

# Plastic in the Arctic?

## Microplastics in Bearded Seal Tissues Over Two Time Periods

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### Introduction

- Plastic is omnipresent in our environment and an estimated 1 quintillion microplastic particles are released into the Arctic ecosystem annually through the continued melting of sea ice.
- It is important to gain an understanding of microplastics in bearded seals (*Erignathus barbatus*), as they are a vital indicator species for ecosystem health and a critical food source for subsistence communities in Alaska.
- The objective of this study is to investigate **if microplastic concentrations are at higher (#MP/g tissue) in more recently harvested seals than seals harvested 10-15 years ago.**



Fig. 1. Sampling a bearded seal in Utqiagvik.

Fig. 2. Bearded seal on the sea ice.

### Methods

- Seal samples were harvested in Point Hope, Little Diomed Island, and Gambell, Alaska in coordination with subsistence users and ADF&G.
- Approximately 20g of muscle, liver, and blubber was dissolved in 20% potassium hydroxide for about 48 hours at 60°C.
- Dissolved tissue was passed through a Whatman glass microfiber filter (0.7um porosity) in a vacuum filtration system.
- The filter was then treated with sodium iodine to purify the microplastics from the dark filter containing tissue debris.
- The microplastics were then quantified and characterized by type and color under a Leica Microsystems stereoscope.
- We followed a strict protocol to avoid contamination, including filtration of chemicals, air blanks, etc.

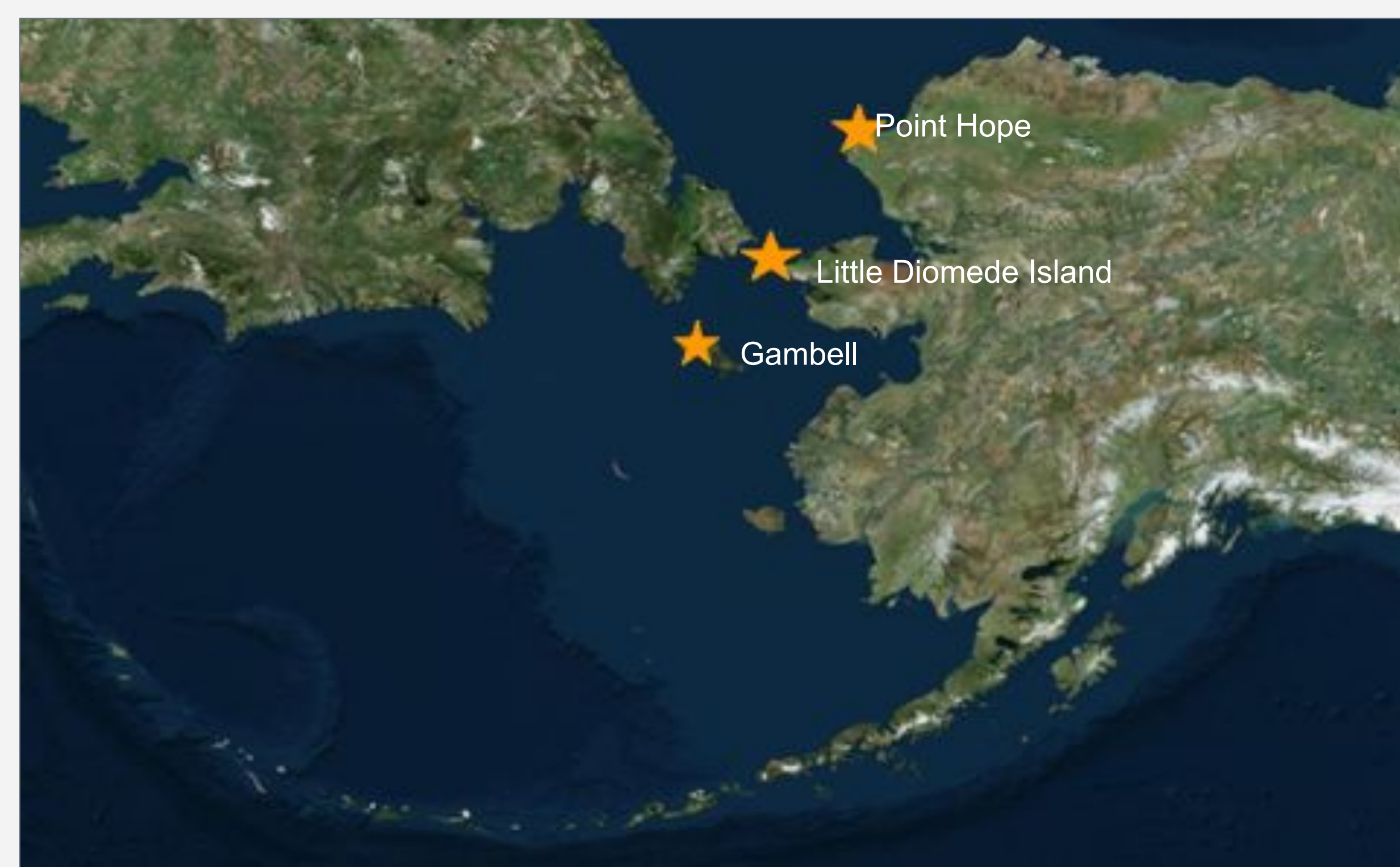


Fig. 3. Map of the subsistence communities, where bearded seal tissues were collected.

### Results

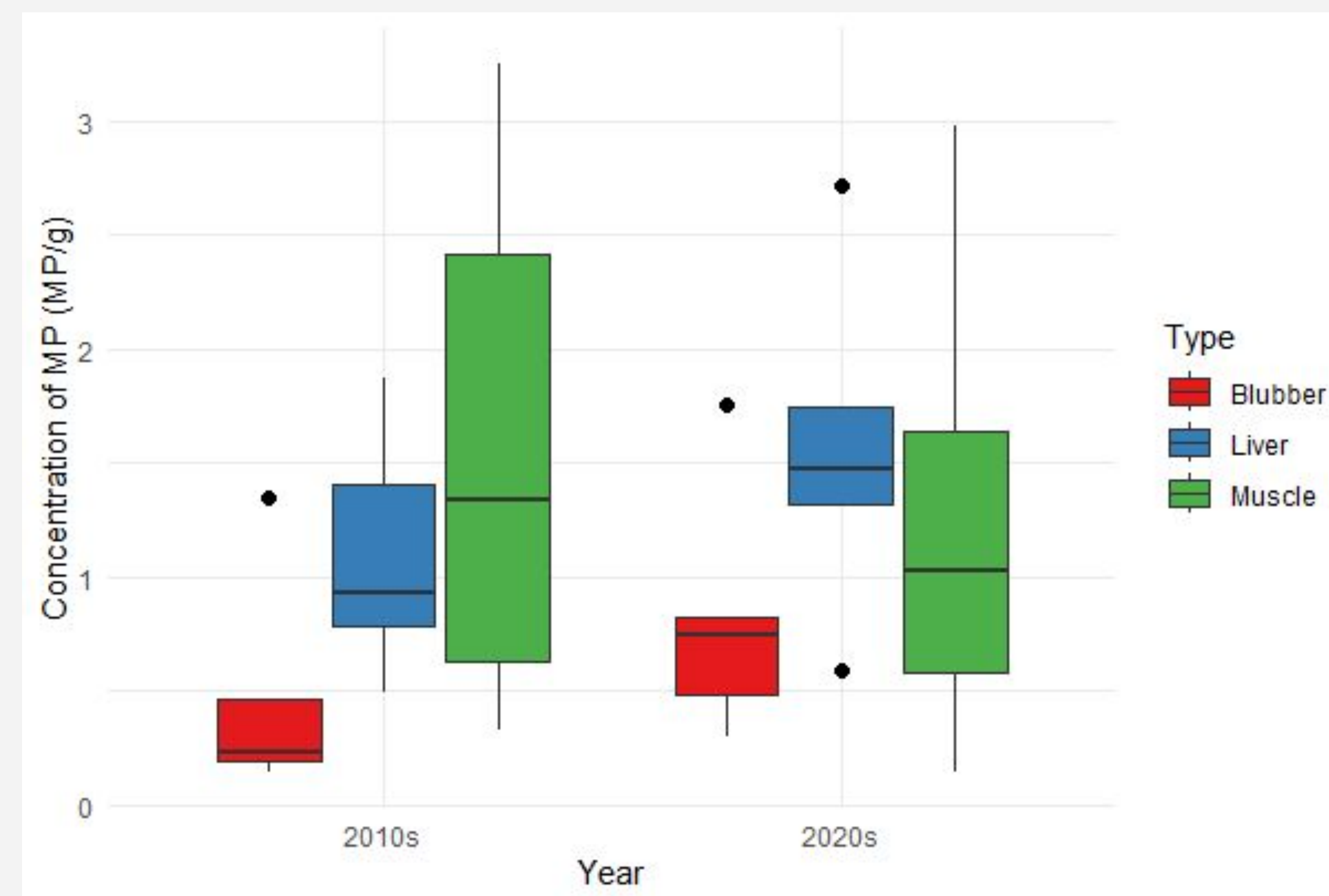


Fig. 4. Comparison of total microplastic concentrations by time periods and tissue types. Variability was similar in recent years, but both time periods were not significantly different ( $p > 0.05$ ). Whiskers indicate the variability outside the upper and lower quartiles, i.e., boxes and the darker line inside the boxes show the sample mean.

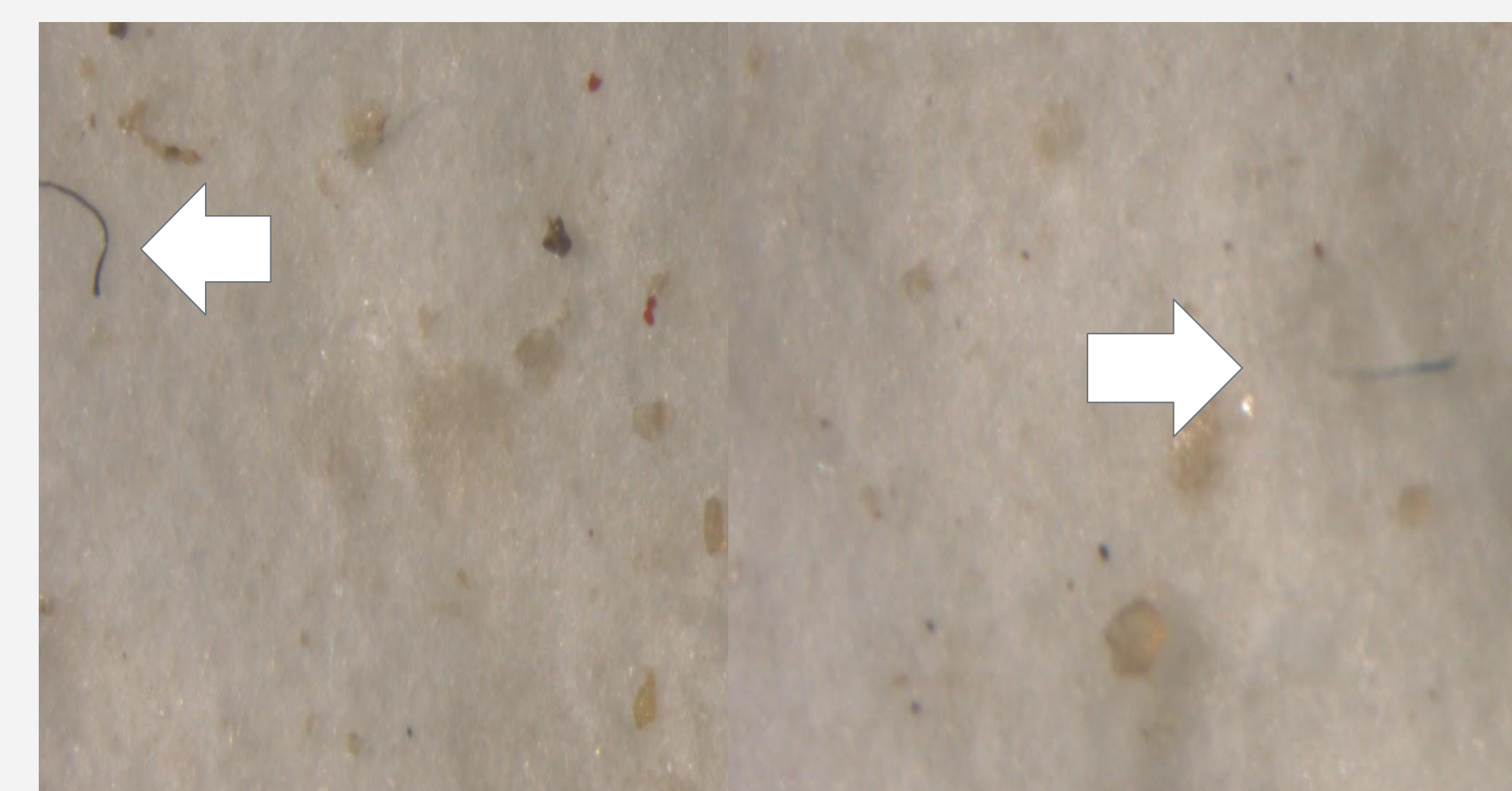


Fig. 5. Example of microplastics fibers (blue and black) in bearded seal muscle.

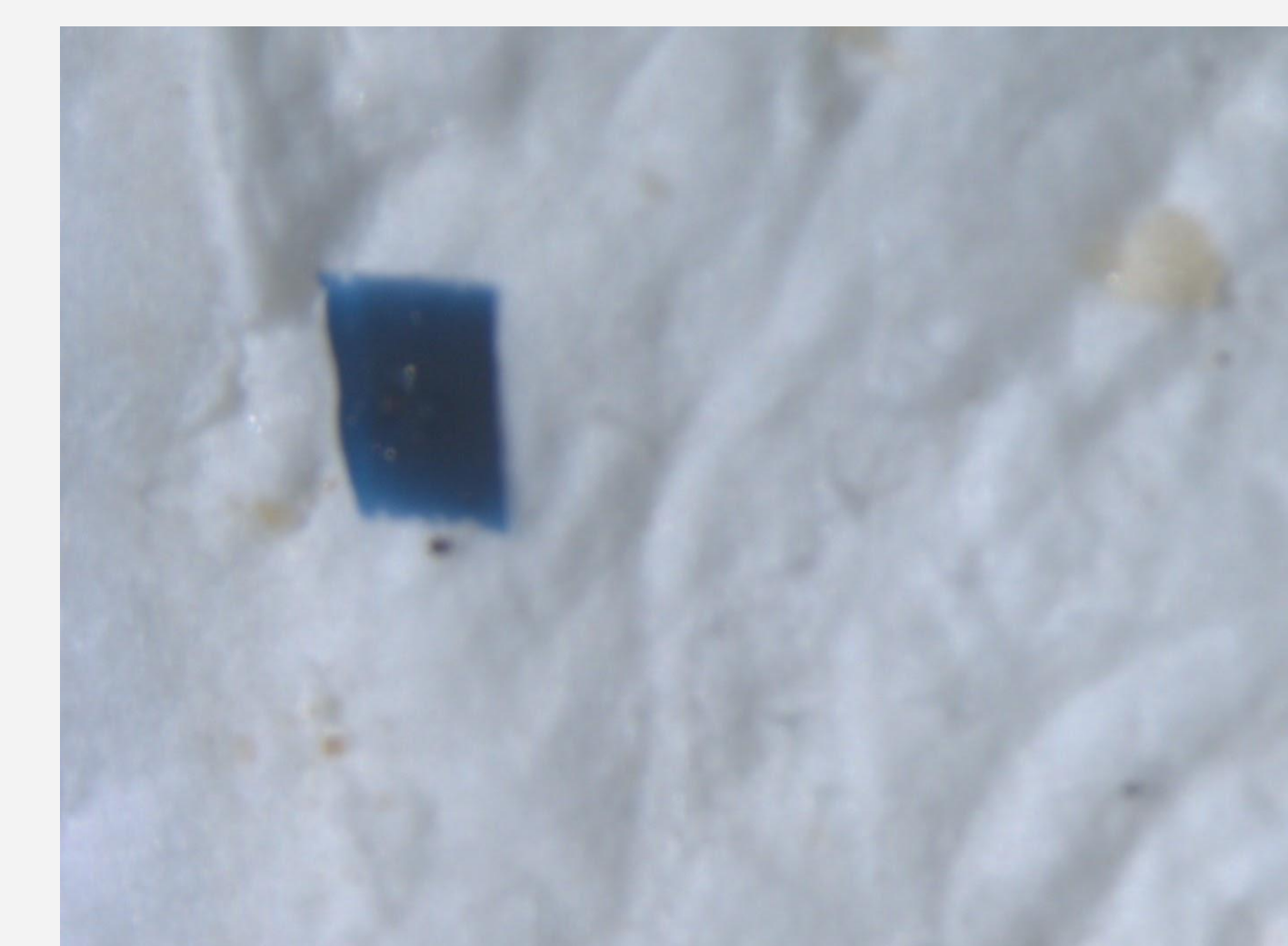


Fig. 6. Example of a blue microplastic fragment in bearded seal blubber.

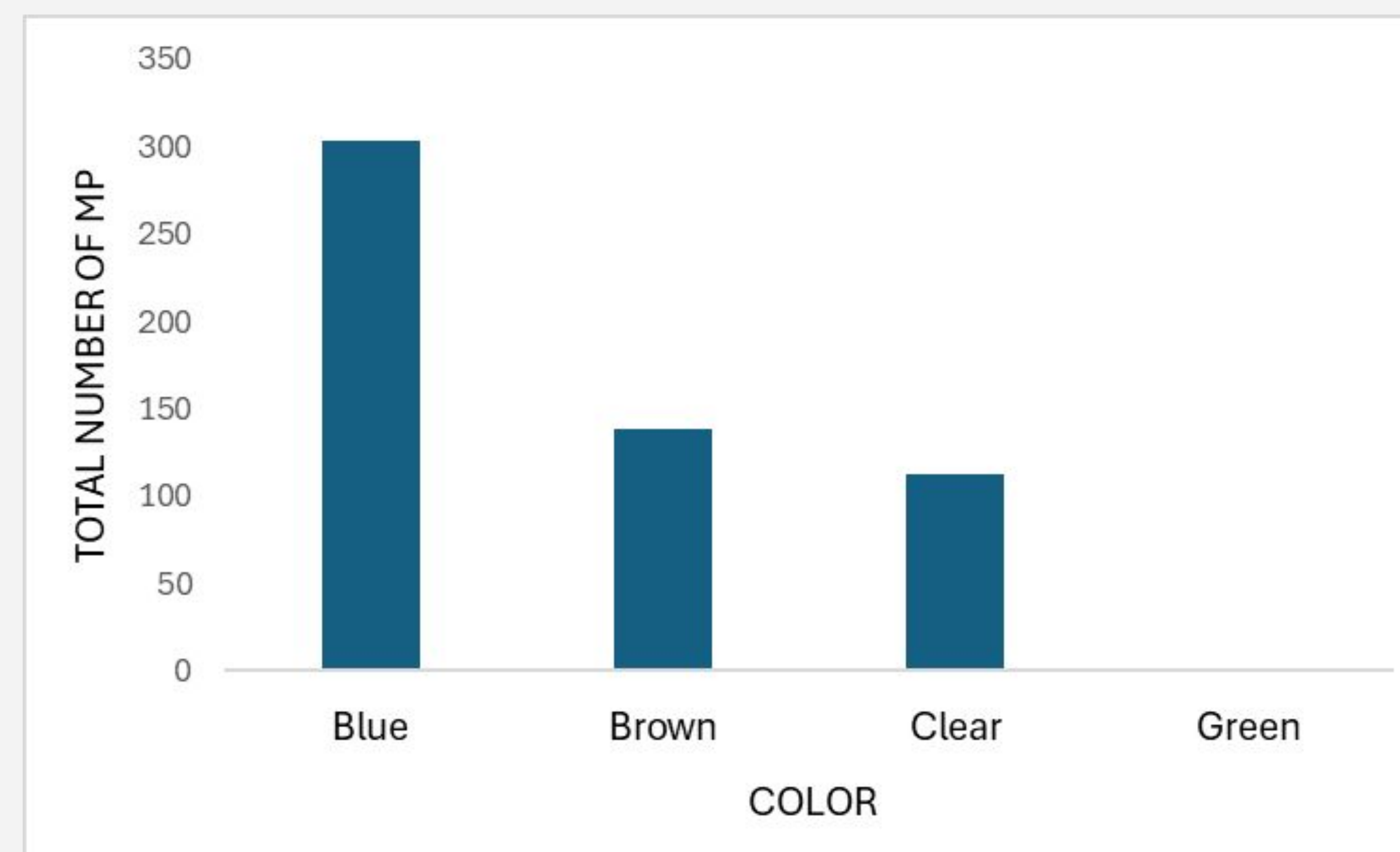


Fig. 7. Proportions of microplastics fibers in bearded seal tissues (all tissues and time periods combined) by color. Blue= 55%, Brown= 25%, Clear= 20%, Green= 0.36%.

### Discussion

- All sampled tissues contained microplastics (MP)
  - Muscle had the highest concentration: 1.43 MP/g  $\pm$  1.11
  - Followed by Liver: 1.33 MP/g  $\pm$  0.68
  - And Blubber: 0.64 MP/g  $\pm$  0.53
- The average concentrations of the two time periods were:
  - 2010-2011: 1.05 MP/g  $\pm$  0.90
  - 2021-2023: 1.22 MP/g  $\pm$  0.84
- The two time periods were not statistically different ( $p = 0.5693$ ).
  - This indicates that MP have been **present in tissues of bearded seals for at least the past decade, and MP concentrations appear not to have changed.**
- Microplastics concentrations in tissues of bearded seals are within the range of those reported in commercial sea foods and other marine mammal tissues in our lab.

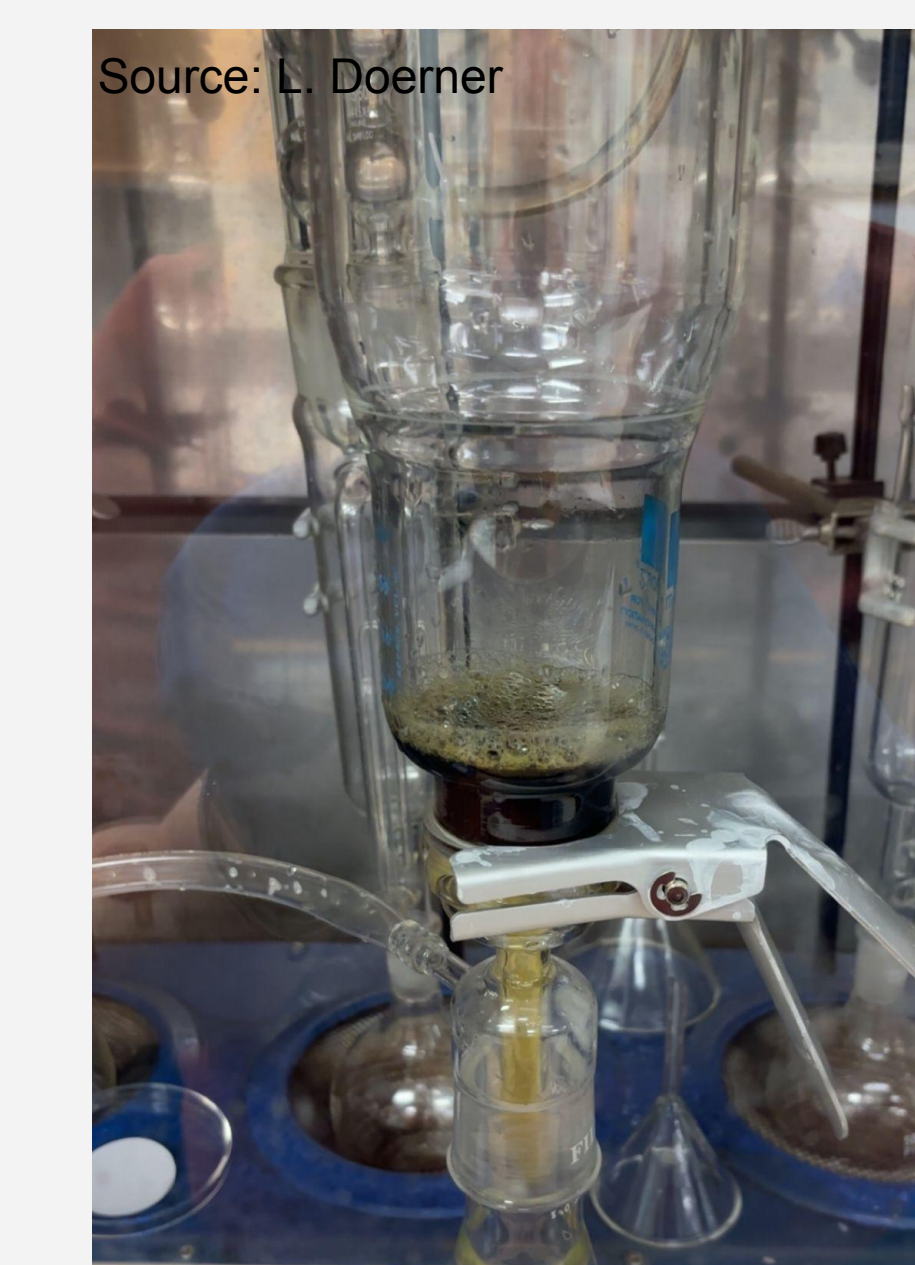


Fig. 8. Vacuum filtration of digested bearded seal tissue.



Fig. 9. Hanging seal meat to dry on Little Diomed Island.

### Future Directions

- Determine microplastic concentrations change in each tissue type over the two time periods to explore if MP is accumulating in one type of tissue.
- Determine the source of plastics in the Arctic (e.g., fishing gear, clothing) and their chemical fingerprint.
- Determine microplastic concentrations in older seal tissues, to explore if and how long microplastics have been present.

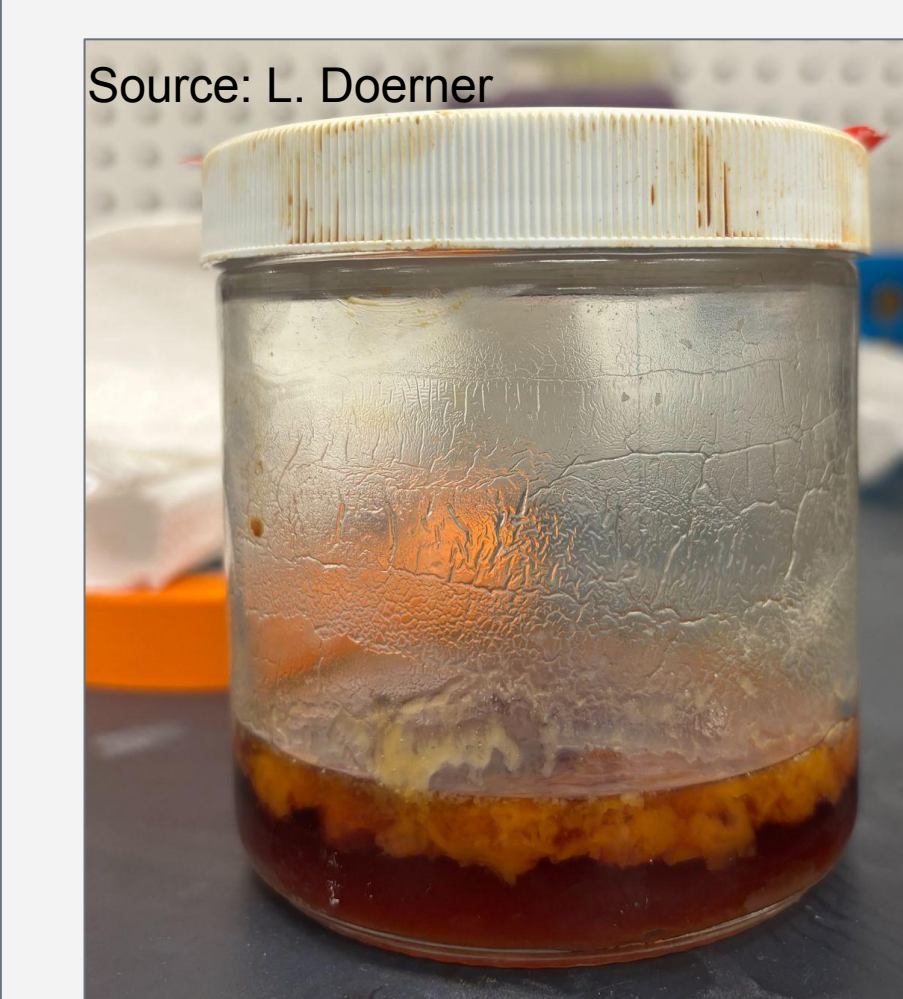


Fig. 10. Bearded seal blubber sample digesting in potassium hydroxide solution.



Fig. 11. Subsistence hunter with a harvested bearded seal on the ice near Utqiagvik.

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