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Using Dredged Material to Reduce Contaminant Bioavailability

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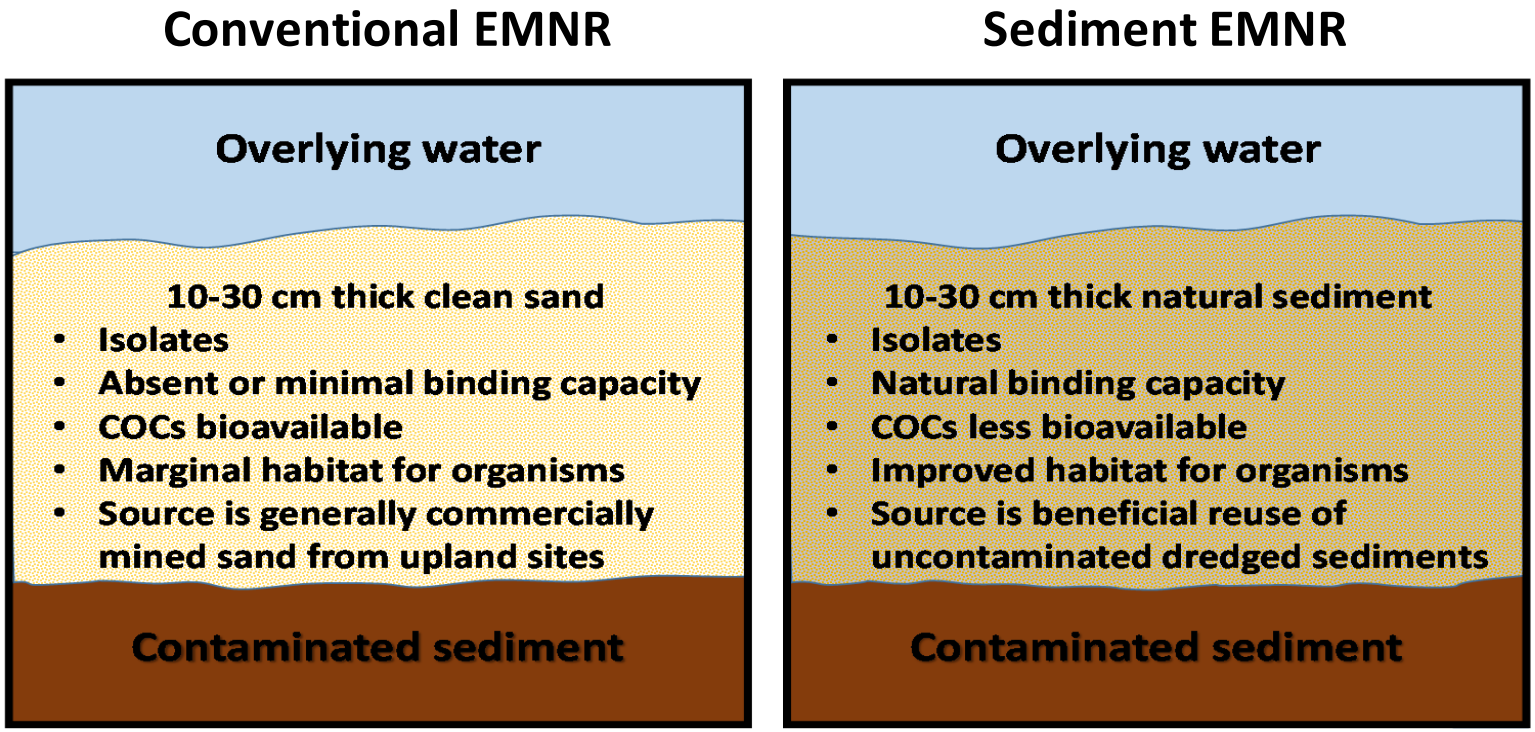
Background

- **Clean Dredged Material has multiple potential advantageous over Sand for EMNR**
  - **Natural organic matter for contaminant sequestration, improved habitat, beneficial use, lower cost**



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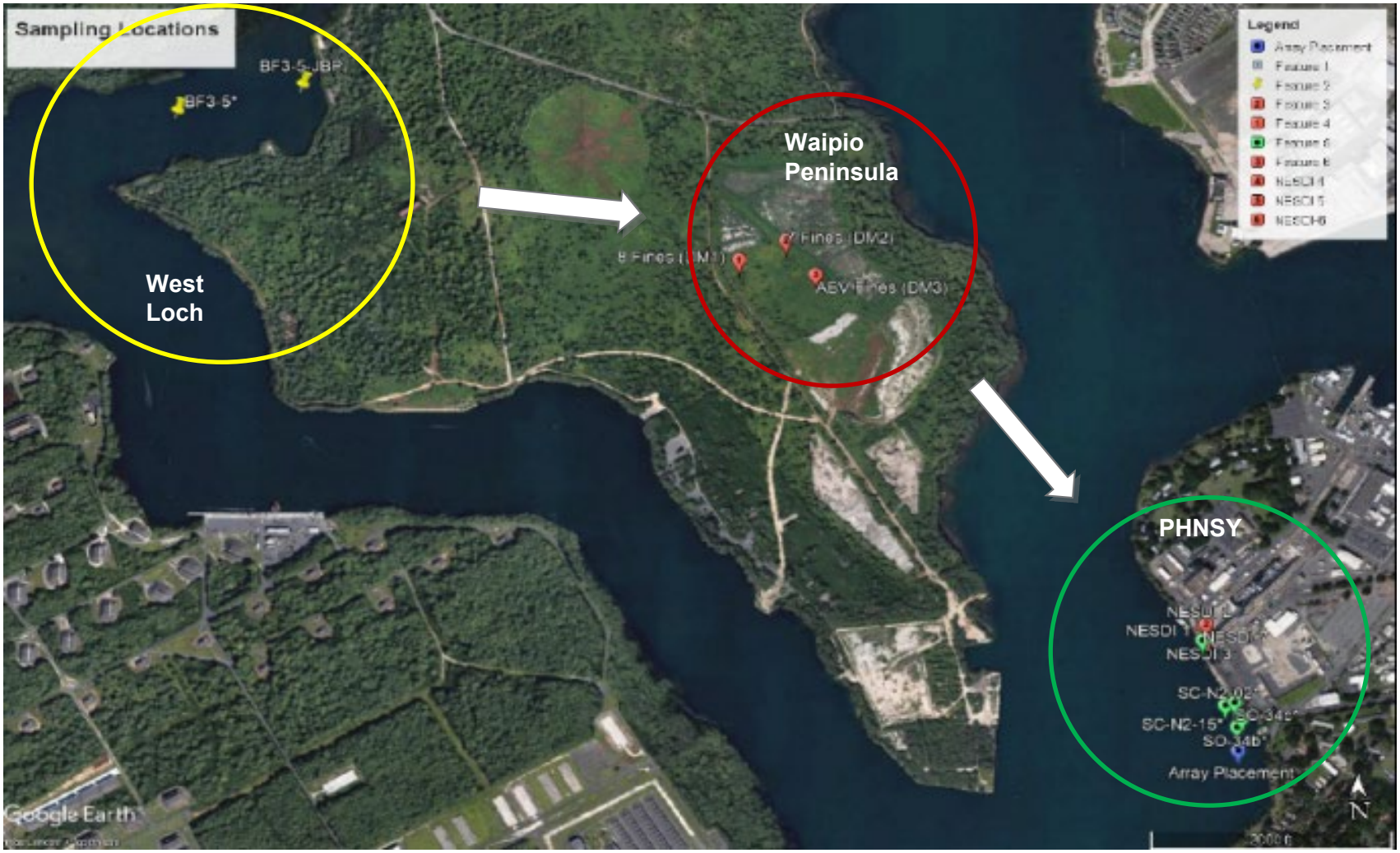
Case Study: Beneficial Reuse of stockpiled Clean DM at Pearl Harbor



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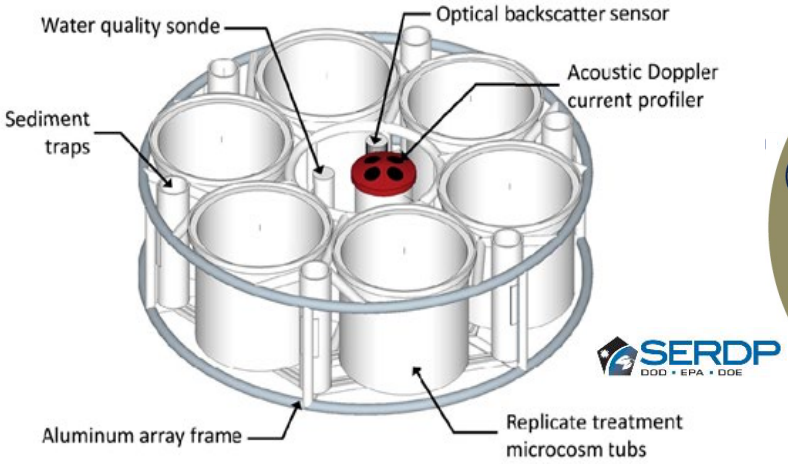
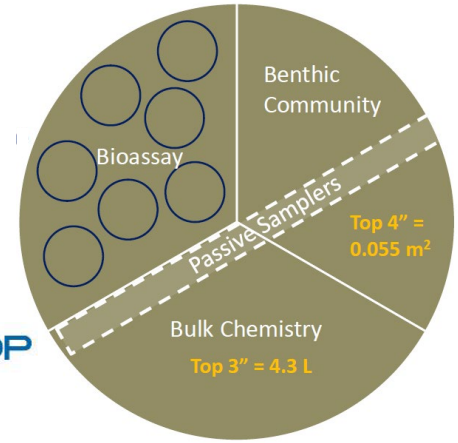
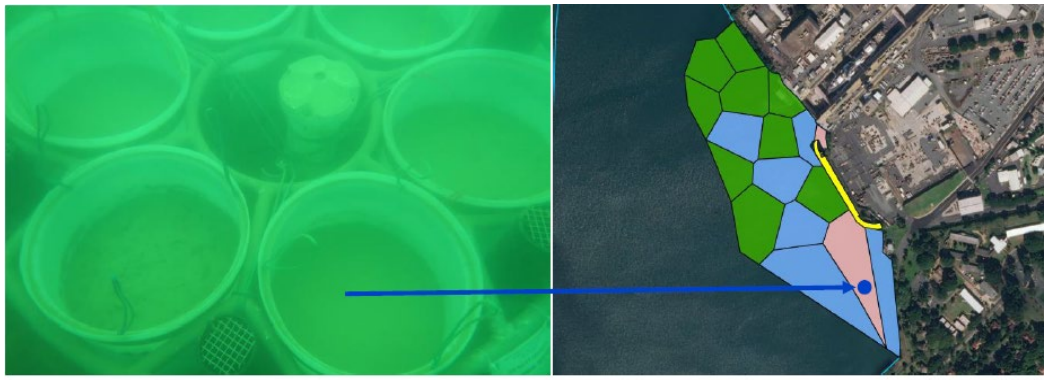
Approach: Demonstration at PHNSY

- **10-month mesocosm scale *in situ* assessment of multiple remedies**
  - Clean Sand (EMNR)
  - Clean DM (EMNR)
  - MNR (Control)
  - AquaGate + PAC
- **Multiple lines of evidence**
  - Bulk chemistry
  - Bioaccumulation
  - Passive sampling
  - Benthic community indices
  - Sediment Deposition







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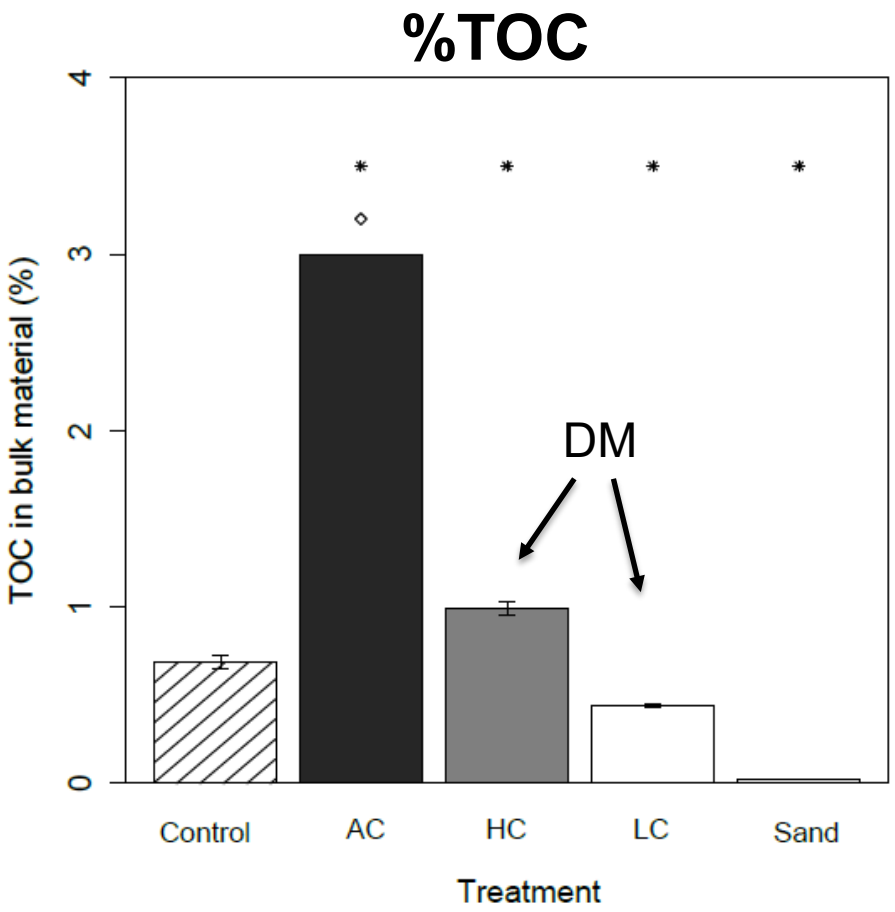
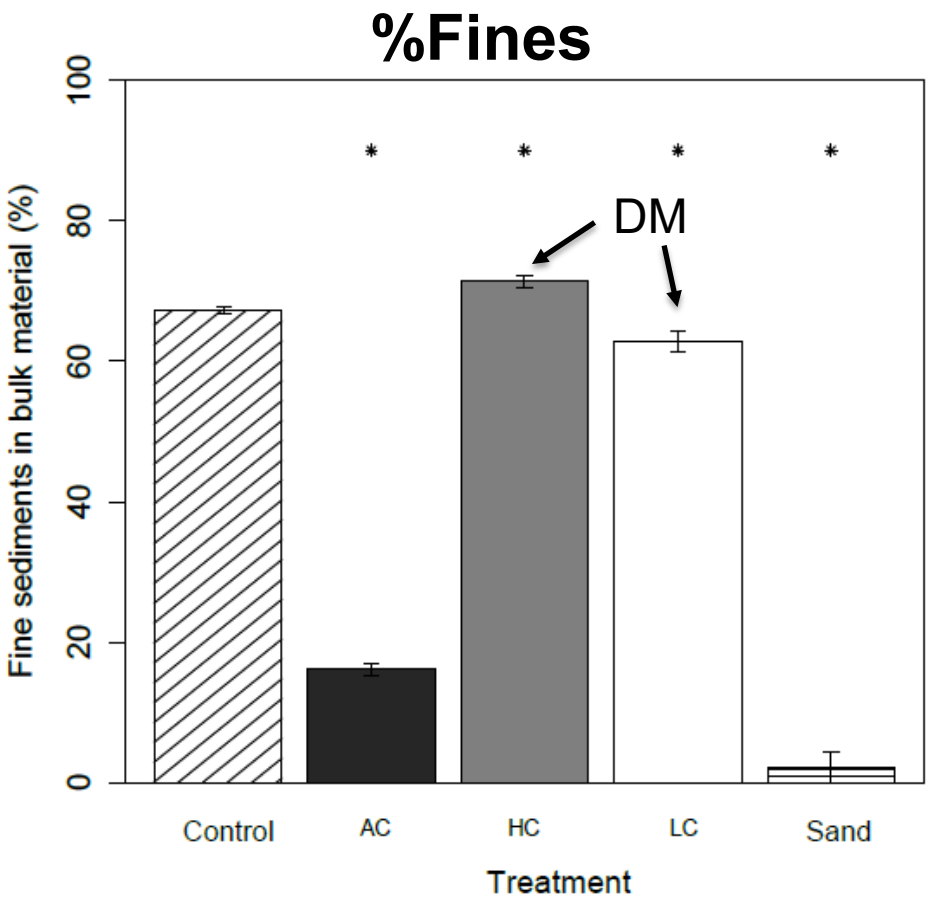
Results: Physical Characteristics (T=0 months)





- Total organic carbon (TOC) and grain size (% Fines) in **DM more comparable to site sediment** than clean sand.

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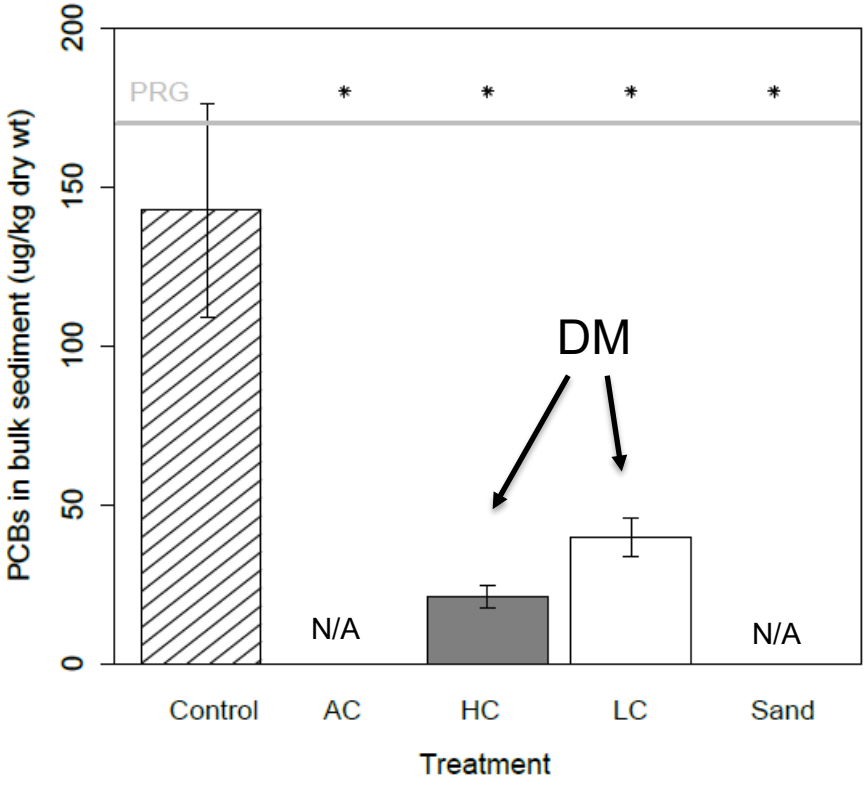
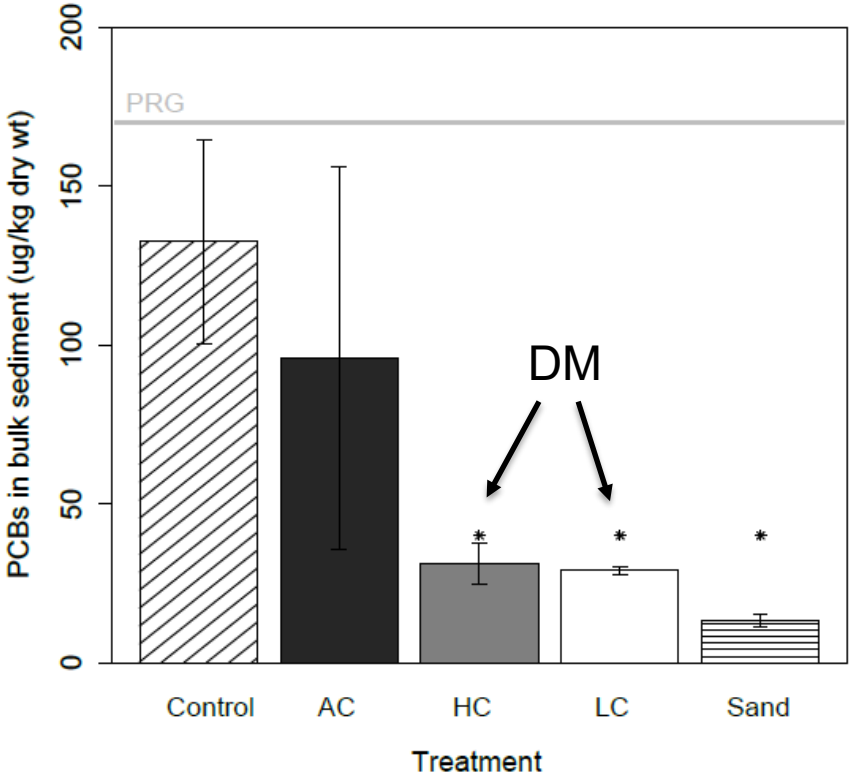
Results: Surface Sediment PCBs

T=0 months (Source Material)



T= 10 months



- Both Clean DM and Sand effective at reducing surface (top 3") bulk sediment PCBs

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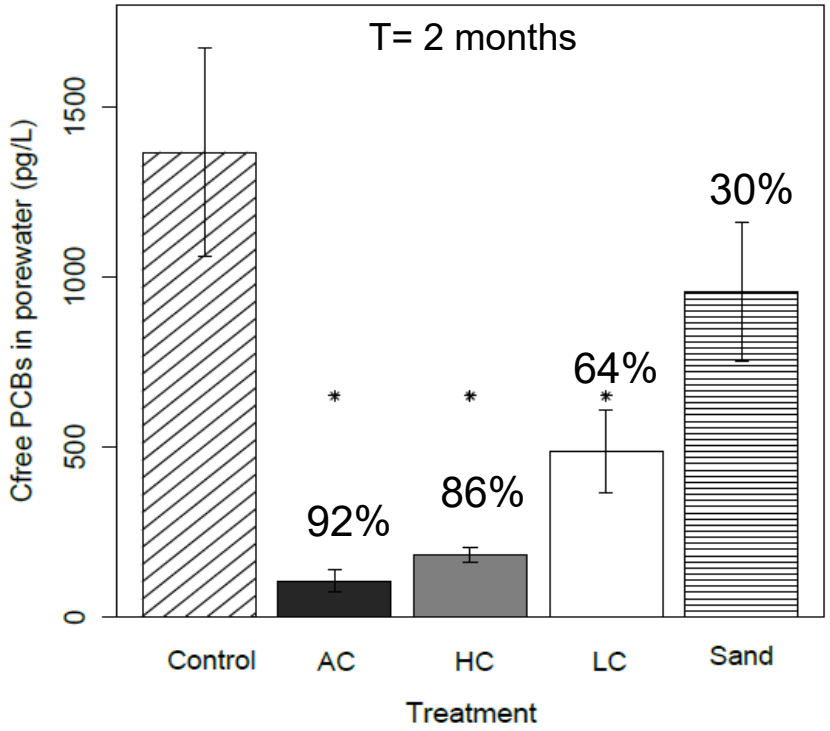
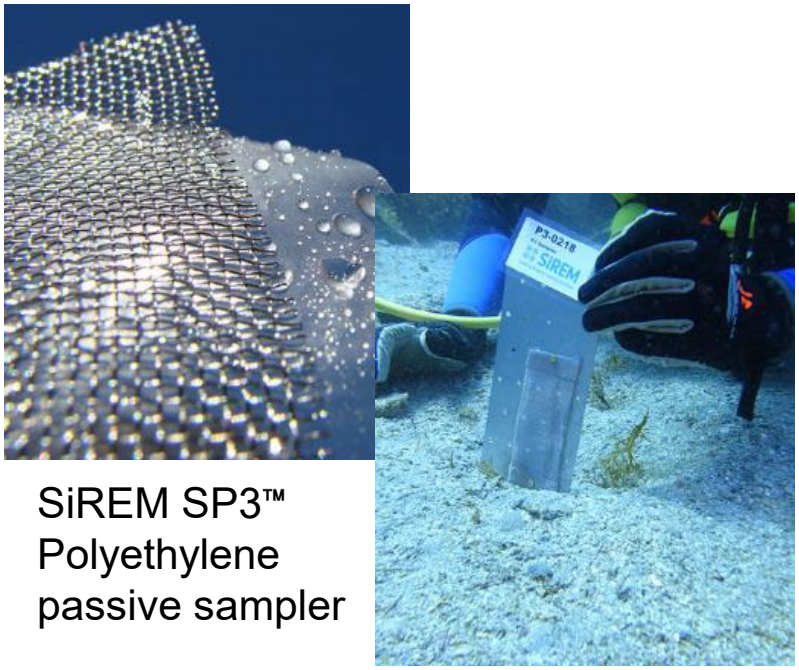
Results: PCB Bioavailability (Porewater)





SiREM SP3™ Polyethylene passive sampler

- High Carbon DM comparable to AC and more effective than Sand
- Similar reductions from Bioaccumulation testing with marine worm
- Similar reductions for key metals (e.g. Hg, Pb, Zn)
- Also no adverse effects of Clean DM to benthic community

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Summary and Discussion Questions…

- Clean Material from Navigation Dredging…
  - Reduced contaminant concentrations and bioavailability of COCs, typically more so than Sand
  - Could reduce remediation costs by eliminating need to procure clean sand
  - Should be further evaluated for scientific, regulatory, and stakeholder acceptance
- Questions:
  - Is there interest in this approach?
  - What is the long-term protectiveness?
  - What cap construction options need to be considered?

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- NESDI Program (Project #522)
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Backup Slides

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Waipio Peninsula Confined Disposal Facility

Modified Incremental Sampling Methodology

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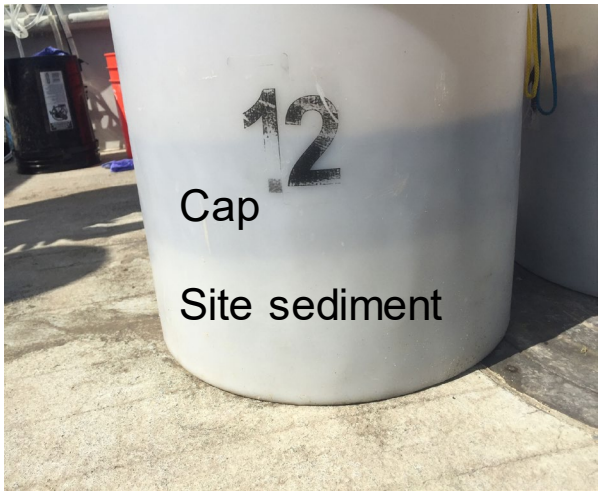
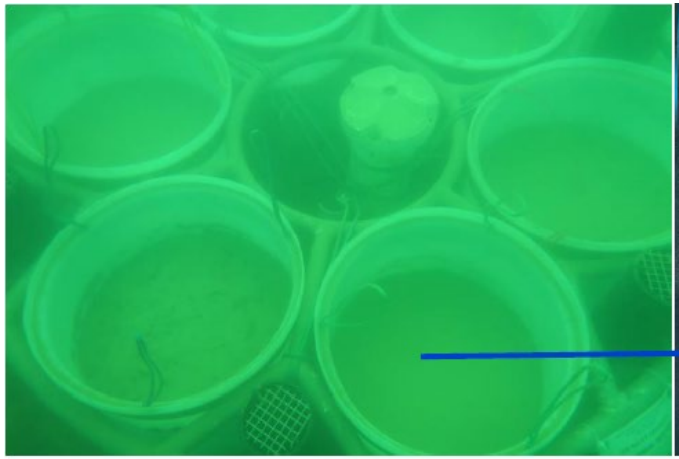
Remedy & Recontamination Assessment (RARA) Arrays

SERDP DOD • EPA • DOE





Chadwick et al. 2017. SERDP ER-2537 ; Rosen, Rivera, et al., 2020. NESDI 522

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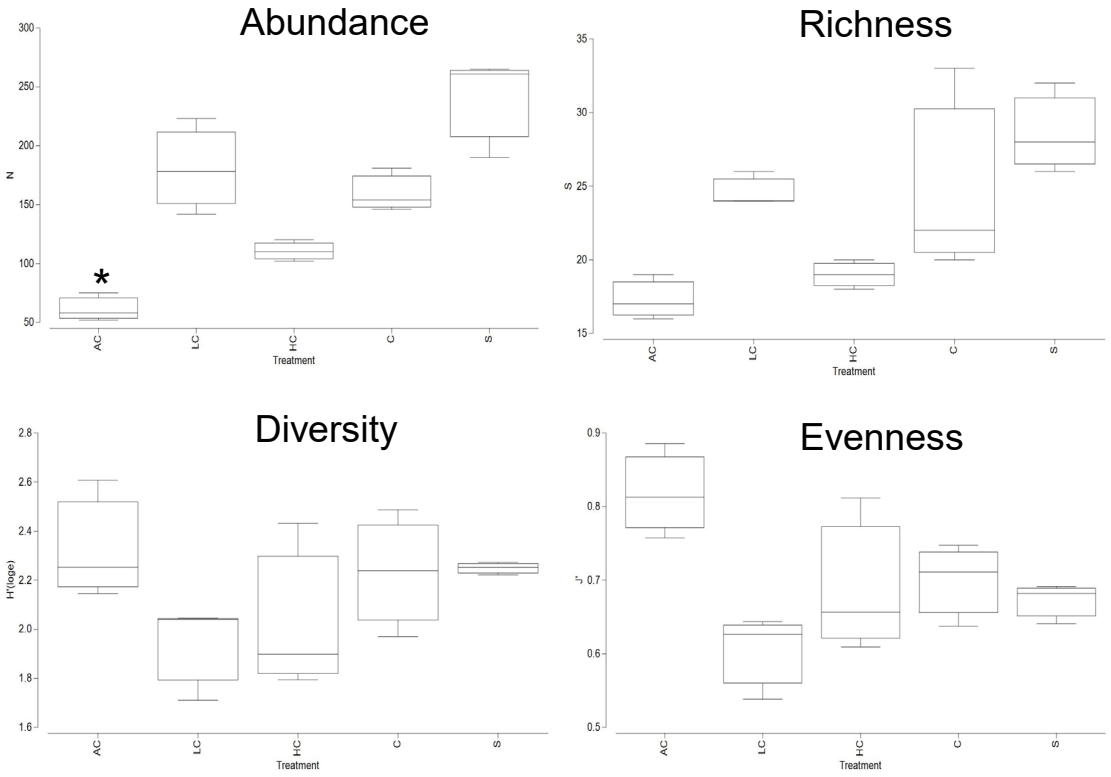
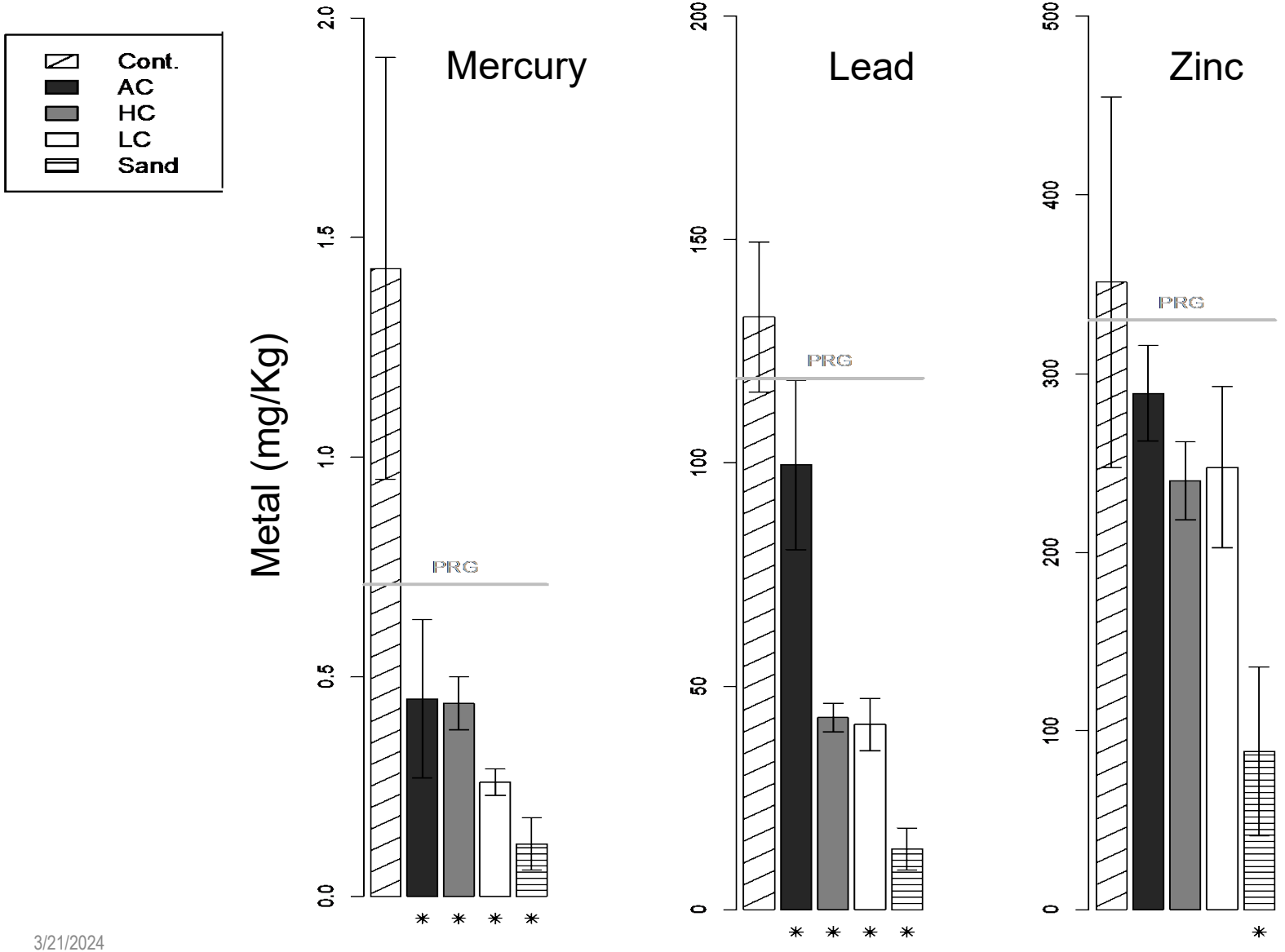
Results: Benthic Community Recovery (10 mo.)



- DM similar recovery to sand
- ~3X decrease in annelid abundance in the AC treatment (*)
  - AC historically associated with reduced annelid abundance
  - Annelids are deposit feeders and may be adversely impacted over short term due to AC

Results: Surface Sediment Metals (T=10 months)

- All treatments resulted in metal concentrations below PRGs



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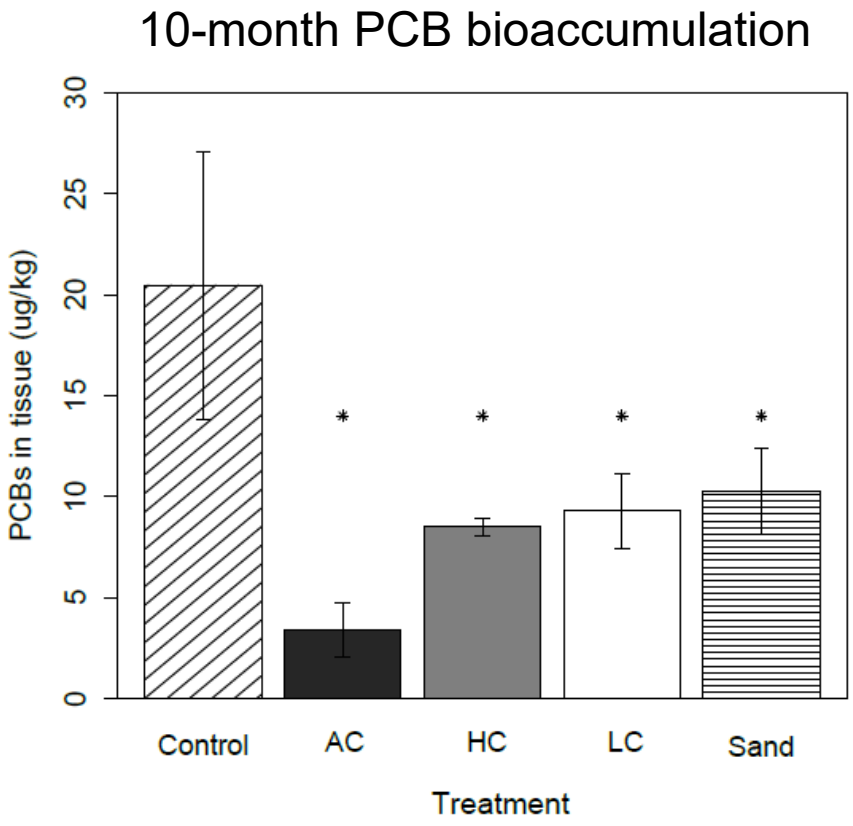
Results: PCB Availability (Bioaccumulation)



- 28-day lab exposure of intact cores
- ~60% reduction of tissue PCBs (NOAA18)
- DM performed just as well as clean sand
- Metals reductions more variable
  - Likely due to burrowing behavior of deposit feeder