Meet the Plastics: An Evaluation on Plastics Found in California Eastern Sierra Lake Environments

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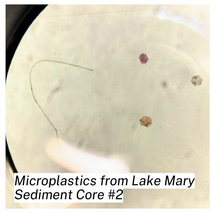
Introduction

- Plastic is known to damage the health of soils, contaminate groundwater, endanger wildlife, and bioaccumulate across food webs, making it a concern for ecosystems worldwide.
- While the presence and effects of plastics have been studied in both marine and terrestrial environments, less is known about the presence of plastics in freshwater lake environments.
- The objective of this project was to understand critical factors that influence plastic prevalence in the lakes of the California Eastern Sierra mountain range.
- Factors considered: site popularity, distance from parking lot to sample site, fishing activity, and the relationship between macroplastics and microplastic count.



Microplastics from Lake Mary Sediment Core #2

Macroplastics from Lake Mary Transect #1

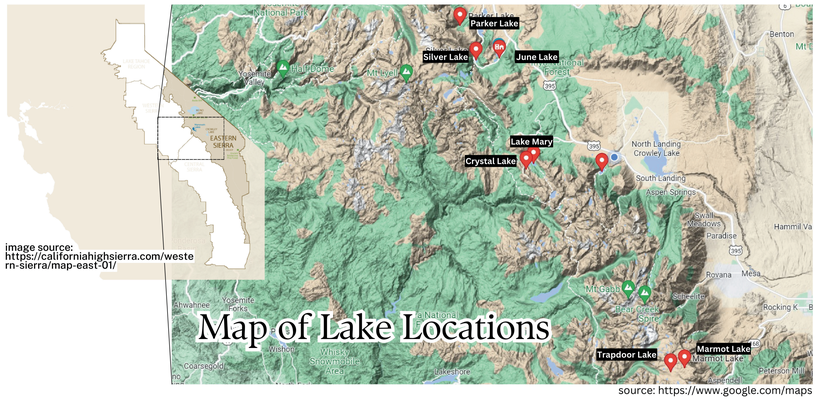


image source: https://californiahighsierra.com/western-sierra/map-east-01/

Map of Lake Locations

source: https://www.google.com/maps

Hypotheses

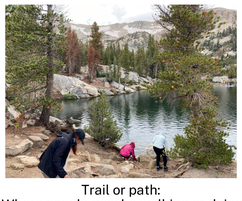
(1) Lakes higher in activity and popularity will have more plastics

(2) Higher macroplastic count will lead to a higher microplastic count

Methods

Macroplastic survey: Using methods by Reynolds et al. (*In progress*), 3 pass litter surveys were conducted at 4 sites located in the Californian Eastern Sierras in September 2023. Briefly, for Pass 1 the surveyor walked for 15 minutes (timed) from a trail/path to shoreline, picking up visible litter within an arm's distance of path. For Pass 2 and Pass 3, surveyors followed the same path as Pass 1 [1].

- Macroplastics were analyzed by looking at: Popularity (**popular**= >100 google reviews and <1 mile length of trail; **not popular**= <100 google reviews and >1 mile length of trail)
- List of lakes surveyed: Crystal, June, Mary, Silver



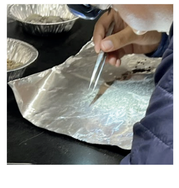
Trail or path:
Where people may be walking or doing recreational activities.

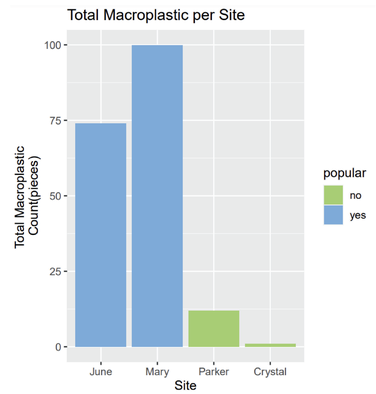
15 min.

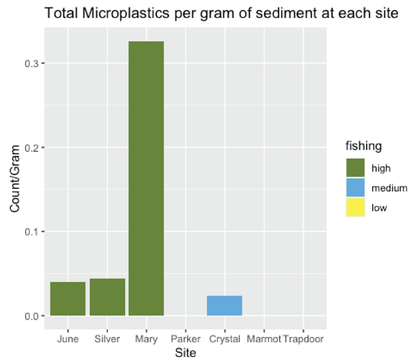
Lake Shoreline:
Where precipitation may transport plastics into the body of water.

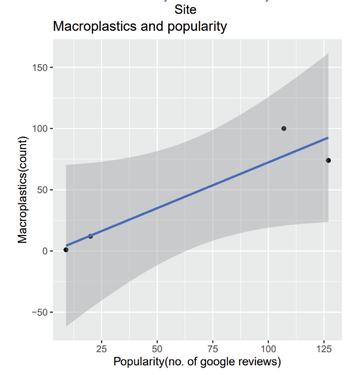
Microplastic survey: For 7 lake sites, three sediment cores were collected at the shoreline to be analyzed for microplastics. After allowing sediment samples to settle (1-2hrs), top water is drained using a pipette leaving roughly 1 mm of liquid above the sample to preserve any plastics that may be on top. Each sample was dried in an oven at 50 degrees Celsius for a minimum of 12 hours. Using a dissecting microscope, shifted sediment was sorted through with tweezers, and microplastics were collected on a piece of tape. [2]

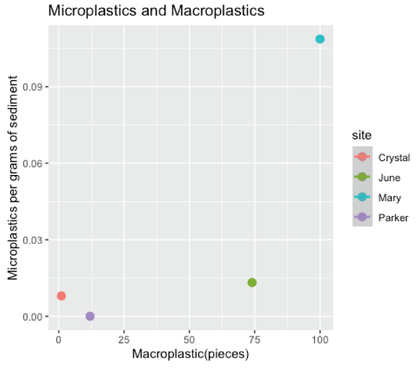
- Microplastics were analyzed by looking at: Fishing activity (**high**=accessible and advertised as fishing/recreational, **medium**=harder to get to and advertised as fishing, **low**=hard to get to and not advertised as fishing)
- List of lakes lakes surveyed: Crystal, June, Marmot, Mary, Parker, Silver, Trapdoor

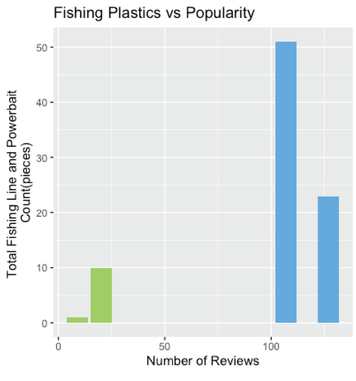


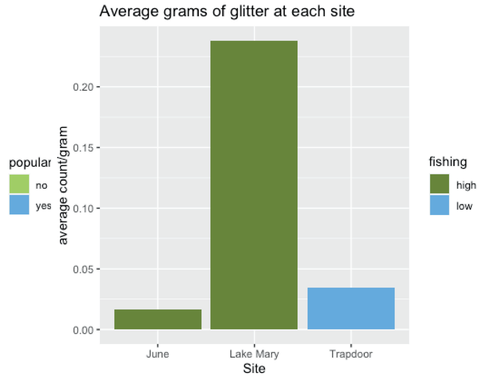












Results

- To determine the relationship between microplastics and our factors of interest (popularity, fishing, & distance) a multiple linear regression test was conducted.
- When all factors were included in the model, we found that only popularity has a significant effect on microplastic count (p=0.0487). While fishing (p=0.0726) and distance (p=0.1263) did not significantly influence microplastics.
- In a reduced model, which only included popularity as a factor, its influence was no longer significant (p=0.252).
  - This discrepancy may be due to overfitting, which can occur in multiple linear regression when there is limited data.
- To determine which factors affected macroplastics, a multiple linear regression test with distance and popularity as the factors of interest was conducted. Neither distance (p= 0.493) nor popularity (p=0.801) were found to be significant in affecting macroplastic count.
- A linear regression test on macroplastic's effect on microplastics(p=0.2123) showed that their relationship was not significant.

Conclusion

This project showed that while there was no statistically significant effect of (1) macroplastic count on microplastic count, and (2) fishing popularity on plastic count (high p-values, low r-values), there was still a positive correlation which can be observed that supports the hypotheses. With more data collection sites and time, we believe there will be a higher statistical result to further the relevancy in the amount of plastics found in lake ecosystems.

Things to consider:

- Human limitations- we can only see so much with the naked eye- microplastics are hard to discern
- Difficulty with identification plastic or nonplastic

Future Improvements

- Chemical analyses to see whether material is natural or plastic
- More sites to gather more data
- Look at more factors that may impact plastic prevalence

Acknowledgments

We would like to thank Dr. Jannine Chamorro and PhD Candidate Becca Reynolds for being amazing mentors, fellow undergrad Andy Estrada for her contributions to this project, Dr. Carol Blanchette at the Sierra Nevada Aquatic Research Laboratory, Dr. Chris Jerde for his expertise in R Studio and always lending a helping hand, Dr. Doug McCauley for his valuable insight, Lastly, Dr. Gretchen Hofman for creating the UCSB FUERTE Program to diversify the field of Ecology and Conservation Science. Our project was supported by the UCSB FUERTE Program, funded by the U.S. National Science Foundation.

References

[1] Reynolds et.al. 2024, "K-pass Depletion Litter Survey" *In Progress*
[2] Reynolds 2023, *Unpublished*

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