A first look at microplastics in juvenile Striped Bass

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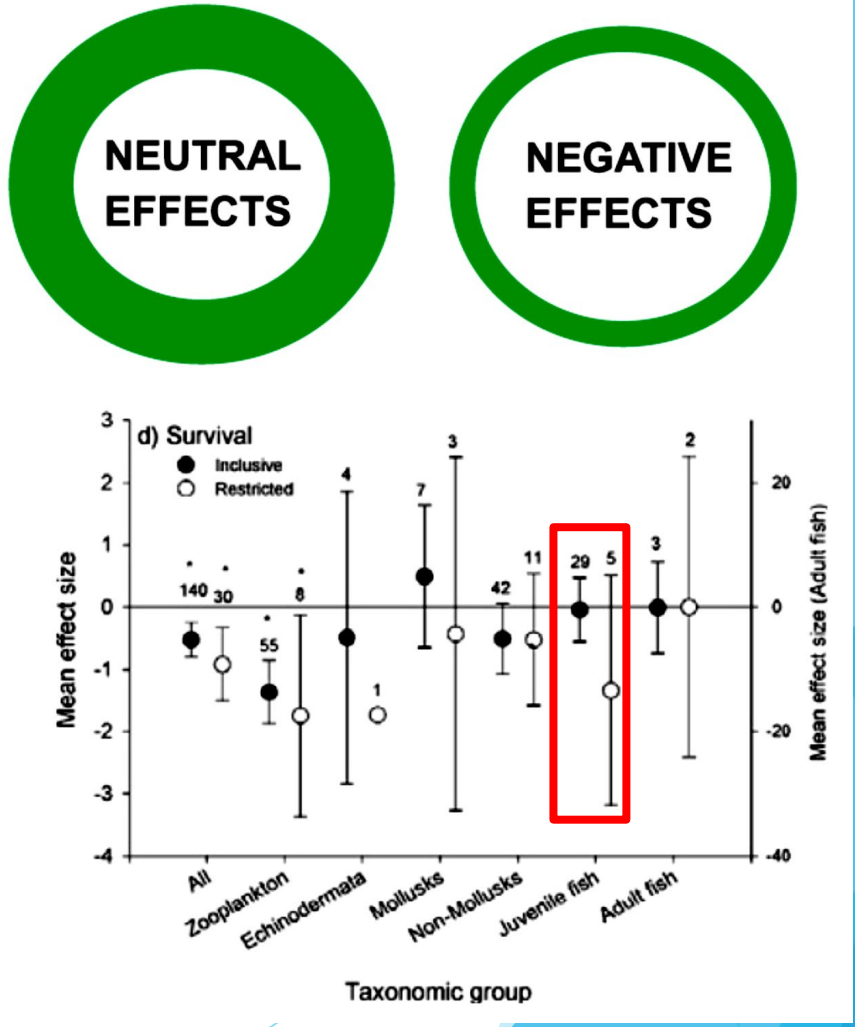
Potential risks from microplastics ingestion and/or nanoplastics assimilation

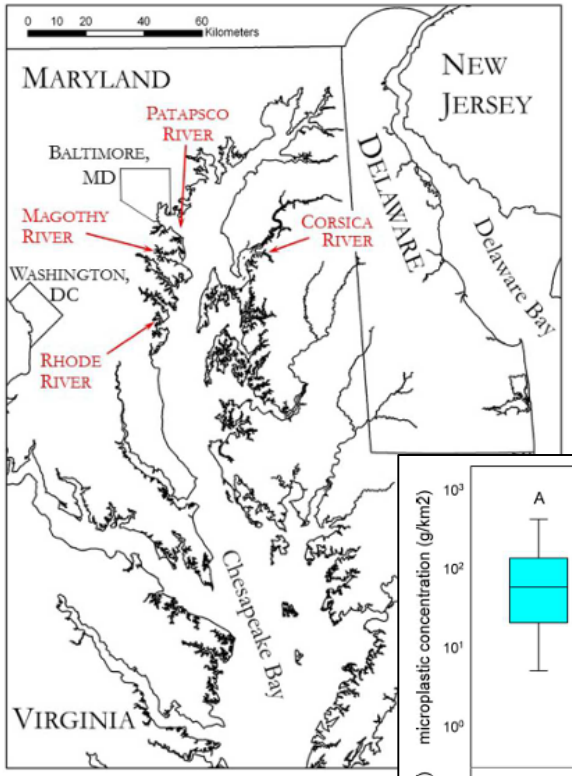
- Microplastics (MPs) are everywhere
- MP disruption pathways in fish
  - Physical (e.g., blockage, satiation, energetic)
  - Biochemical (e.g., hormonal, metabolic, oxidative stress, immunological, neurotoxicological, genotoxicological)
  - Potential vector for metals and organic contaminants
- Common effects
  - Reduced consumption (growth, survival, condition)



Jovanović 2017, Foley et al. 2018, Bhuyan 2022

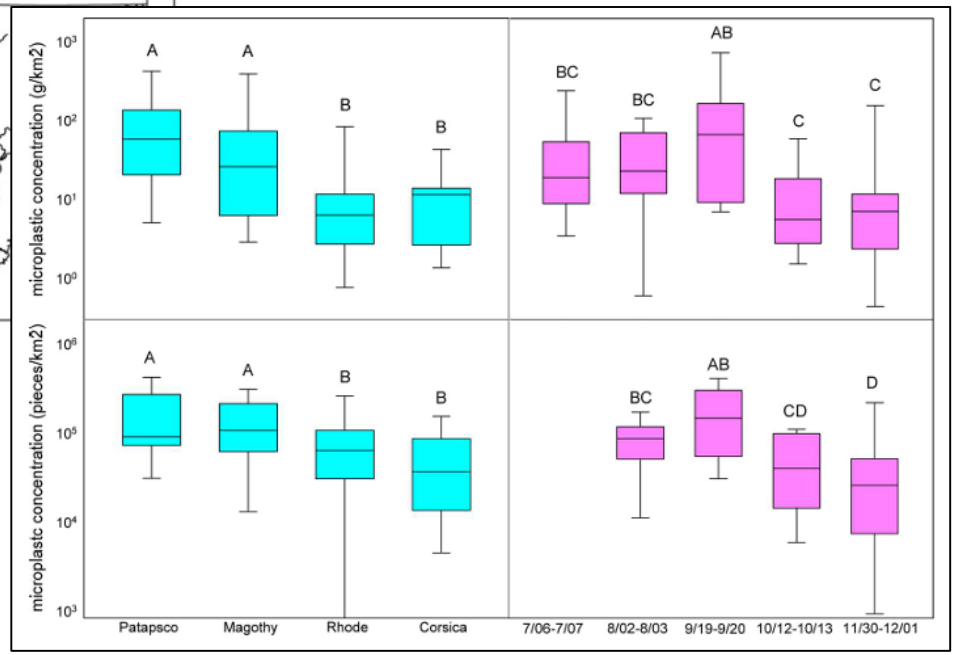
MPs prevalent in Chesapeake Bay ecosystem

Multiple tributaries

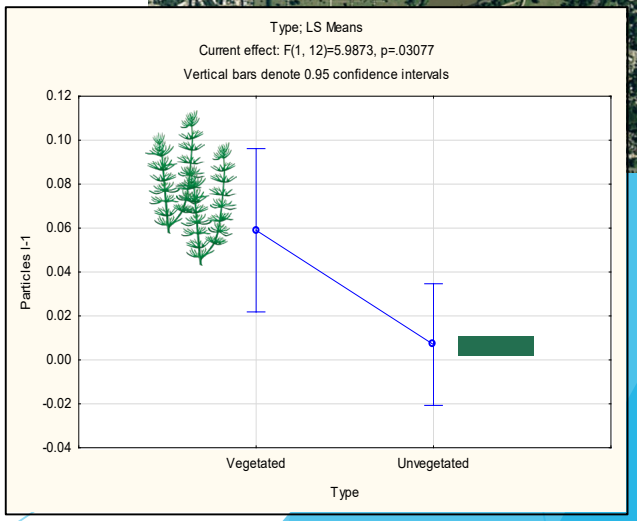


MPs present in all ecosystems surveyed to date

- Relationship between (sub)watershed population and MP concentration
- Habitat specific differences in local concentrations (e.g., SAV vs bare sediment)



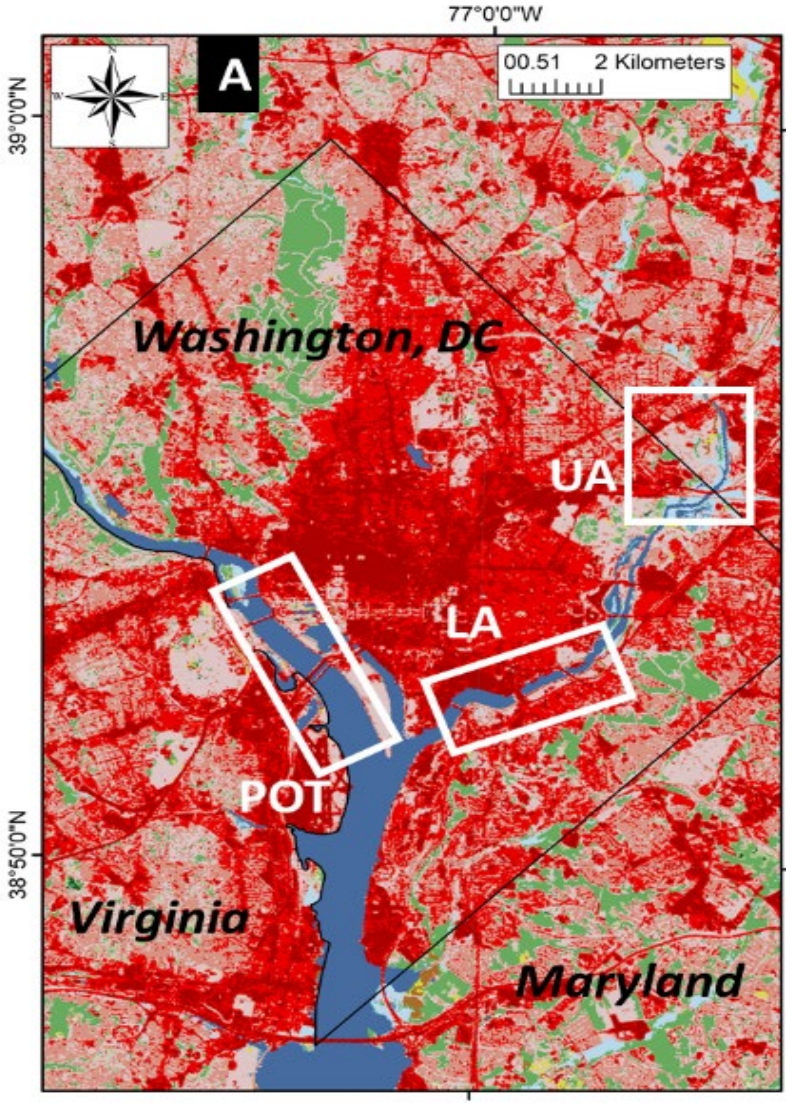
Anacostia River



Yonkos et al. 2014, Tetra Tech 2019

MPs prevalent in Chesapeake Bay fishes

Potomac/Anacostia River

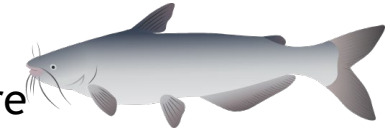


MPs in all functional groups of fish examined

- Stomachs only
- Killifish, Sunfish, Large/Smallmouth Bass, Blue Catfish, Northern Snakehead
- 0-9 MPs per individual
- Fibers (dominant), particles and macroplastics
- Inversely correlated with HSI and stomach fullness

Functional groups of fish

Benthic omnivore



Piscivore/ Invertivore

Invertivore

Planktivore/ Zoobenthivore

Sampling via electroshocking

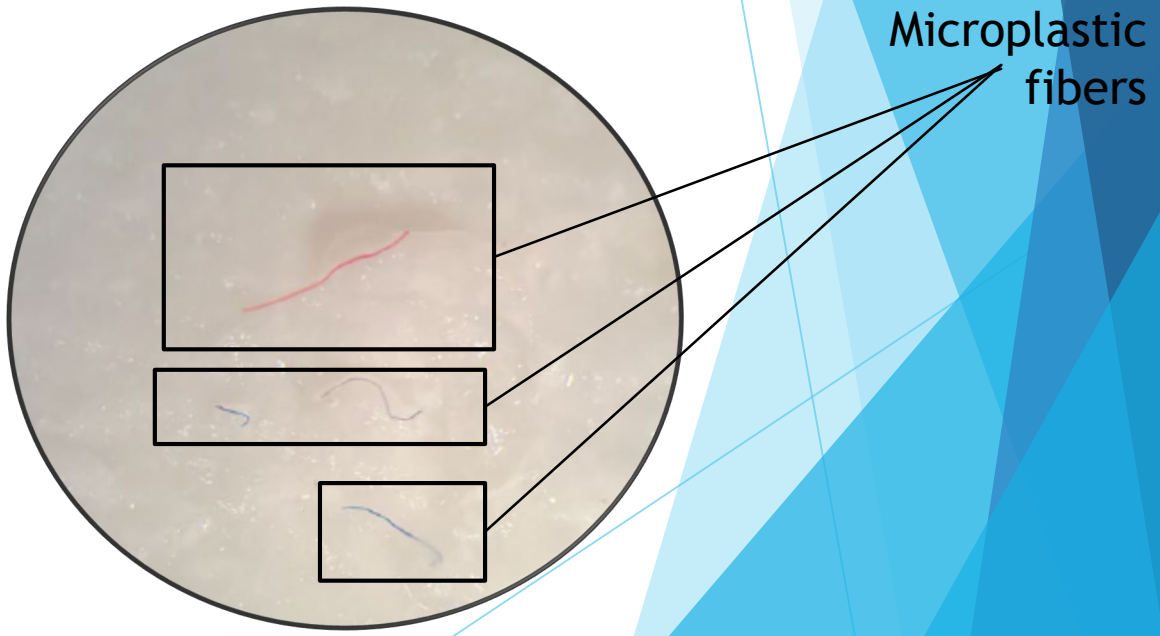
IAN.umces.edu (images), Murphy and Woodland 2022, Murphy and Woodland *unpublished*

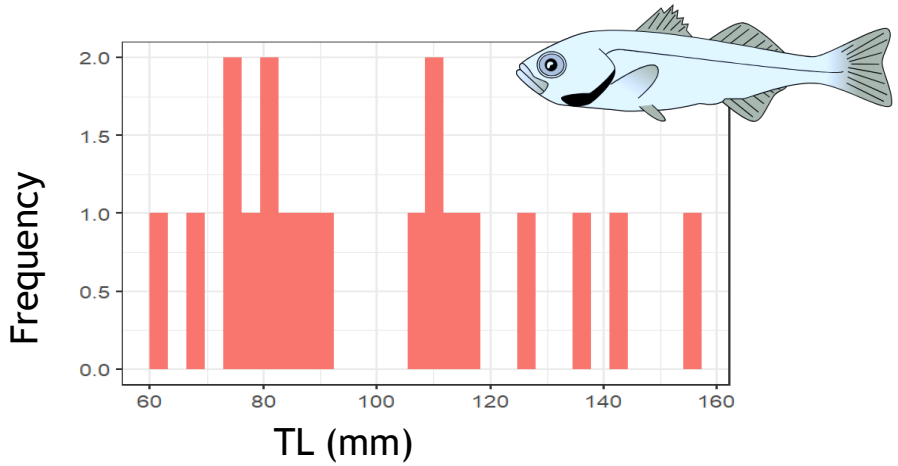
A pilot dataset of YOY juvenile Striped Bass from the Lower Potomac River

Image credit: https://www.cbf.org

MPs found in YOY Striped Bass in Potomac

- Approx. 25% of YOY striped bass had MPs (N = 25)
- MP counts of 0-2 per fish
- GLM → inverse relationship with HSI but not SCI or LWI



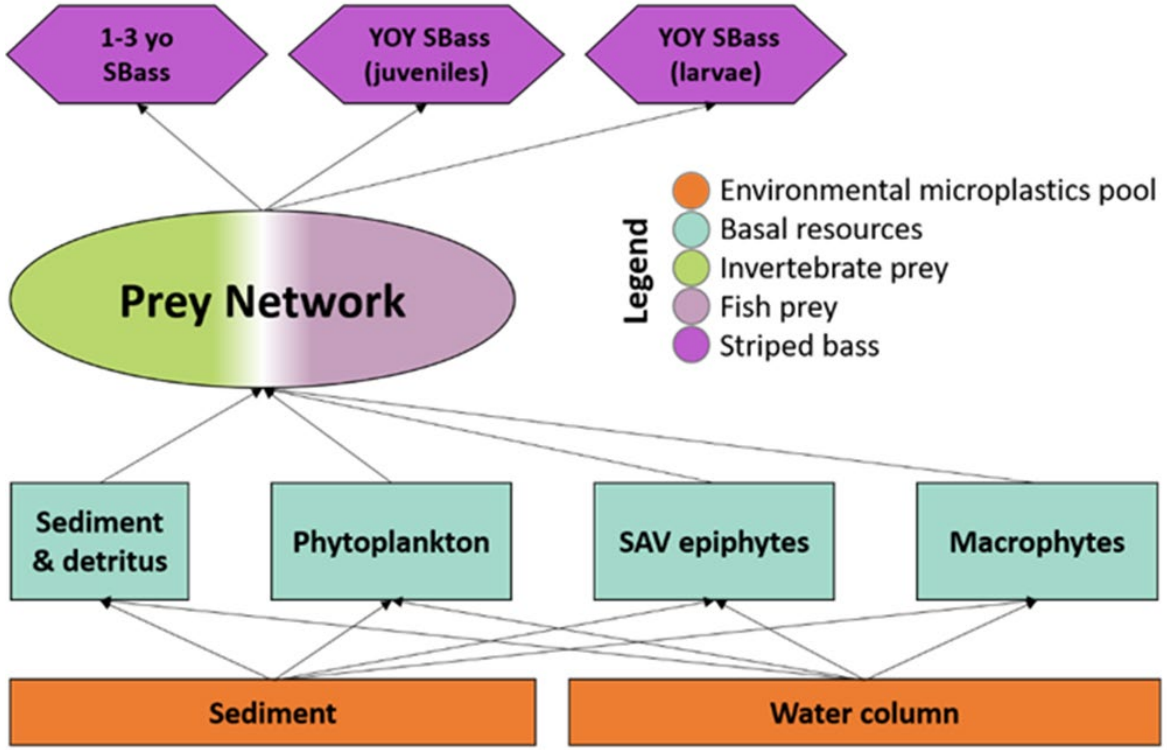


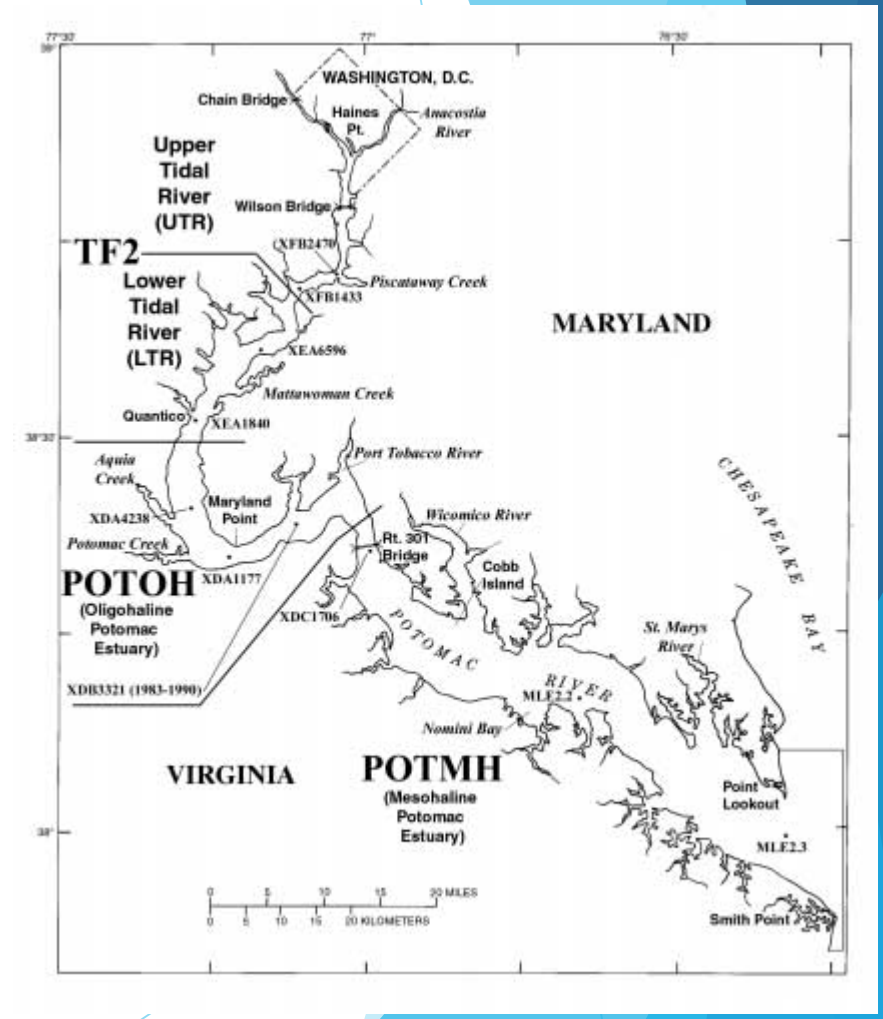
Murphy and Woodland 2022, Murphy and Woodland unpublished

Striped Bass Ecological Risk Assessment

Literature study of prey for Chesapeake Bay Striped Bass

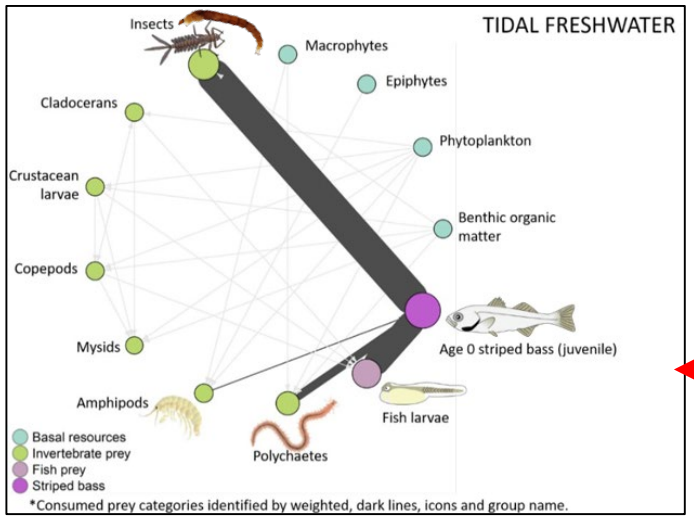
- Trophic uptake > ambient uptake of MPs (lab studies)
- Environmental sources and transfer pathways to YOY Striped Bass

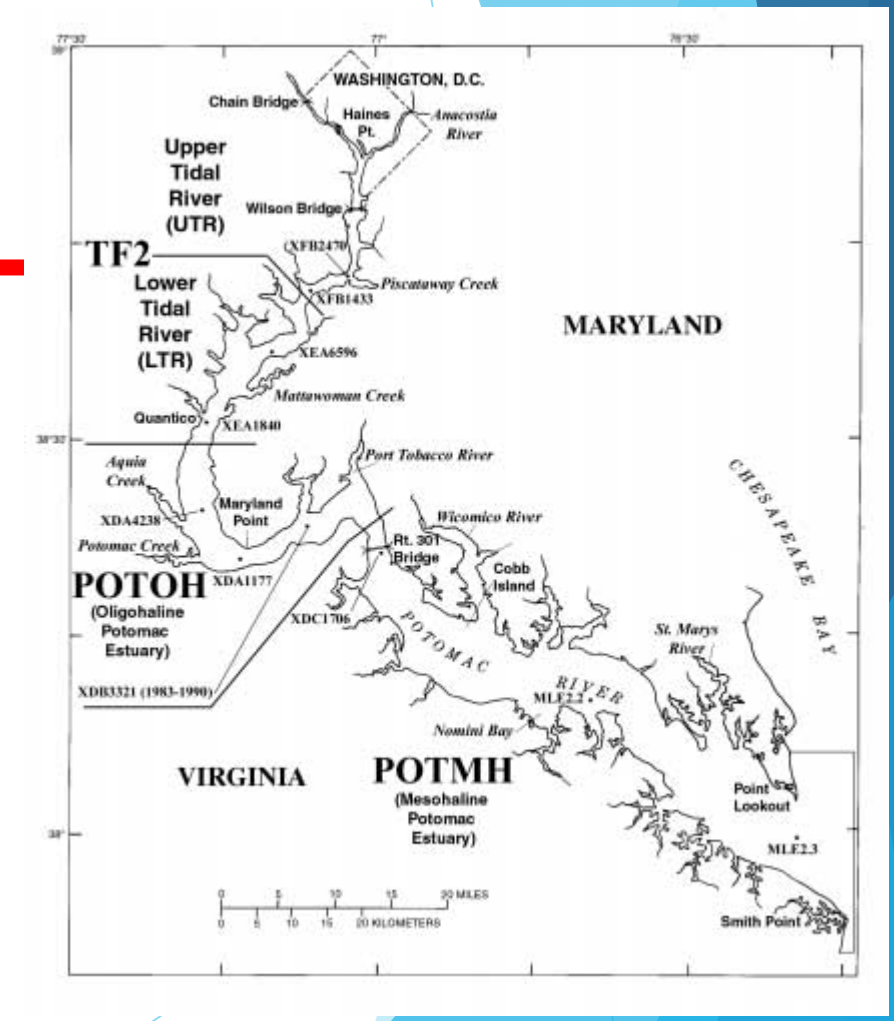




Murphy et al. 2020

Semi-quantitative predator-prey interactions





Boynton et al. 1981, Murphy et al. 2020

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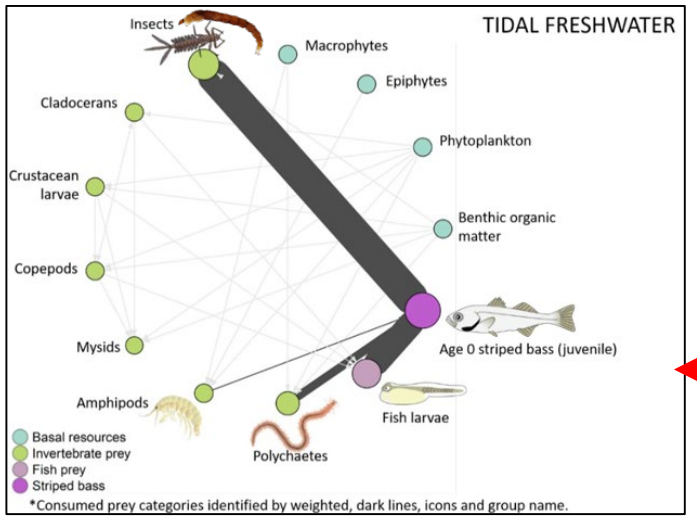

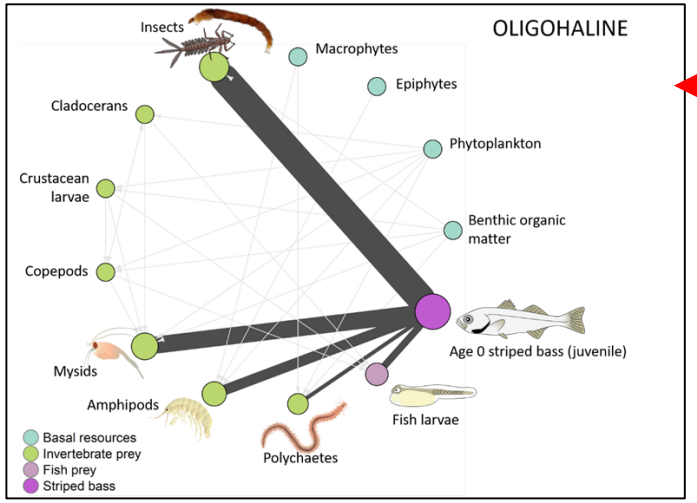

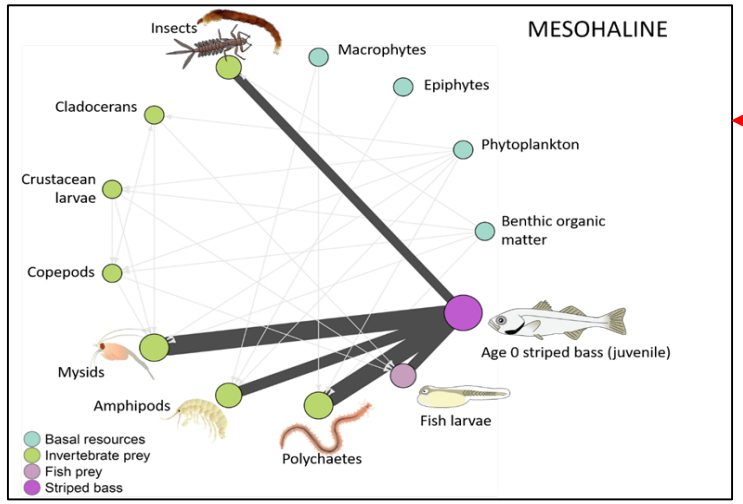

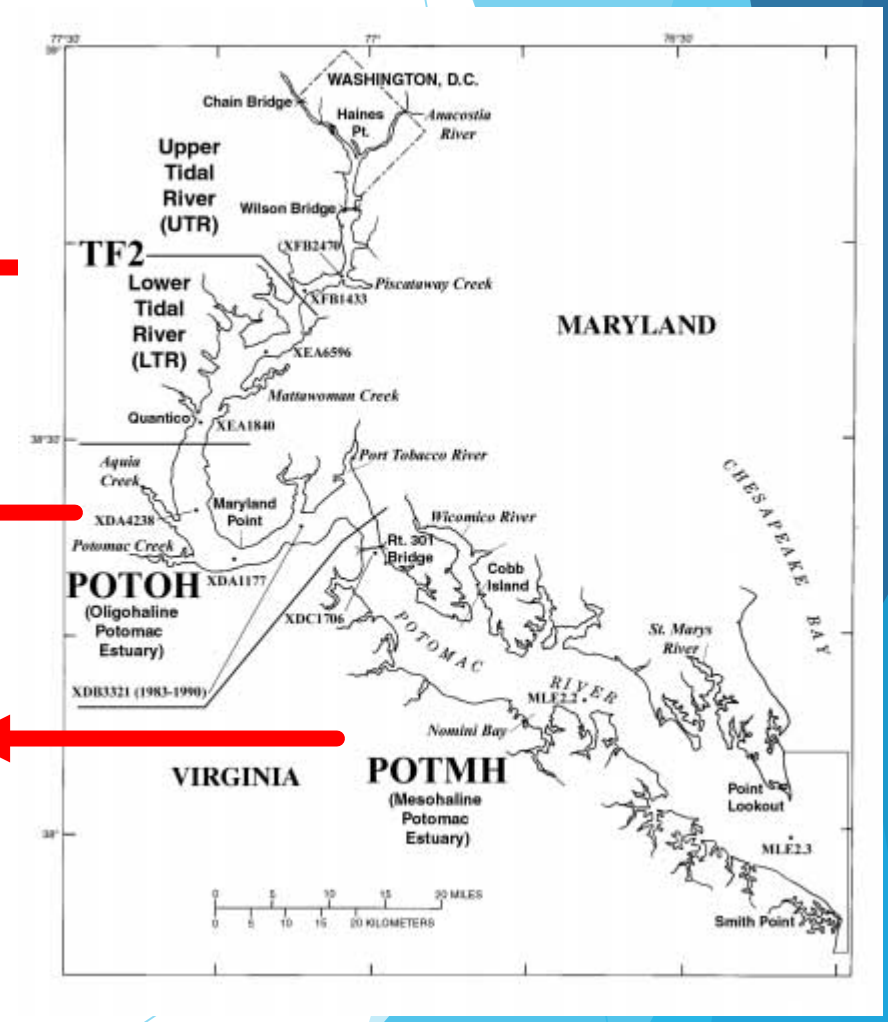

Boynton et al. 1981, Murphy et al. 2020

Priority prey items for Striped Bass

	Age-0				Age-1	Age-2	
	Larval	Juvenile			SA	SA	
Prey category	OLIGO	TF	OLIGO	MESO	MAIN	MAIN	Priority-level
Insects		47.5	40	12.5			
Cladocerans	26.2						
Larval zooplankton	1						
Adult copepods	40.3						
Bivalves					0.9	1.2	
Mysids		0	24.5	27	4.5	21	
Amphipods		1.5	15	15.5	1.9	5	
Other crustaceans					2.8	4	
Polychaetes		12	5.5	25	4.4	9.4	
Bay Anchovy					57.8	15.6	
Fish larvae		35.5	10	14			
Atl. Menhaden					1.9	17.9	
Other fish					7.6	8	

Diet of resident life-stages of Striped Bass in Chesapeake Bay

Beaven and Mihursky 1980, Boynton et al. 1981, Ihde et al. 2015, Murphy et al. 2020, *and others*

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Focus on YOY juvenile life-stage specifically (Potomac R. data)

Beaven and Mihursky 1980, Boynton et al. 1981, Ihde et al. 2015, Murphy et al. 2020, *and others*

Priority prey items for Striped Bass

Historical priority prey

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Reported MP loads from literature (global)

(1-3)

(1-38)

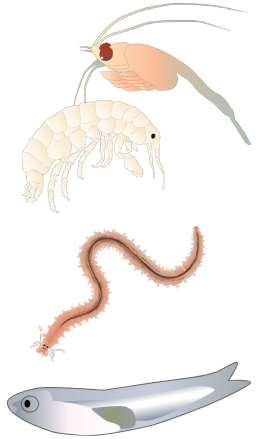
(1-73)

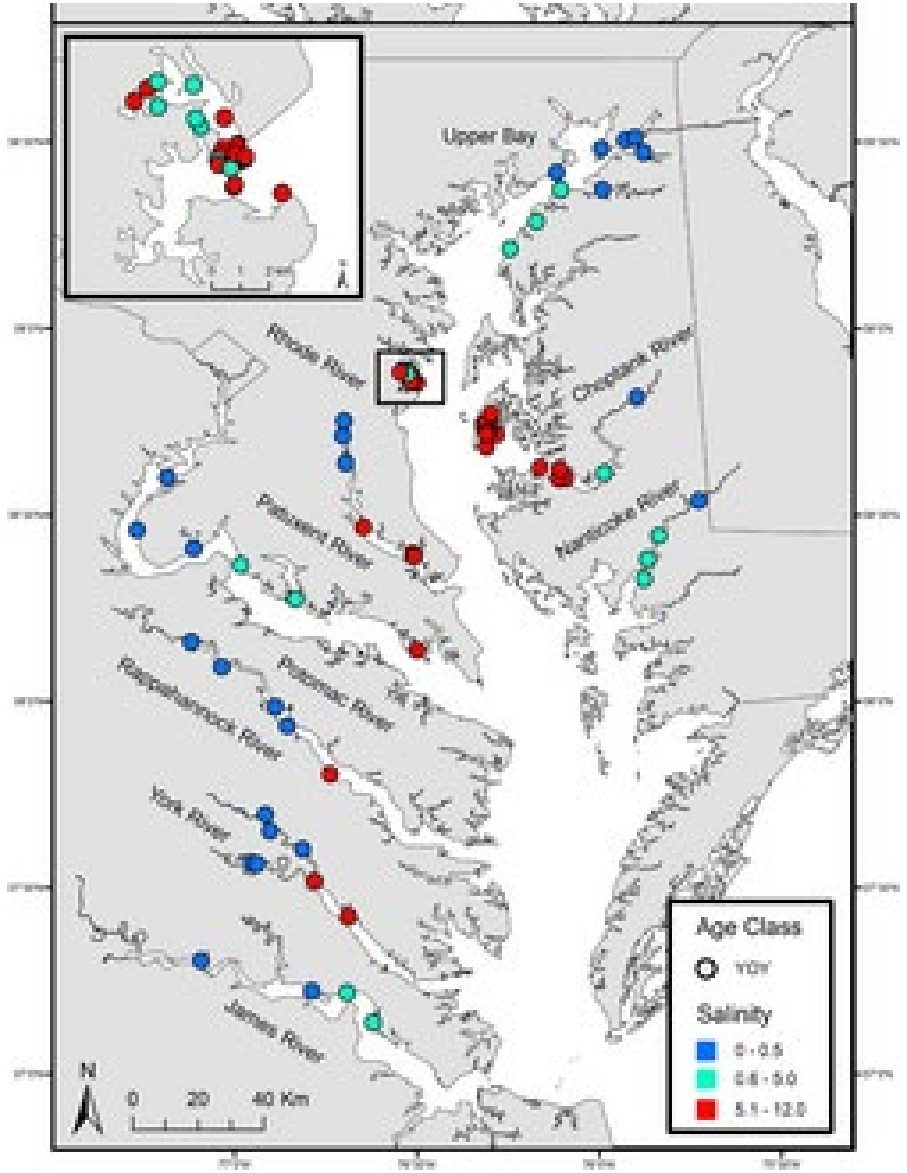
(1-4 [179])

Beaven and Mihursky 1980, Boynton et al. 1981, Ihde et al. 2015, Murphy et al. 2020, *and others*

Priority prey items for Striped Bass

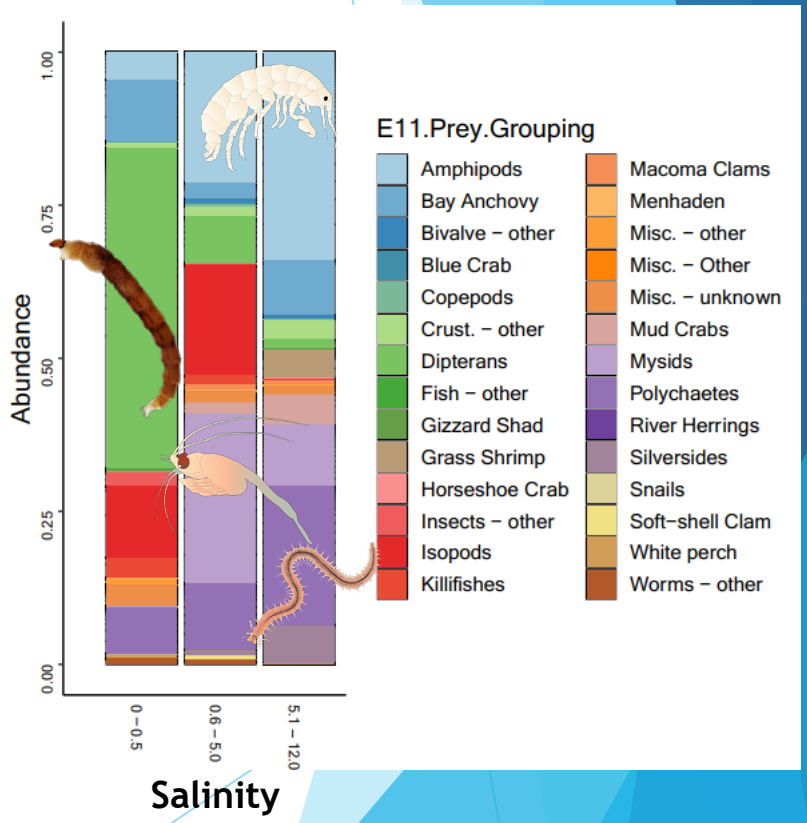
Historical priority prey





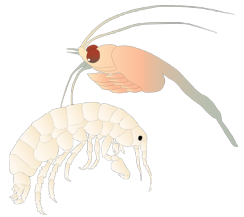
Pagenkopp Lohan et al. 2023

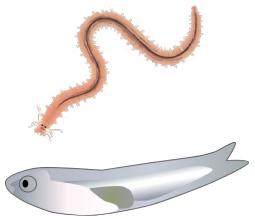
Recent (genetic) diet data show very similar patterns

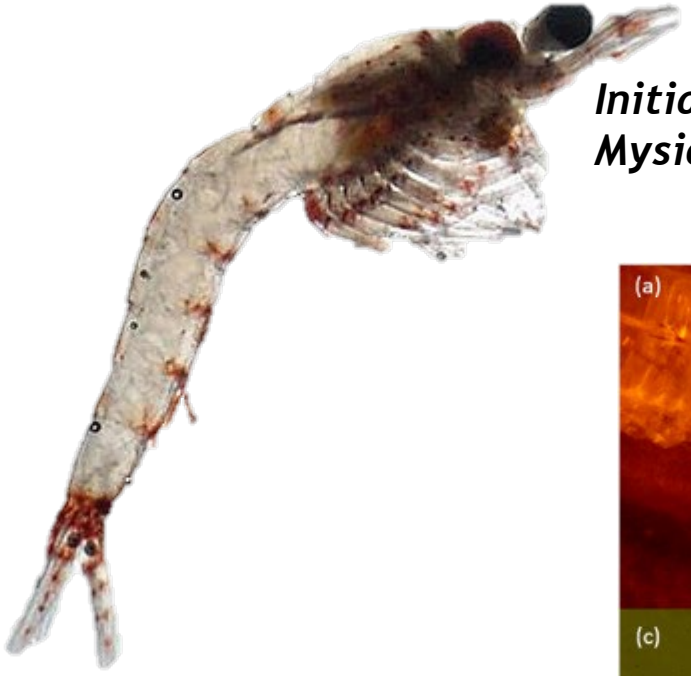


Priority prey items for Striped Bass

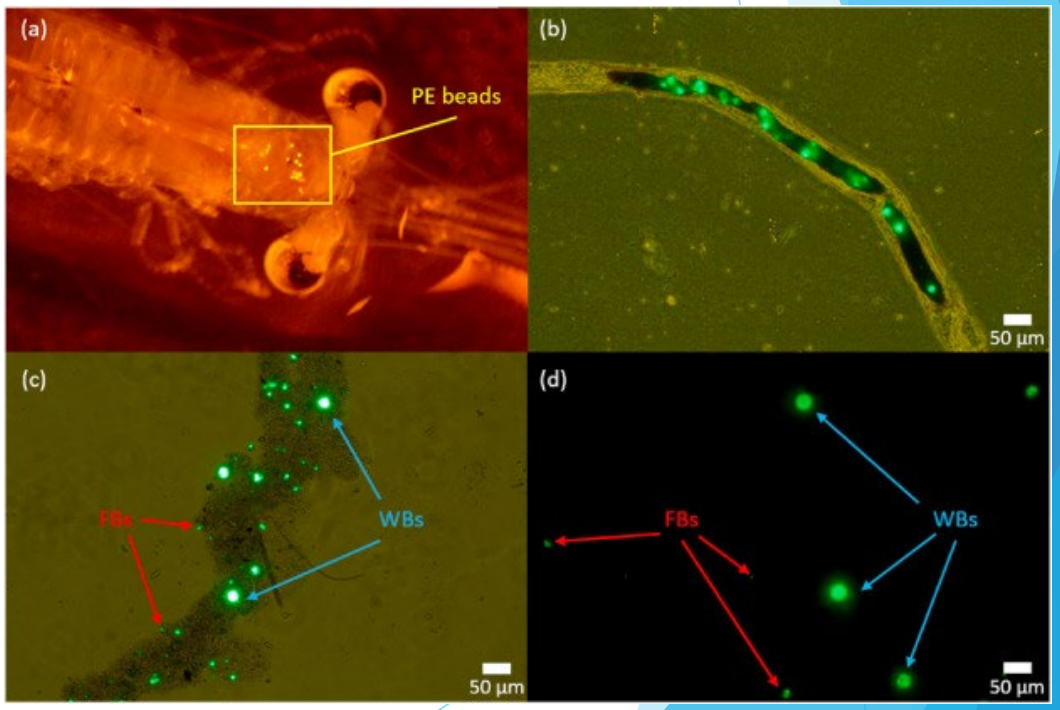
Historical priority prey







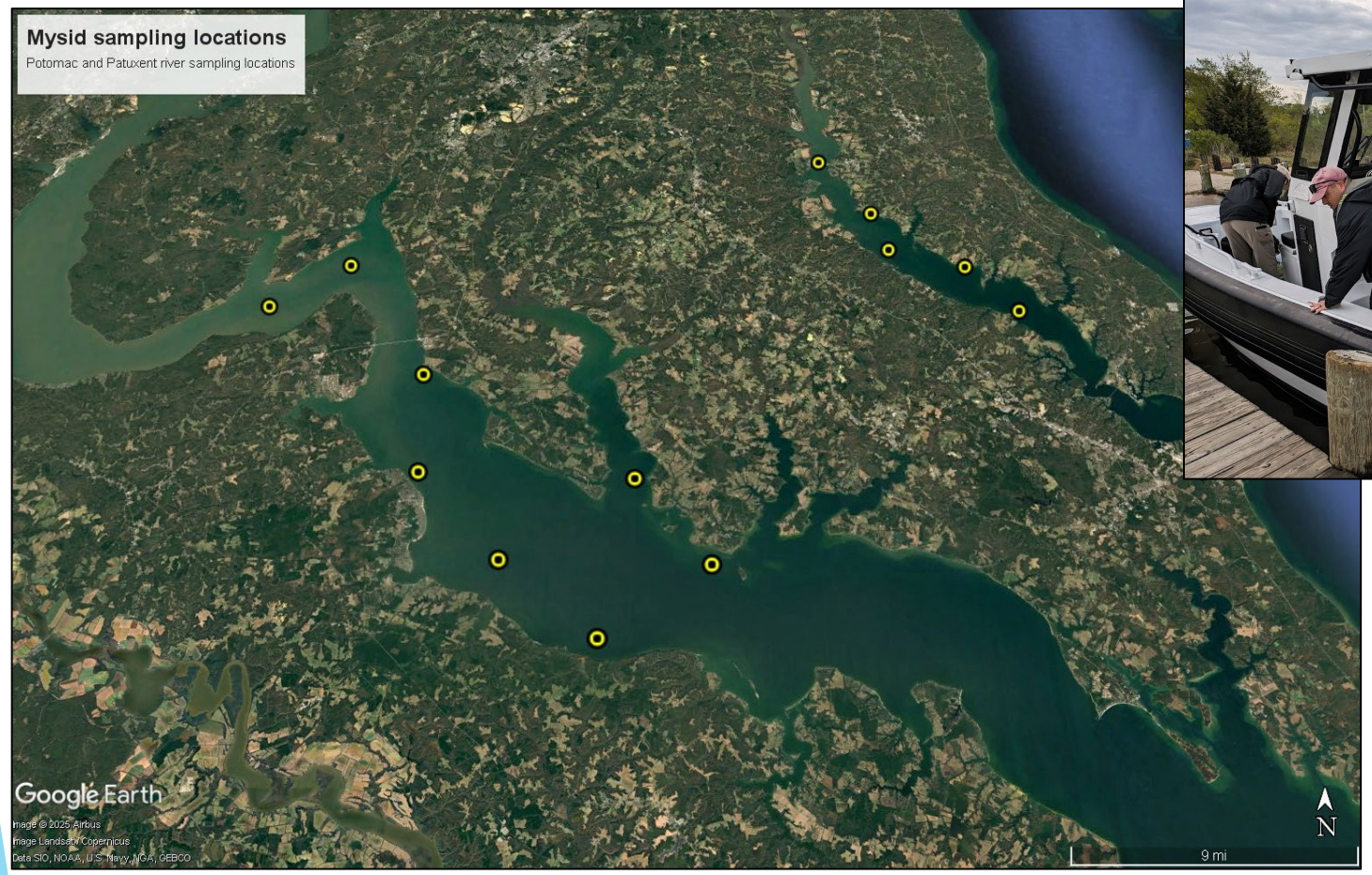
Initial focal prey item:
Mysid "shrimp"



Beaven and Mihursky 1980, Boynton et al. 1981, Ihde et al. 2015, Murphy et al. 2020, Pagenkopp Lohan et al. 2023

Current MP research: Mysids as a vector for trophic transfer to YOY striped bass

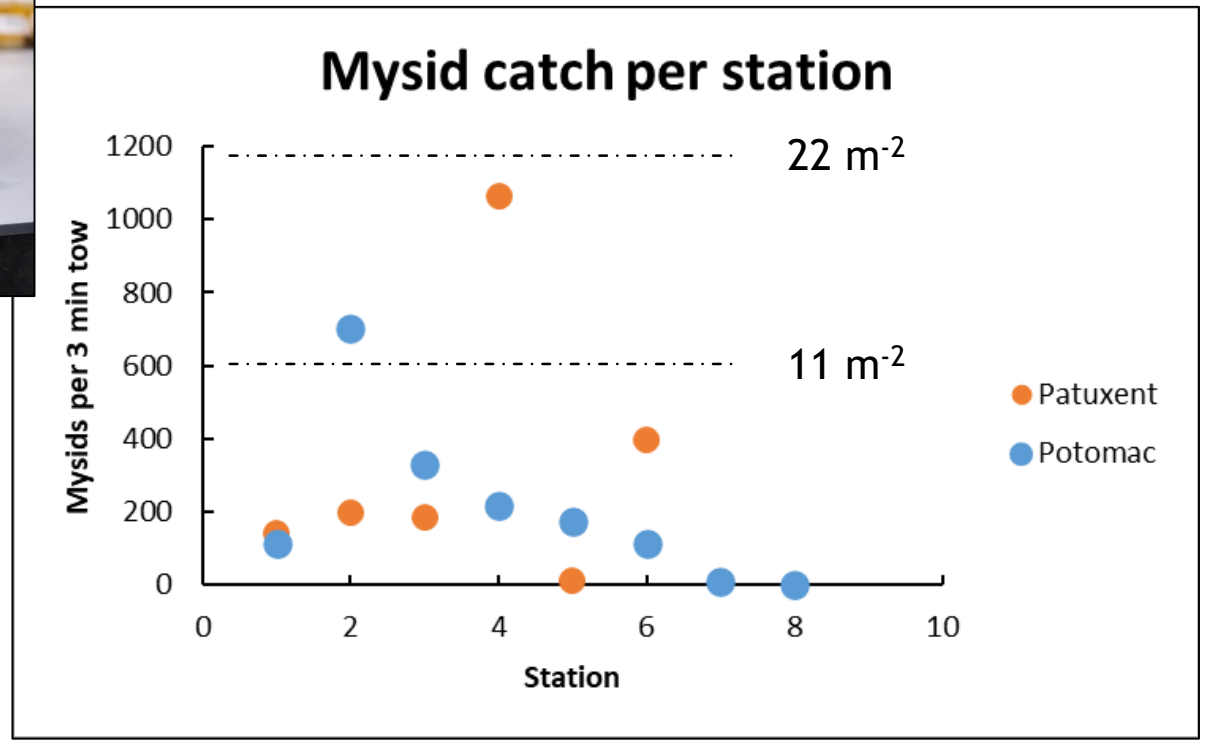
Late spring sampling of Potomac and Patuxent River (3-5 m site depth)

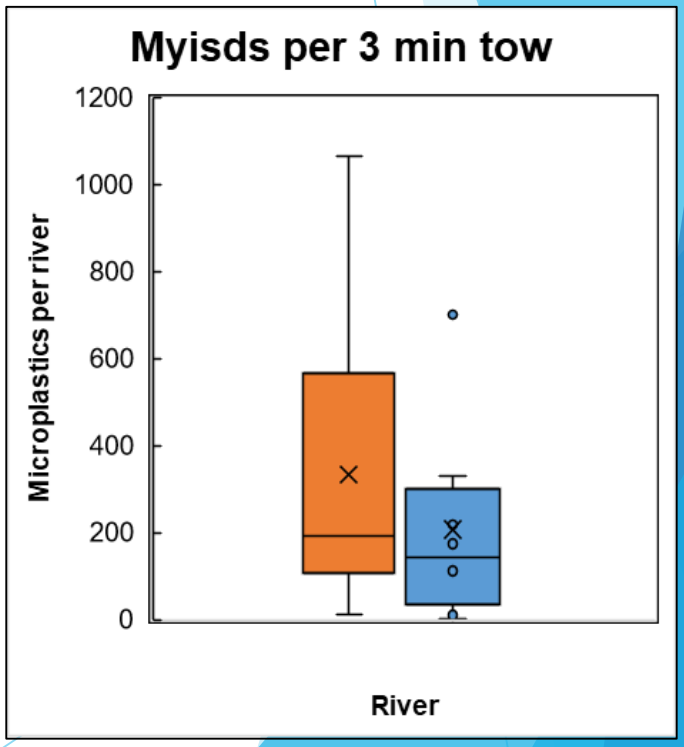


3-min tow, area sampled ~56 sq-m per tow

Current MP research: Mysids as a vector for trophic transfer to YOY striped bass

Sorting, identifying and counting mysids from each site





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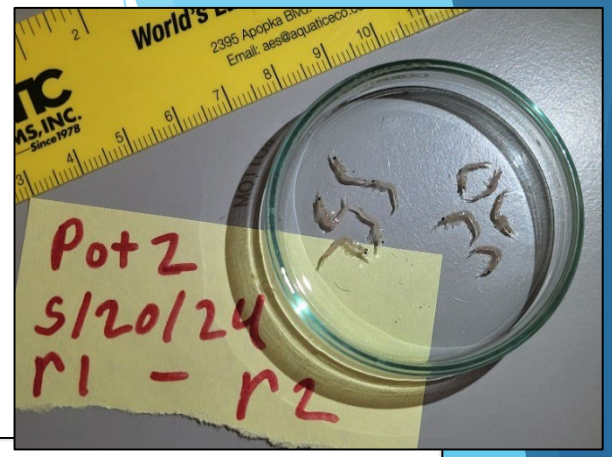
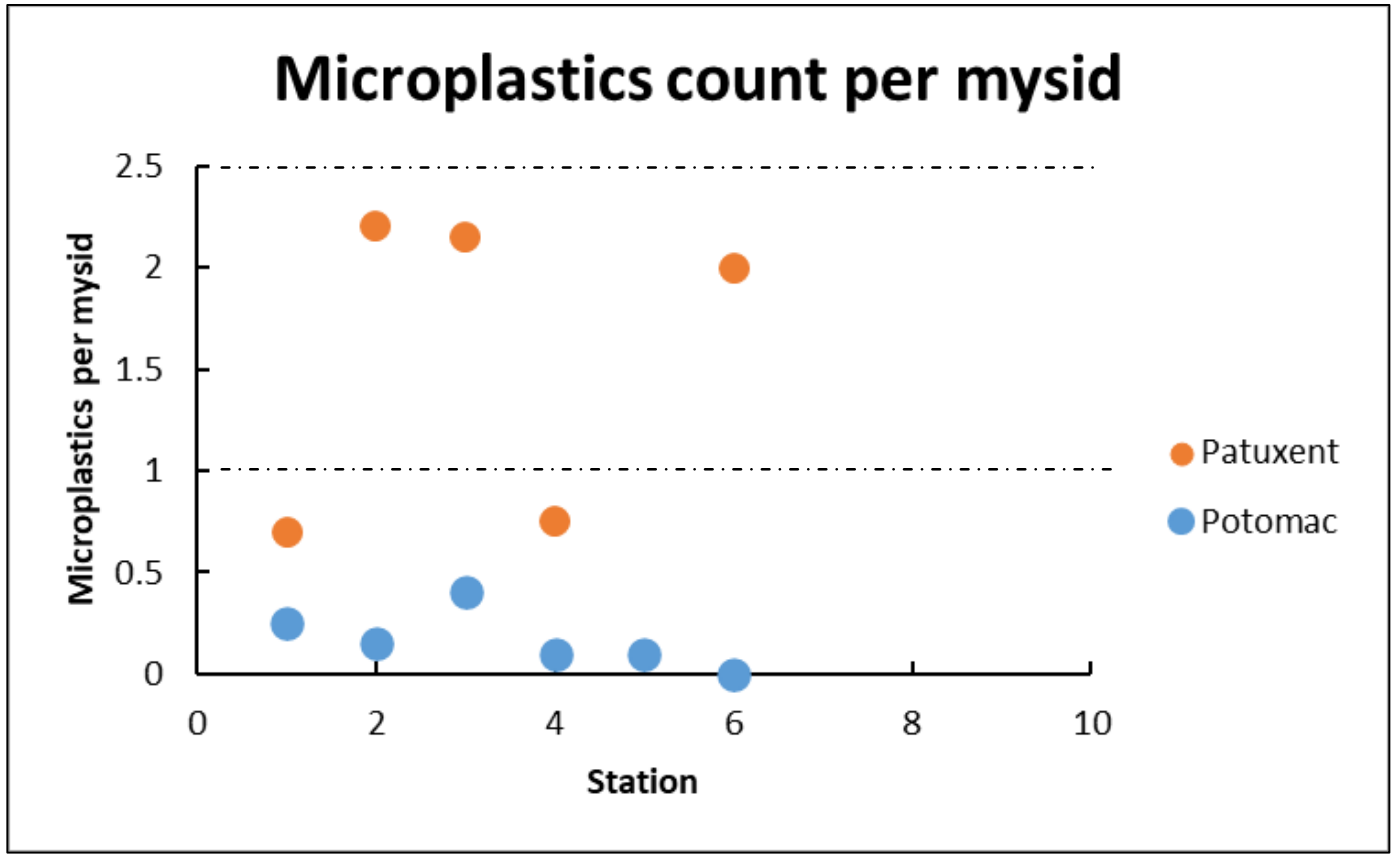
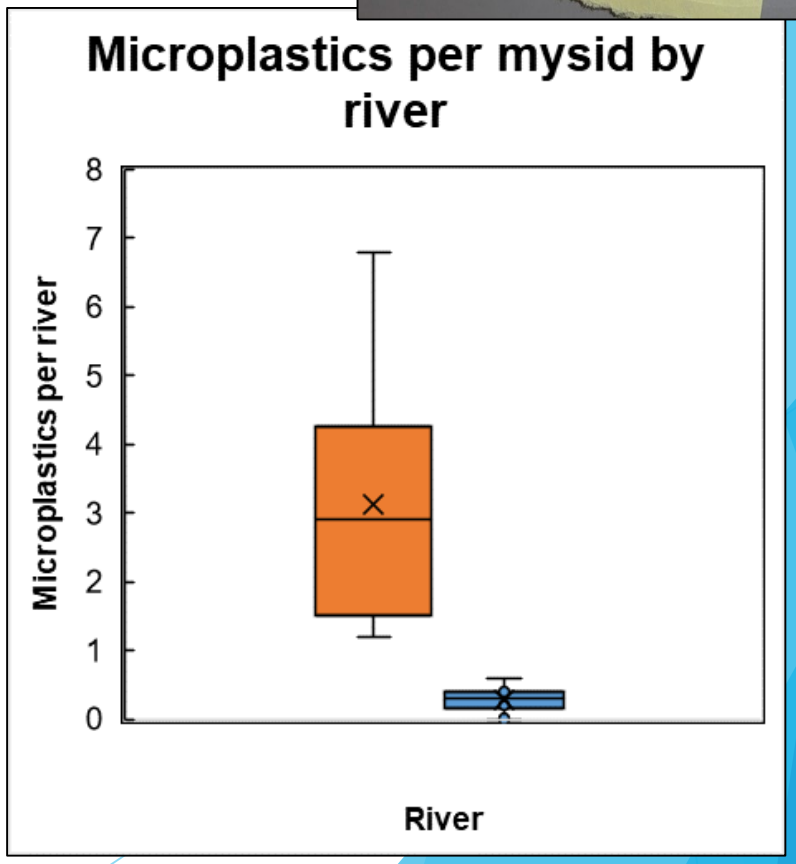


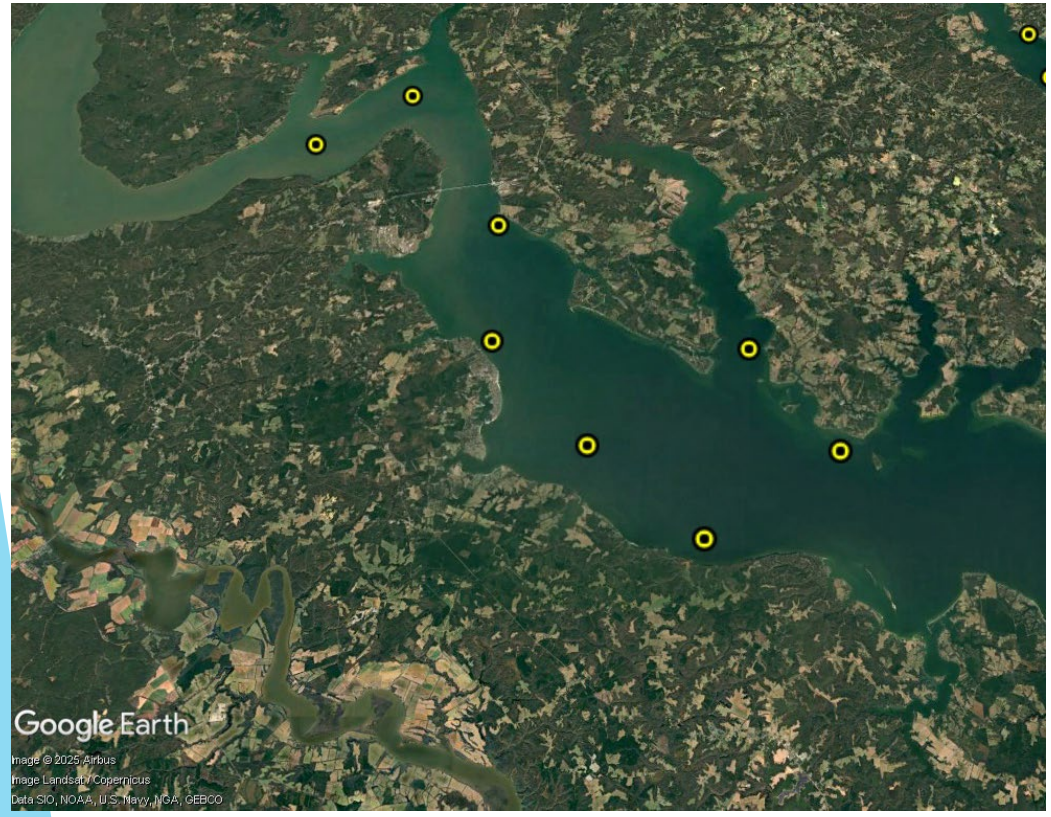
Mysids sorted by genus (if feasible), digested, filtered, & MPs counted

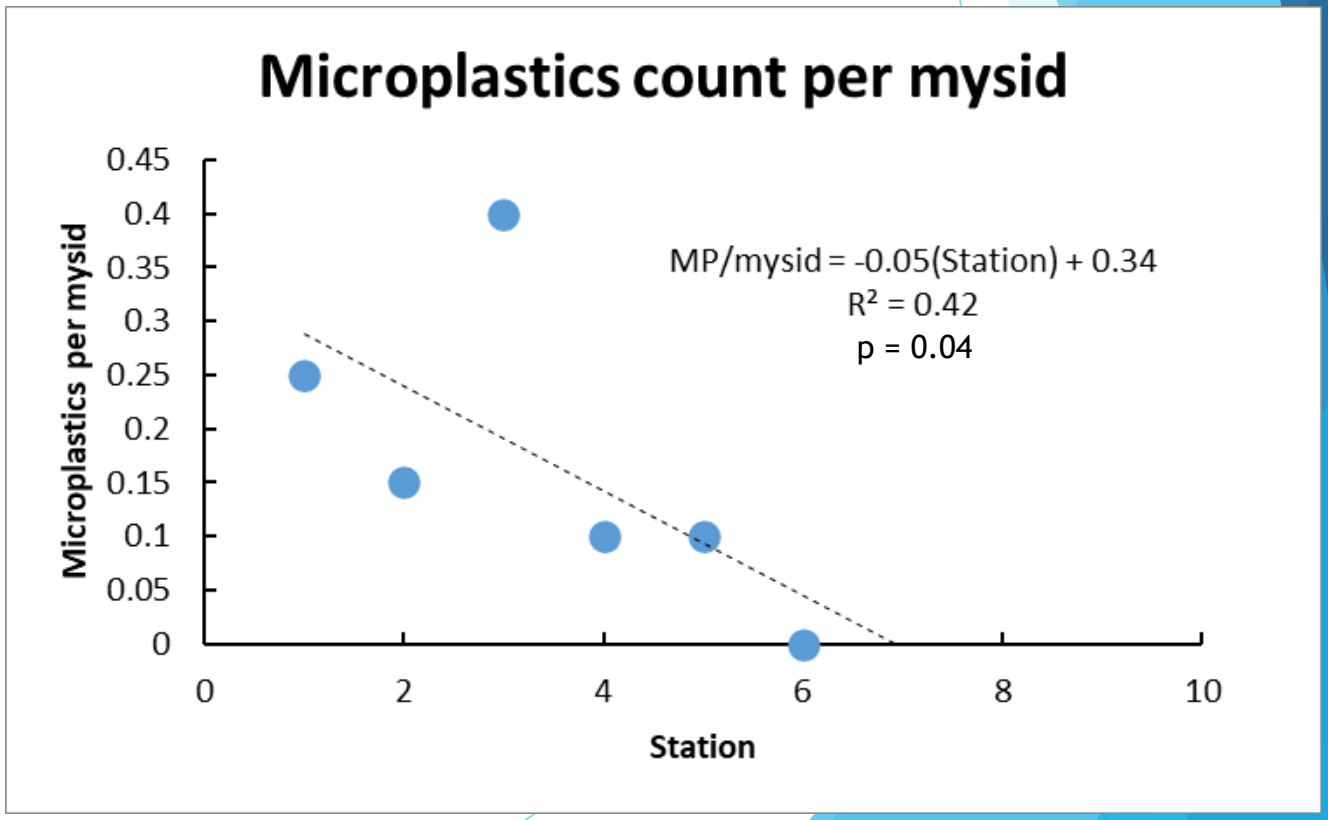




Current MP research: Mysids as a vector for trophic transfer to YOY striped bass

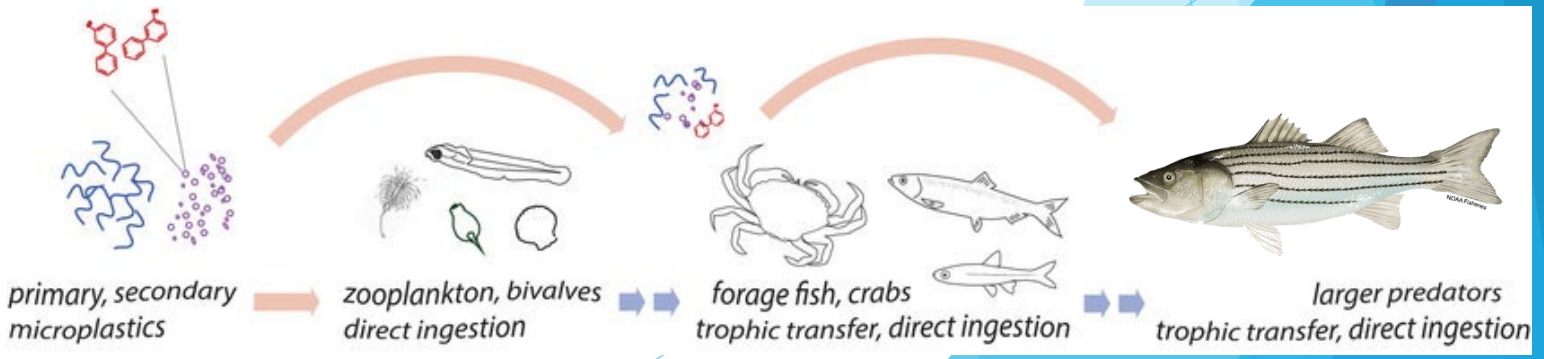
Potomac only – evidence of downstream decline in MP loads in mysids (dilution?)





Next steps in MP research: Mysids as a vector for trophic transfer to YOY striped bass

- Continue analysis of MPs found in mysids
- Conduct initial laboratory study
  - Mysid shrimp uptake
  - Trophic transfer to YOY Striped Bass
  - Measure multiple responses (e.g., physiological, behavioral)
- Future work (?)
  - Robust field sampling of Striped Bass stomach contents
  - Tissue concentrations of MPs
  - Additional prey types
  - Spatial patterns in MP distribution



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