Microplastic Concentration Analysis of the Atlantic Sand Fiddler Crab (*Leptuca pugilator*) in Murrells Inlet, South Carolina

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BACKGROUND AND INTENT

Background

- Current estimate of microplastic (plastic fragmentation < 5 mm in length) concentration within the oceans is **8.3 million microplastics per m² of seawater** (Brandon et al., 2019) resulting in direct and indirect ingestion by marine biota
- **Trophic transfer** of plastic contamination **can potentially damage human cells** and affect immune response, barrier attributes, and oxidative stress (Danopoulos et al., 2021)
- Marsh **fiddler crabs** (*Leptuca pugilator*), a keystone species in intertidal zones, are deposit-feeders, which increase their exposure to microplastics as this feeding strategy requires skimming marsh surfaces for **food particles often compromised with plastic pollution**
- Leading sources of microplastic contamination in the oceans- degradation of larger plastics, synthetic textile fibres, car tire abrasion ➔ Ebb and flow of tides allows microplastics to settle into marsh sediment ➔ Feeding grounds of the fiddler crab are infiltrated

Intent

1. Determine the significance of sex and human development on the frequency of microplastics in fiddler crabs
2. Evaluate the possible causation of microplastics in the local area

METHODOLOGY IN THE MARSH

Marsh systems sampled in Murrells Inlet, SC

1. Oyster Landing- located within Huntington Beach State Park which acts as a buffer to anthropogenic impacts, relatively undeveloped

2. Atlantic Avenue- high residential and commercial development nearby

Collection of 120 adult fiddler crabs of similar size between September and October of 2021

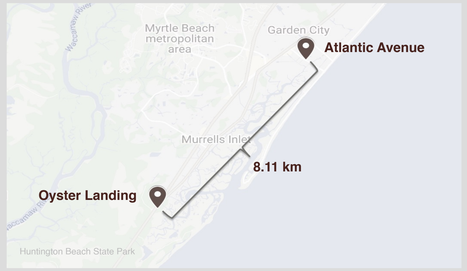


Figure 1: Aerial map view of study sites in Murrells Inlet.

MICROSCOPIC ANALYSIS OF CRAB EXCREMENT

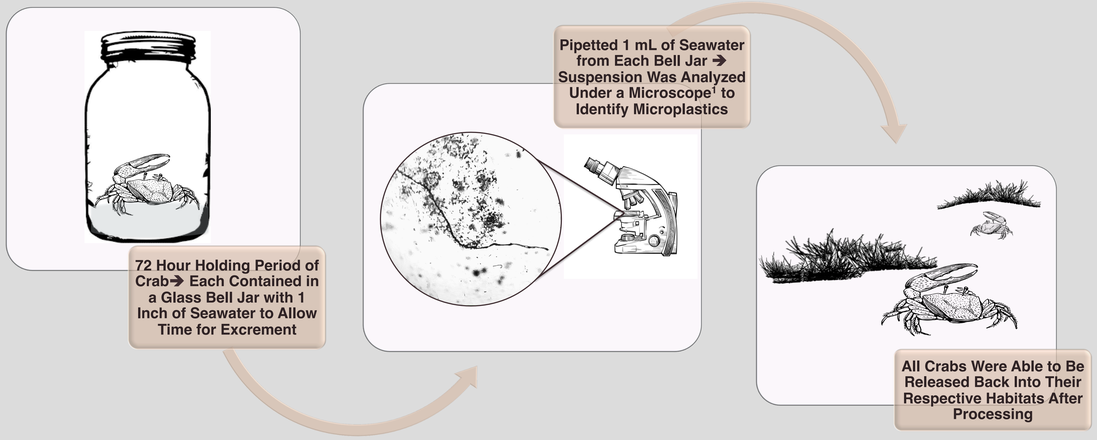


Figure 2. Lab protocol for processing the 120 crab sample population.
[1]Actual scope view of a sample displaying an identified microplastic

RESULTS

Microplastic Quantity vs. Marsh Location:

SALIENT FINDINGS

1. SIGNIFICANT DIFFERENCE IN QUANTITY OF MICROPLASTICS BETWEEN MARSHES
2. MICROPLASTIC FREQUENCY INCREASED WITH HUMAN PROXIMITY

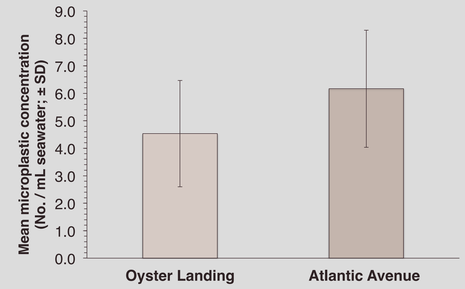
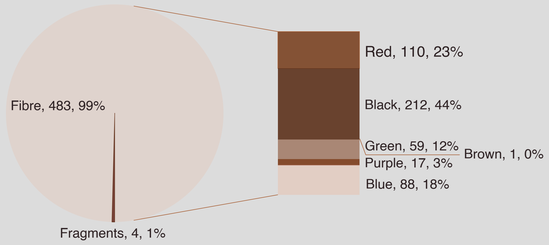


Figure 3. Average quantity of microplastics within a one mL sample between the two marsh systems. Standard deviation bars for the y-axis. Significant difference in microplastic concentration between the two locations (t-test, $P < 0.00$, $df = 119$, $t = 19.302$).

Microplastic Quantity vs. Coloration and Type:



SALIENT FINDINGS

PRIMARY MICROPLASTICS (FIBRE) WERE THE OVERWHELMING MAJORITY IDENTIFIED

Figure 4. Types of microplastic identified with further distinction of color distribution.

Microplastic Quantity vs. Sex of Fiddler Crab:

SALIENT FINDINGS

NO SIGNIFICANT DIFFERENCE IN QUANTITY OF MICROPLASTICS BETWEEN MALES AND FEMALES

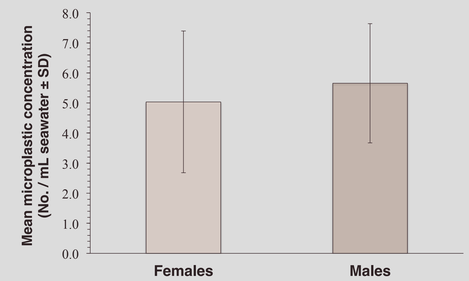


Figure 5. Average quantity of microplastics within a one mL sample between female and male crabs. Standard deviation bars for the y-axis. No significant difference in microplastic concentration between the two sexes (t-test, $P = 0.120$, $df = 119$, $t = 2.454$).

CONCLUSIONS AND FUTURE WORK

Conclusions

1. Proximity to metropolitan area significantly increased microplastic concentration in fiddler crabs
2. As fibre was the most abundant microplastic identified, the laundering of synthetic clothing is a relevant threat facing the Murrells Inlet marsh systems
3. Location holds greater significance than sex on microplastic concentration in fiddler crabs

Future Work

- Determining microplastic content in a predator species (blue crab, red drum, spotted bass, etc.) of the fiddler crab to measure the scope of **biomagnification in the area**

REFERENCES
Brandon, A.B., Freibott, A., Sala, M.L., 2019. Patterns of suspended and salp-ingested microplastic debris in t he North Pacific investigated with epifluorescence microscopy. Limnol. Oceanogr. 5, 46-53.
Danopoulos E., Twiddy, M., West, R., Rotchell, M.J., 2021. A rapid review and meta-regression analyses of the toxicological impacts of microplastic exposure in human cells. J. Hazard. Mat. 427.