

Microplastics in subsistence harvested bowhead whale stomach, colon, and muscle

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Introduction

- Microplastics (MP) are particles >5um
- 8-12 million tons of plastics enter the ocean annually, MP are in surface and sub-surface waters, beaches, sediments, and in marine organisms
- Baleen whales ingest MP from the water column during prey capture or via prey species leading to an estimated daily consumption of 200,000 to 10 million MP
- Plastic polymers contain chemical additives including endocrine disruptors that may be harmful even at low concentrations, leading to potential risks to marine ecosystem, biodiversity, and food availability
- Bowhead whales are important subsistence resources to Iñupiat and Yupik hunters and families

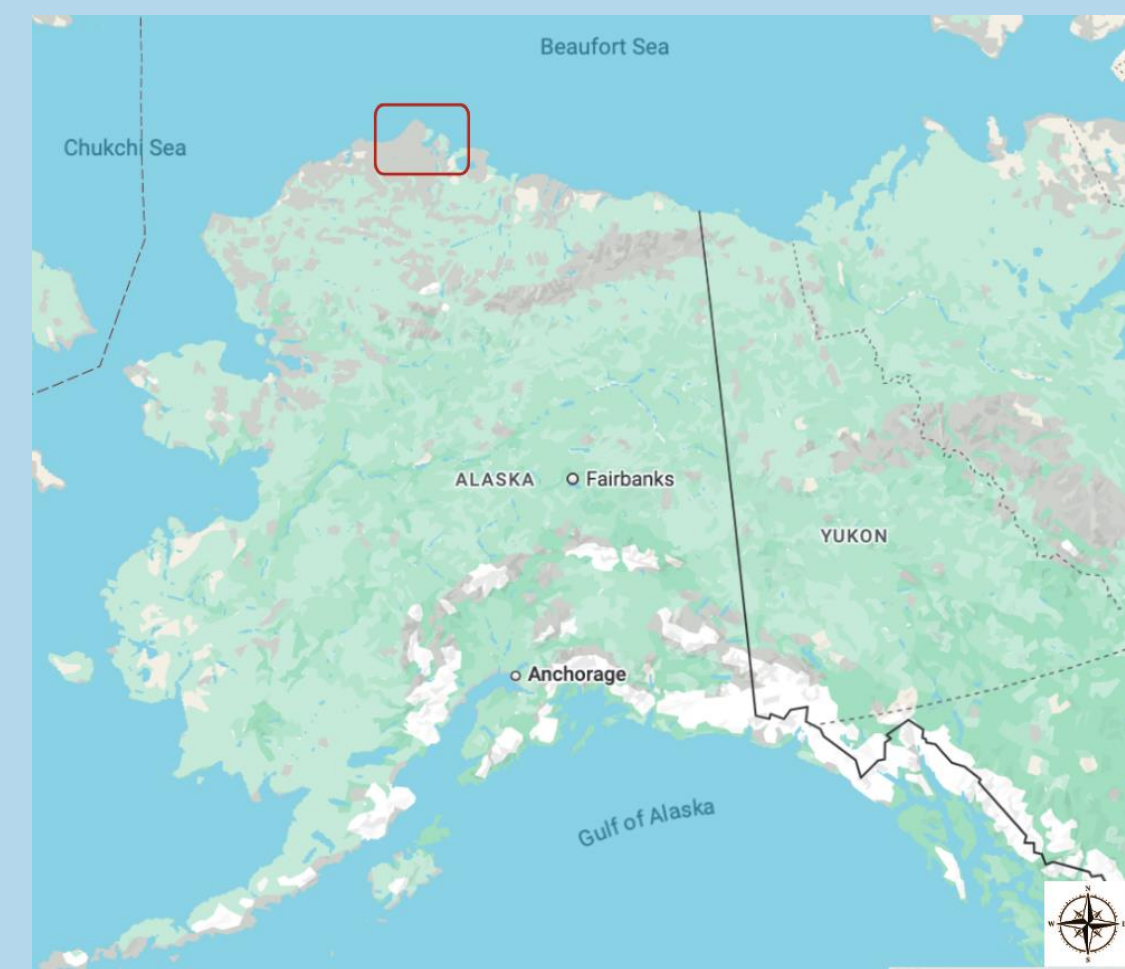


Figure 1. Map of Alaska. Red rectangle is area of Utqiagvik, AK, where bowhead whales were harvested for subsistence use

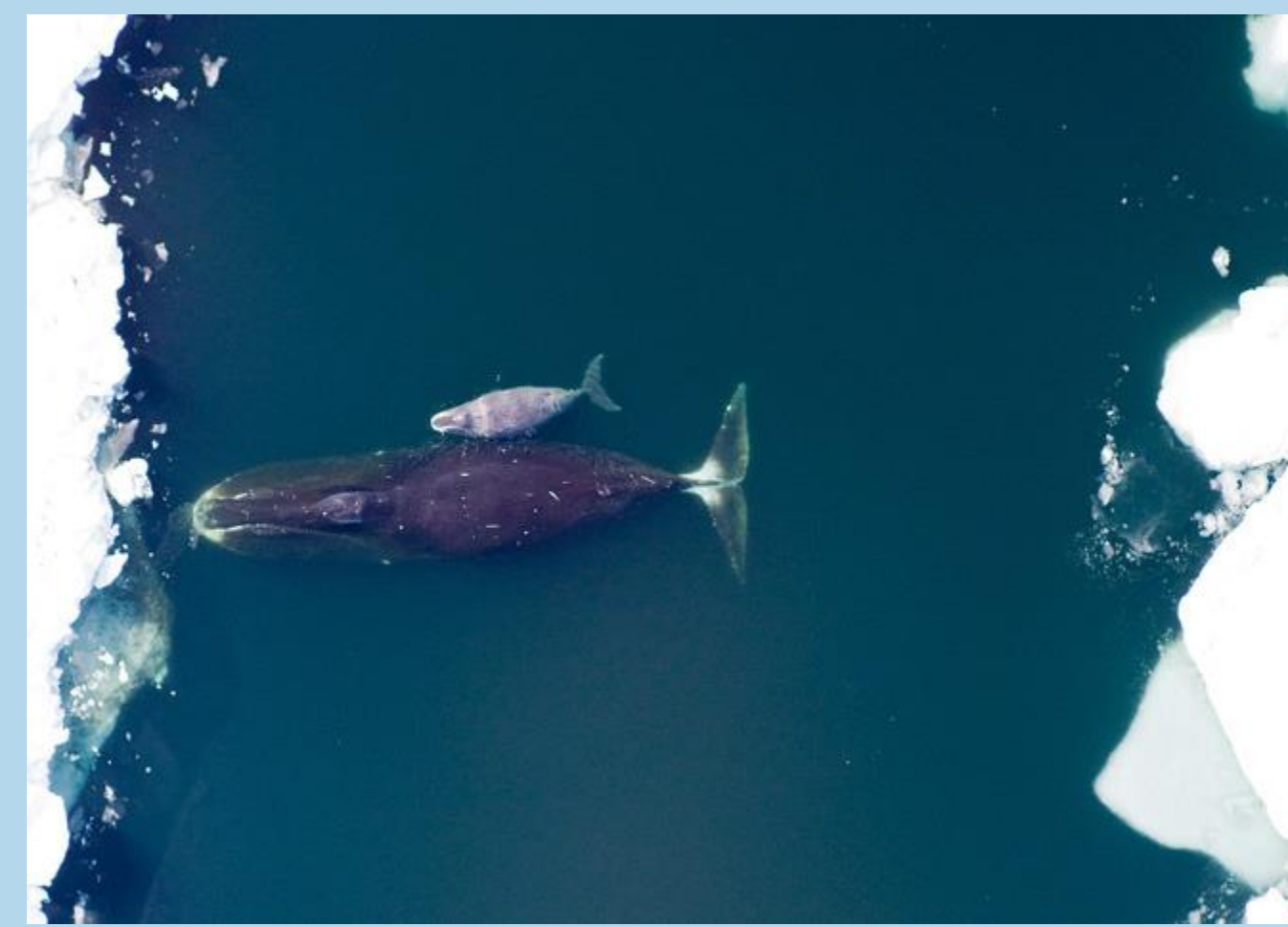


Photo from NOAA

Objective

How do MP isolated from bowhead feces compare to microplastics in stomach contents and muscle

Methods

- Collected samples of colon contents, stomach contents, and muscle from 6 individual whales harvested in fall 2022-2024 in Utqiagvik, AK (Figure 1)
- Tissues were dissolved in 3:1 KOH volume (tissue weight) and incubated at 60C for at least 72 hours
- Some sample filters with dark tissue residue were washed in NaI to make them lighter and easier to count
- Counted, characterized, and measured microplastics on filters (Figure 2)

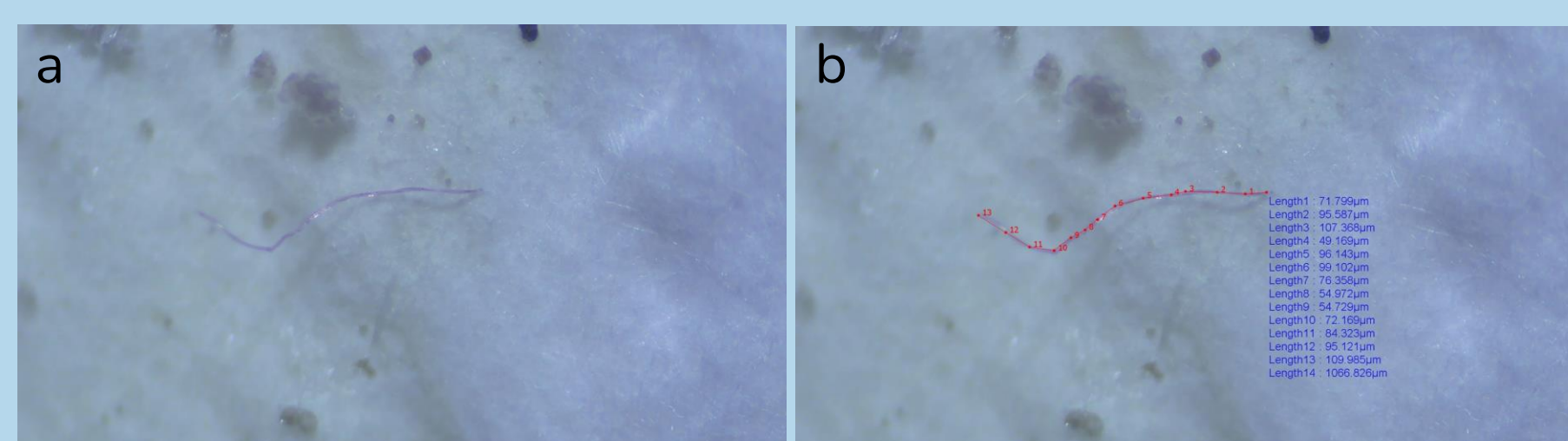


Figure 2. (a) Red microplastic fiber in colon sample of bowhead whale 23B22. (b) Measurement of that particle (1066.826 um length).

Results

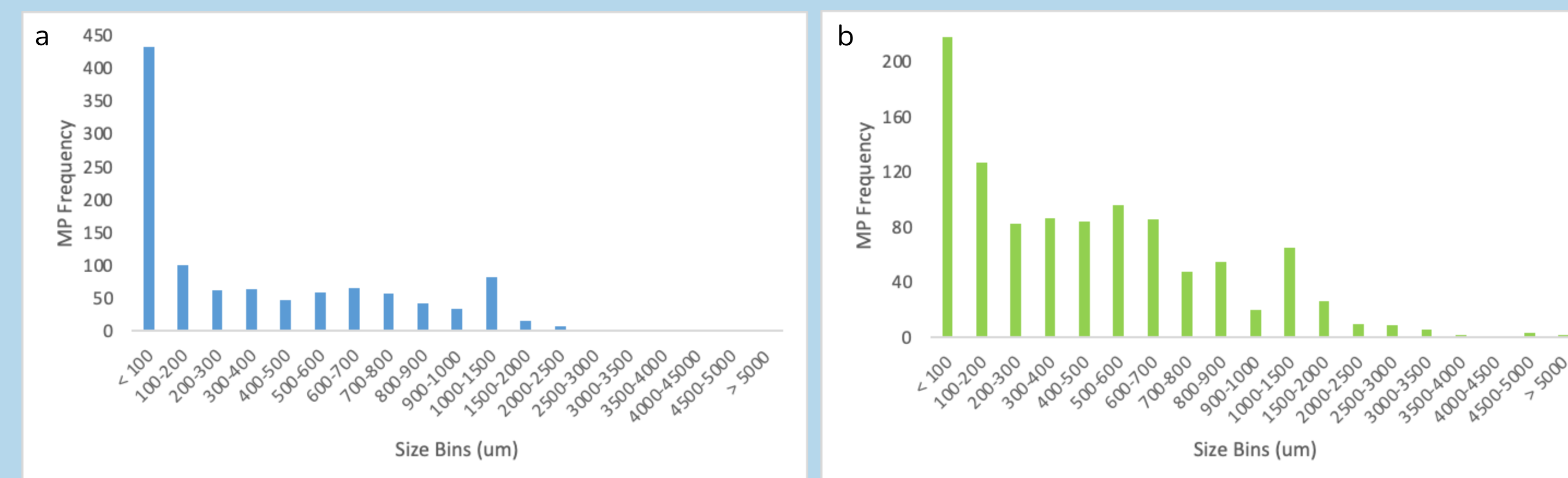


Figure 3. Histograms of microplastics (MP) length (um) identified, counted, and measured in bowhead whale samples (bin size increments of 100um up to 1000um, then 500um increments). All microplastics counted from the blank were subtracted prior.
(a) Stomach samples.
(b) Muscle samples.
(c) Colon samples.

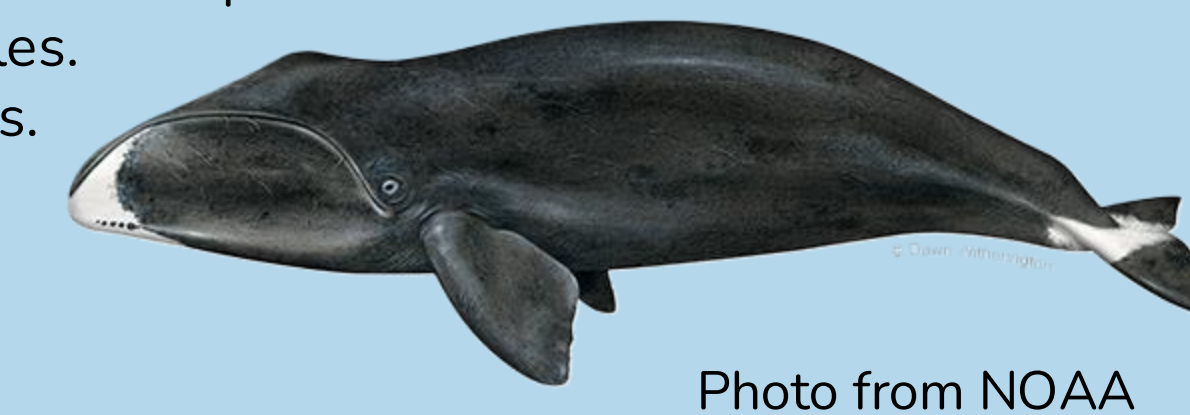


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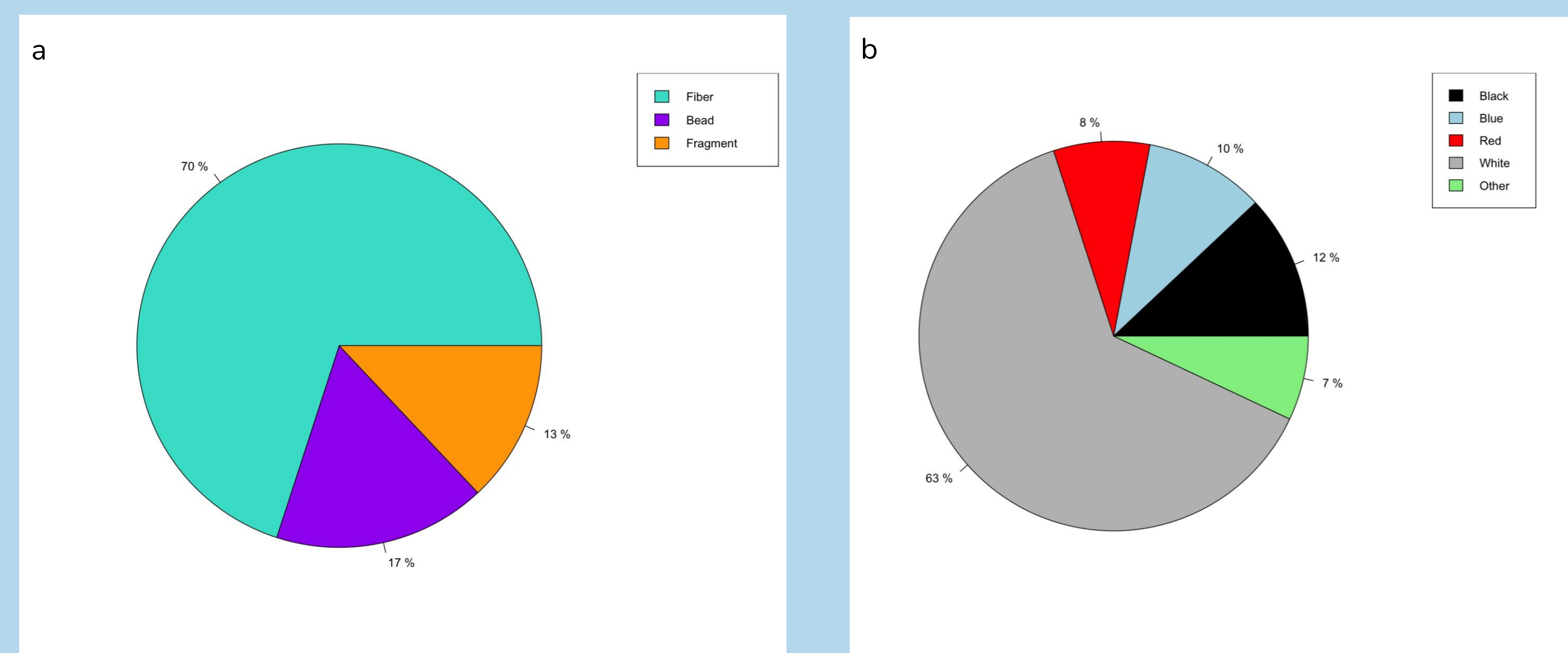


Figure 4. (a) Proportions of microplastic types (i.e., fibers, fragments, beads) from all bowhead whale samples combined. (b) Proportions of microplastic fibers by color from all bowhead whale samples combined. Other is any color fiber identified that is not one of the main four colors.

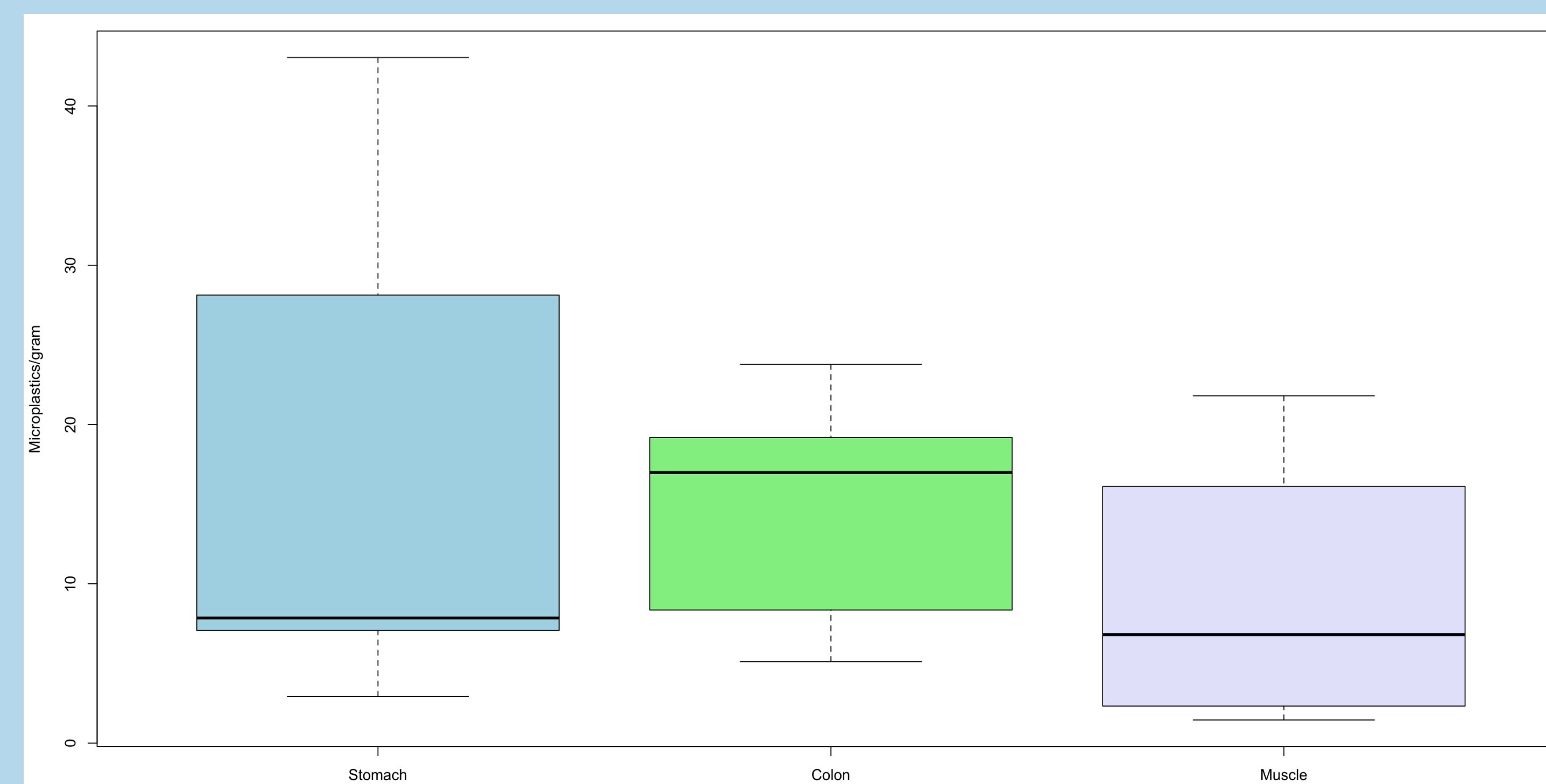


Figure 5. Microplastics comparison in bowhead whale tissues. There are no significant difference in microplastics among tissues (p-values > 0.05). Bold lines in boxes represent medians, and the whiskers represent maximum/minimum values. Stomach 7.85 +/- 7.17 MP/g; Colon 16.99 +/- 7.09 MP/g; Muscle 6.81 +/- 9.25 MP/g

- All bowhead whale tissues contained microplastics
- 2,909 MP were counted
 - Muscle: 805 MP
 - Colon: 1028 MP
 - Stomach: 1076 MP
- Most MP were <1000um (Figure 3)
- Fibers were the most common MP (Figure 4.a) and aligns with most common MP found in Chukchi Sea sediment
- White was the most common fiber color (Figure 4.b) and does not align with most common fiber color found in Chukchi Sea sediment, which were black and blue fibers
- MP concentrations in all tissues were similar, suggesting that each tissue can serve as an exposure monitor (Figure 5)
- MP concentrations taken in through the stomach is reflected in MP concentration translocated between tissues

Future Directions

- Expand tissue selection
- Compare MP tissue concentration between sexes
- Look at blubber for MP

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