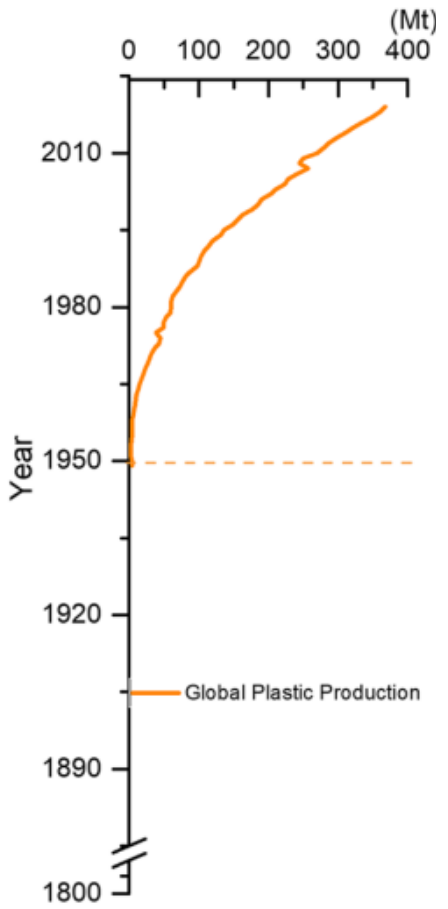
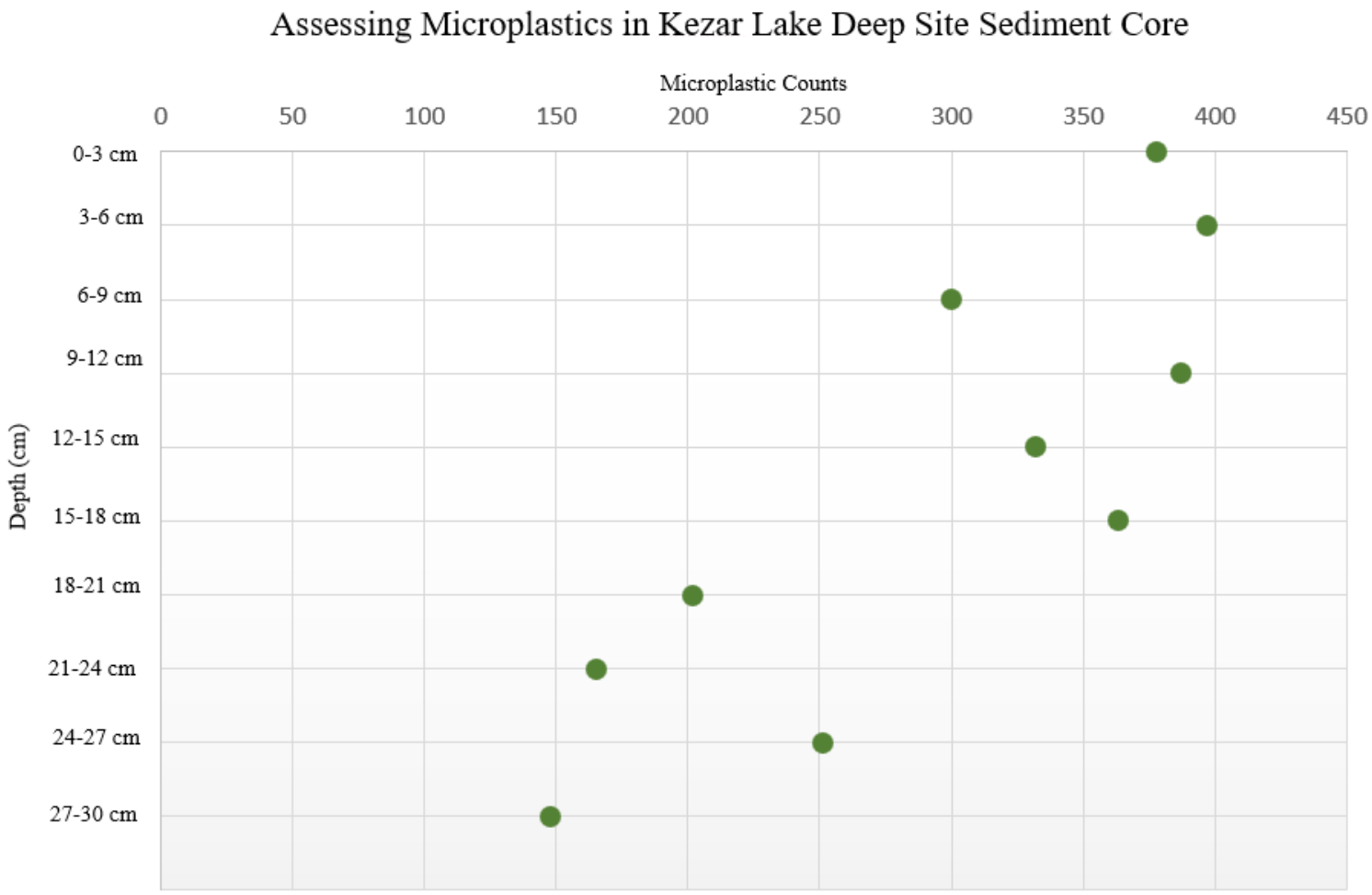


Fig. 6 Representative curves of microplastic abundance over time, in lake, coast, and marine sediments

Chen, H., Zou, X., Ding, Y. *et al.* Are microplastics the 'technofossils' of the Anthropocene? *Anthropocene Coasts* 5, 8 (2022). https://doi.org/10.1007/s44218-022-00007-1

Results





Recent

Oldest

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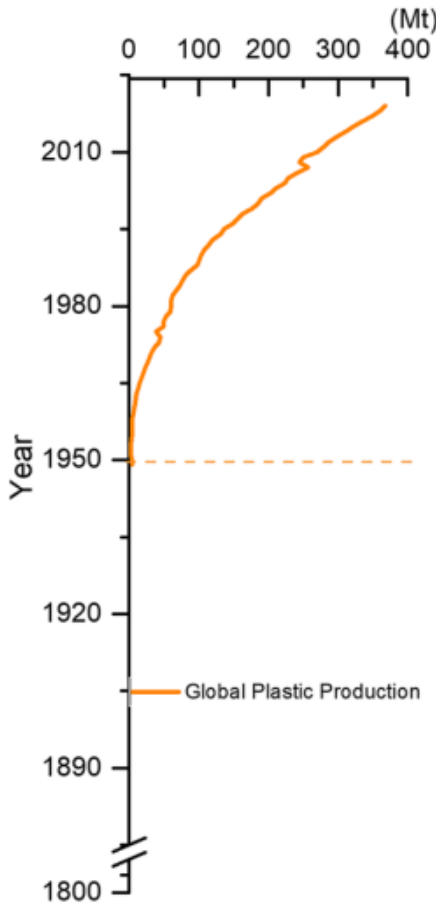

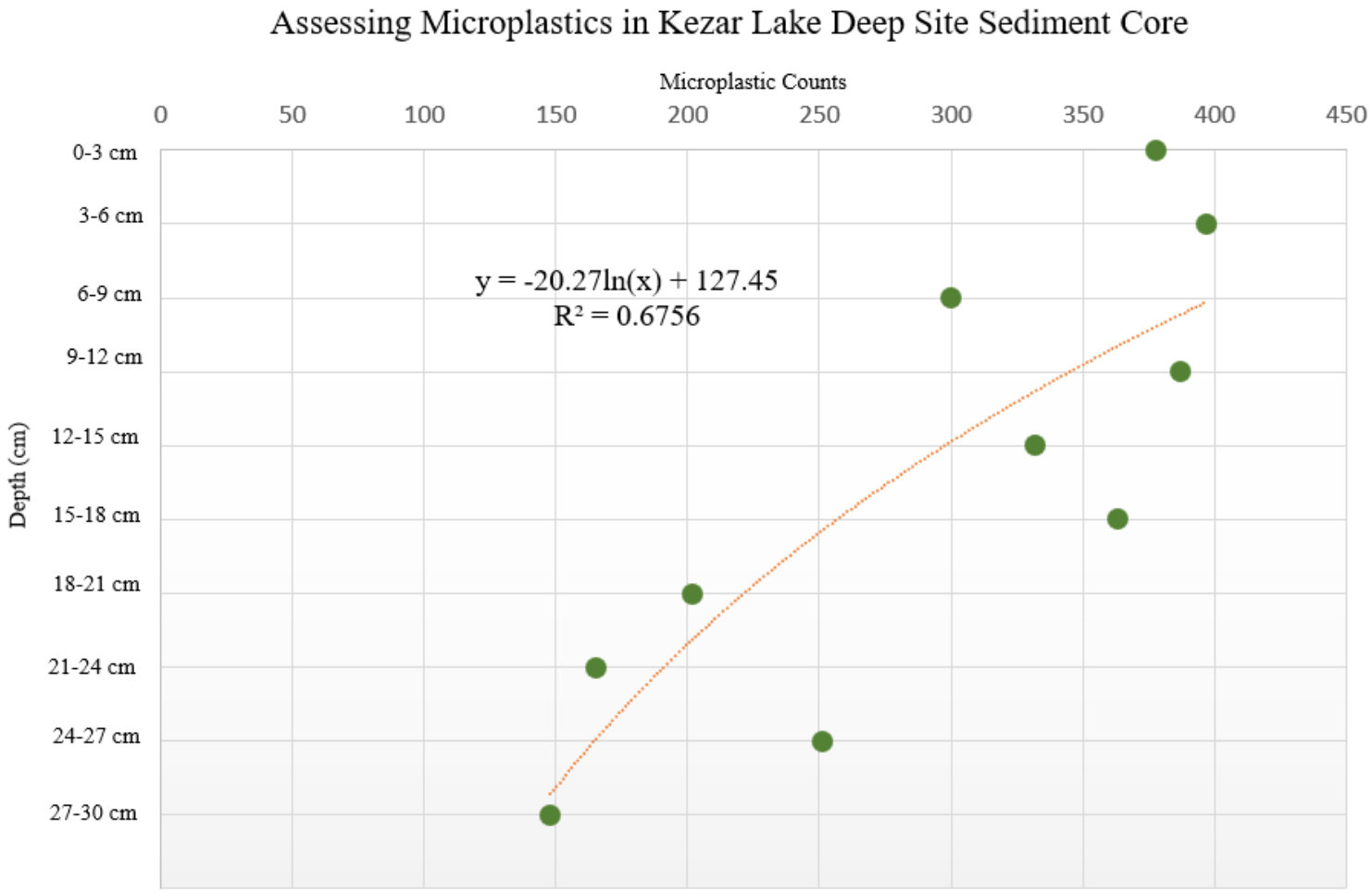

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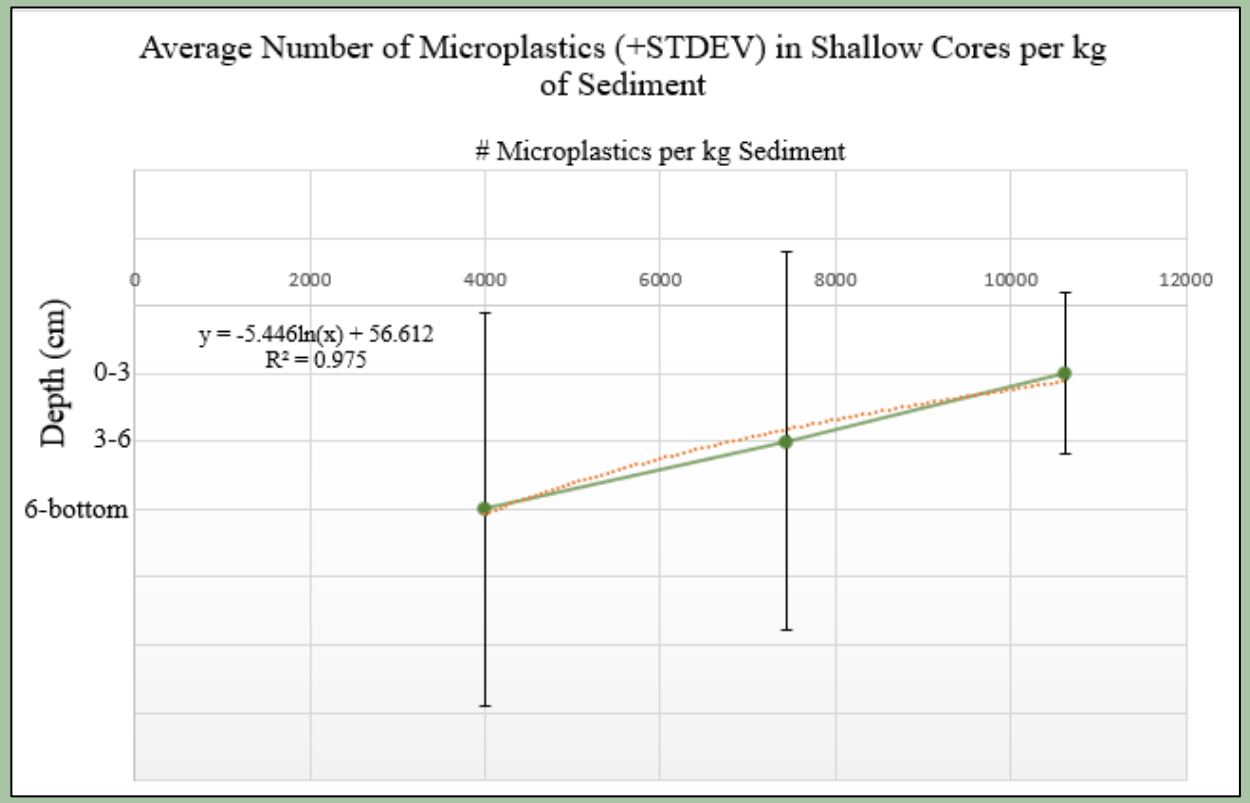
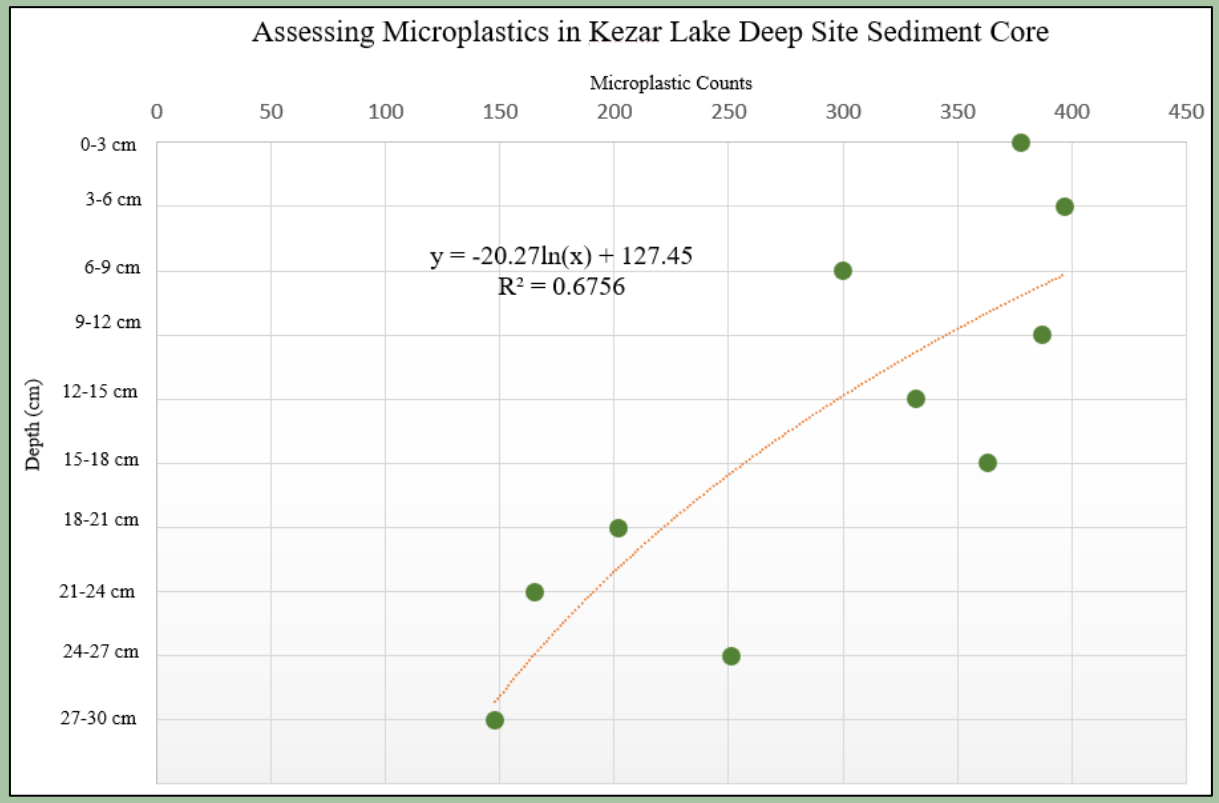
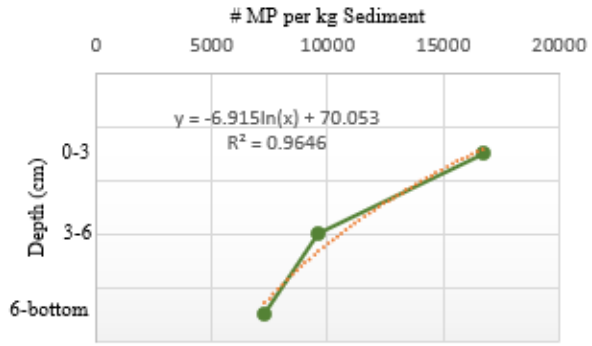
Results: Shallow vs. Deep



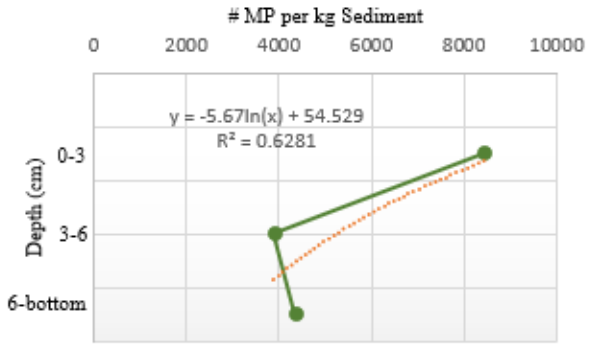


Variation in Shallow Cores

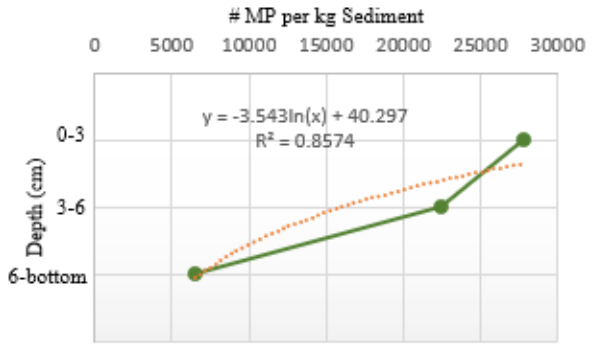
Inlet Shallow Core #1



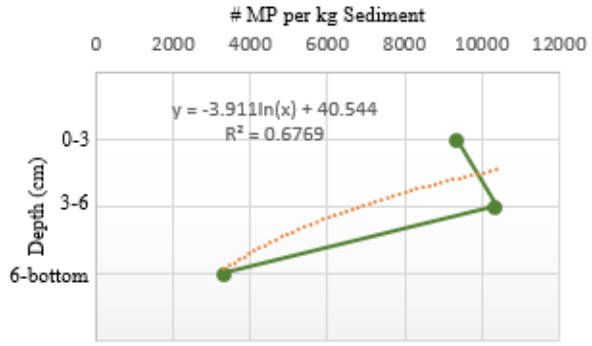
Inlet Shallow Core #2



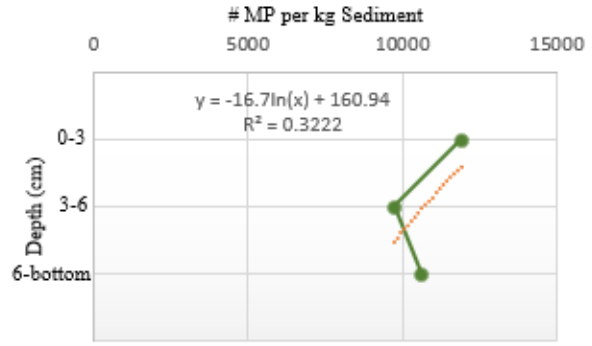
Inlet Shallow Core #3



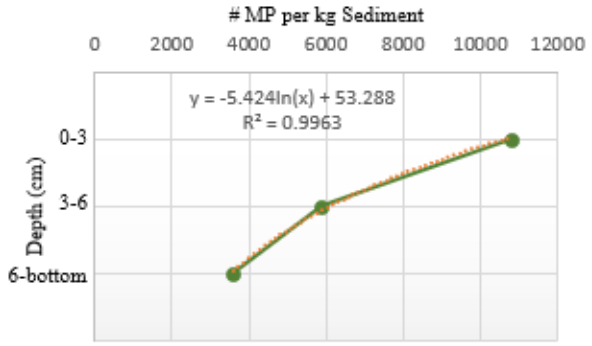
Outlet Shallow Core #1



Outlet Shallow Core #2



Outlet Shallow Core #3



Results:

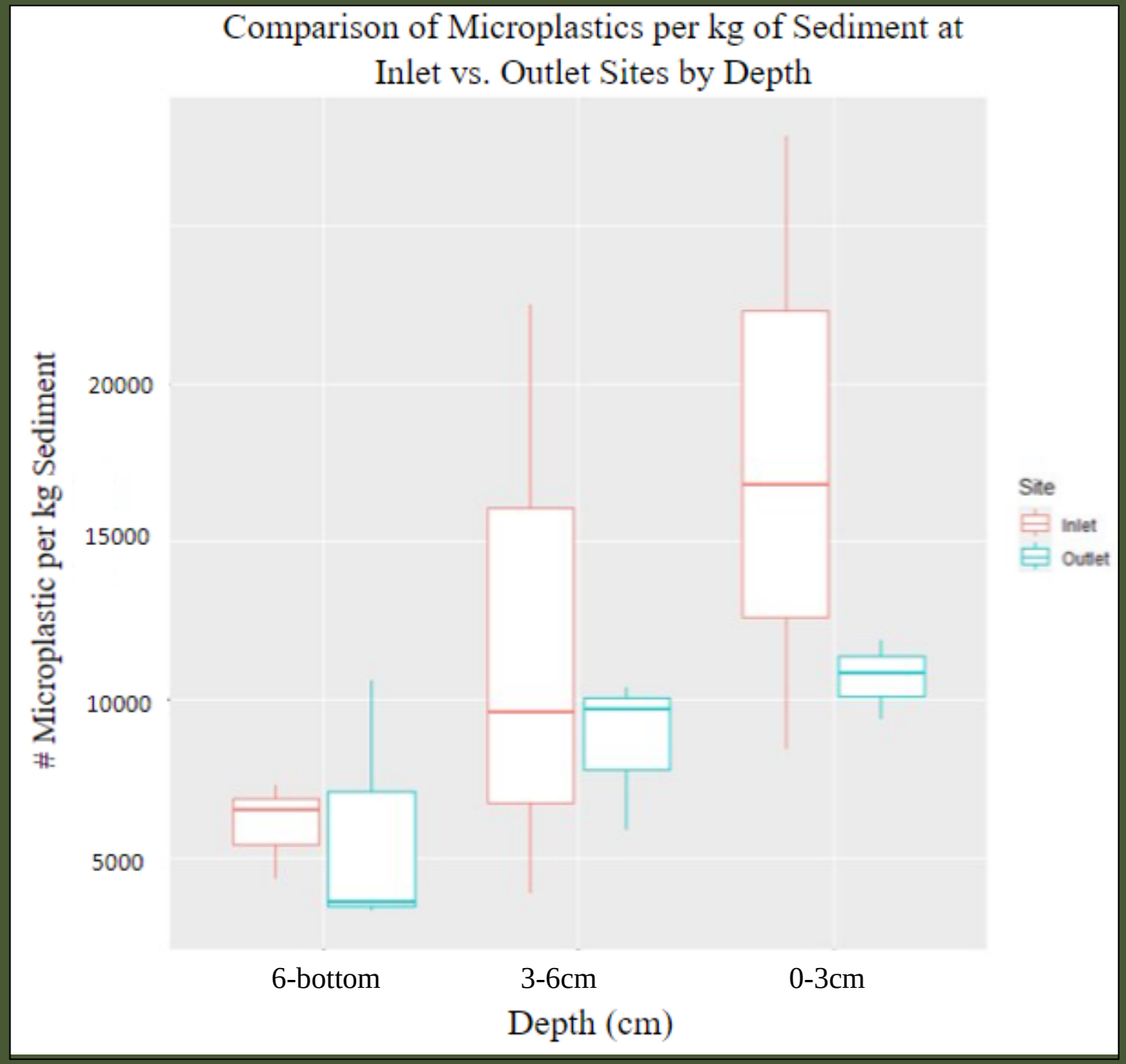
Two-way ANOVA test

Log transformed:

- P $value_{depth}$ = 0.04873*

Bootstrapped:

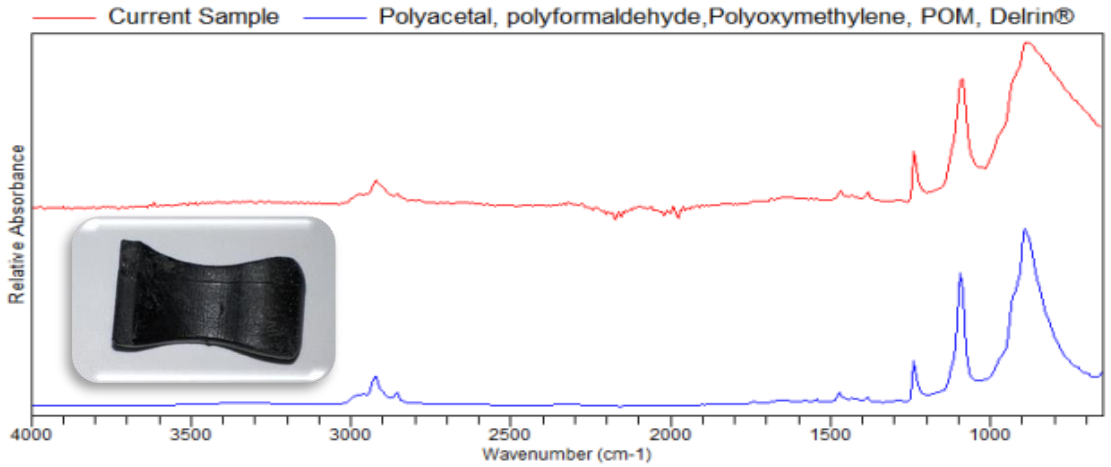
- P $value_{site}$= 0.04191*
- P $value_{depth}$ = 6.065e-08***

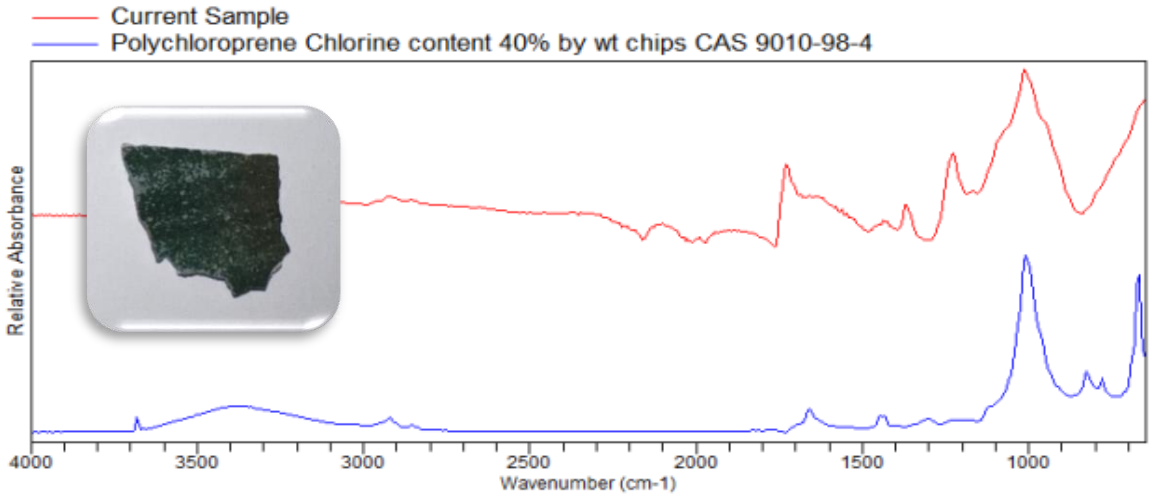


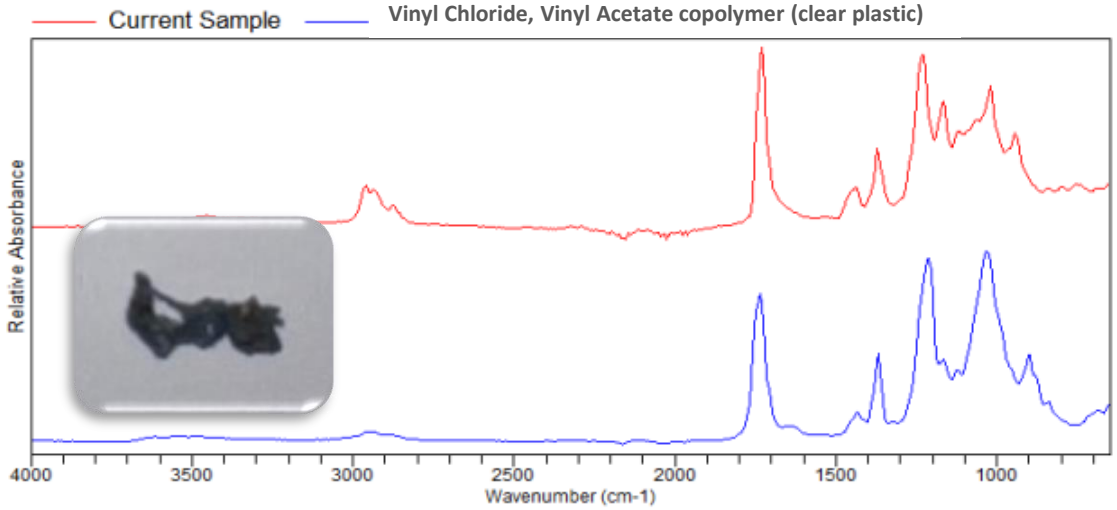
Results: Categorization

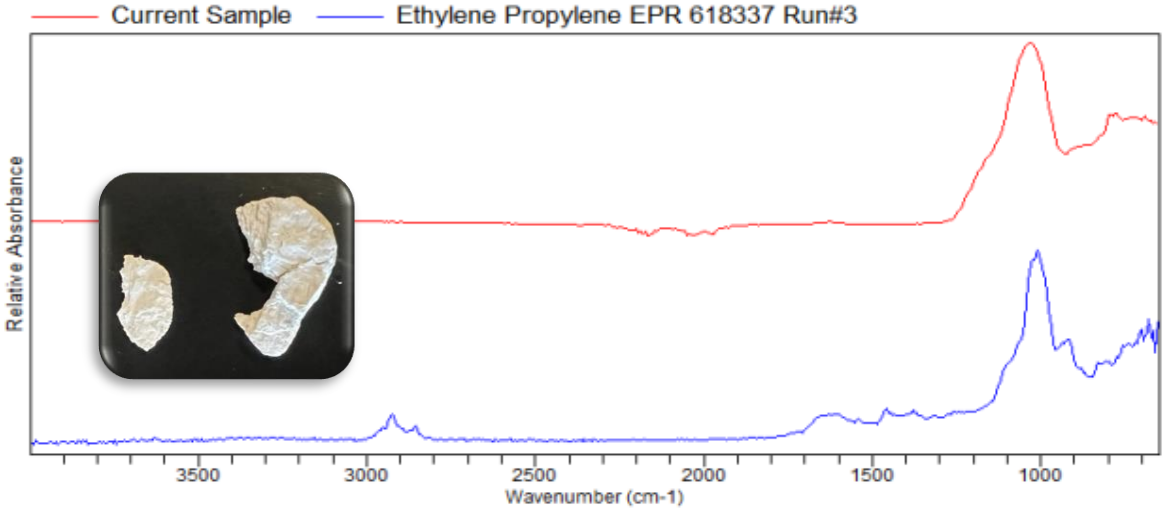
Outlets	Total MP #	Fibers	Pellet	Piece
0-3cm	359	344	5	9
3-6cm	218	206	5	6
6-9cm	338	327	8	3
Inlet				
0-3cm	440	423	5	12
3-6cm	406	385	7	13
6-9cm	315	305	1	8
Kezar				
0-3cm	378	372	1	5
3-6cm	397	388	0	9
6-9cm	300	290	3	7

Infrared Spectroscopy









Discussion

Distribution of MP in Deep vs. Shallow Cores?

- Large variation in **Shallow Core**
- Accumulative distribution in **Deep Core**

Greater amount of MP at Inlet or Outlet?

- **Inlet**
- Found significance **by depth** through **logarithmic transformation**
- **Bootstrapping** demonstrates that significance **by site** can be accomplished using 12 reps.

Thank You!

From the Team:

Allison L'Heureux, Caitlyn Boucher, Kylie Marquis

With the Guidance of Jim Killarney

Special thanks to Nick Baer & Leon Malan who lent a huge helping hand along the way. As well as to Moby and Steele Killarney, the best boys who encouraged us every moment.


QUESTIONS?