



Final Presentation - Ingestion of Common Microplastics

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Background: Microplastics in Crabs

Impacts of exposure to microplastics:

Mangrove crab (Capparelli et al. 2024):

- increased accumulation of lead

Pacific Mole Crab (Horn et al. 2019):

- increased adult mortality
- decreased retention in egg clutches

Purple Shore Crab (Prestholdt and Kemp 2020):


- Avoidance of plastics

Research article

Synergistic effects of microplastic and lead trigger physiological and biochemical impairment in a mangrove crab

SPECIAL ISSUE-LETTER

Effects of environmentally relevant concentrations of microplastic fibers on Pacific mole crab (*Emerita analoga*) mortality and reproduction

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Short Communication

The effects of anthropogenic marine debris on the behavior of the purple shore crab, *Hemigrapsus nudus*

Tara E. Prestholdt , Luke Kemp



Research Question:

Do microplastics impact oxygen uptake in hairy shore crabs and/or accumulate in their gills and tissues?

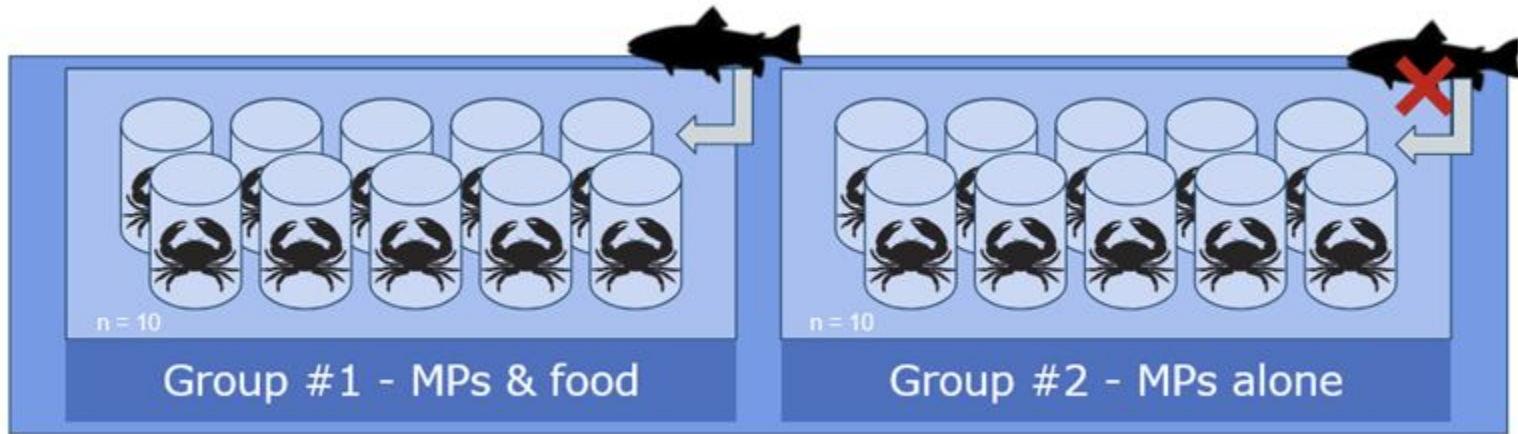


Objective: Hypothesis & Null-Hypothesis

H_0 : No impact of oxygen uptake and microplastics will not accumulate

H_A : Decreased oxygen uptake and microplastic accumulation in gut and gills

Experimental Design: Set-Up



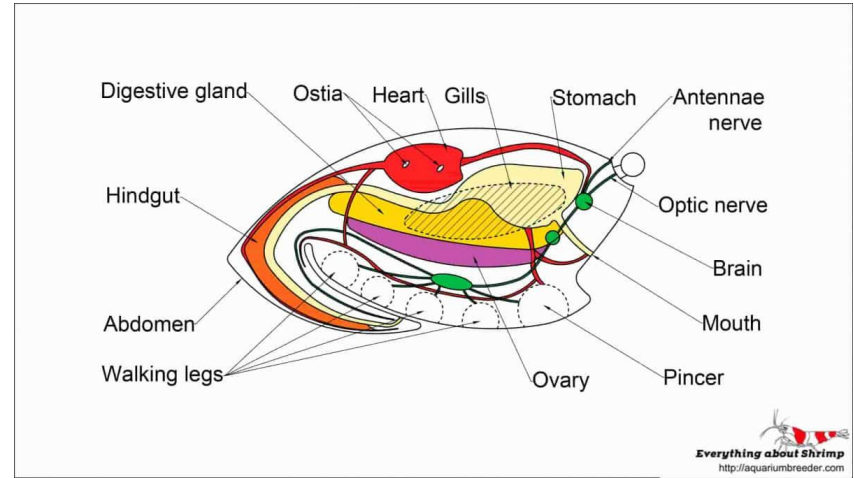
Experimental Design: Choice of Plastic

- “Recycled” plastic, simulating what’s available in the water column rather than a specific isolated type of plastic.
- Blue color easily visible against beige crab tissues



Experimental Design: Data Collection

- Claw hemolymph extracted- tested for L-lactate concentration
- At end of experiment, all crabs weighed & dissected
- Examining digestive tract & gills for plastic particles



Complications & Adjustments



Mass mortality event

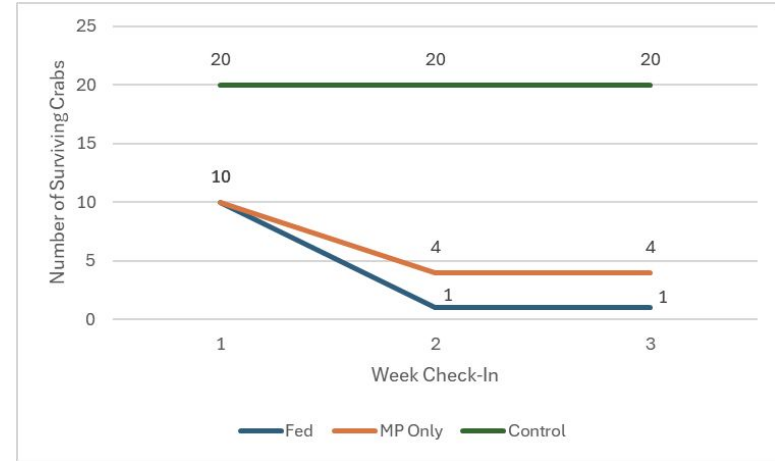
- Group A: 60% Mortality Rate
- Group B: 90% Mortality Rate

Causes

- Hypoxia: Low Oxygen saturation due to restrictive water flow
- Ammonium Toxicity: Toxic compounds from decaying food matter

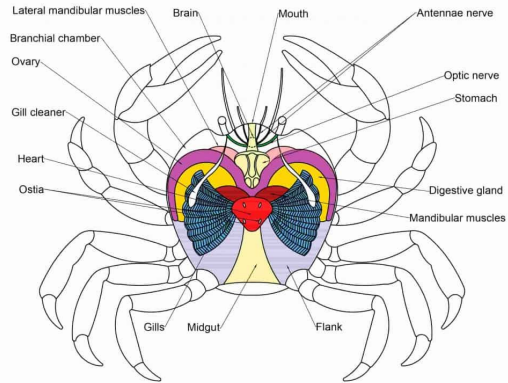
Adjustments

- Transition from individualized jars to communal tank setups
- All MP and food matter was also transferred into the tank setups

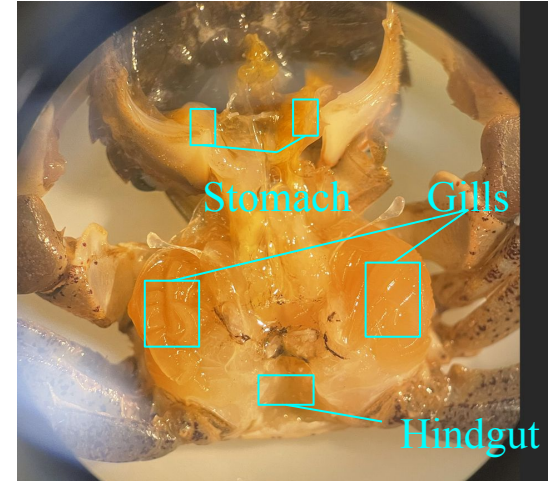


Dissections & Accumulation

Top view

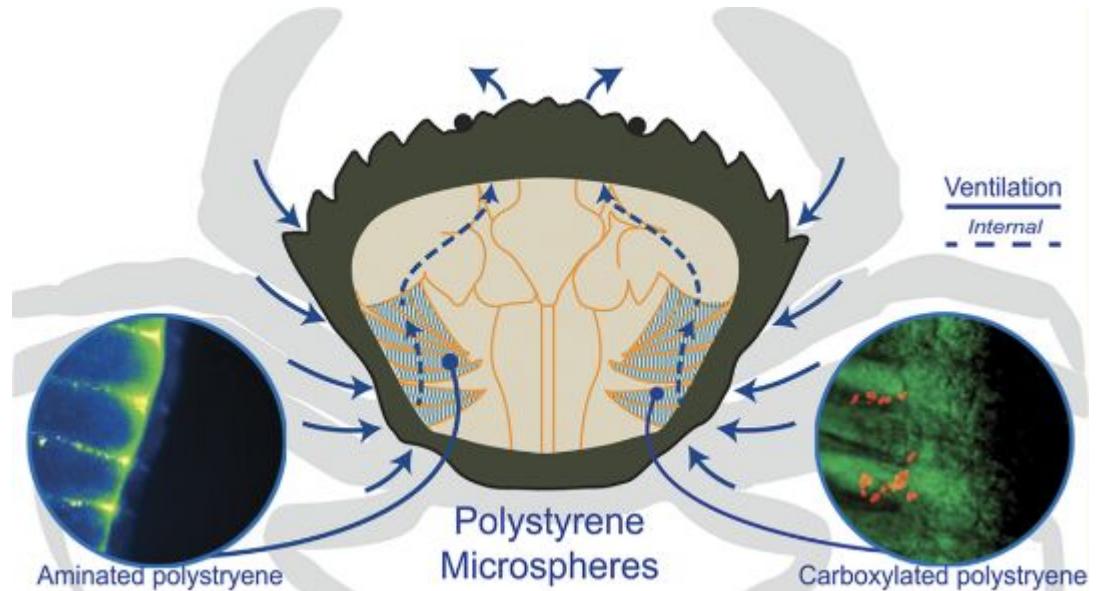


Everything about shrimp
<http://aquariumbreeder.com>



Comparison to Green Crabs

No accumulation,
unable to compare to *C. maenas*



Watts et al. 2016

Lactate

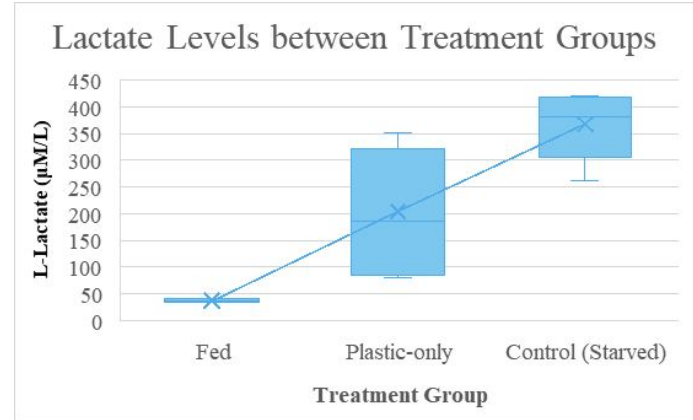
Control groups - Group FOUL and Group CAFF

- Average ~ 300 micromolar lactate

Experimental group

- Group PLAST - Fed: ~40 micromolar lactate
- Group PLAST - Fast: ~200 micromolar lactate

Control groups and PLAST Fast had larger sample sizes (Between 3 to 5 crabs per sample group)



Implications



Pilot studies are important

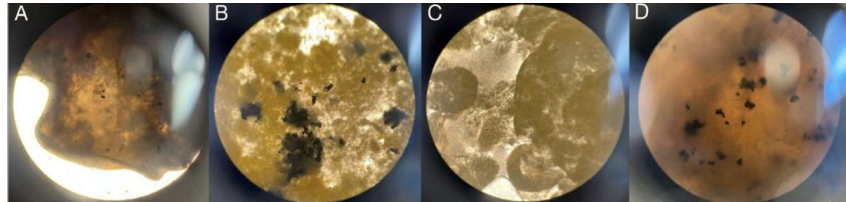
- Fully communal tank design vs. individual jar design to minimize hypoxia and nitrogen toxicity
- Collect behavioral data
- Perform water changes daily as opposed to a bi-weekly structure
 - Allows for prompt diagnosis of novel issues
 - Dead crabs can be preserved faster to prevent internal organ decay & loss of specimen for visual analysis

Data Analysis

- Small sample size implies less conclusive findings
- Mortality caused limitations on what assays could be done

Implications

- Fed individual had lower lactate than both control and plastic only group.
- Lactate is proportional to anaerobic respiration, which is a stress response
- Possible reasons:
 - Low Fed
 - Reduced food stress
 - Hearty individual
 - Higher MP
 - Particulate stress
 - HDPE toxicants
- Lack of consumption compared to FISH 497C Tire Tread Team 2024
 - Our HDPE was...
 - Buoyant
 - Colored brightly
 - Hard and non-porous



Future

CLASSIFY

PLASTIC A -> SP.A

PLASTIC B -> SP.B

SURVEY

20% PLASTIC A

80% PLASTIC B

PROTECT

SPECIES B > A

- Plastic type likely has some impact
 - Classifying plastics risk, I.E. species specific bioavailability
 - Allows risk assessment if a pollution survey is conducted
- Recycled hard plastics may be less detrimental to crab populations than tire tread
 - Efforts to reduce runoff from road -> ocean
 - Prevention/cleanup of tire dumping



Conclusion

Key takeaways:

- Low lactate levels in Fed individual
 - Lactate = stress
- The type of plastic could have an impact in ingestion rates
 - “Food like” plastic actually consumed
- Bioavailability based risk assessment

