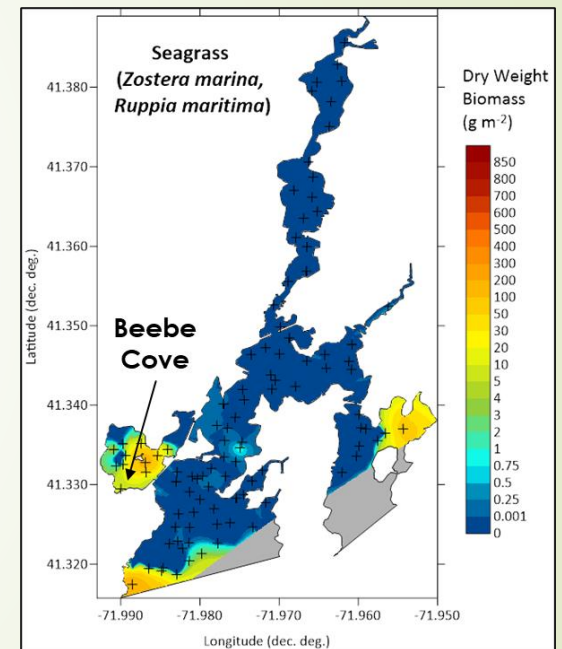# Oyster aquaculture associated with eelgrass habitat – maybe we can get along after all

Craig Tobias, Jamie Vaudrey - UCONN

Ashley Hamilton – Sixpenny Oyster Farm

Connecticut Sea Grant Project Duration: 2024 - 2026
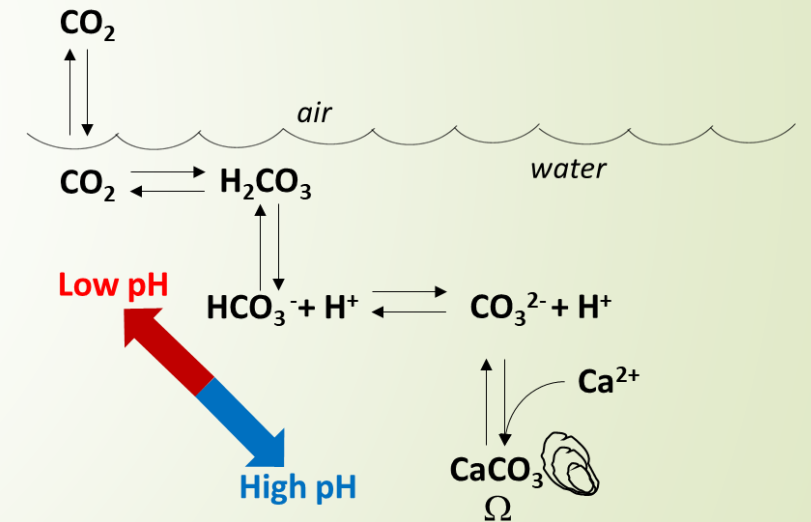
Motivation

1) The irony of regulatory conflict

EFFECTS OF OYSTER DEPURATION GEAR ON EELGRASS (*ZOSTERA MARINA* L.) IN A LOW DENSITY AQUACULTURE SITE IN LONG ISLAND SOUND

JAMIE M. P. VAUDREY,[1]* TESSA GETCHIS,[2] KAITLYN SHAW,[1] JAMES MARKOW,[3] ROBERT BRITTON[1] AND JAMES N. KREMER[1]

**2) Eelgrass as carbonate refugia for calcifiers**

CO_2

air

water

$CO_2 \rightleftharpoons H_2CO_3$

Low pH

$HCO_3^- + H^+ \rightleftharpoons CO_3^{2-} + H^+$

High pH

Ca^{2+}

$CaCO_3$

Ω

Hypothesis: The two-way street of mutualism?

Mutualism?

🦪 Oyster effect on environment	🦪 Oyster effect on plants
Shading ↑	Potential growth limitation 0, -
DIN Excretion	Enhanced epiphyte growth 0, -
CO_2 (respiration, calcification) ↑	Alleviates pCO_2 limitation 0, +
Fecal pellet delivery of N.P to sediment	Fertilization 0, +
Plant effect on environment	**Plant effect on oysters**
CO_2 ↓ pH, CO_3^{2-}, Ω ↑	Enhanced calcification, shell quality 0, +
Concentration of microalgae and detrital particles	Enhanced growth rate 0, +

The approach
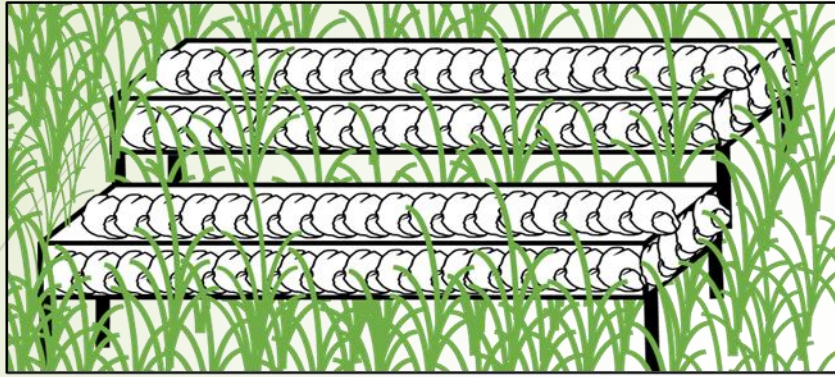
- **Raised bottom cages**
- **Four treatments**
- **Two years**
- **Continuous monitoring**
  - O_2, pH, sal, temp
- **Weekly and 2x diel sampling**
  - Carbonate parameters
  - Nutrients
  - Particles
- **Before / After sampling**
  - Eeelgrass metrics
  - Oyster metrics
  - Sediments



A. Sediment only

B. Sediment + oysters

C. Eelgrass only

D. Eelgrass + oysters

Subplot for measurements

Elevated oyster cages
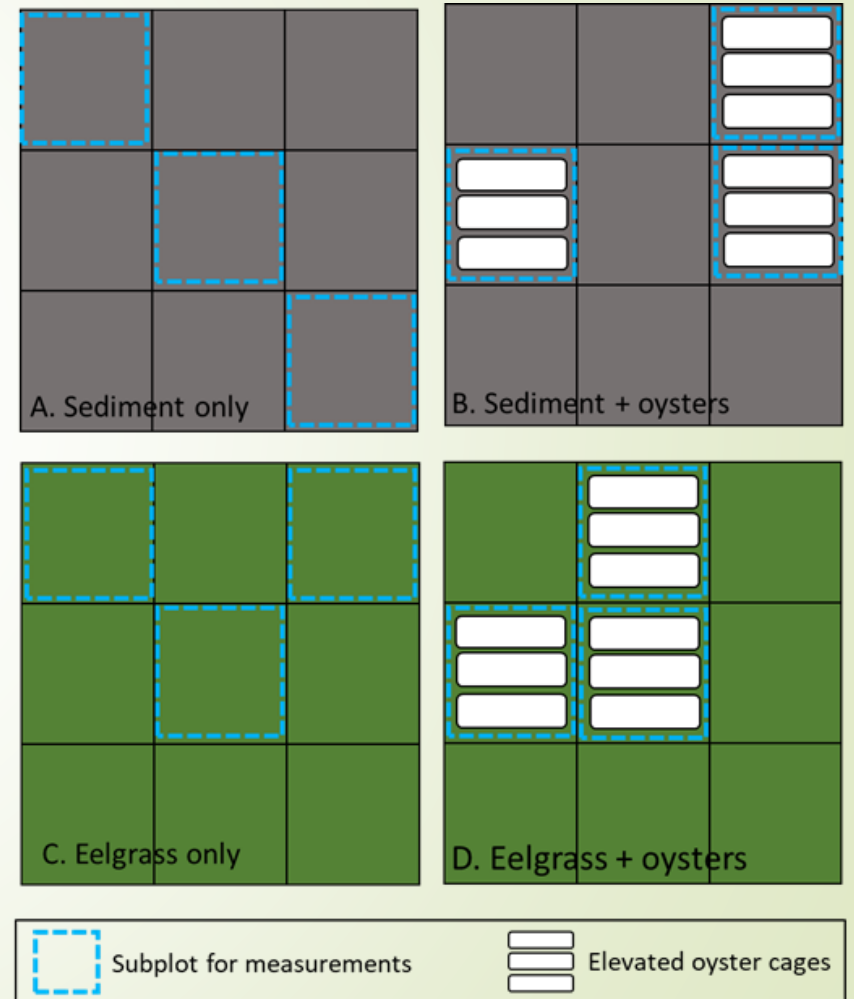
The metrics

| Analysis	Method	Reference
Eelgrass Metrics	Sheath Length, NPI, Density, Biomass	Gaeckle et al. 2006 Lee et al. 2004
DIC , δ^{13}C-DIC	IRMS	Torres et al. 2005
Alkalinity	Endpoint Titration	Zeebe and Wolf-Gladrow, 2001
$CaCO_3$ Saturation Ω	CO_2 Sys	Van Heuven et al. 2011
Particle Concentration & Distribution	Coulter, and Flow-Cam	Menden-Deuer et al. 2020
Oyster Metrics	Shell Geometry, Thickness, Growth	Mizuta and Wikfors, G.H. 2019 Poirier et al. 2020 Theodorou et al. 2023

Eelgrass   **Water quality**   Oyster
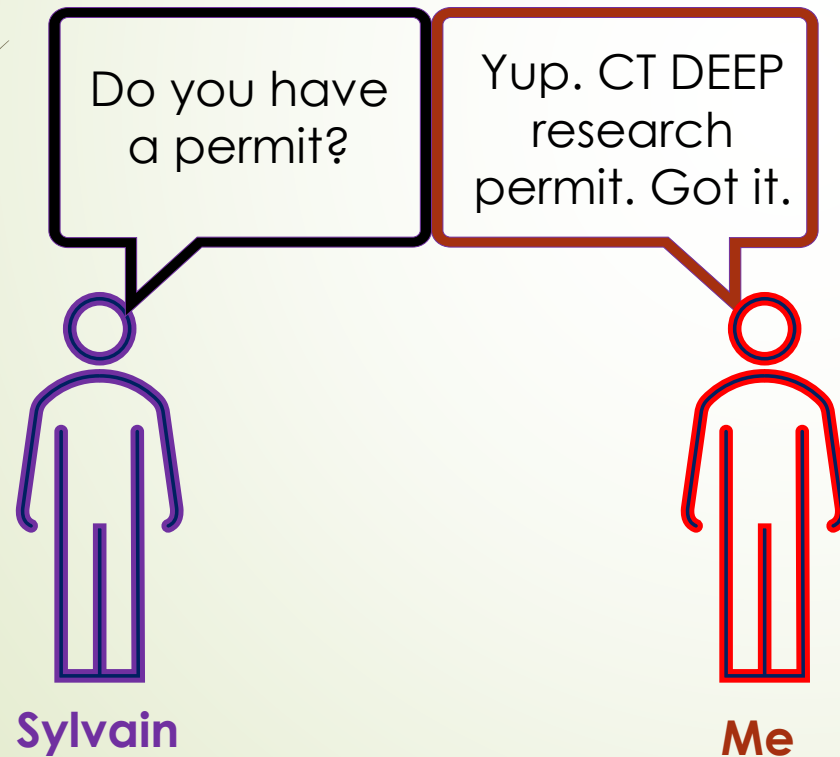
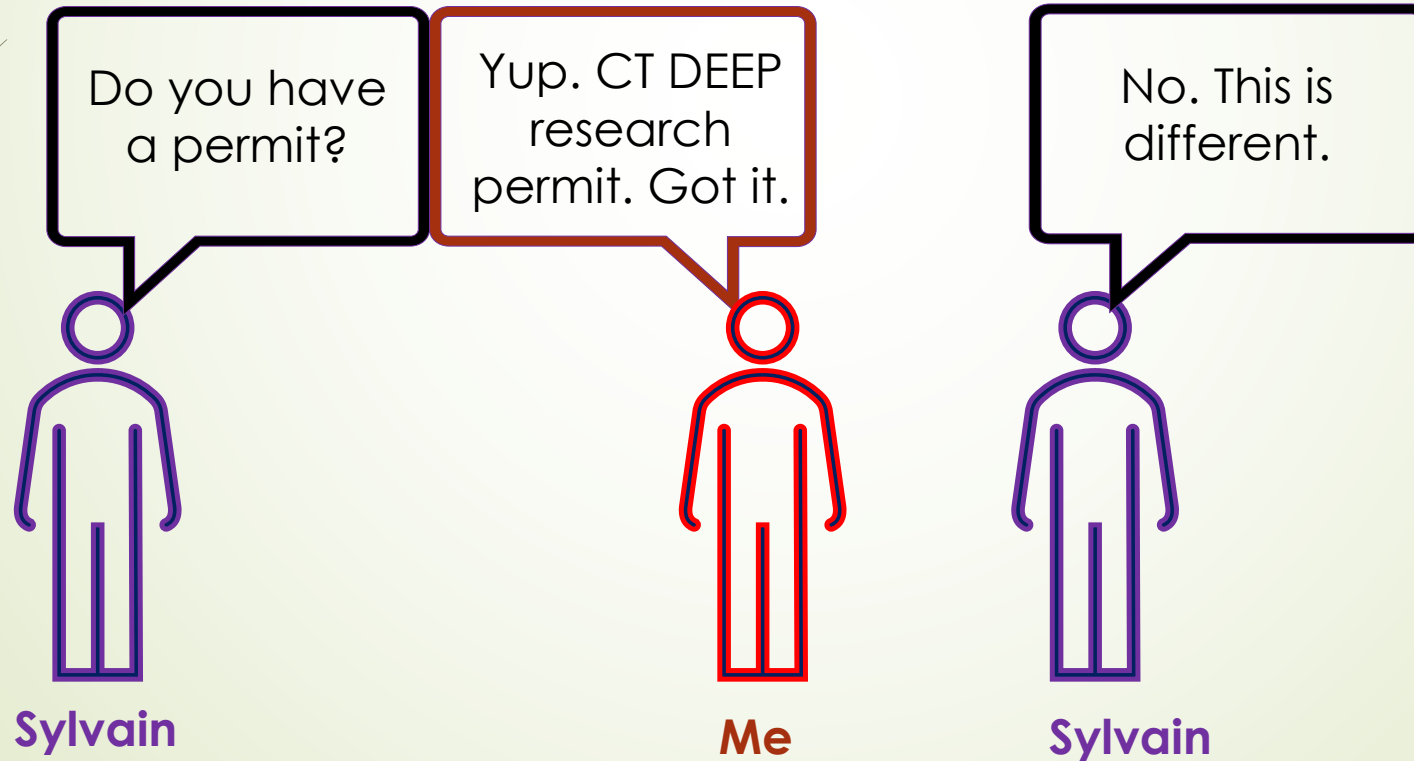# Implementation
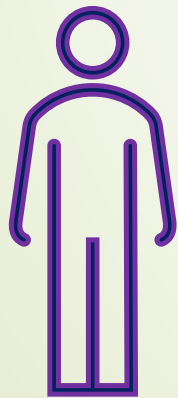
Sylvain

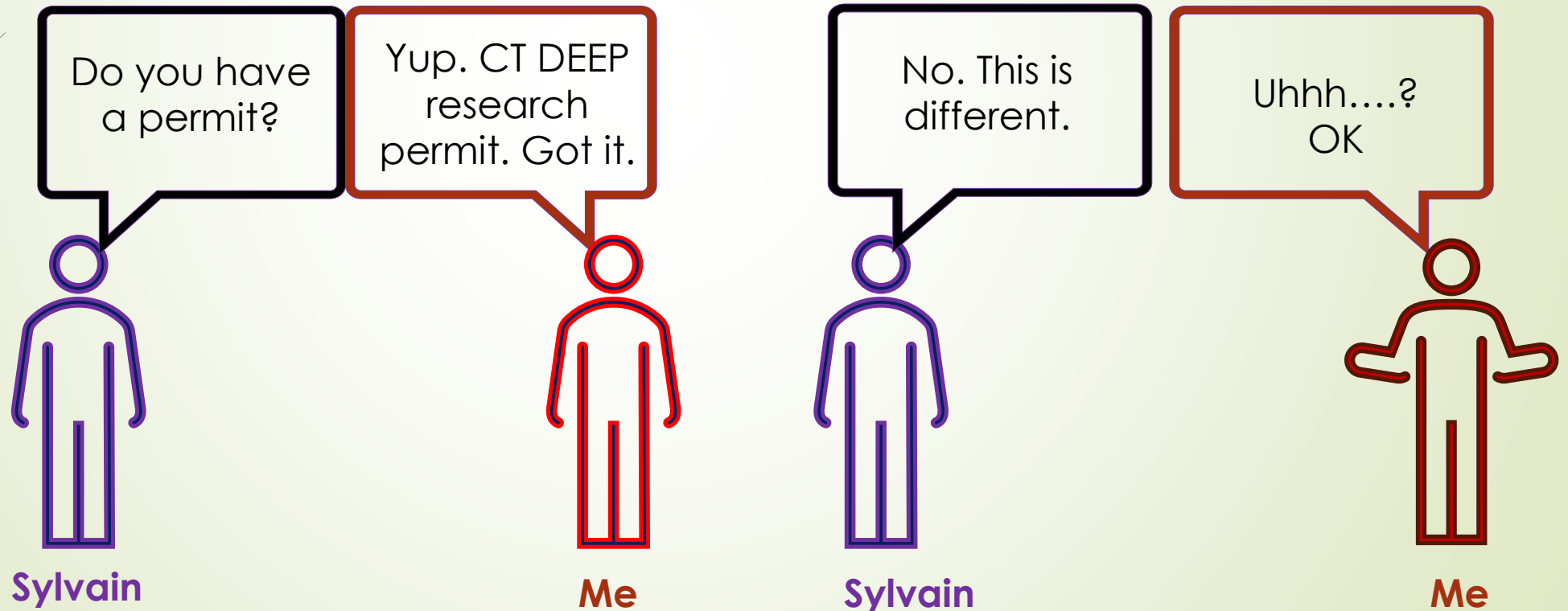# Implementation
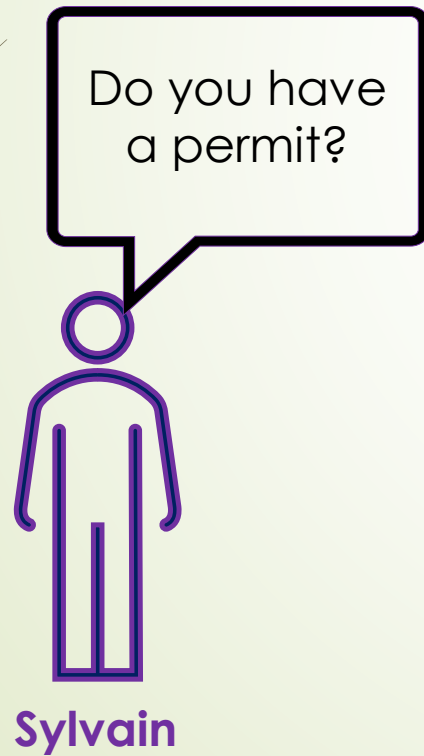
Implementation

Implementation

Implementation

Permit timeline

2023

- 9/26 - Craig & Ashley attend CT Aquaculture Permitting Workgroup to give project intro
- 9/27 - Joint Agency Application submitted to DA/BA
- 12/5 - Checked in with DA/BA on status & next steps of application; was informed that were submitted to DEEP & USACE
- 12/5- DEEP informed that the research project is exempted from their permitting

2024

- 1/25 - Asked DA/BA for a status update, they said DEEP/USACE will reach out to us as needed
- 2/9 - Reached out to USACE to ask about permit status
- 2/14 – USACE followed up with a list of questions about the project & explanation of approval process, indicated that we may be able to get an expedited review
- 2/14 - Answers to USACE questions were sent
- 3/11 - Reached out to USACE about permit status & confirmation on expedited review timeline
  - Informed that USFWS would try to get USACE a response by the end March
  - Additional, detailed questions about project & eelgrass presence in Beebe Cove were requested for the EFH with NOAA

- 3/29 – USACE sends approved permit to DA/BA, pending marker buoys
- 4/2 – CT DEEP Boating requires spar buoy marking based on cage configuration
- 4/19 – Town Manager signs application
- 4/23 USACE approves amended cage configuration
- 4/24 CT DEEP Boating signs off on marker buoys
- **4/29 DA/BA greenlights project work.**

❑ **Seven months start to finish**

❑ **Ashley H. effort = 2 days**

❑ **Novice person effort = 5-10x**

The tip of the eelgrass / aquaculture iceberg

Discussion fodder

What are two research priorities to help inform policy/regulations or to create new BMPs/guidance related to aquaculture - eelgrass interactions?

- Better understand benefits and impacts of interactions.

- Research different aquaculture gear type impacts on eelgrass and BMPs.

- How do we define a significant impact to an eelgrass bed?

- What do we know about eelgrass mitigation in LIS?