

Microplastics Found in Fish from Remote Locations in Upper Snake River Watershed

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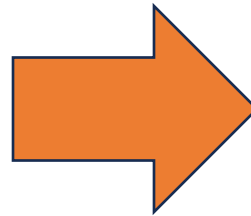


What are Microplastics?

- Particles smaller than 5 mm that separate from plastics as it degrades
 - Resist mineralization (especially in salt water)
- Global pervasiveness
 - 2016 NOAA found microplastics at all 37 sampled beaches across 35 US coastal parks



<https://www.newscientist.com/article/2262297-microplastics-left-in-water-are-more-easily-absorbed-by-mouse-cells/>



<https://pirg.org/articles/how-to-protect-yourself-from-microplastics/>

Research Problem

- Biological process disruption
- > 98% of seafood is reportedly contaminated
- Human organ contamination has increased by 50%

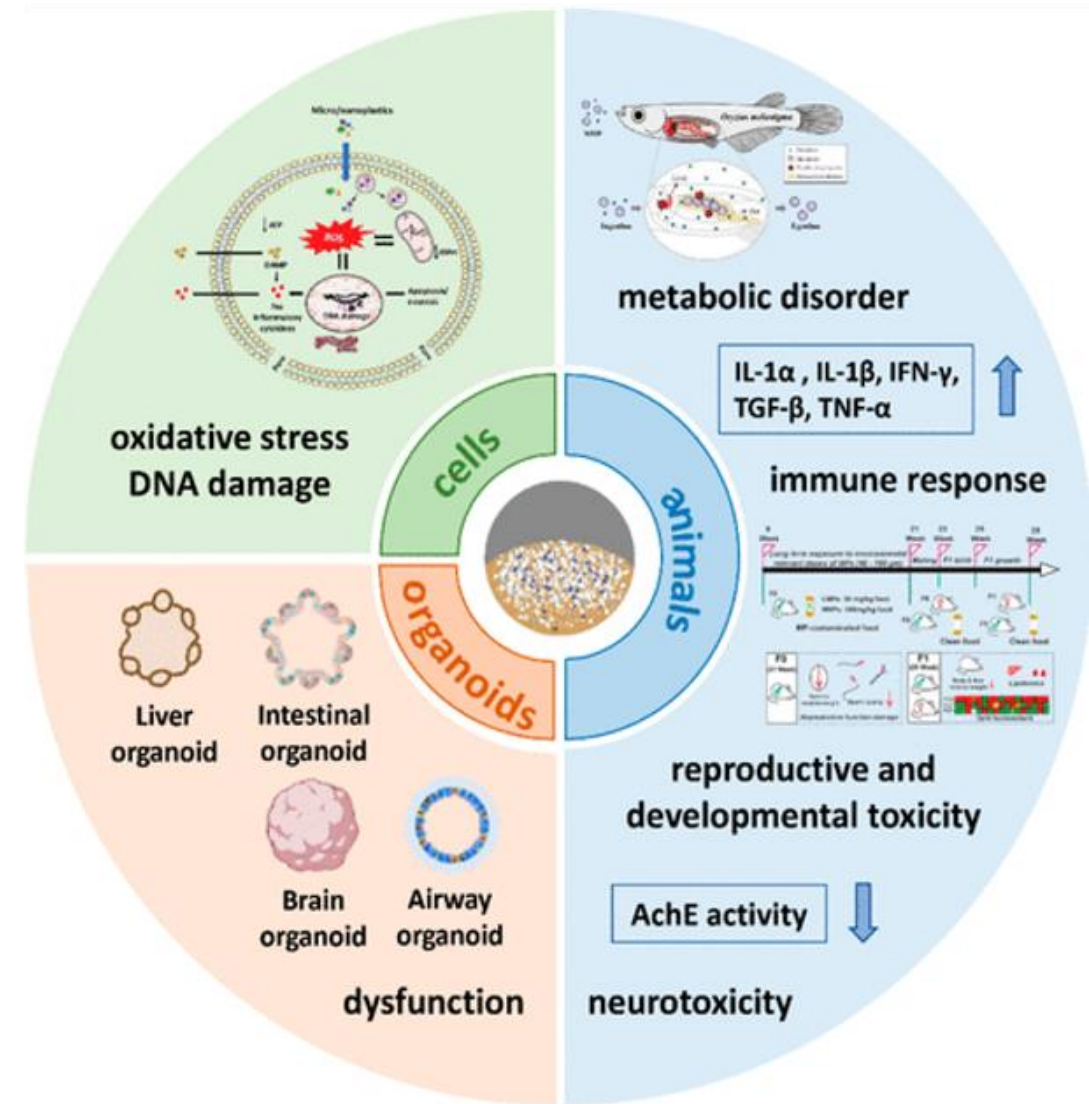
https://www.sei.org/headlines/study-finds-microplastic-contamination-99-seafood-samples?utm_

https://www.theguardian.com/environment/2025/feb/03/levels-of-microplastics-in-human-brains-may-be-rapidly-rising-study-suggests?utm_



Health Risks

- Microplastics capable of penetrating critical body tissues
 - Act as toxins
- Smaller microplastics can cross biological barriers
 - cell membranes
 - Placenta
 - blood brain barrier
- Once absorbed, they increase reactive oxygen species (ROS)
 - Oxidative stress
 - Mitochondrial dysfunction
 - Cell Death



Endocrine and Reproductive Ramifications

- Chemicals found on microplastics surfaces disrupt signaling pathways
 - Testosterone
 - Estrogen
 - FSH
- Animal studies link microplastic exposure to certain health issues
 - Low Sperm Counts
 - Gonadal tissue damage
 - Placental abnormalities
 - Delayed fetal development

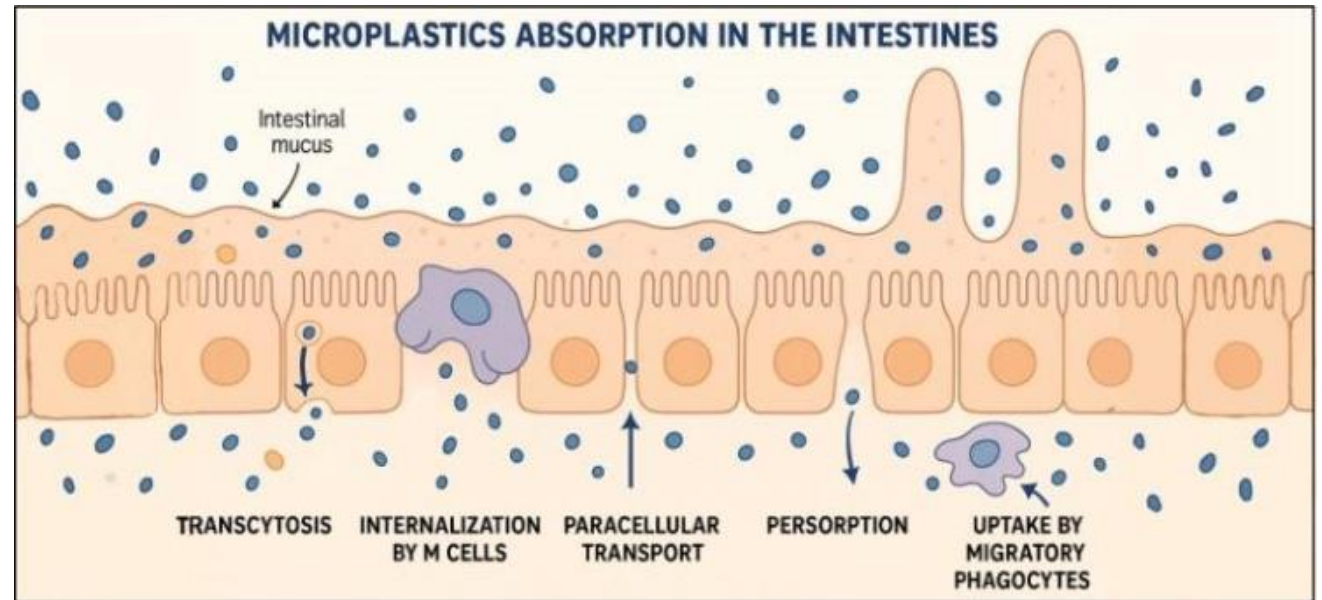
Ingestion as a Primary Exposure Route

- Humans constantly exposed to microplastics
- Annual human microplastic consumption
 - (est. 39-52K particles)
 - <https://pubmed.ncbi.nlm.nih.gov/31184127/>
 - ~5 grams consumed weekly
 - https://www.newcastle.edu.au/newsroom/featured/plastic-ingestion-by-people-could-be-equating-to-a-credit-card-a-week?utm_
- Ingested particles pass intestinal mucous and intestinal epithelium
- Absorbed into bloodstream



Intestinal Absorption Mechanism

- Transcytosis
- Internalization by M-Cells
- Paracellular Transport
- Persorption
- Uptake by migratory phagocytes

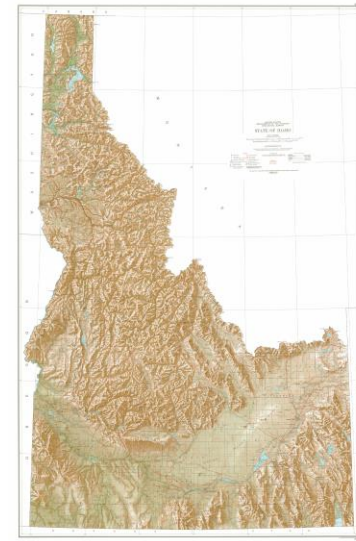


Microplastics in Remote Freshwater Areas

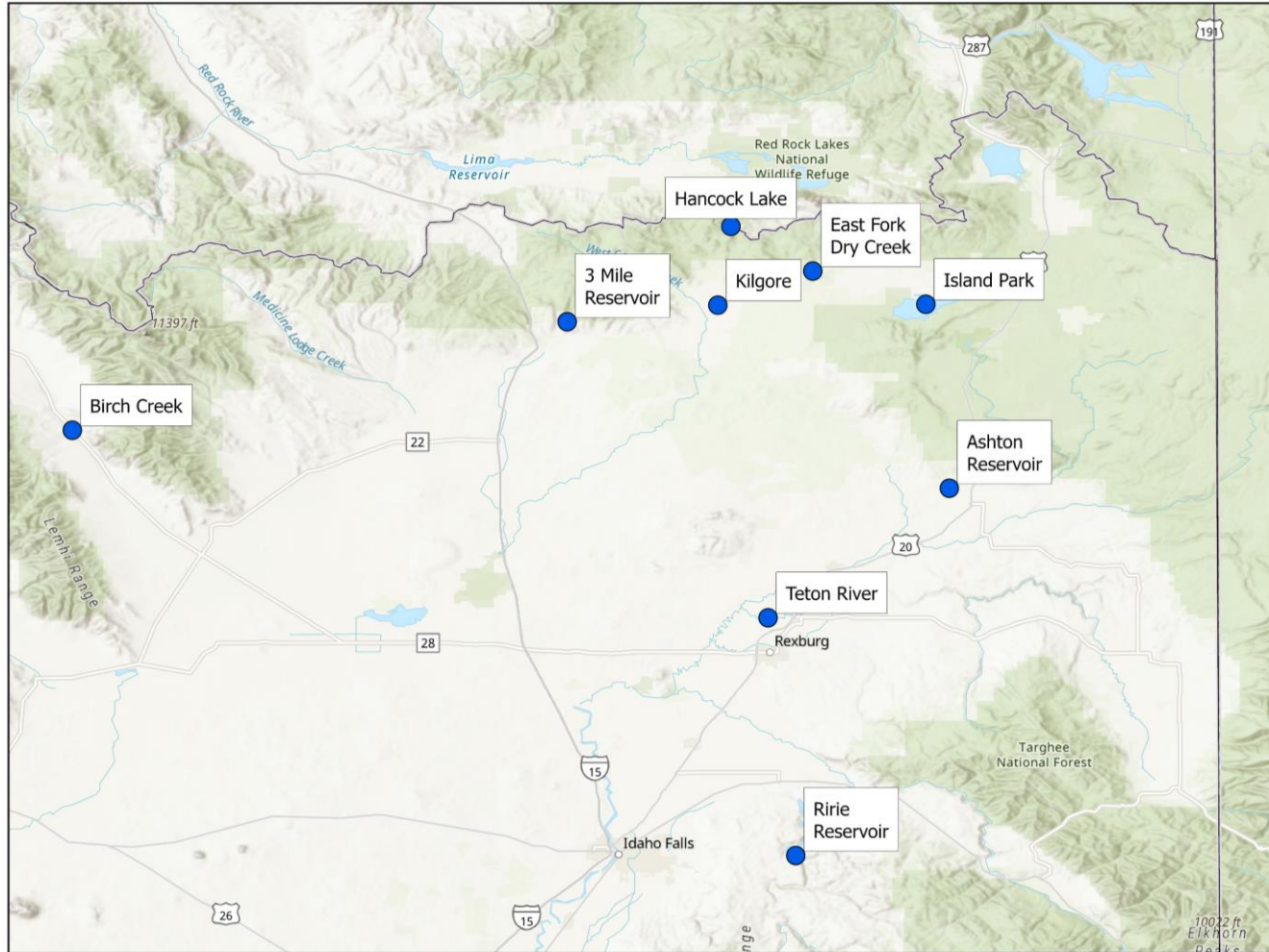
- Study on microplastics in fish (Illinois, 2020)
 - <https://aslopubs.onlinelibrary.wiley.com/doi/epdf/10.1002/lo12.10140>
 - n=49
 - ALL fish had contamination (gizzard shad, large mouth)
- Current Nez Pearce microplastic research on Small Mouth
 - https://www.usgs.gov/centers/western-fisheries-research-center/news/new-research-investigating-microplastics-fish?utm_

Research Objective

- Determine if microplastics contamination is detectable in remote watersheds in eastern Idaho
- Remote, minimally disturbed upper tributaries
- Columbia and Snake River systems in SE Idaho



Overview of Sites



Sample Size (n) of Each Species at Each Location

Location	Fish Species						Total
	RBT	BKT	CTT	MWF	YP	USF	
Ririe Reservoir					7		7
Kilgore		4				2	6
Ashton Reservoir	1						1
3 Mile Reservoir		5					5
Birch Creek	9	9					18
East Fork Dry Creek		2					2
Teton River				2			2
Hancock Lake			6				6
Island Park	1						1
Total	11	20	6	2	7	2	48

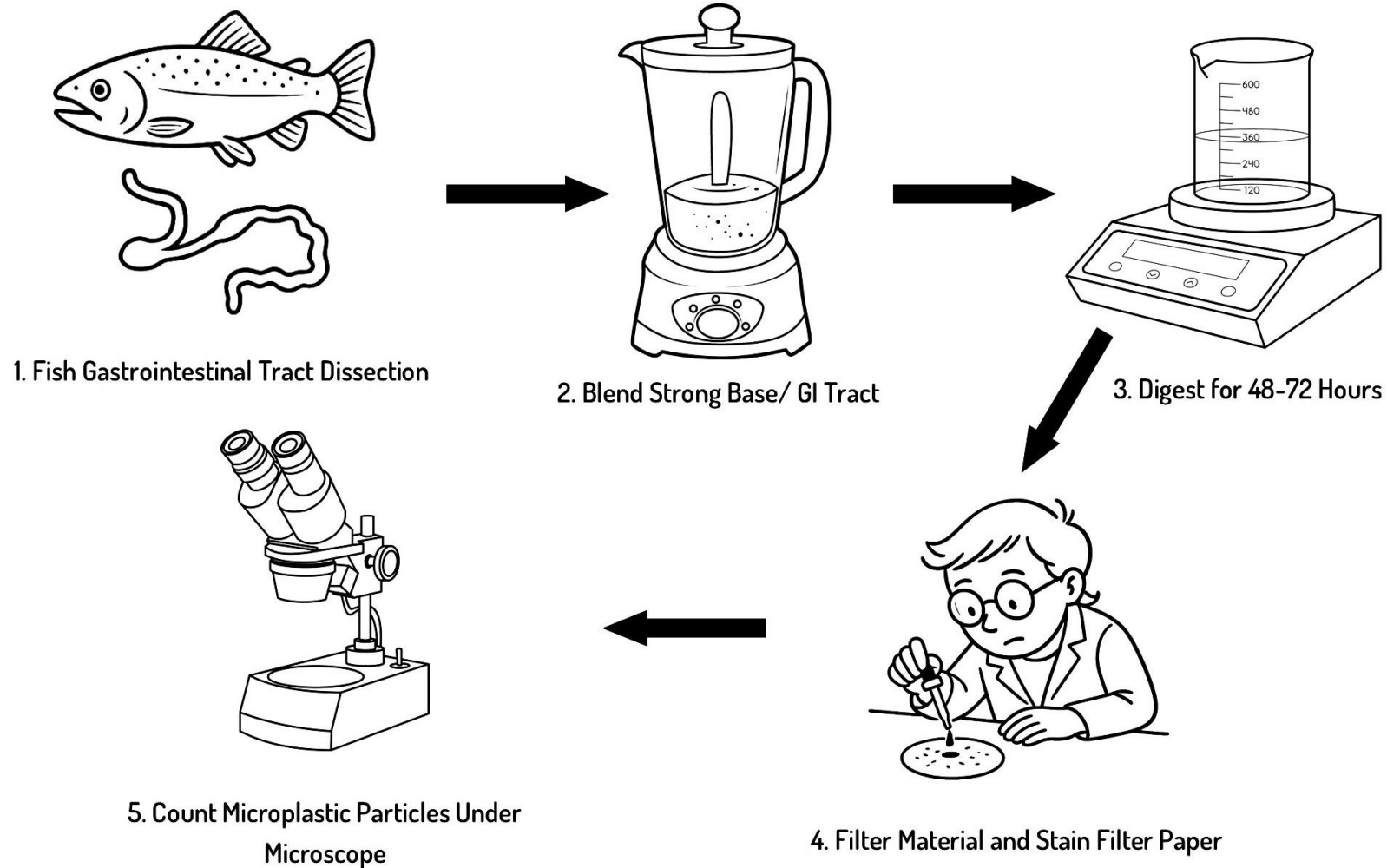
- Hook and line techniques and electrofishing
- Fish frozen post capture
- Dissection to isolate GI tract
 - Esophagus to vent

Sample Site Variation

- Kilgore, Idaho (population 794)
- Threemile Reservoir (accessible only by dirt roads)
- Compared to Ririe Reservoir
 - Dammed reservoir and popular for recreation= higher contamination?



Lab Analysis Methods Overview



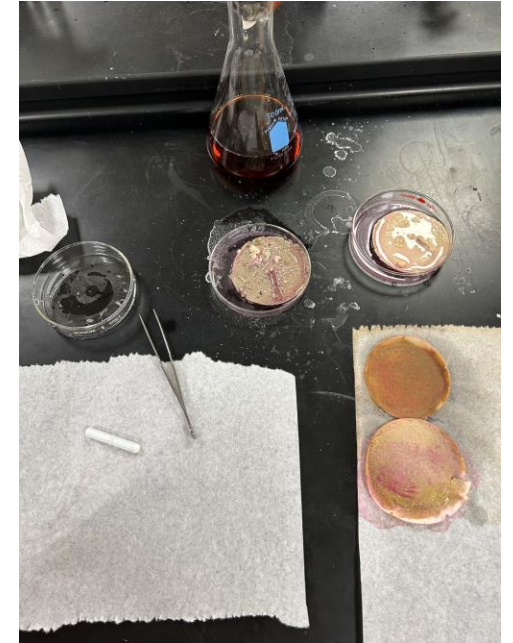
Isolating the Microplastics

- Protocol adapted using dual digestion and density separation
 - Speeds up filtration
- GI tract samples blended in a 10% w/v NaOH solution (72 hrs.)
- Density separation used a saturated NaCl brine to allow less dense microplastics to float
- Top of brine solution filtered using vacuum filtration apparatus with 5 micrometer VMR filter paper

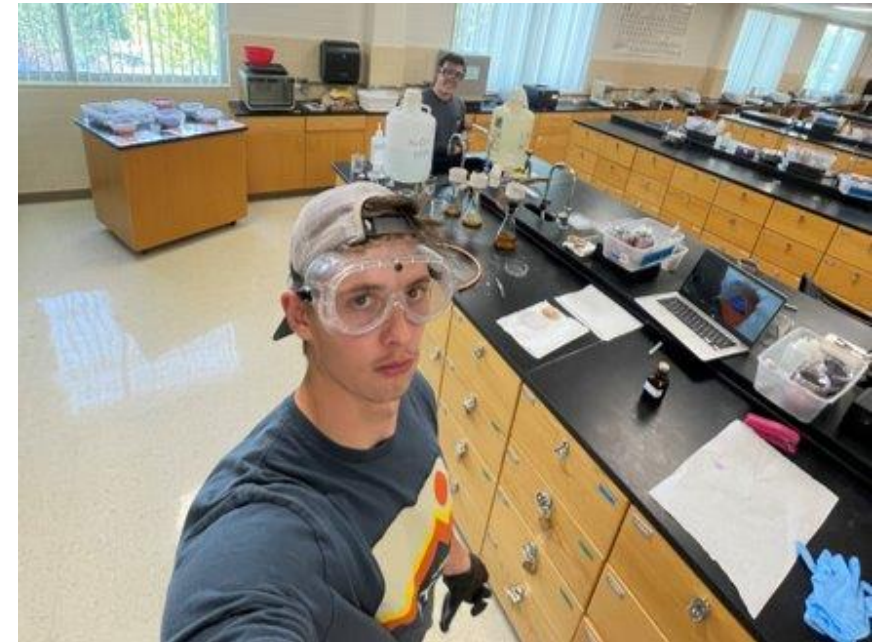


Marking & Counting Microplastics

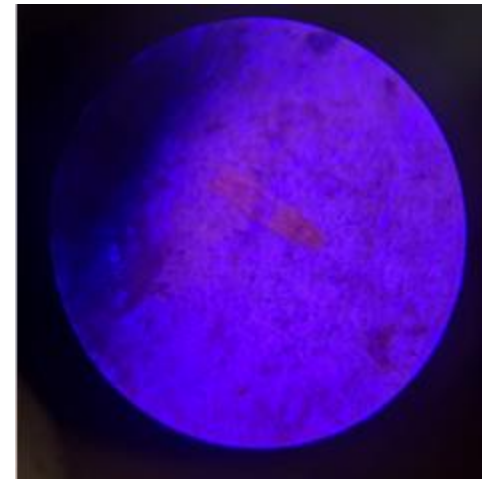
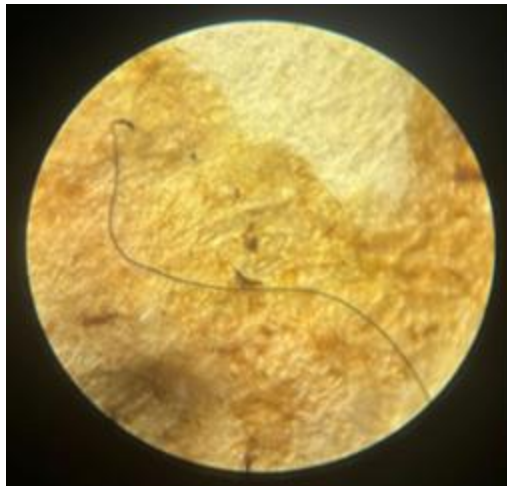
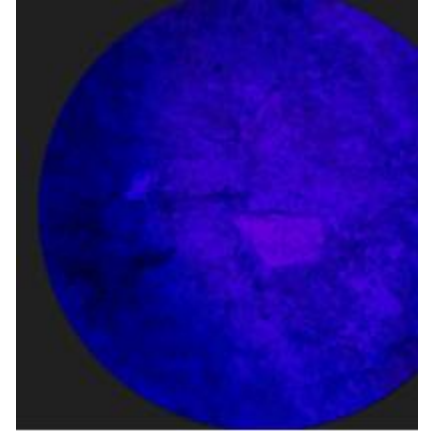
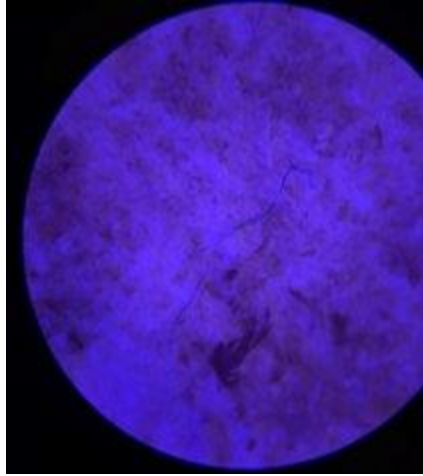
- Nile Red dye stains plastics
- Stained filters were viewed under dissection microscope
- Blue light and orange filter illuminate microplastics
 - Regular light



- 2 researchers counted plastics

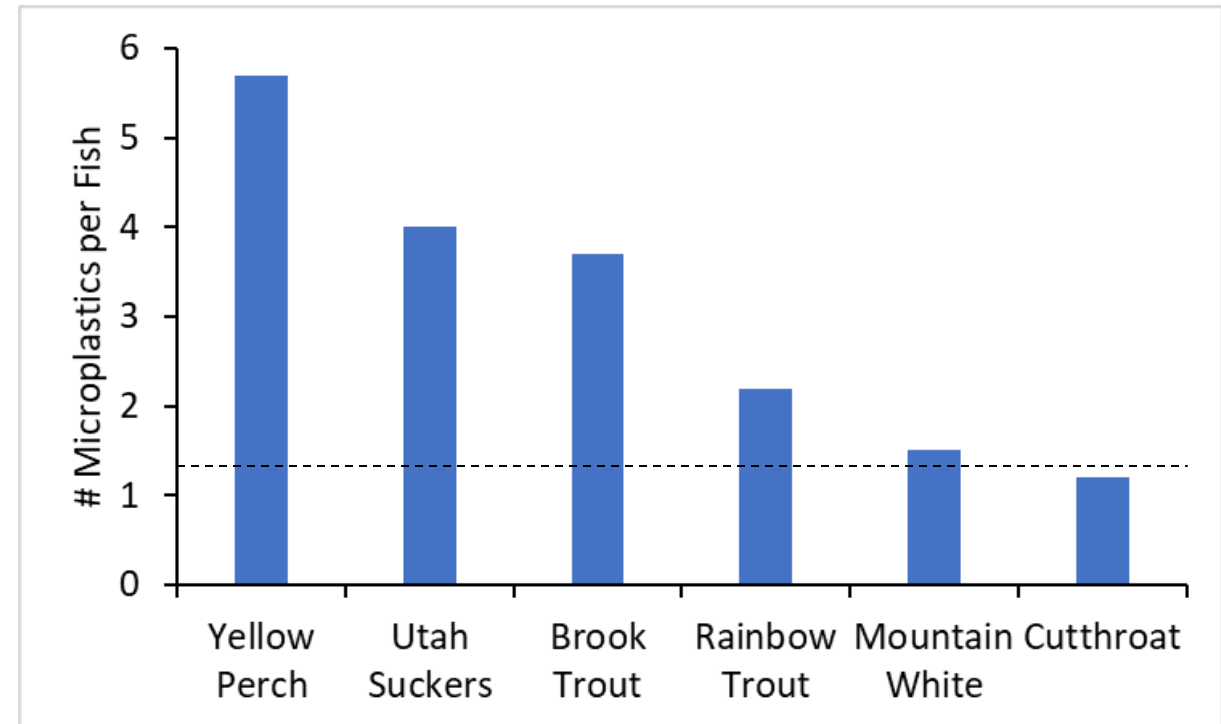


Examples of Microplastics



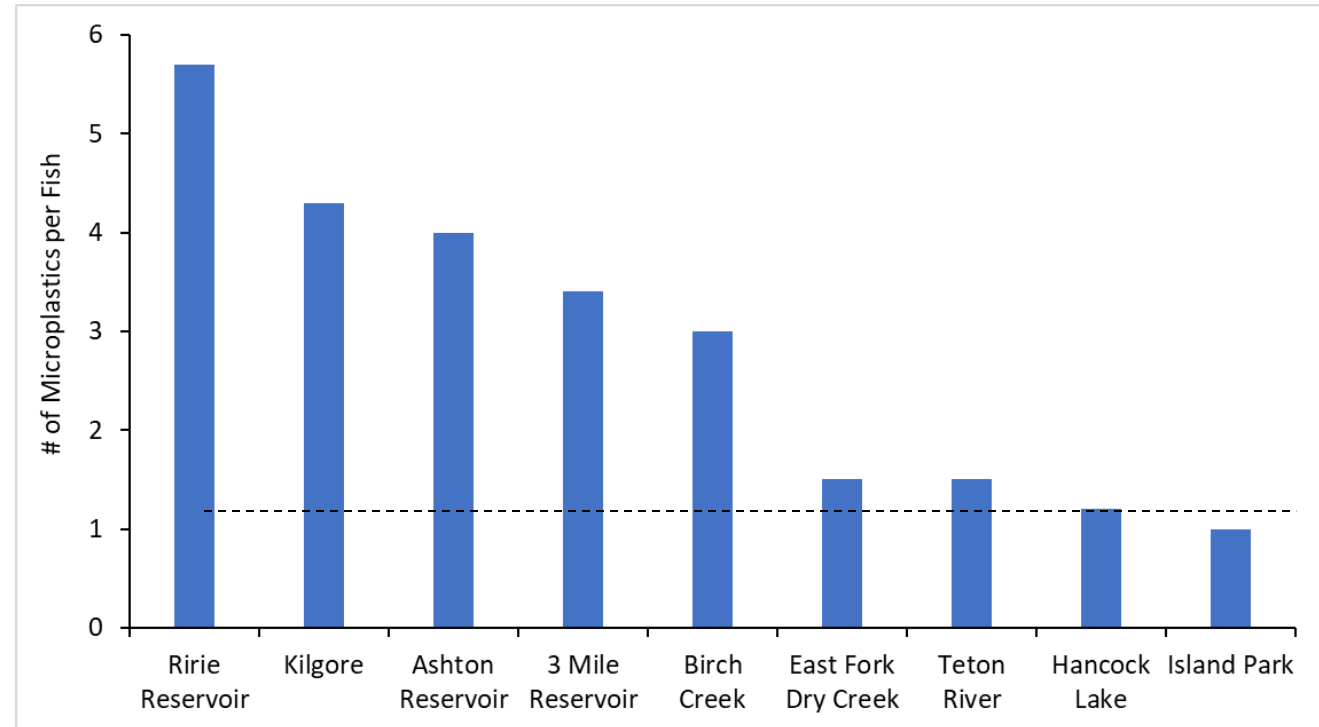
Microplastic Contamination by Species

- Yellow Perch had highest avg. contamination
- Highest count in a single fish (10) was a Yellow Perch from Ririe Reservoir
- Cutthroat Trout had lowest avg. contamination



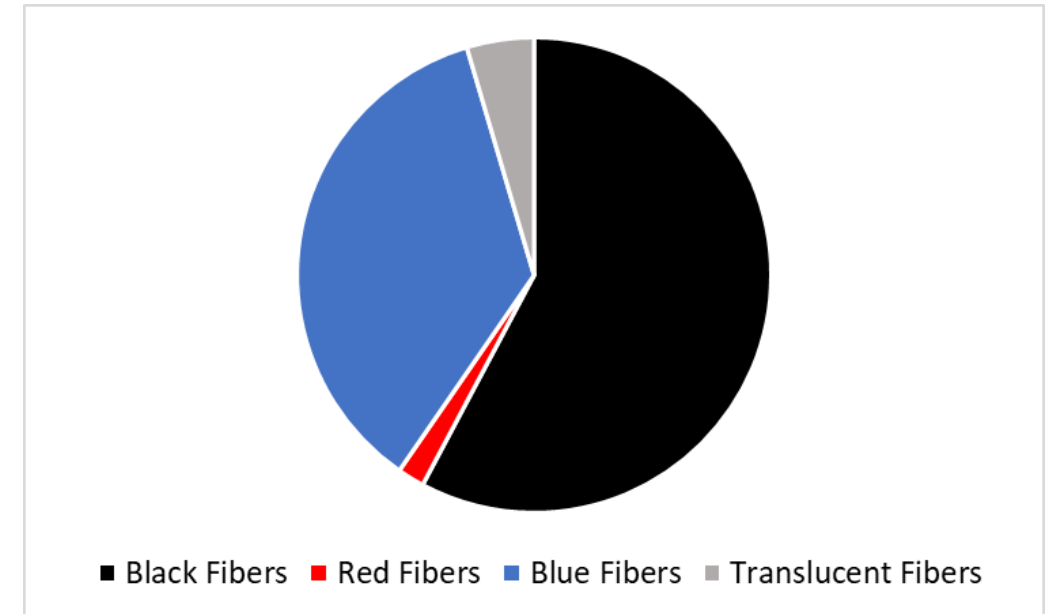
Microplastic Contamination by Site

- Ririe reservoir exhibited highest avg. microplastic contamination per fish
 - Kilgore had 2nd highest
 - Disclaimer: all fish analyzed from Ririe were Yellow Perch
- Island Park and Hancock Lake fish showed the lowest avg. contamination



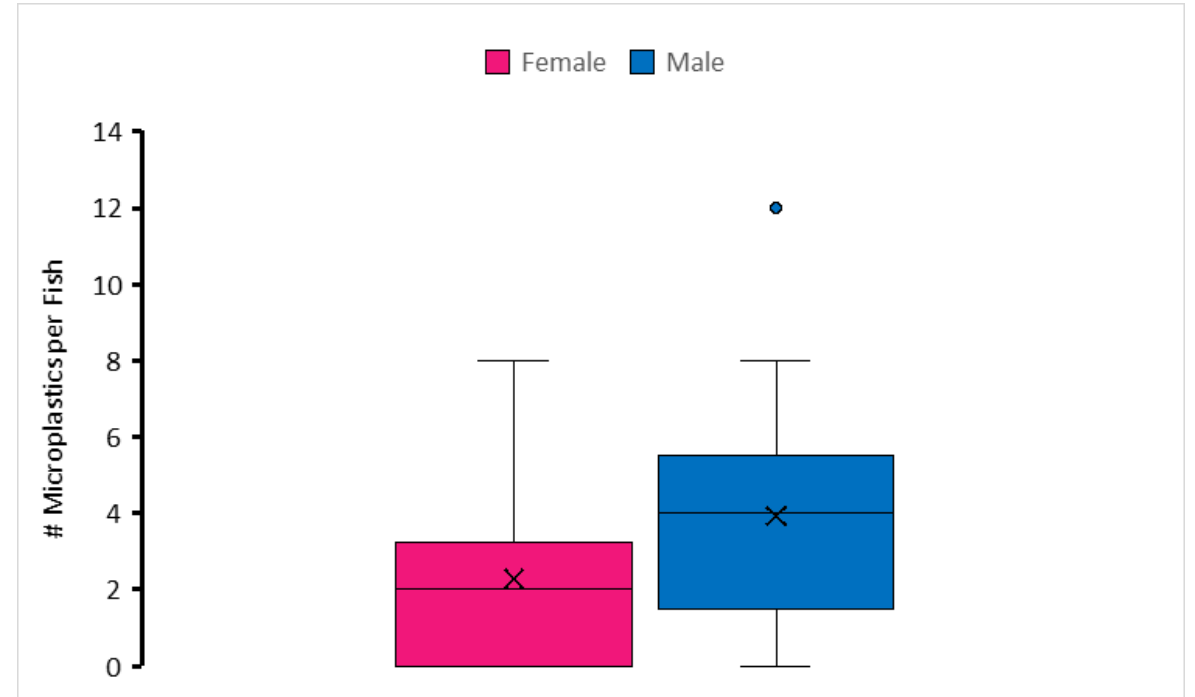
Morphological Analysis of Microplastics

- Total breakdown of microplastics found:
 - 109 fibers
 - 7 polygons
 - 39 sheets
- Fibers were predominantly black, blue, translucent, and red



Size and Sex of Fish

- No significant Correlation between microplastics and...
 - Fish length ($R=-0.2$)
 - Body mass ($R=-0.15$)
 - GI tract mass ($R=-0.2$)
- Contamination by sex
 - Male (N=30, 3.8)
 - Female (N=18, avg. 2.3)

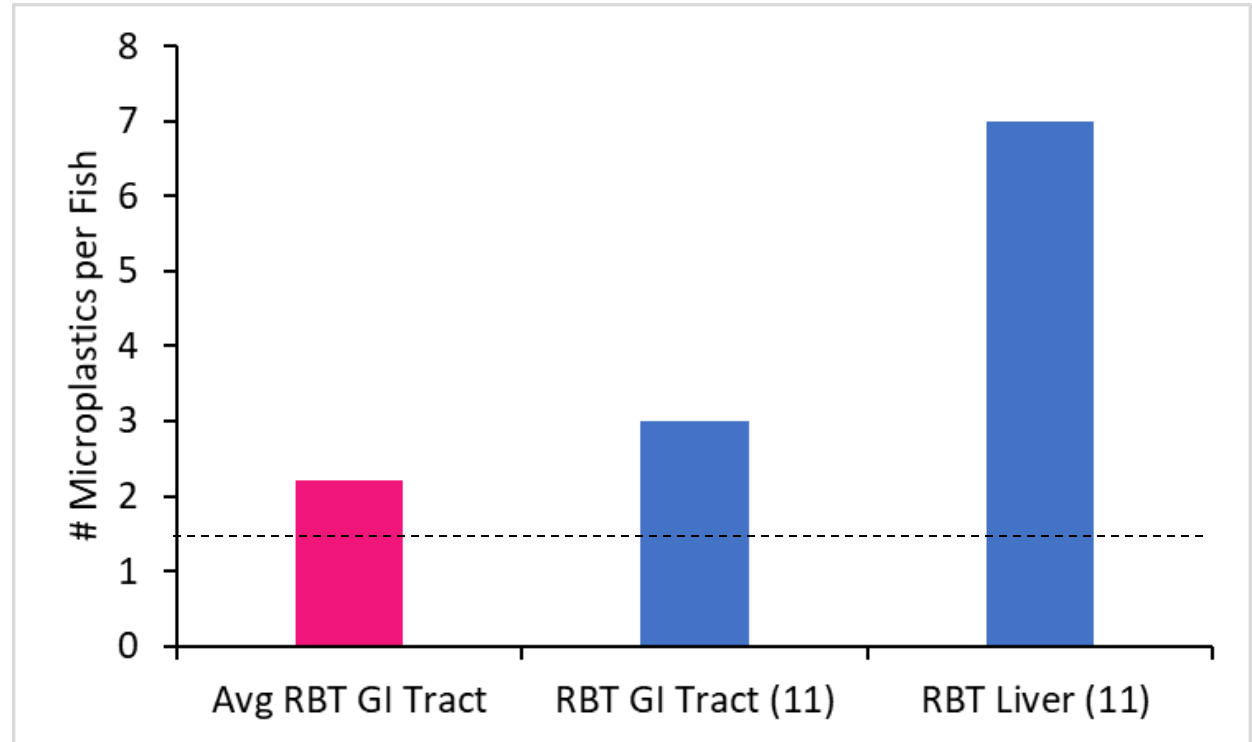


Exploratory Microplastic Contamination

- Sampled additional Fish tissues (4/6 species)
 - Gonads
 - Livers
- Can contamination be detected in other organs?
- How does it compare to contamination in GI Tract?

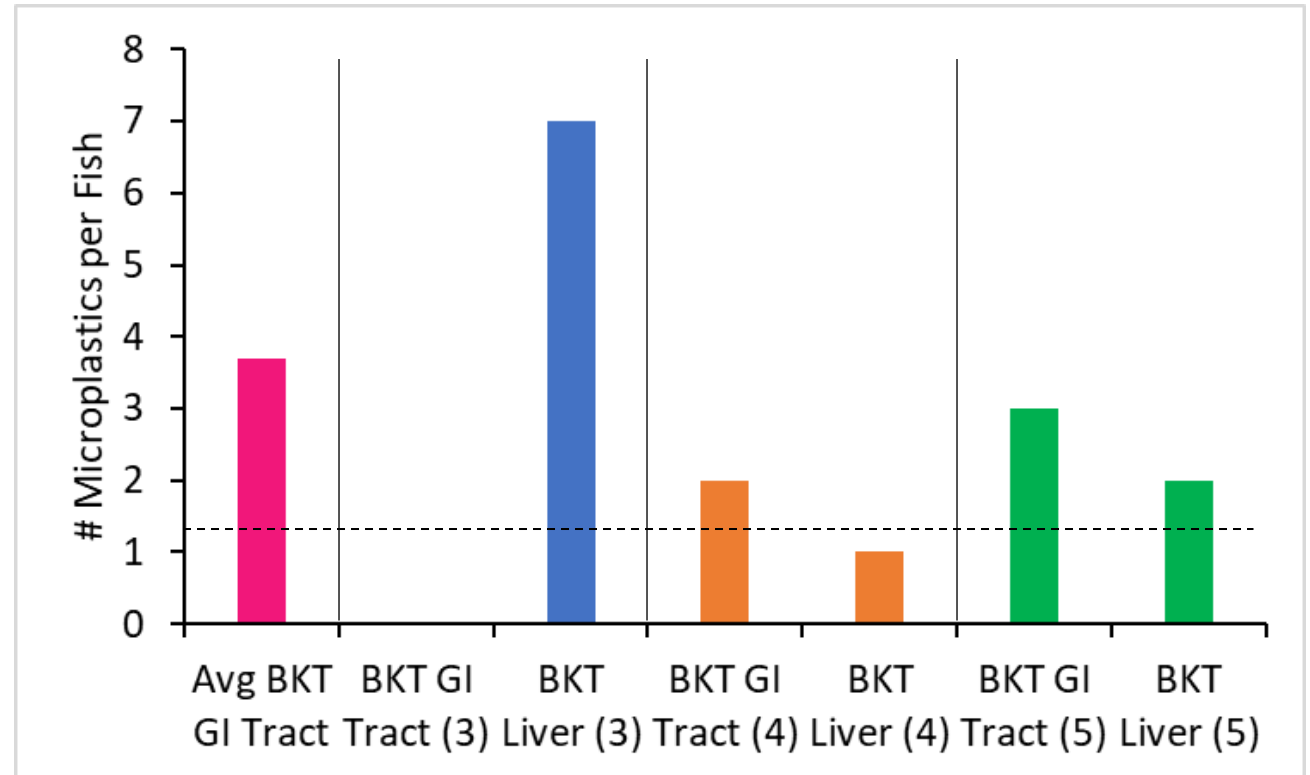
Systemic Microplastics Contamination

- Rainbow Trout Liver
 - Sample 11
 - Birch Creek



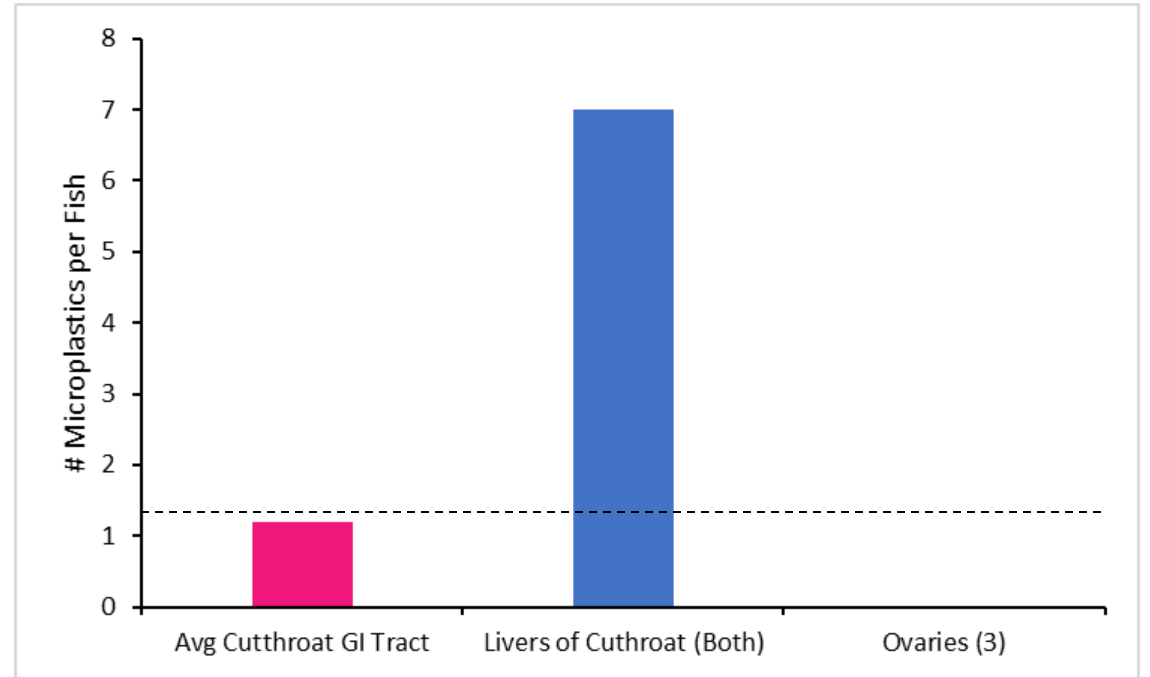
Systemic Microplastics Contamination

- Brook Trout
 - Samples 3, 4, and 5
 - Birch Creek



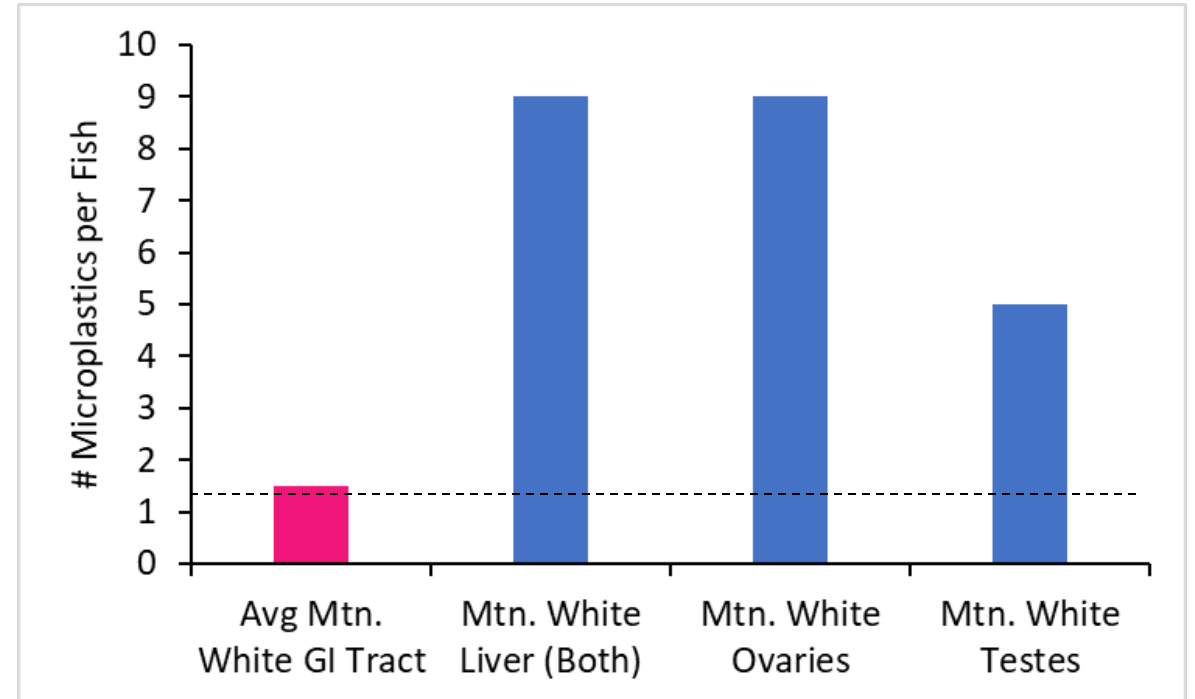
Systemic Microplastics Contamination

- Cutthroat Livers
 - Only 2 samples from Henry's Lake
 - Large fish
 - Pooled samples
- Cutthroat Ovaries
 - Sample 3
 - Large fish
 - Hancock Lake



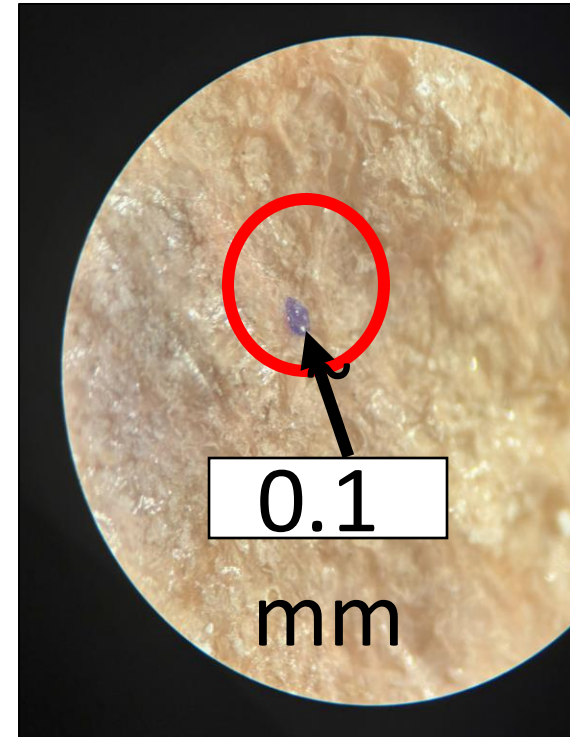
Systemic Microplastics Contamination

- Mountain Whitefish Liver
 - Pooled Sample
- Mountain Whitefish Ovaries
- Mountain Whitefish Testes



Discussion

- Microplastics found in both GI tract and other organs
- MWF, CTT, and RBT had higher contamination in non-GI tissues
- Suggests absorption into blood and relocation to other organs
- Raises concern for transfer into humans



Discussion

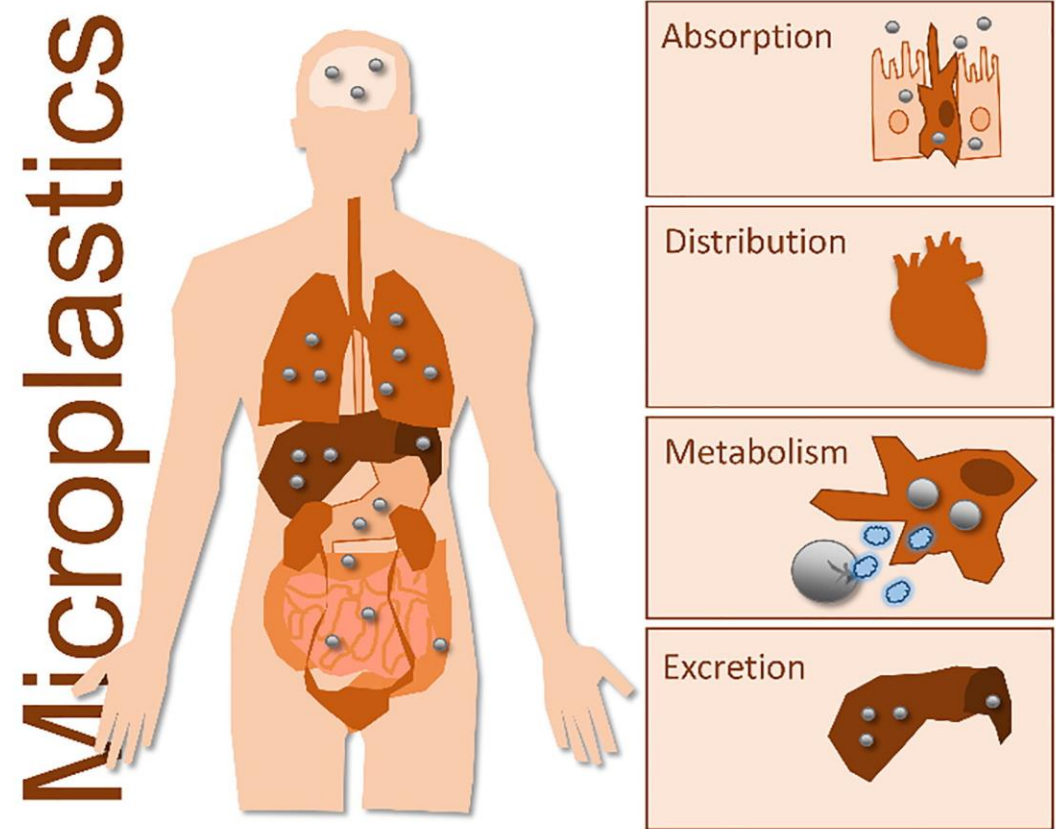
- Lack of correlation with fish size or GI mass suggests exposure is independent of body condition
 - Fish are exposed regardless
- Additional potential contamination sources include recreation and agriculture
 - How are the microplastics getting there?

Conclusion

- Widespread microplastic contamination found in freshwater fish across SE Idaho, including remote areas
- Presence in reproductive and hepatic tissues indicates exposure and health concerns for fish and humans
- Fiber-type microplastics in non-GI tissues suggest absorption into circulation
- Microplastics travel via atmospheric deposition, water transport, reaching remote, high-elevation environments

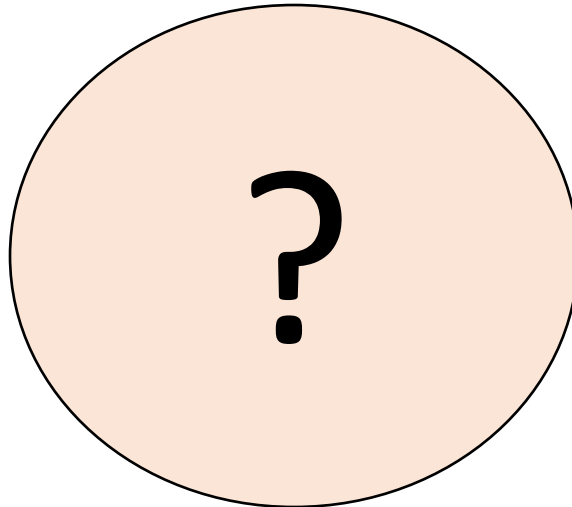
Future Directions

- Confirm preliminary trends
 - Species
 - Sites
- Alternate Tissue Analysis
- Longitudinal Monitoring
- Trophic level analysis
- Source tracking
- Human health impacts
- Solutions



Summary

- Discovery of contamination in even the most remote fish populations highlight true scope of microplastic contamination
- Old Question: “Are plastics present?”
- New Question: “What are they doing once they get to these areas?”



Acknowledgments

- Mentor Ryan Sargeant
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 - Eric Billman
 - IDFG

Questions



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