INTRODUCTION
Microplastics (≤5 mm diameter) - found in fresh and marine waters worldwide [1] 

Microplastics can be ingested by a wide range of marine species [1] (Fig. 1) 

Charleston Harbor watershed - high abundance of black polybutadiene (synthetic rubber) fragments (Fig. 2) 

- 63-150 μm size range 
- Believed to be tire wear particles (TWP) based on FT-IR spectroscopy 

Figure 1. Tire wear particles in the gut of Palaemonetes pugio (daggerblade grass shrimp) 

Figure 2. Tire wear particles visualized under a dissecting microscope (left) and scanning electron microscope (right) [2] 

Tires: 
- Approx. 30% of tread worn off during lifespan producing TWP [3] 
- Contain a wide range of pollutants (e.g., zinc oxide, carbon black, benzopyrene) [2,4] 
- Pick up toxicants from the roadway such as metals and PAHs [2] 

Estimated annual U.S. TWP emission - 500 x 10^6 kg [5] 

- Larger TWP (>20 μm) are deposited on or near the road surface [4,6] 
- Enter aquatic systems from stormwater runoff [7] 

OBJECTIVE 
Assess the contribution of nonpoint stormwater outfalls and detention ponds to the microplastic debris in adjacent, receiving tidal waterbodies 

HYPOTHESES 
H1: Tire wear particle concentrations in stormwater detention ponds and outfalls will be higher than concentrations in receiving waterbodies 

H2: Urban sampling sites will have the highest abundance of tire wear particles 

METHODS 

Sampling Locations 
- Sites: variety of land uses including: residential, commercial, highway and golf courses 
- Stormwater detention ponds (n=12), catch basins (n=6), stormwater discharge pipes/outfalls (n=12) and adjacent receiving tidal waterbodies (n=2 upstream (50 m) and downstream (50 m and 100 m)) 

Sediment Samples (n=3 pond; n=2 tidal creeks; n=1 catch basins) 
- Stormwater ponds and tidal creeks- quadrats (0.25 x 0.25 m²) randomly placed along transect. Top 2 cm removed 
- Catch basins- grab sampler 

Subtidal Sediment Samples (n=3 ponds; n=2 tidal creeks) 
- Handheld Ekman dredge 

Sediment Processing – volume & weight recorded on site 

Saturated NaCl solution: 1.2 g mL⁻¹ 

500, 150, 63 μm 

Categorized: size, shape & color 

Water Samples (n=3 pond; n=2 tidal creeks; n=2 pipes/outfalls) 
- Sea Surface Microlayer 
  - 4 L water collected using screen sampler (61 x 61 cm²) 
  - Water poured through series of sieves (500, 150, 63 μm) 
  - Quantified under dissecting microscope 
- Pipes/outfalls 
  - Sampled during storm event 
  - 4 L water collected using grab sampler 
  - Same process as above 

ACKNOWLEDGEMENTS 
Thanks to my advisor John Weinstein and committee members, Barbara Beckingham, Paul Pennington and Pete Key for their guidance. Also thanks to Rachel Leads for her assistance and training. 

SIGNIFICANCE 
- Limited data exists on tire wear particles in the marine environment – fill in knowledge gaps 
- Help make better informed storm water management decisions 

NEXT STEPS 
- Collect and analyze samples 
- Confirm TWP using micro FT-IR spectroscopy 
- Conduct bioassays using Palaemonetes pugio to determine the toxicity and retention time (ingestion and ventilation) of TWP 
- Analyze samples looking at temporal variation of microplastics in intertidal sediment 

References 