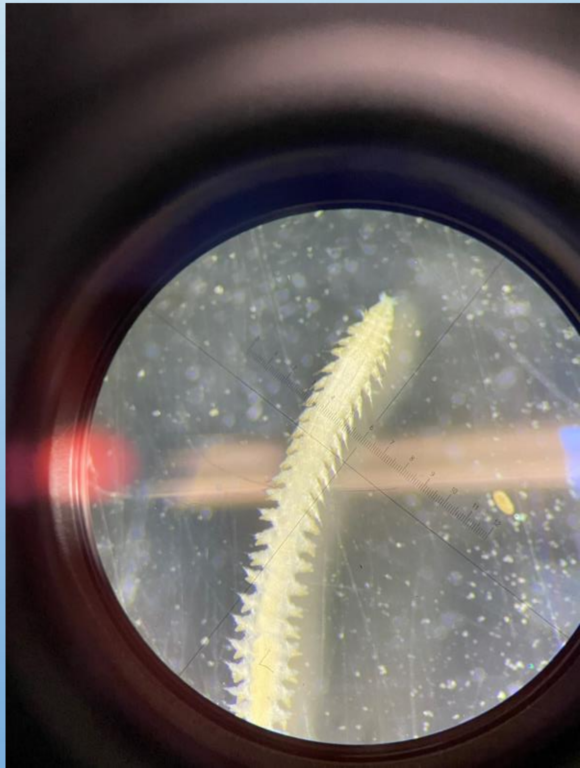
Response of benthic fauna to a changing environment in Narragansett Bay

Who really cares about worms?

By: Shaina Harkins, Jeremy Collie, Candace Oviatt, Austin Humphries, Conor McManus

Introduction and Background: Let's take apart the title



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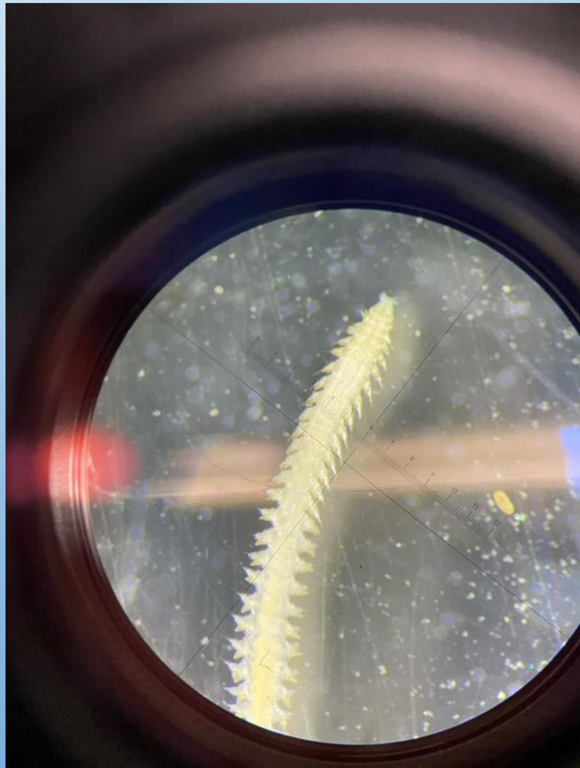

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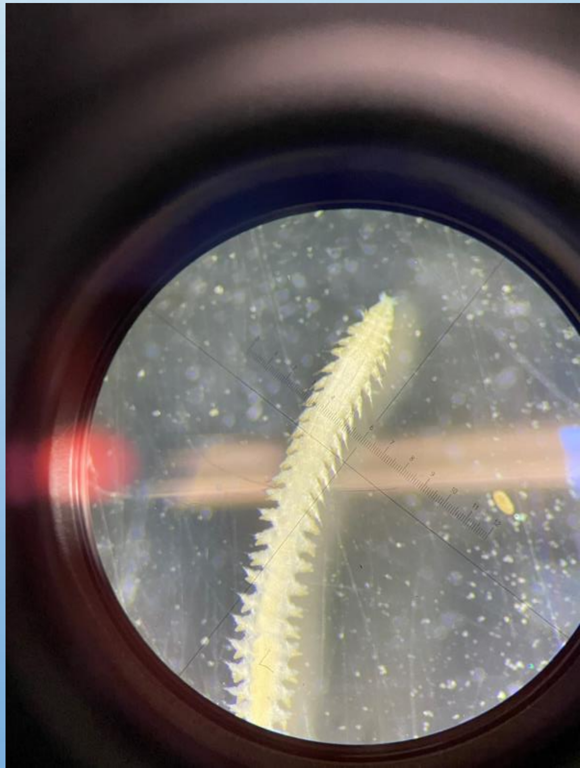
Response of **benthic fauna** to a changing environment in Narragansett Bay

- What is benthic fauna?



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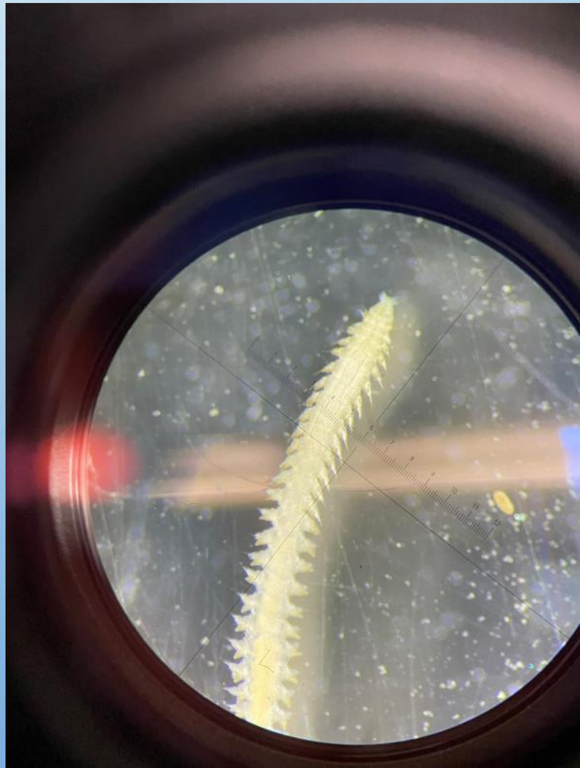
Response of benthic fauna to a **changing environment** in Narragansett Bay

- What is benthic fauna?
- How is the environment changing?



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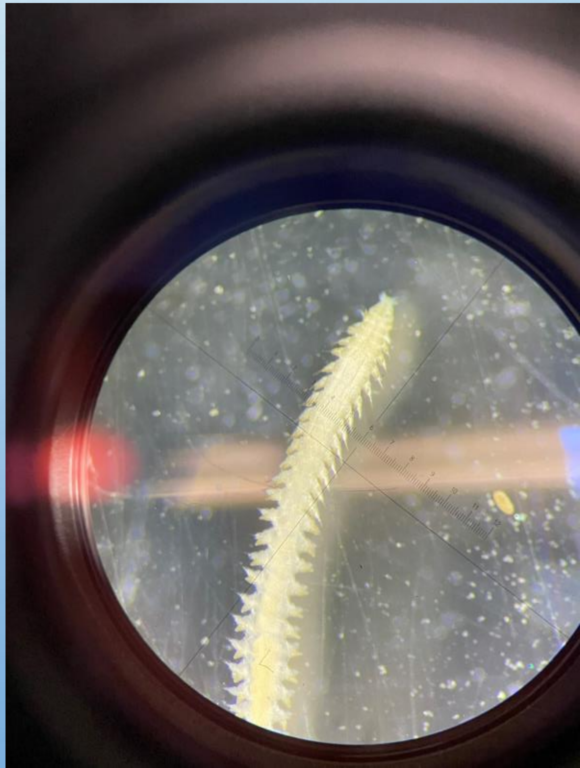

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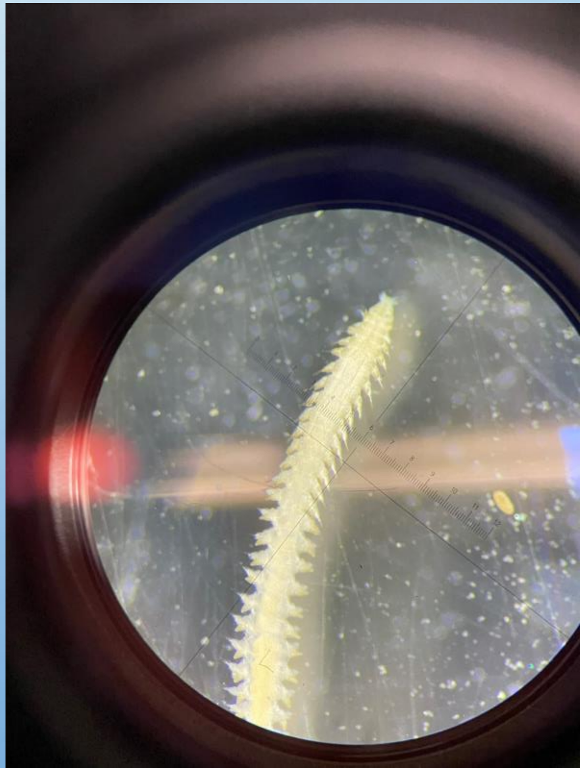
Response of benthic fauna to a changing environment in Narragansett Bay

- What is benthic fauna?
- How is the environment changing?
- What is the response of these critters?
- Why do we care? (**who really cares about worms?**)



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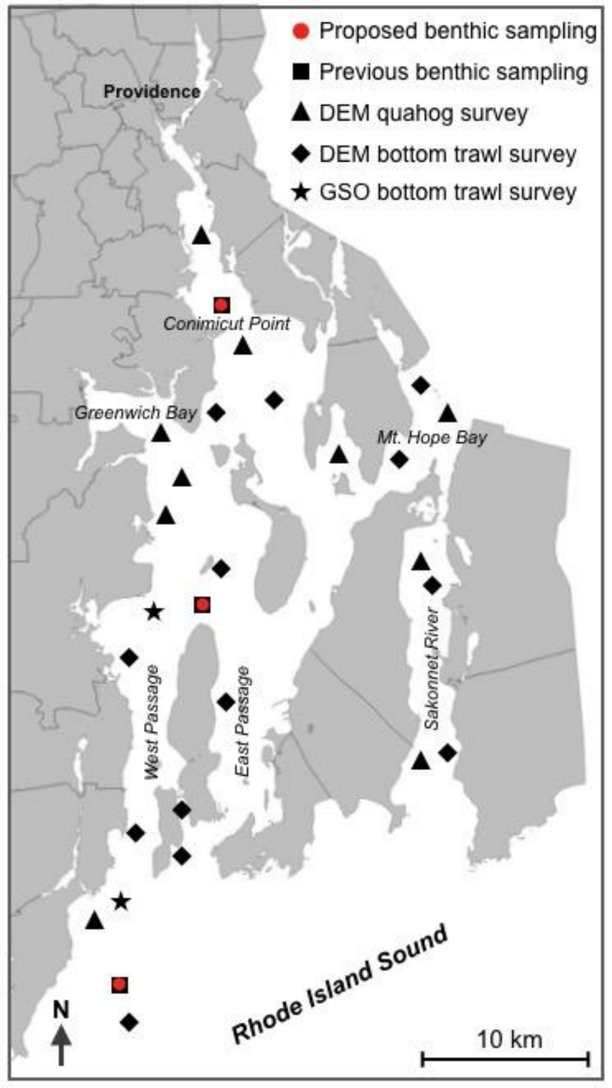
- Worms, arthropods, mollusks, sponges, cnidarians, echinoderms, and demersal fish
- Secondary production fueled by predation and marine snow (feces and carcasses)
- Epifauna live on sediment, infauna live in sediment

How is the environment changing?



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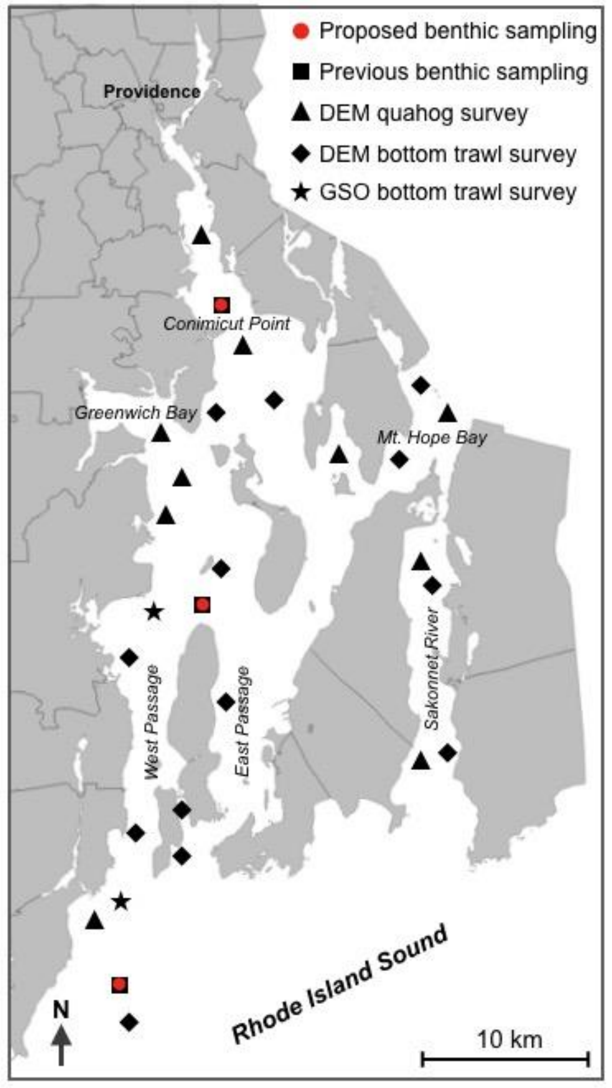

- Hypoxia caused by:

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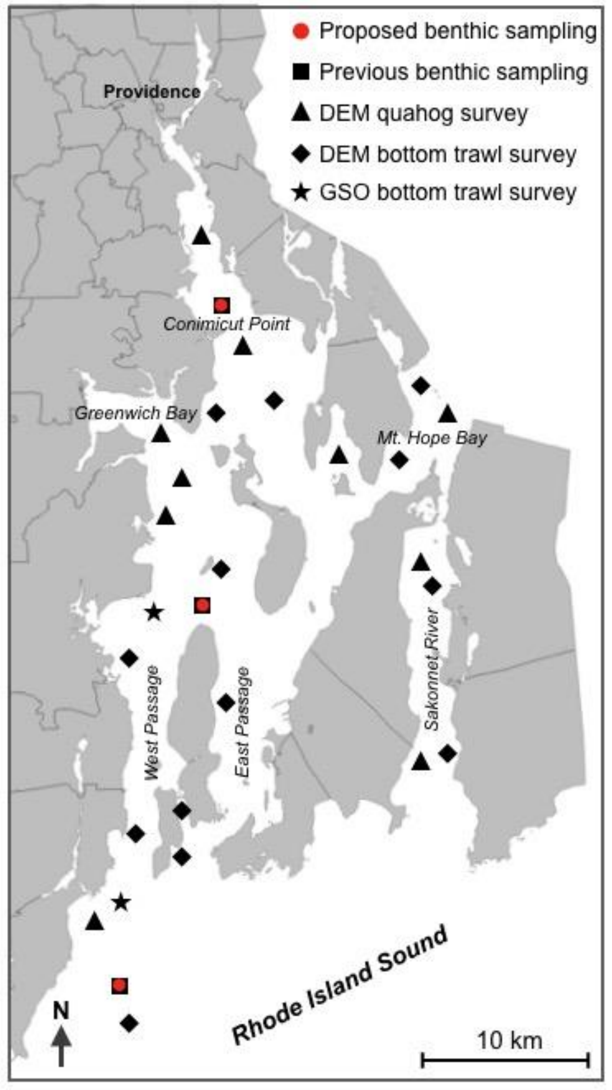

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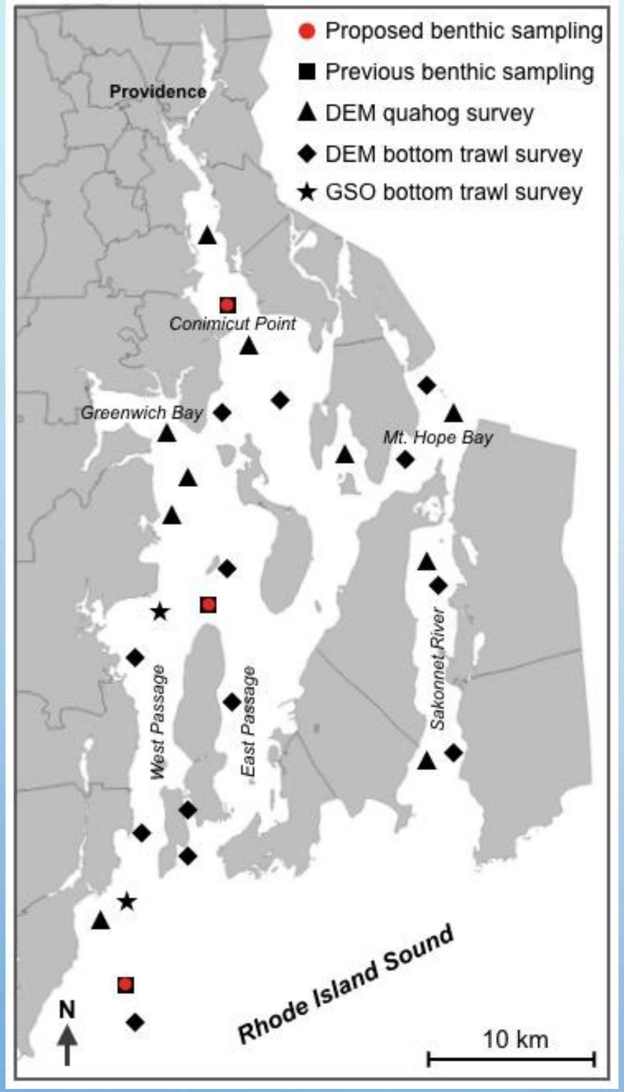

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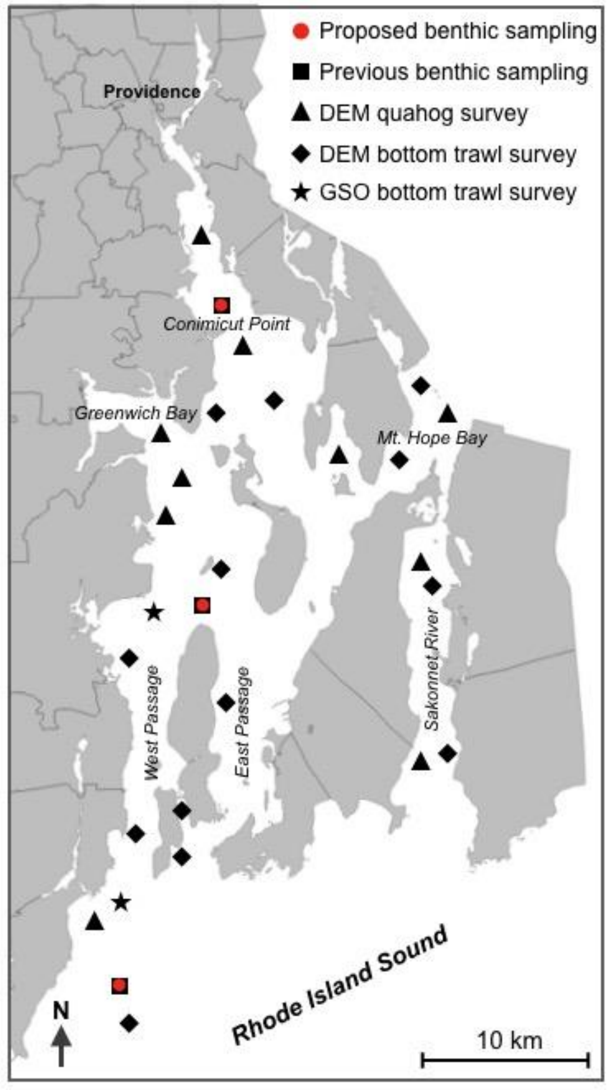

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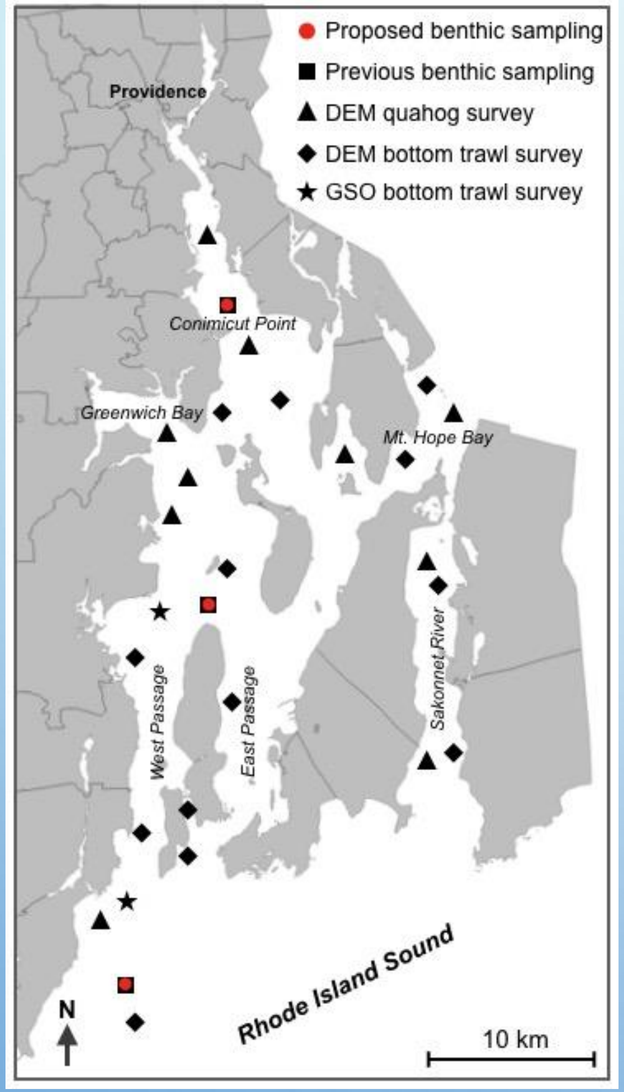

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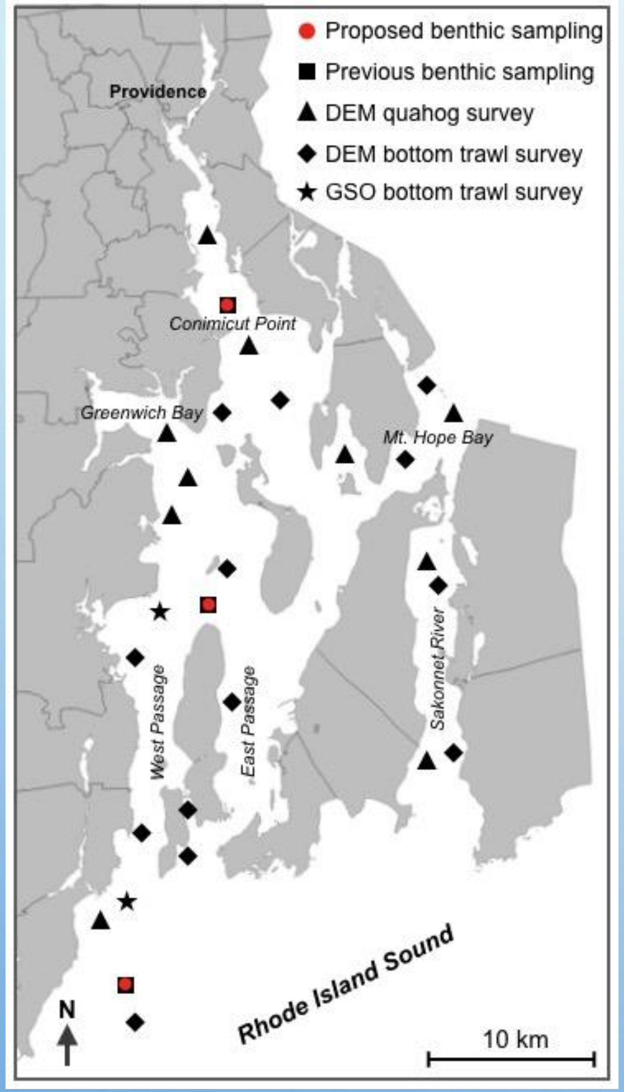

- Hypoxia caused by:
  - **Stratification-** increased SST and freshwater input
  - **Eutrophication-** nutrient loading
- North to south gradient of human population and impact
- Decrease in WWTF nitrogen input
- Continued increase in development and warming

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- Hypoxia begins in the sediment
- Stratification prevents mixing of oxygen to the bottom
- Respiration still occurs despite oxygen depletion
- Sediment is difficult to oxygenate, especially without bioturbation
- No organisms to mix sediment, no oxygenation of sediment, anoxia spreads

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Who really cares about worms?

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- Monitoring benthic organisms gauges overall health of the Bay
- Benthic fauna provide:
    - Sediment oxygenation
    - water filtration
    - nutrient cycling
    - shoreline buffering
    - Secondary production input into the food web

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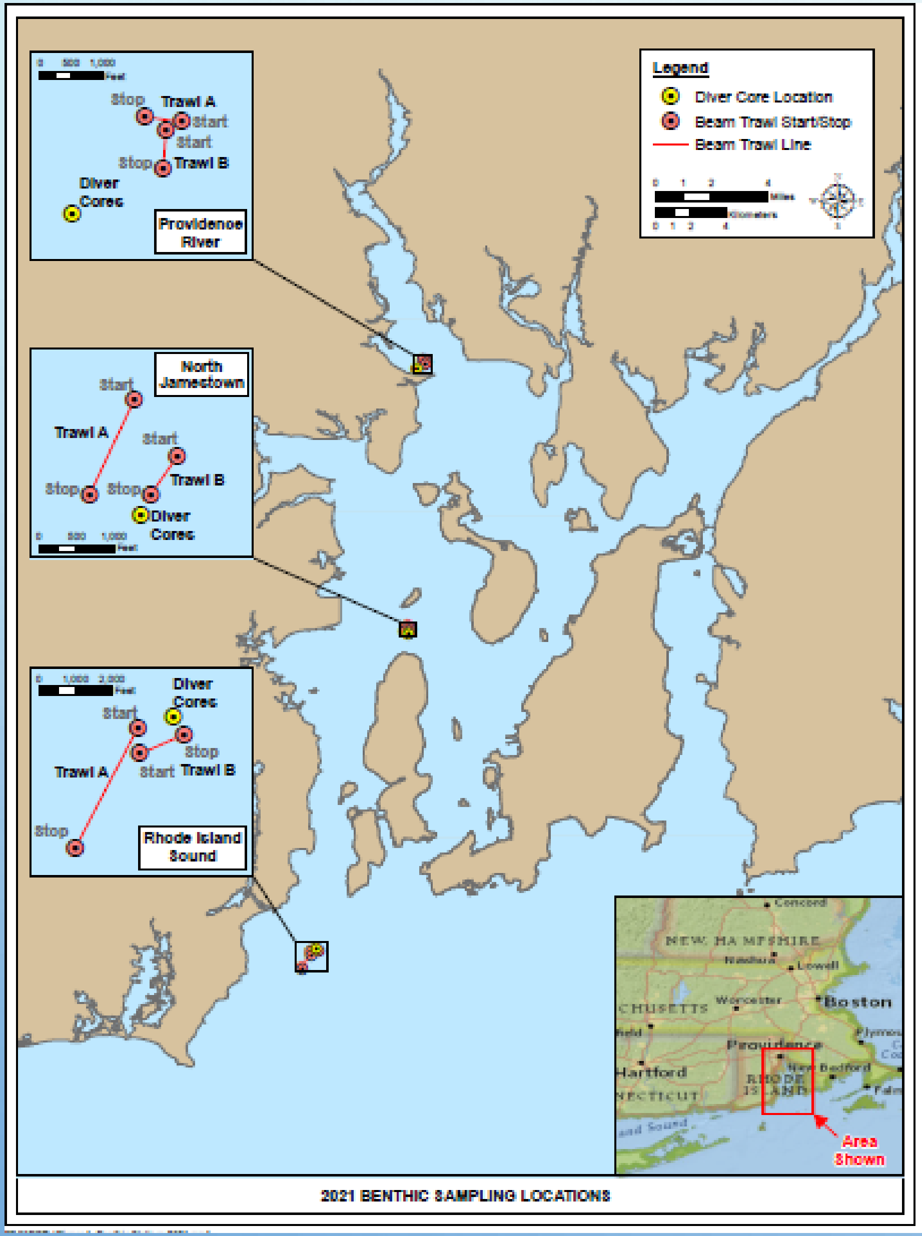
3. To cover wide array of sampling techniques and fauna
4. To incorporate benthic production into food web models

Field methods



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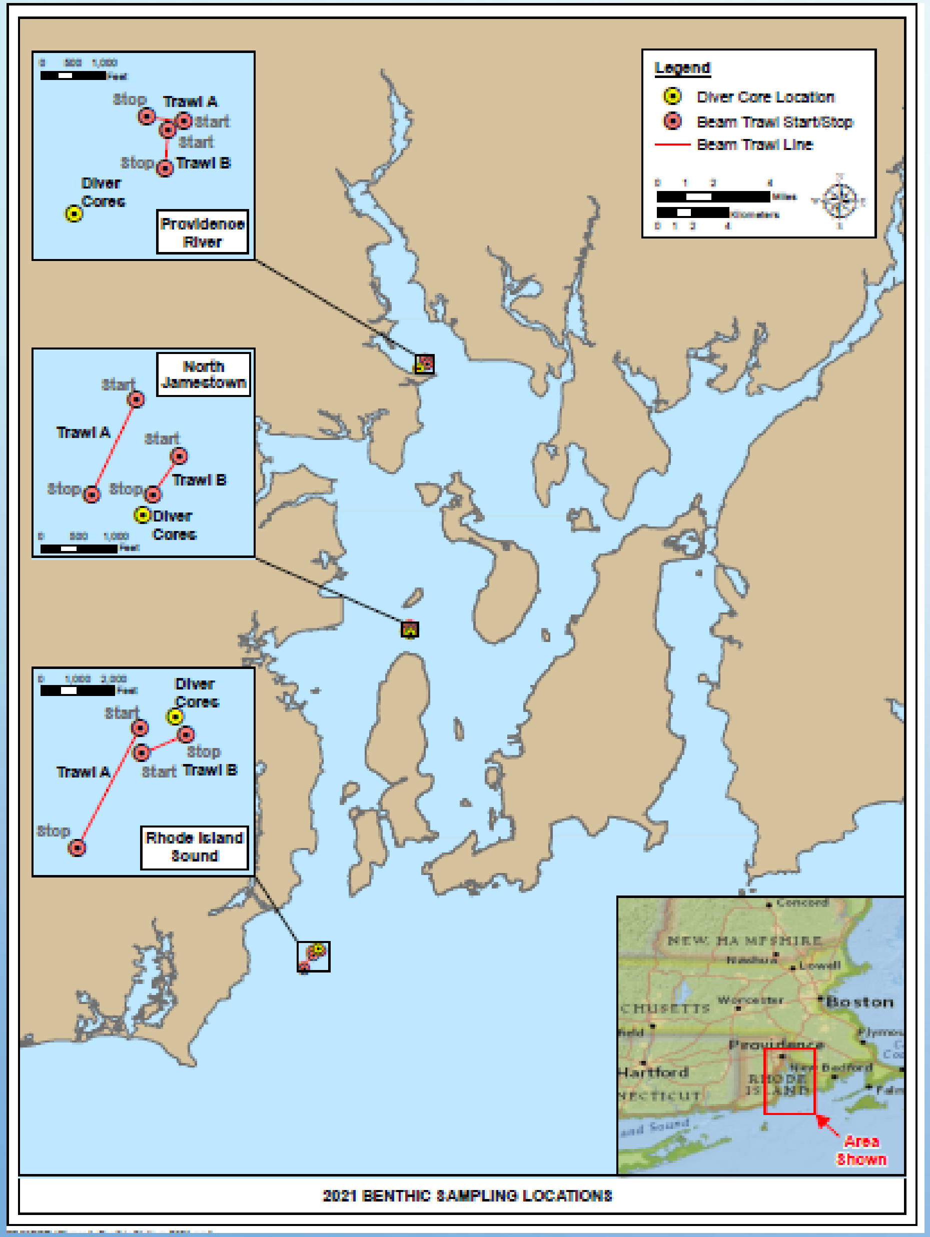
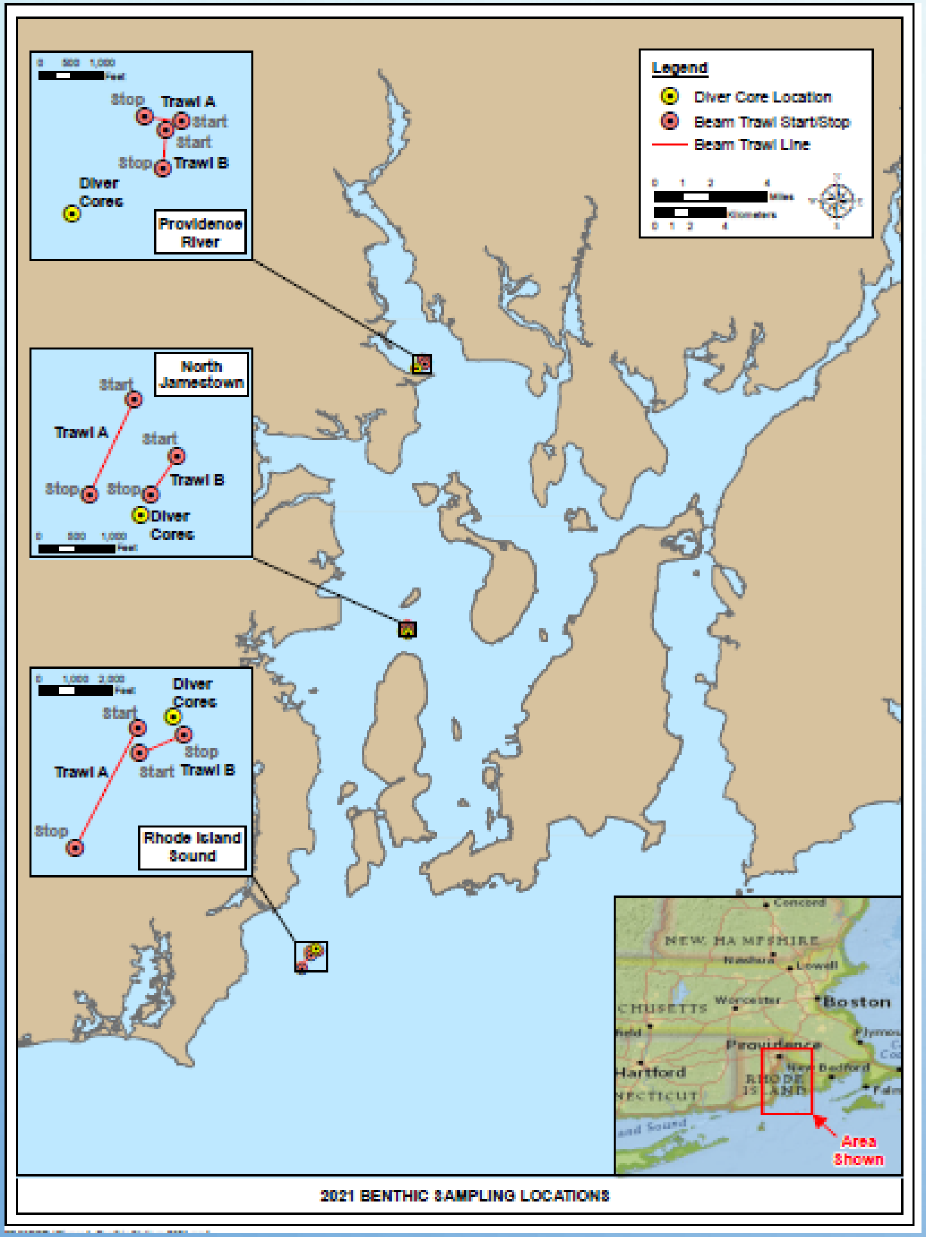


- Sampling occurred end of June 2021 (planned for June 2022) from Cap’n Bert:



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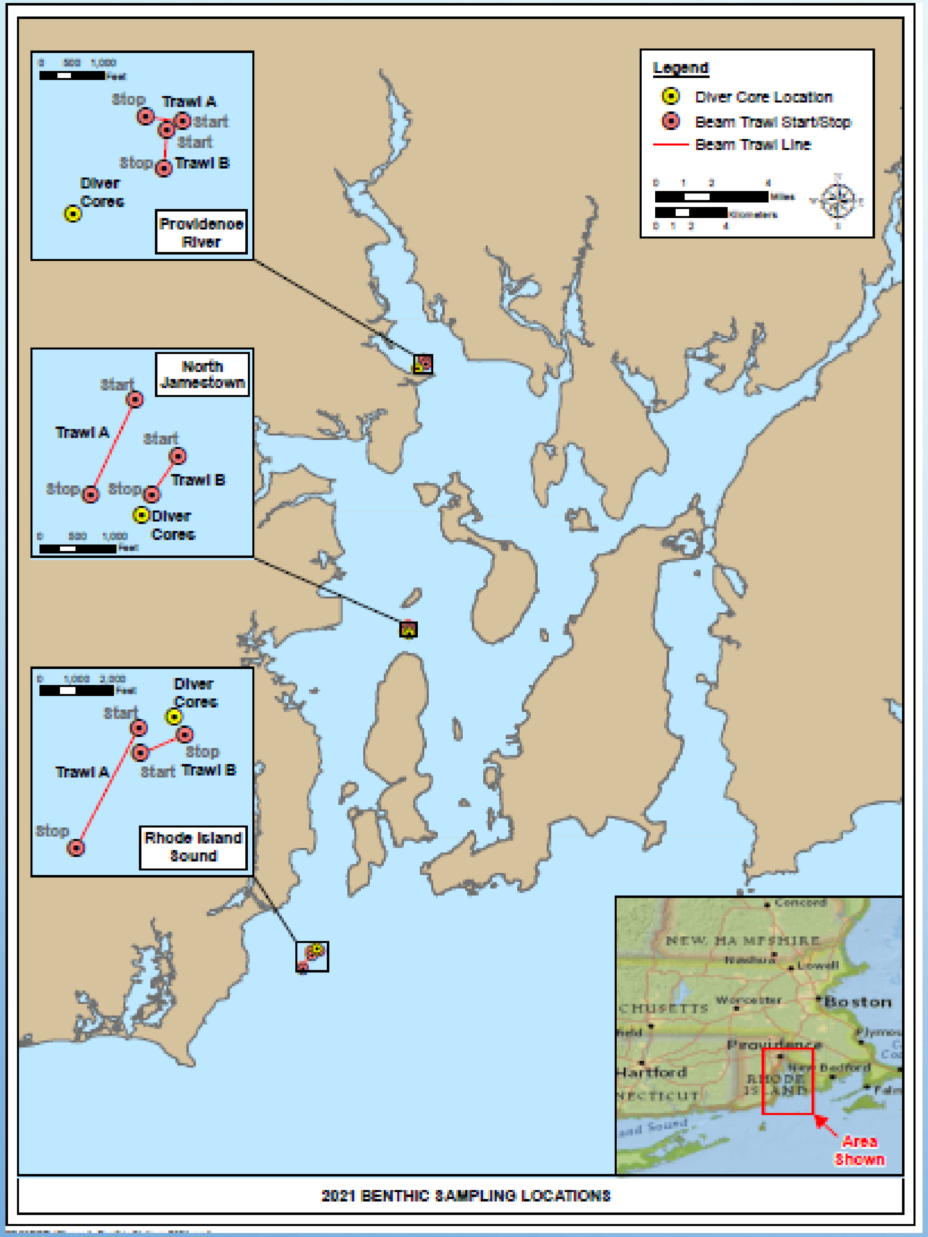

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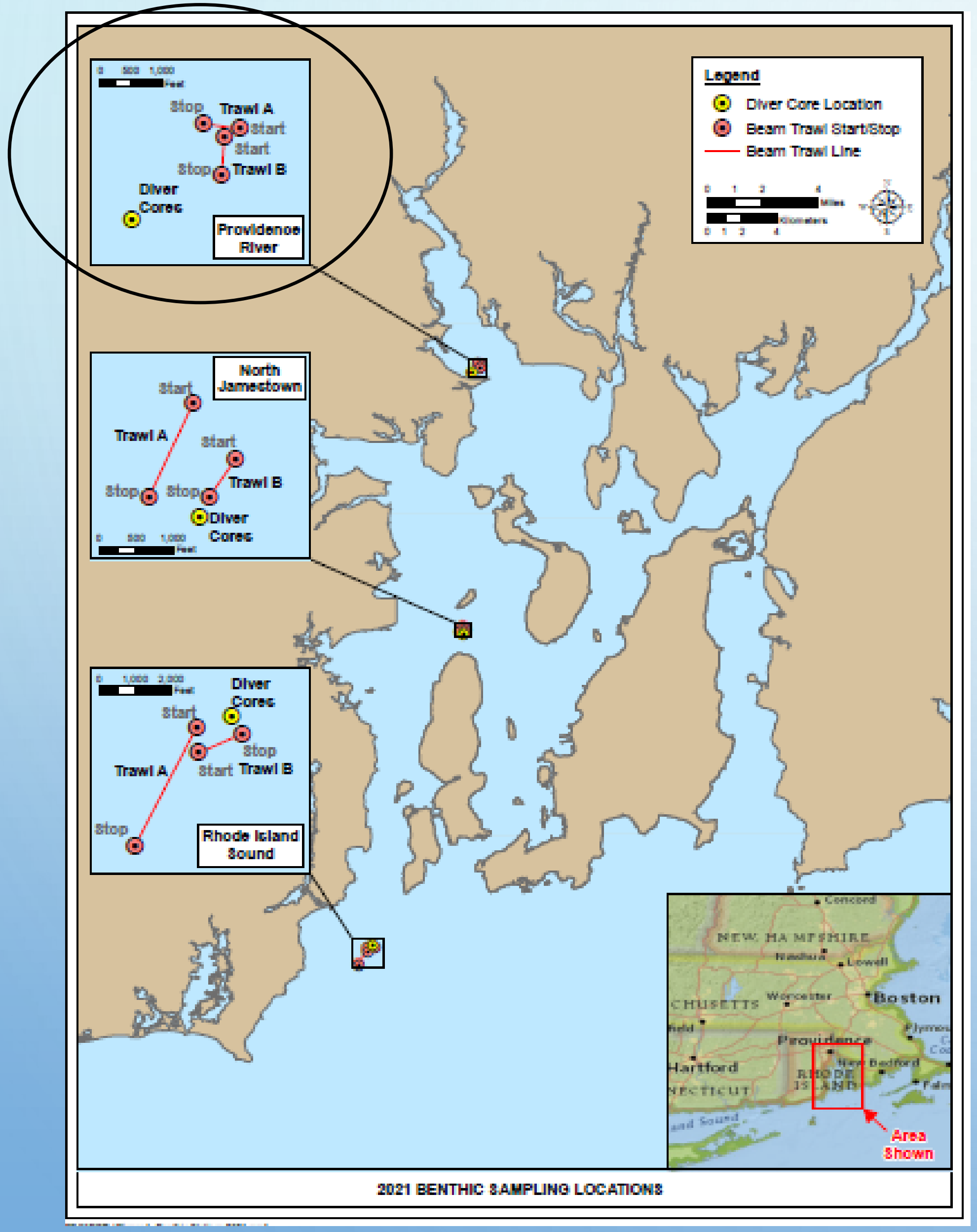
- 3 sampling stations:



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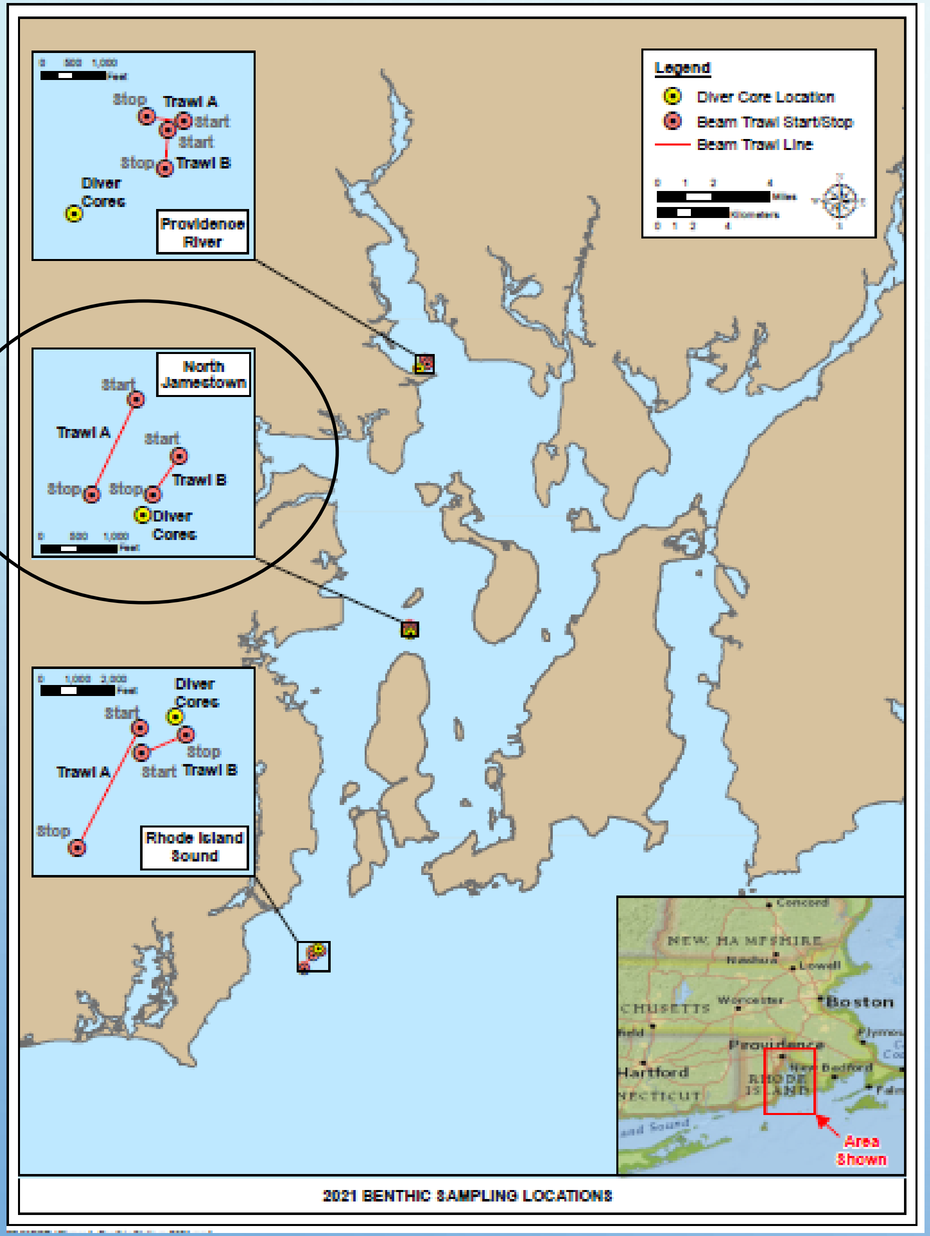
- 3 sampling stations:
  - **Providence River (upper bay)**



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- 3 sampling stations:
  - Providence River (upper bay)
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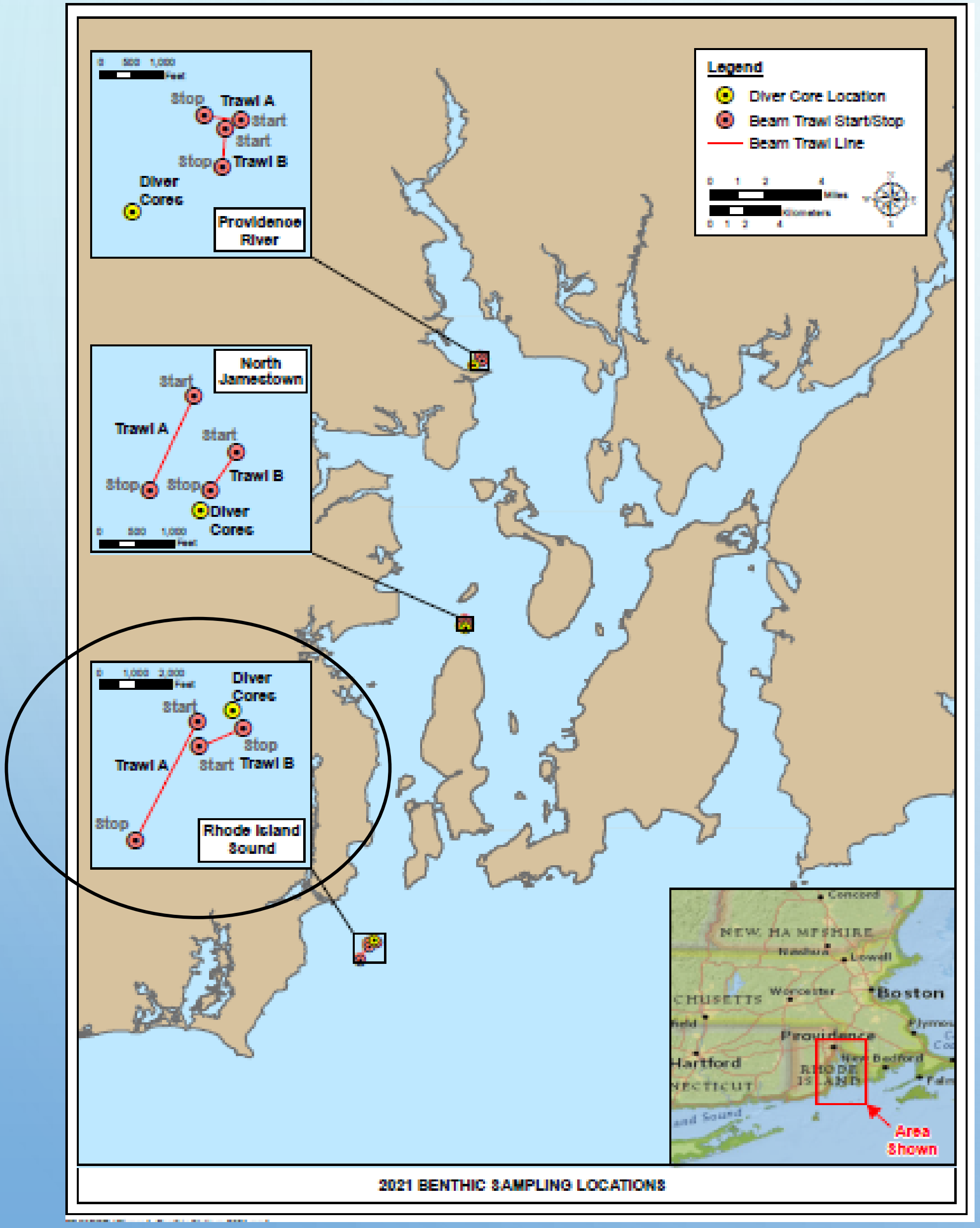
Field methods



- Sampling occurred end of June 2021 (planned for June 2022) from Cap'n Bert:
  - Diver-collected cores
  - Beam trawl
- 3 sampling stations:
  - Providence River (upper bay)
  - North Jamestown (mid bay)
  - **Rhode Island Sound (lower bay)**

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- For each station:

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  - 15 replicate sediment cores for macrofauna

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  - All samples stored in 4% pH buffered formaldehyde & dyed with rose Bengal
  - YSI data including bottom oxygen, temperature, salinity

Laboratory methods



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  - Worms
  - Arthropods
  - Mollusks
  - Miscellaneous

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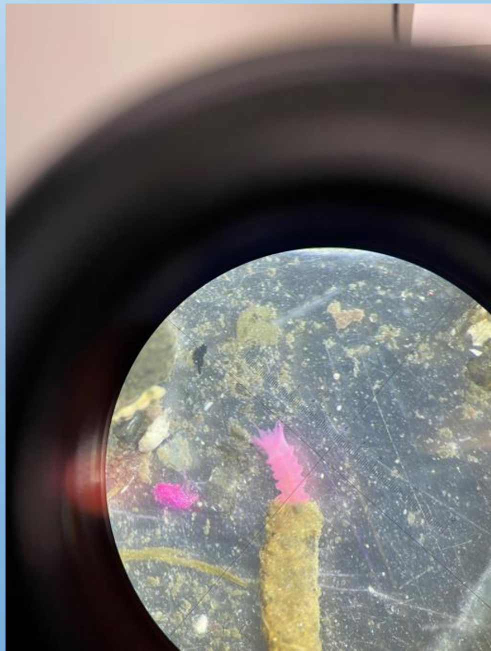
  - Miscellaneous

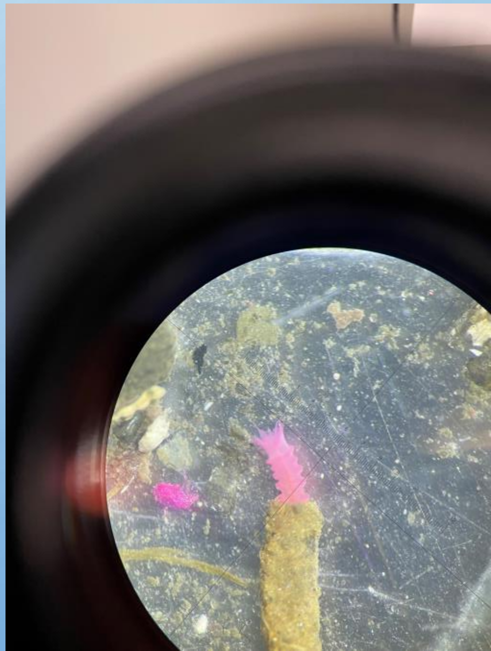
- Currently being identified down to lowest possible taxonomic group and counted

Planned laboratory analysis



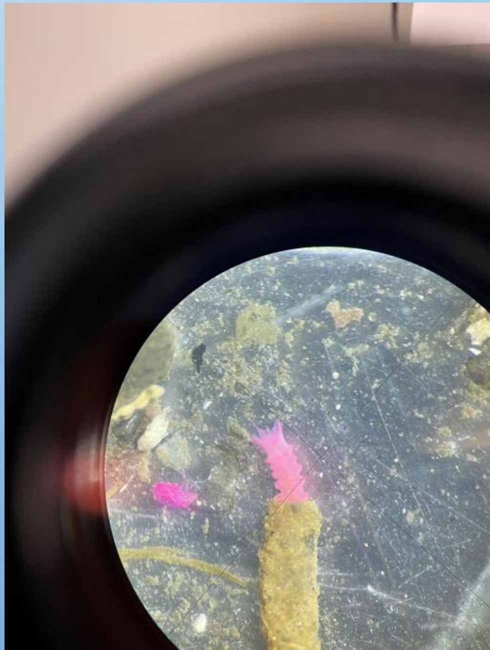
Planned laboratory analysis

- Subset of cores will be weighed for macrofaunal biomass of all cores and historical data



Planned laboratory analysis

- Subset of cores will be weighed for macrofaunal biomass of all cores and historical data
- Pooled weight will be used for epifaunal biomass



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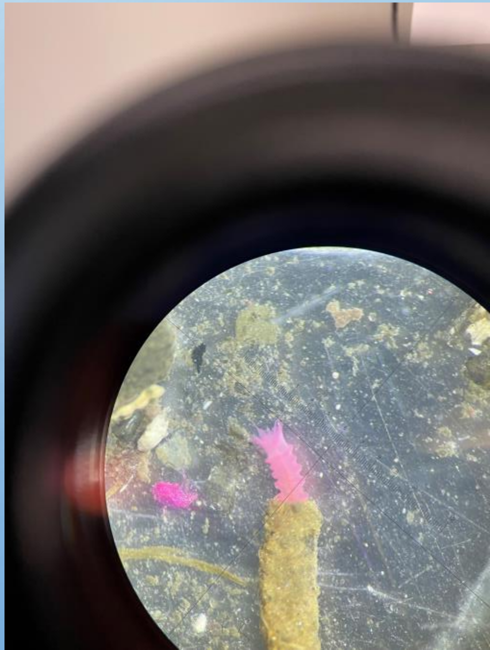
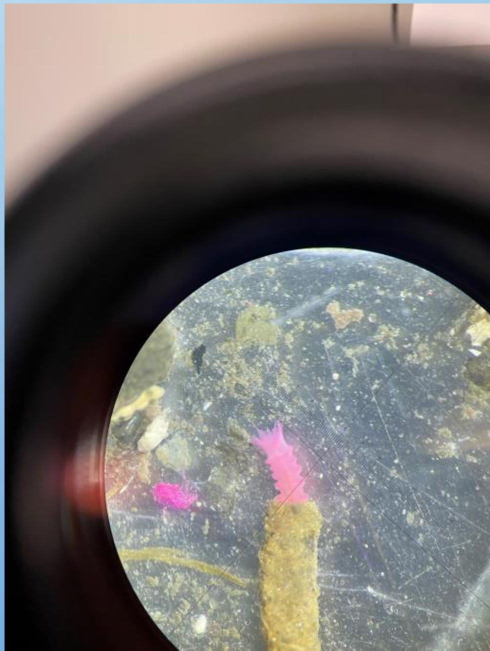


Planned laboratory analysis

- Subset of cores will be weighed for macrofaunal biomass of all cores and historical data
- Pooled weight will be used for epifaunal biomass
- Production will be estimated from biomass
- 2 replicate 10-mL subset of cores for each station will be analyzed for C & N



Planned statistical analysis using biodiversity, biomass and abundance data, let's revisit the objectives:

Planned statistical analysis using biodiversity, biomass, and abundance data, let’s revisit the objectives:

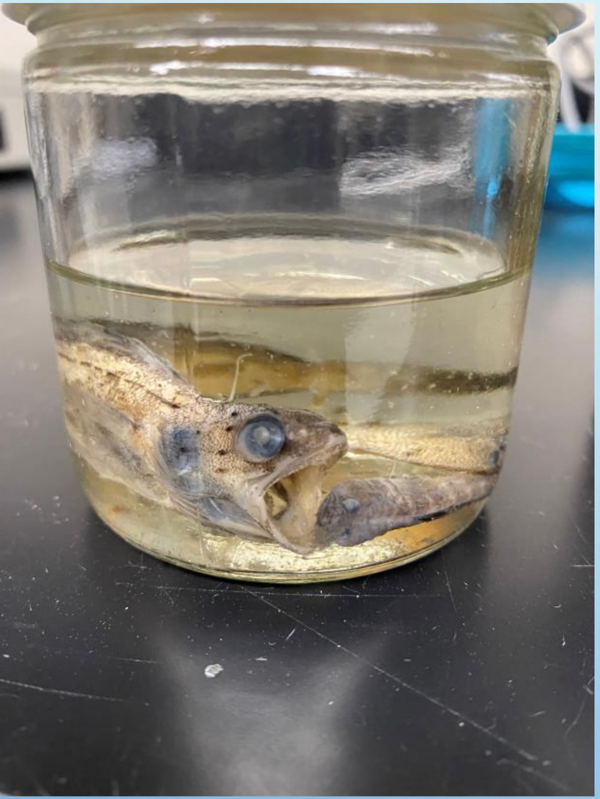
1. To look at long-term benthic responses to explanatory variables:
   - Eutrophication & mitigation: chlorophyll, C & N in sediment
   - Stratification: temperature, salinity

2. To compare current data to historical data
   - Before & after WWTF 50% decrease
   - Long-term climate & oceanographic indices

Planned statistical analysis using biodiversity, biomass, and abundance data, let's revisit the objectives:

3. To cover wide array of sampling techniques and fauna
   - Beam trawl & core data
   - Supplemented with analysis of trawl & dredge surveys from GSO & DEM
4. To incorporate benthic production into food web models
   - Biomass converted to production for both macrofauna & epifauna

Acknowledgements



- Thank you, thank you, thank you to:
  - Co-PIs: Jeremy Collie, Candace Oviatt, Austin Humphries, Conor McManus
  - Collaborators: Christopher Calabretta & Stephen Hale
  - Undergrad fellows: Gwenevier Riendeau & Tina Munter
  - Lab mates: Declan McCormick, Rachel Marshall, Annabelle Leahy
  - Dive team: Anya Hanson, Katie Nickles
  - Captain Steve

GSO

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Questions?