LOC-NESS Project Update

Jennie Rheuban and Dan McCorkle

NEFMC April Meeting

April 14, 2026

WOODS HOLE OCEANOGRAPHIC INSTITUTION

The WHOI PI team

Adam Subhas

Jennie Rheuban

Anna Michel

Aleck Wang

Dan McCorkle

Heather Kim

Ke Chen

Roo Nicholson

With colleagues from:

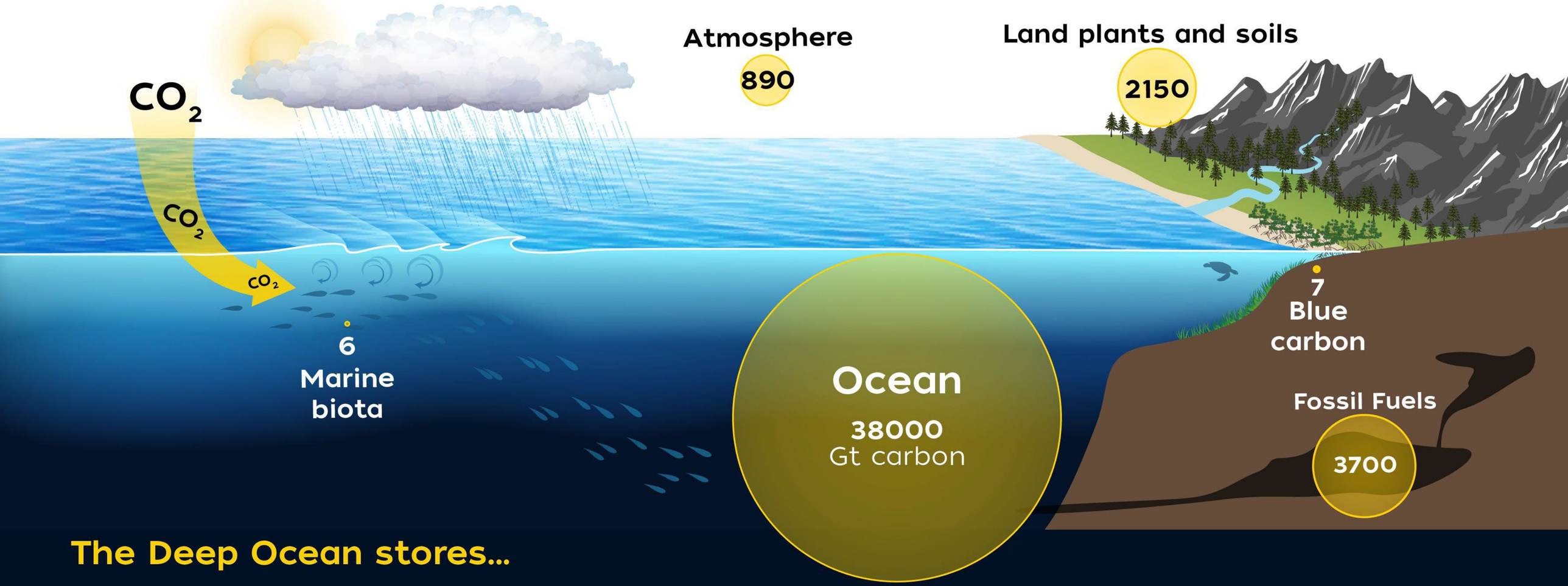
Rutgers University

Monterey Bay Aquarium Research Institute

Environmental Defense Fund

UC Santa Barbara

The ocean is the largest reservoir of carbon on Earth's surface



The Deep Ocean stores...

15-20x more C than land plants and soils

40x more C than atmosphere

5000x more C than blue carbon

WOODS HOLE **OCEANOGRAPHIC** INSTITUTION

WHAT IS OCEAN ALKALINITY ENHANCEMENT?

To accelerate the transfer of carbon dioxide (CO_2) from atmosphere to ocean by boosting the alkalinity of the surface ocean.

HOW DOES OAE WORK?

By lowering the concentration of carbon dioxide in seawater, promoting CO_2 uptake from the atmosphere.

Alkalinity enhancement as a remediation tool

Los Angeles Times

Lime Treatment a Stunning Cure for Sweden's Atran River, Sick From Acid Rain

By HARALD MOLLERSTROM

Dec. 6, 1987 12 AM PT

Kentucky Dept. of Fish and Wildlife

For-profit companies are already plunging in

Contracted for **350,000 tonnes** CO_2 removal by Microsoft

100 tonnes per year CO_2 removal

1200+ tonnes magnesium hydroxide discharged

Carbon credits officially issued

8,000 tonnes olivine sand added to N.C. sediments

What we are (and are not)

LOCNESS IS:

- An interdisciplinary team of scientists, engineers, and communicators
- Committed to rigorous, transparent scientific evaluation of OAE
- Answering key questions about the effectiveness and potential environmental impacts of OAE

LOCNESS IS NOT:

- A company selling CO_2 credits
- Participating in the carbon credit market
- A pathway to deploying alkalinity enhancement at scale

Biological Experiments Update

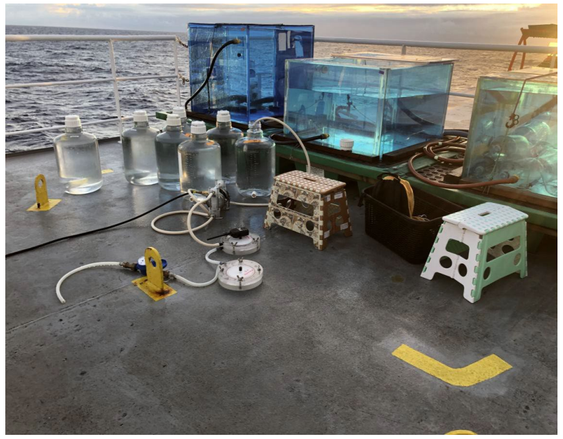
Phytoplankton – in lab and in field (completed and analysis underway)

Zooplankton – in lab – Calanus finmarchicus (completed)

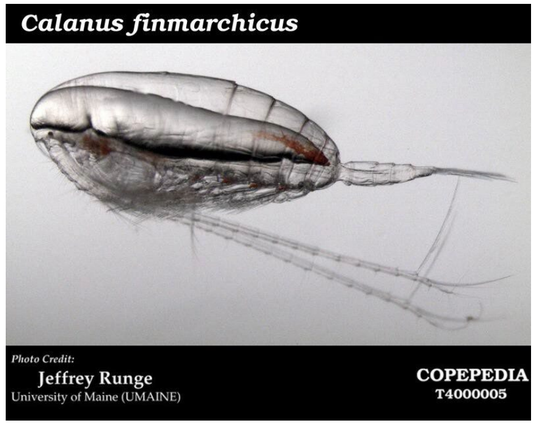
Upcoming:

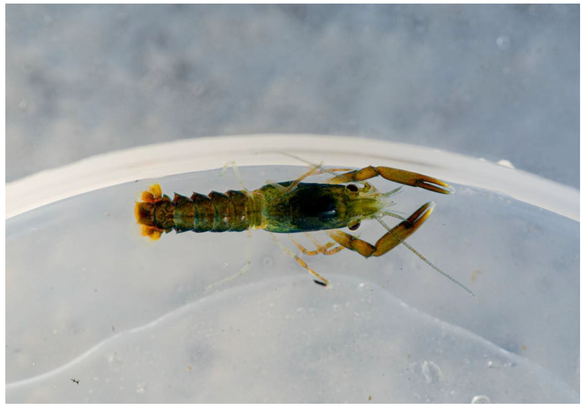
- Lobster larvae (summer/fall 2026)

- Tautog larvae (2027)

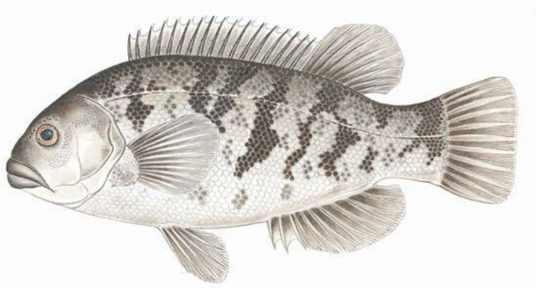


PC: Lukas Marx



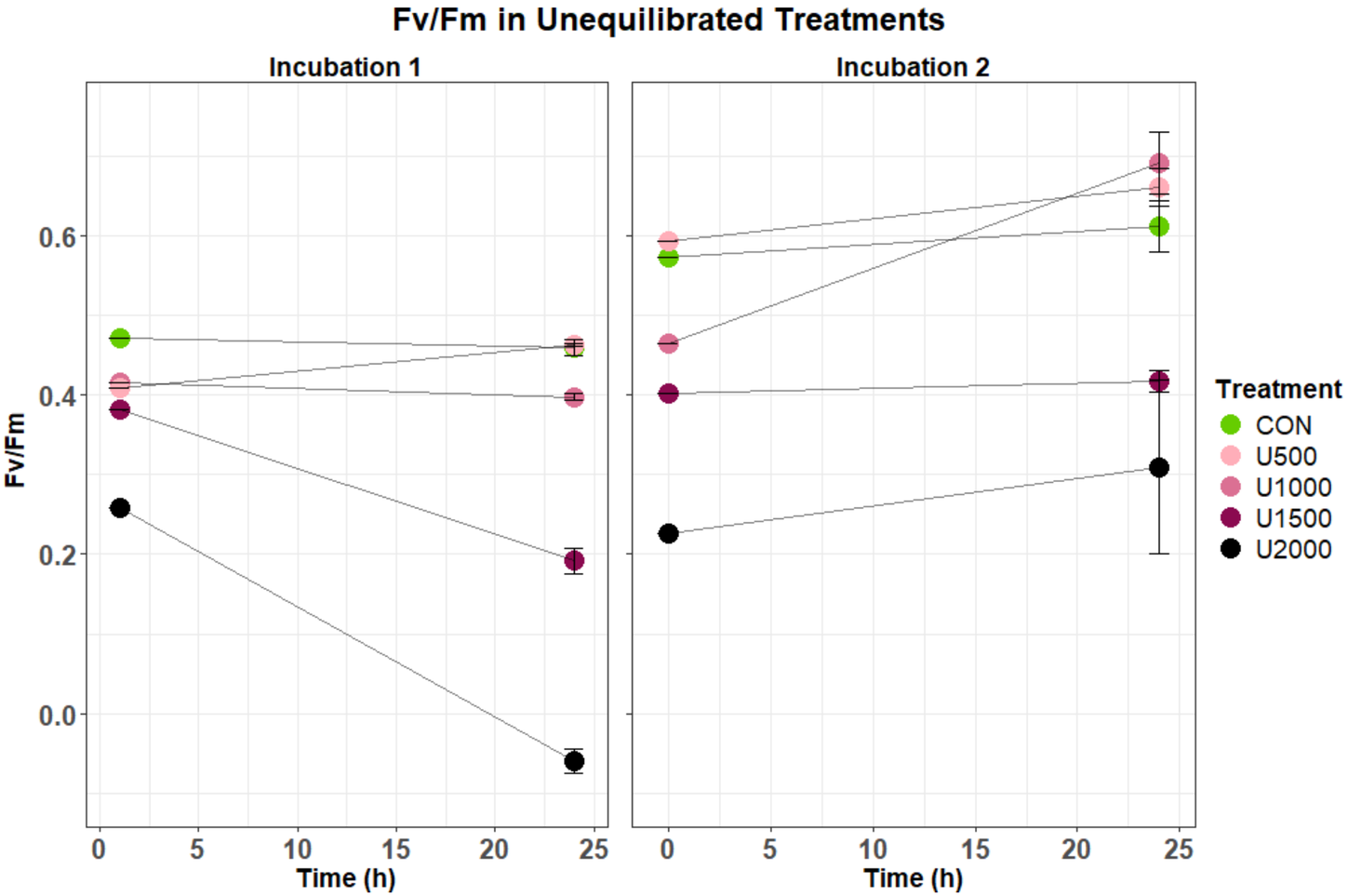


PC: Daniel Cojanu



PC: mass.gov

Low doses of alkalinity do not significantly impact phytoplankton physiology

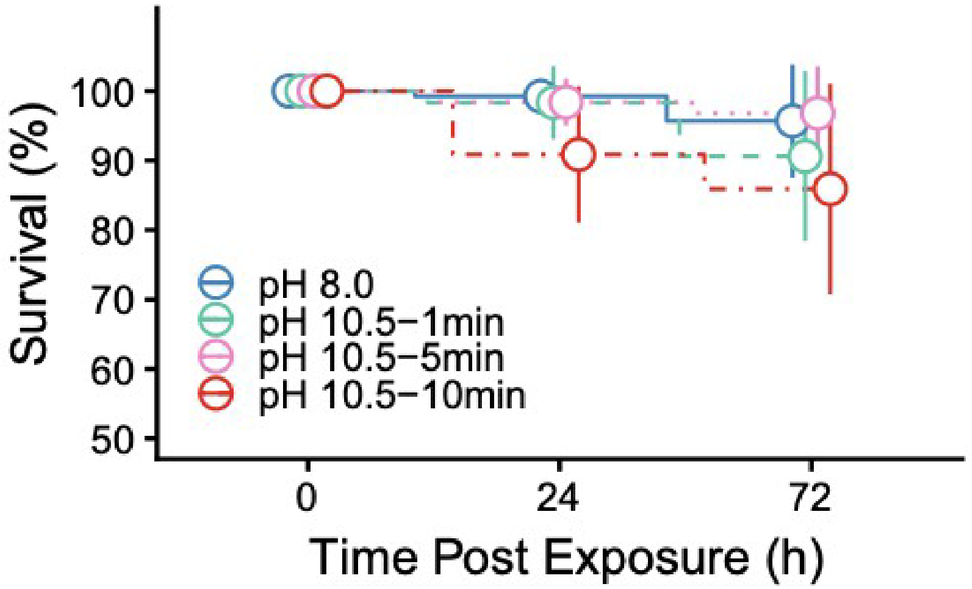


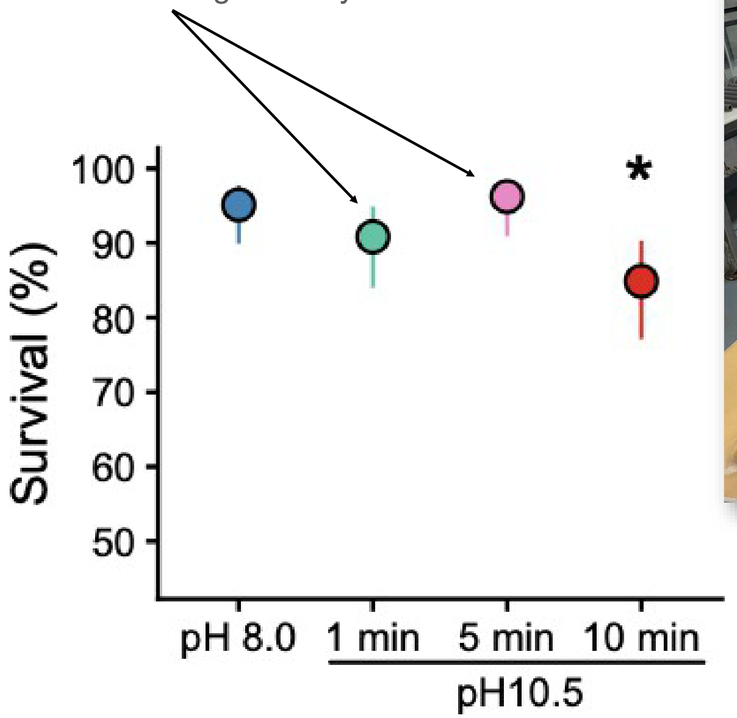
Gulf of Maine
and
NW Atlantic

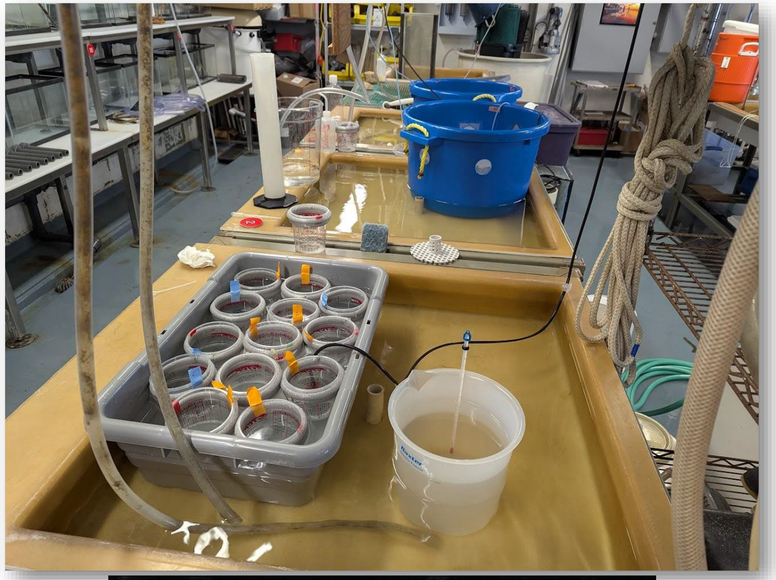
Unpublished data
Rachel Davitt (Rutgers)
Chloe Smith (WHOI JP)

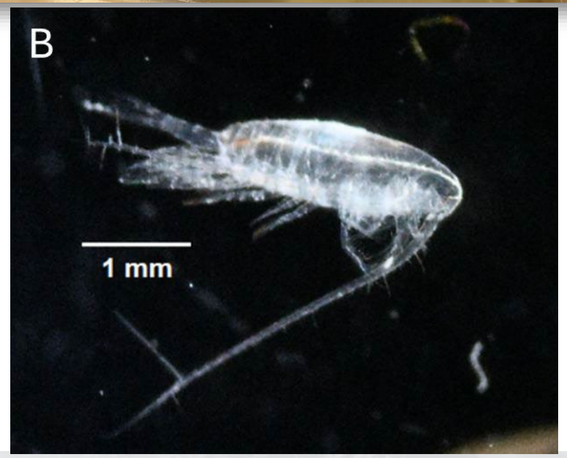
*UNPUBLISHED, PRELIMINARY DATA SUBJECT TO CHANGE

10 minute, pH 10.5 alkalinity exposures do impact the key food web species *Calanus finnmarchicus*





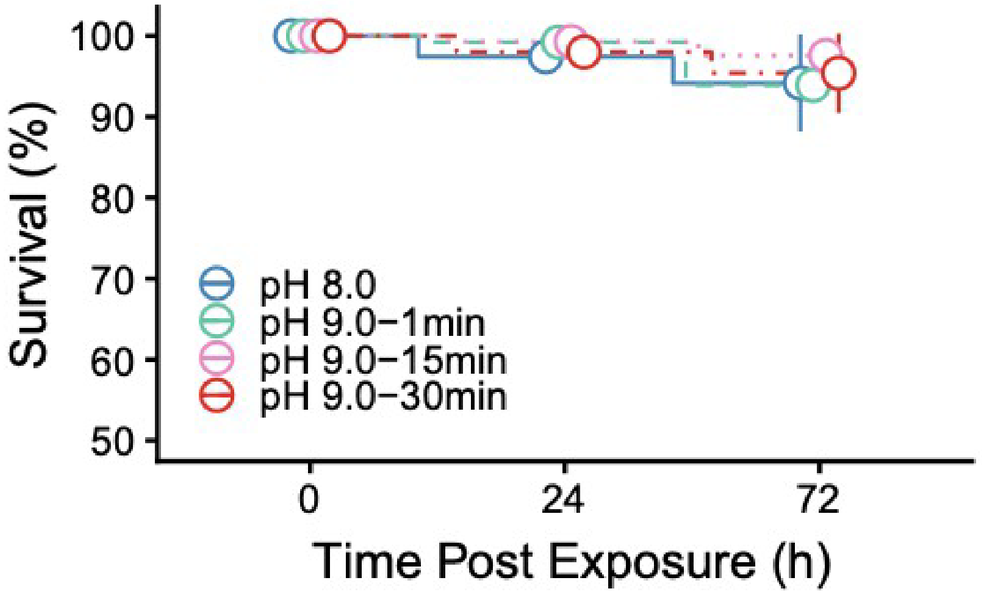


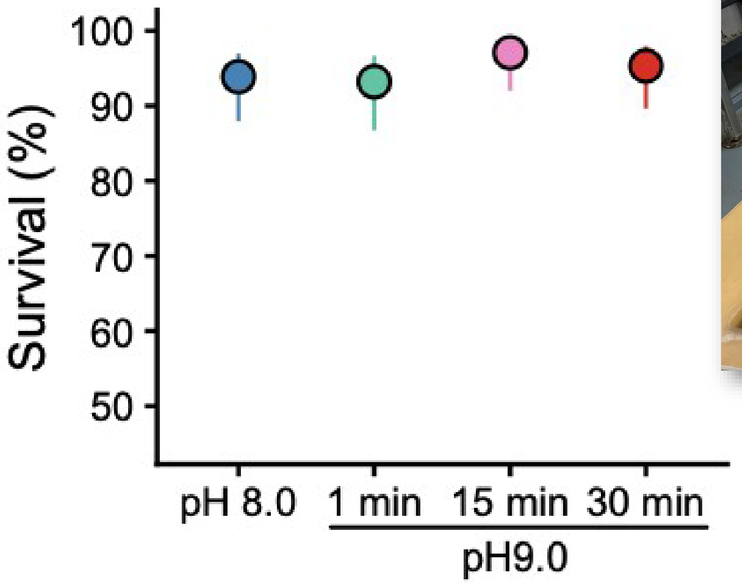


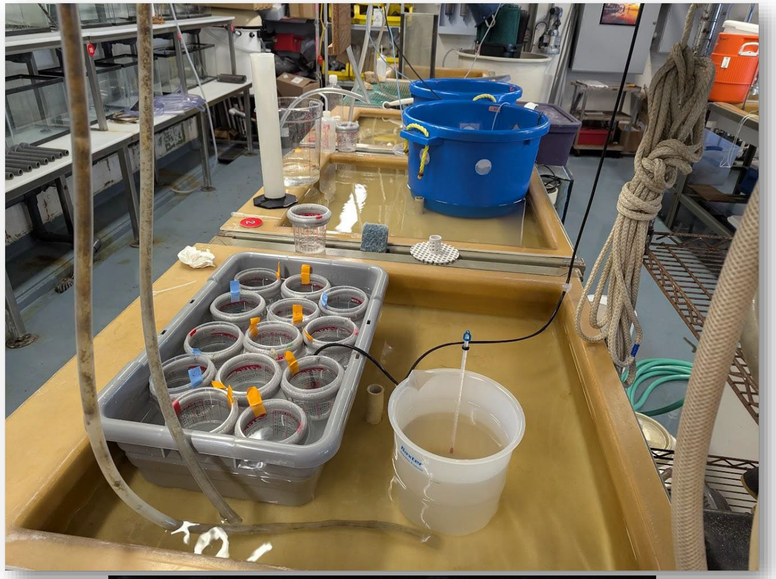
bioRχiv
THE PREPRINT SERVER FOR BIOLOGY

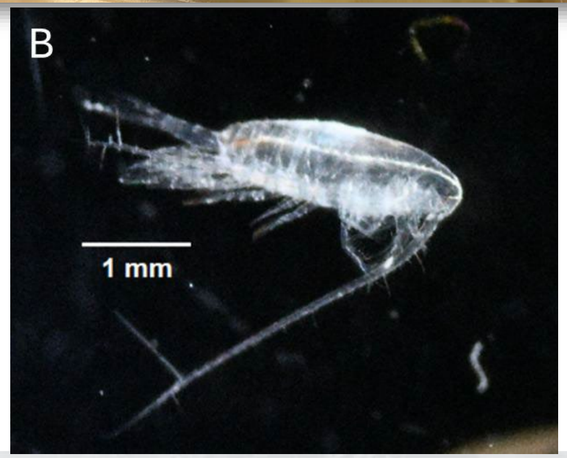
Murray et al., *in revision.*

pH 9 alkalinity exposures do not impact the key food web species *Calanus finnmarchicus*









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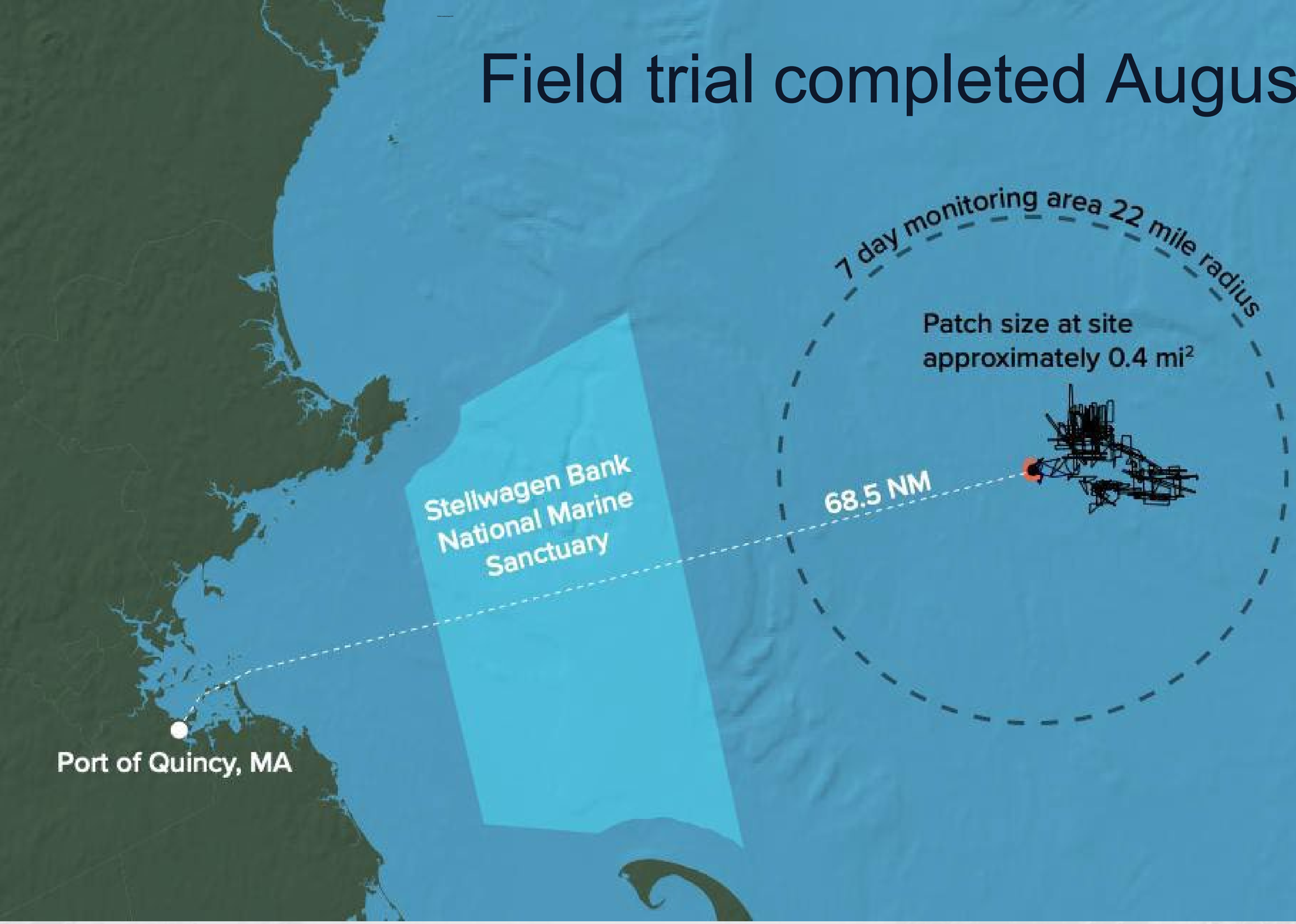
Field trial completed August 2025



~65,000 Liters
50wt% NaOH

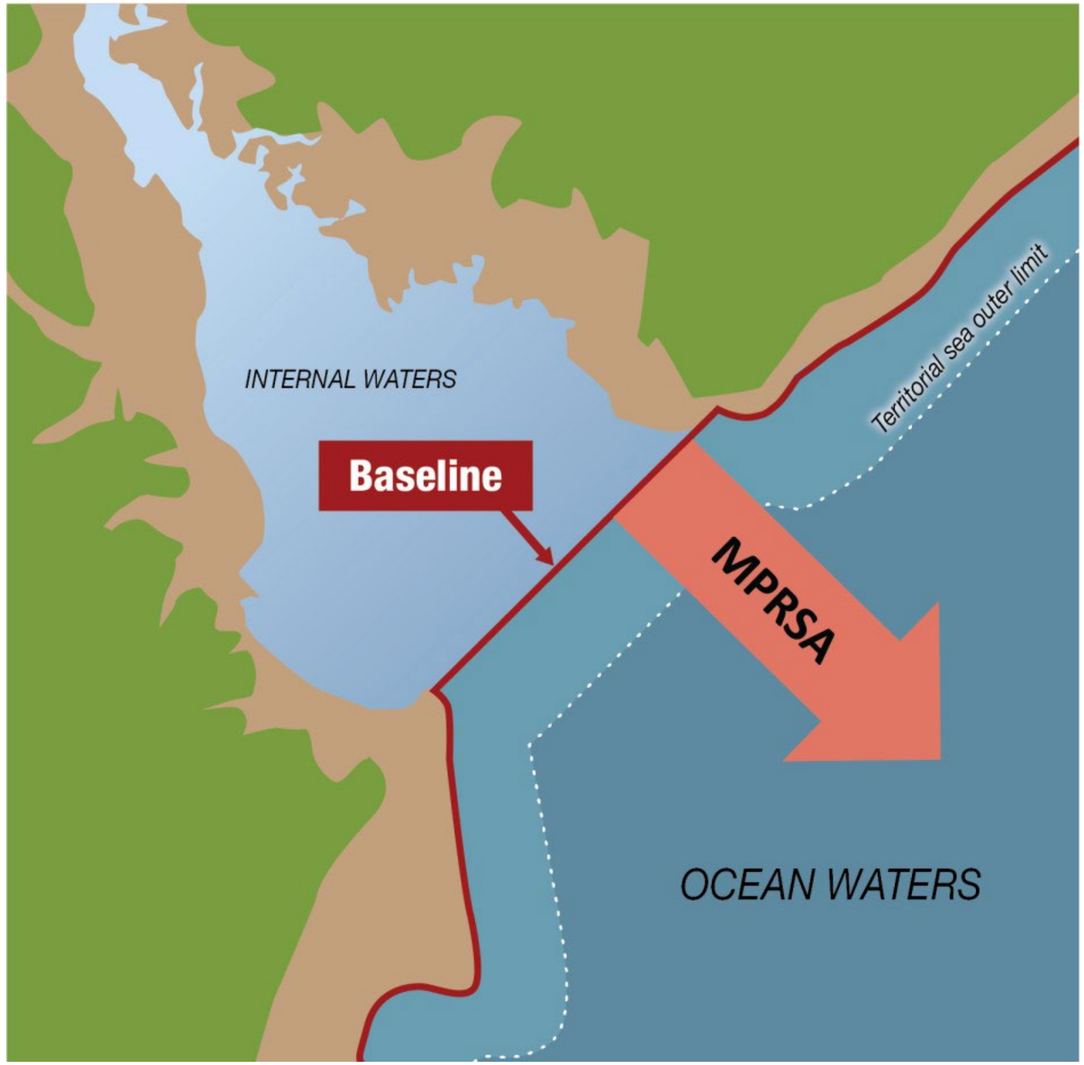
~1000 Liters
20wt%
Rhodamine
Water Tracer

50t CO_2
removal
potential

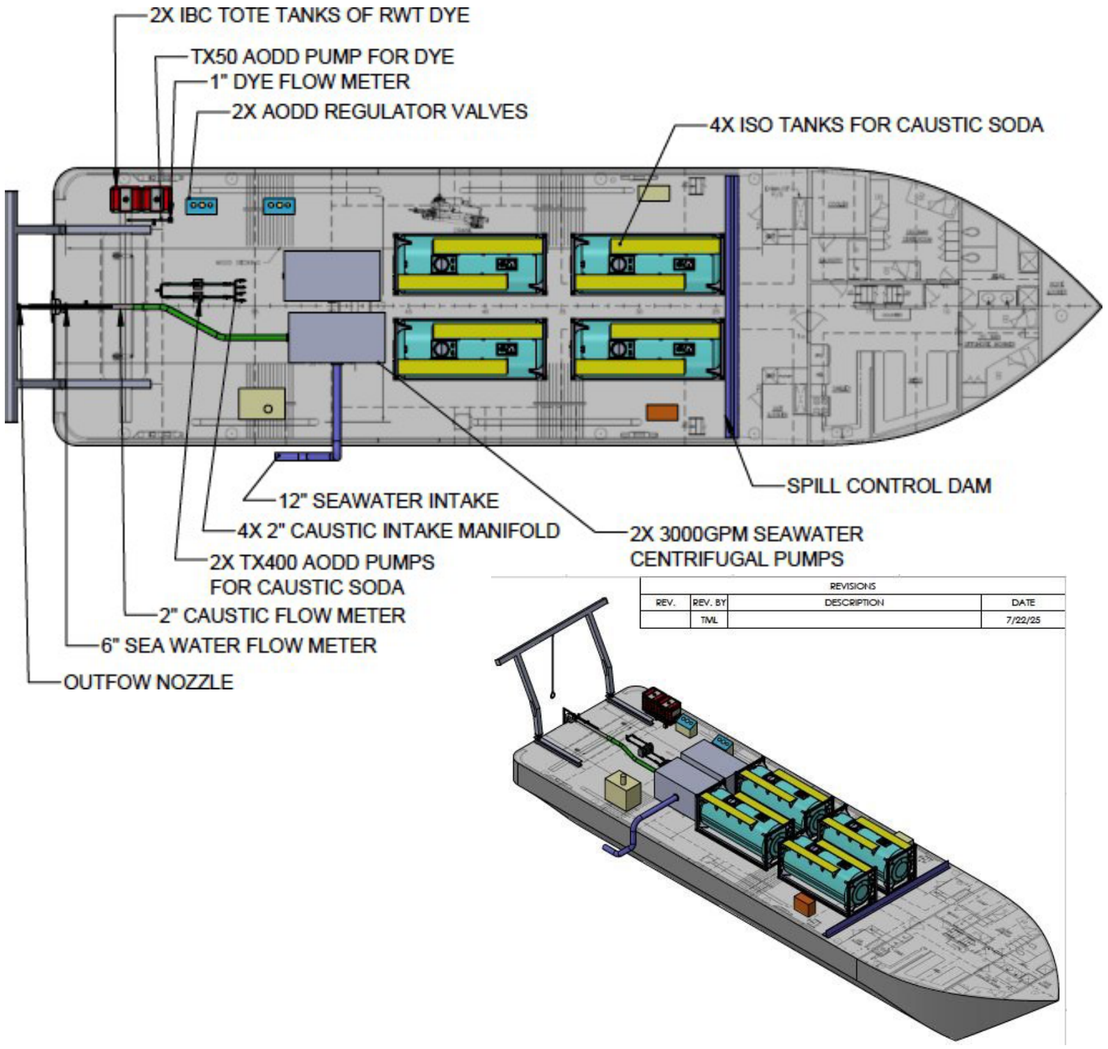
First of its kind EPA Permit for mCDR

- Marine Protection, Research and Sanctuaries Act
- 2.5+ year process
- Regulatory, scientific, and public input
- **Permit issued April 2025**
- **Final report due 1 year after trial completion**

EPA Project Page



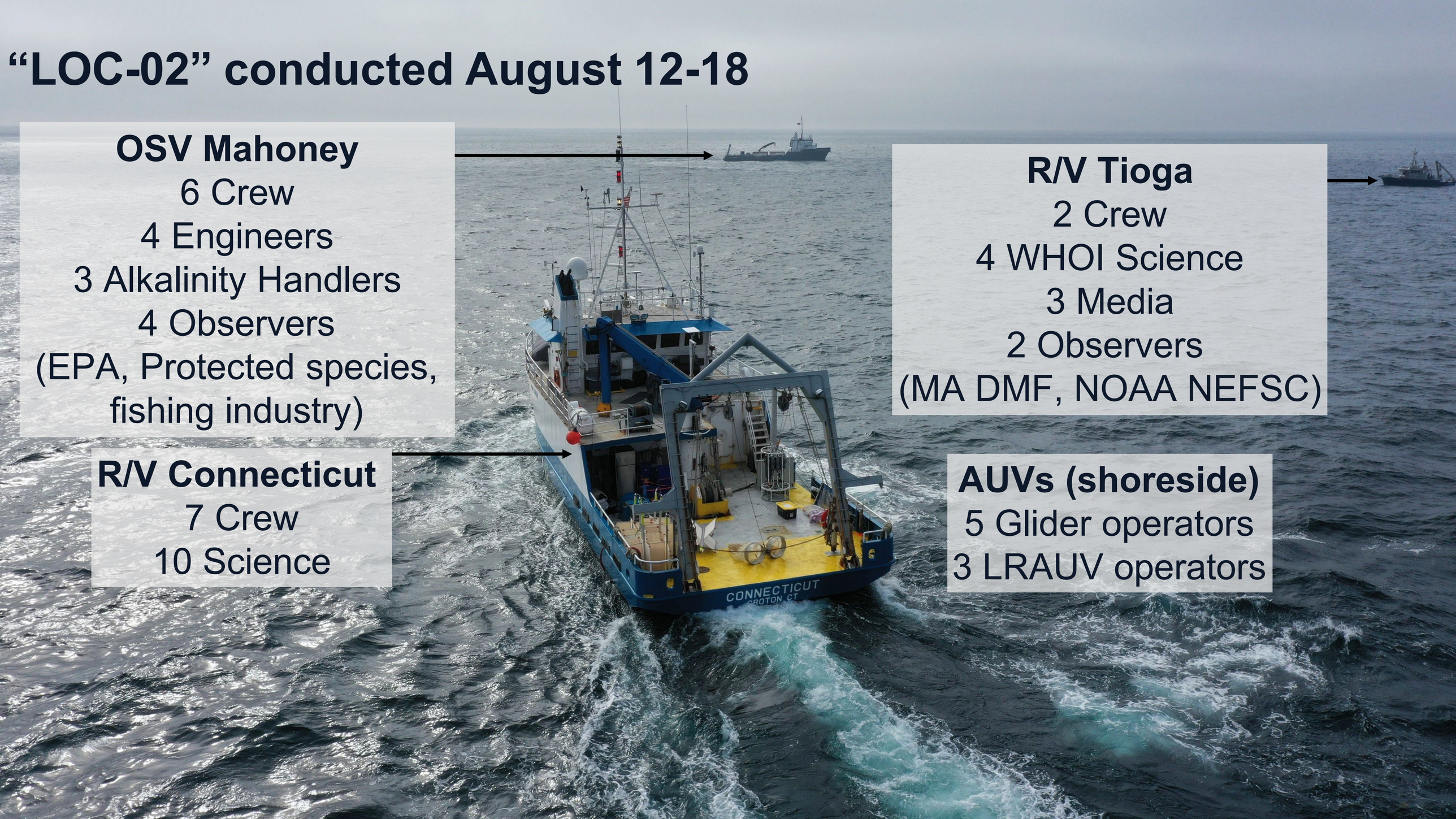
Deck Modification of Supply Vessel for Dispersal



“LOC-02” conducted August 12-18

OSV Mahoney
6 Crew
4 Engineers
3 Alkalinity Handlers
4 Observers
(EPA, Protected species, fishing industry)

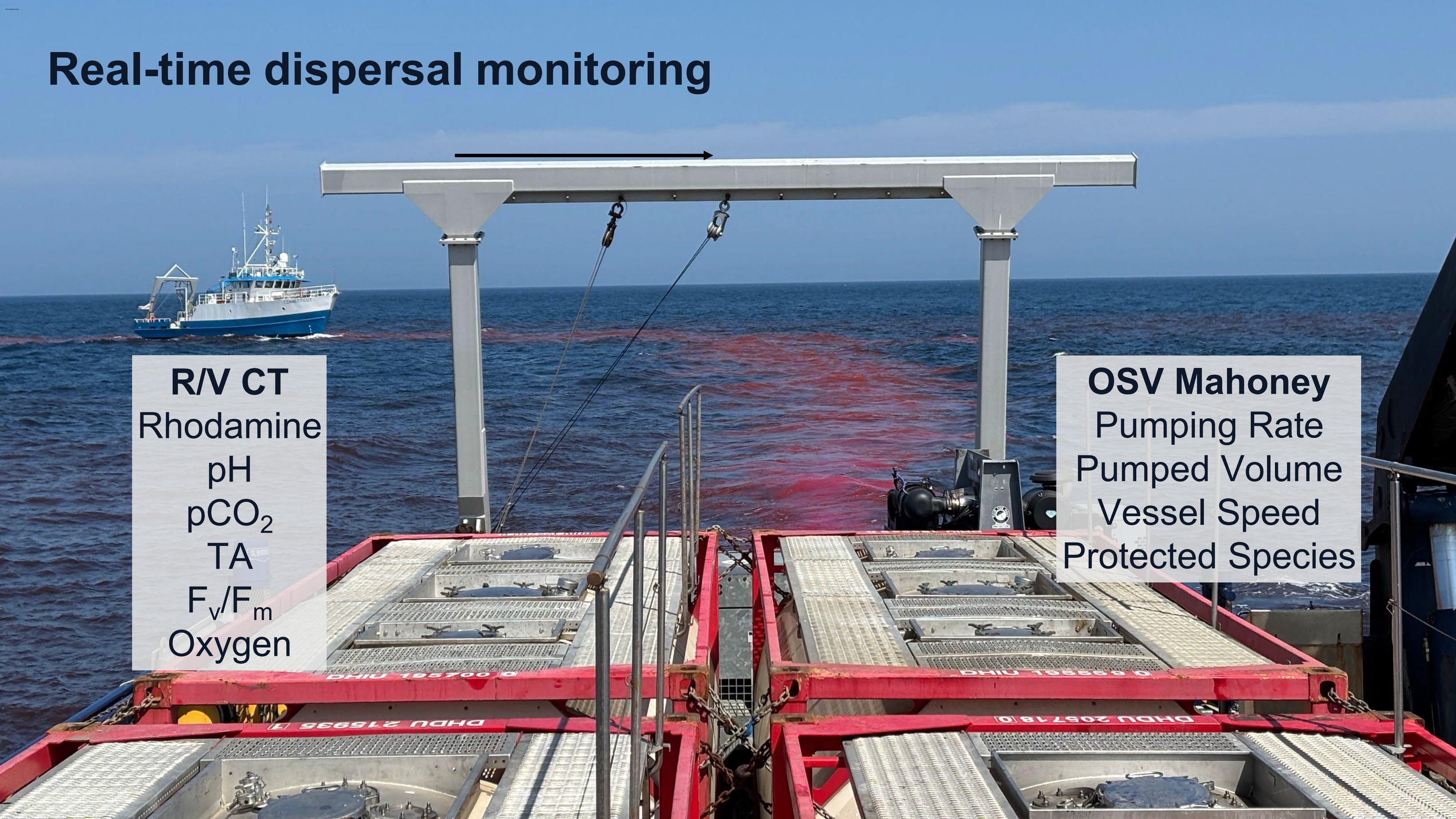
R/V Connecticut
7 Crew
10 Science



R/V Tioga
2 Crew
4 WHOI Science
3 Media
2 Observers
(MA DMF, NOAA NEFSC)

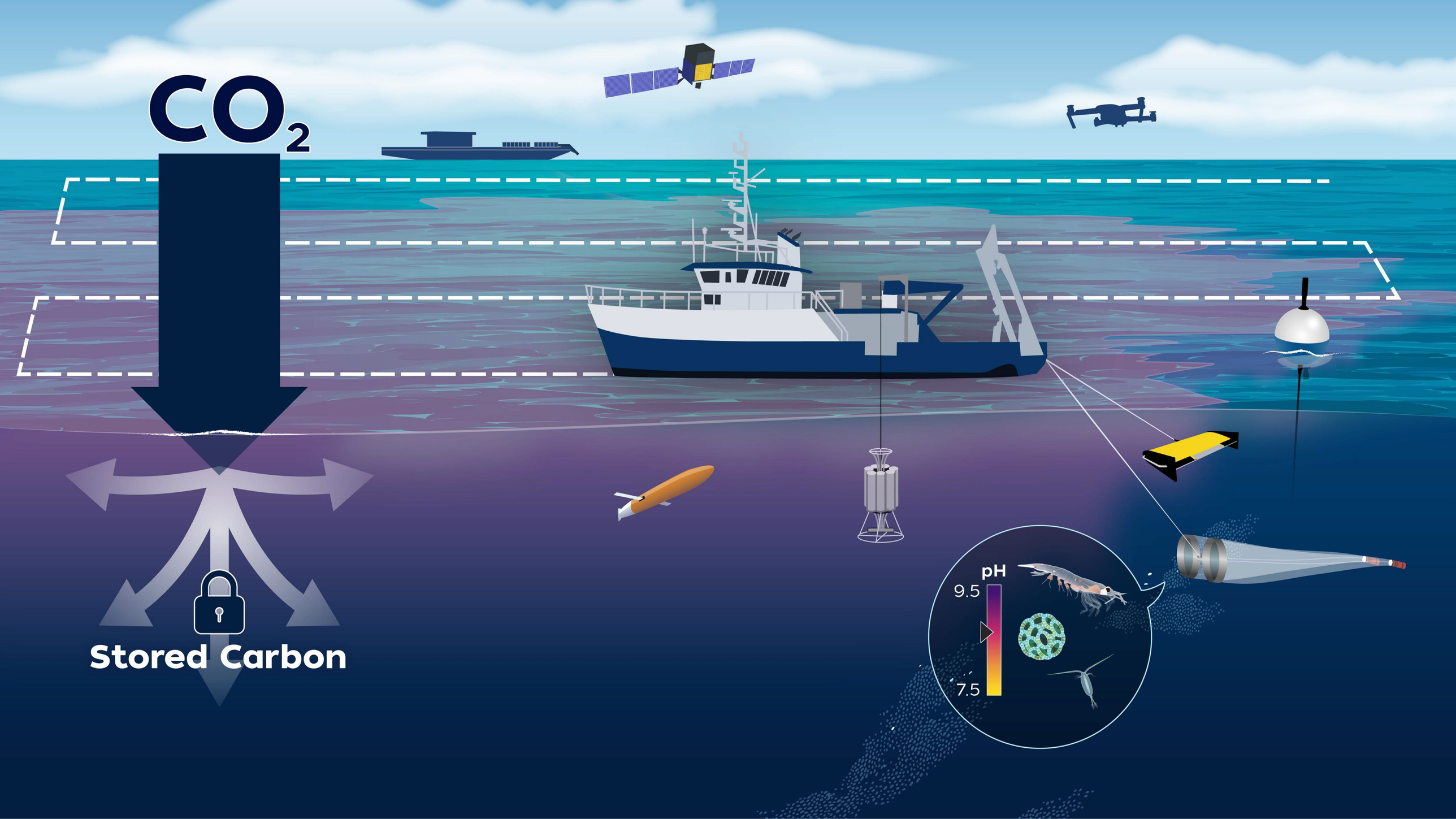
AUVs (shoreside)
5 Glider operators
3 LRAUV operators

Real-time dispersal monitoring

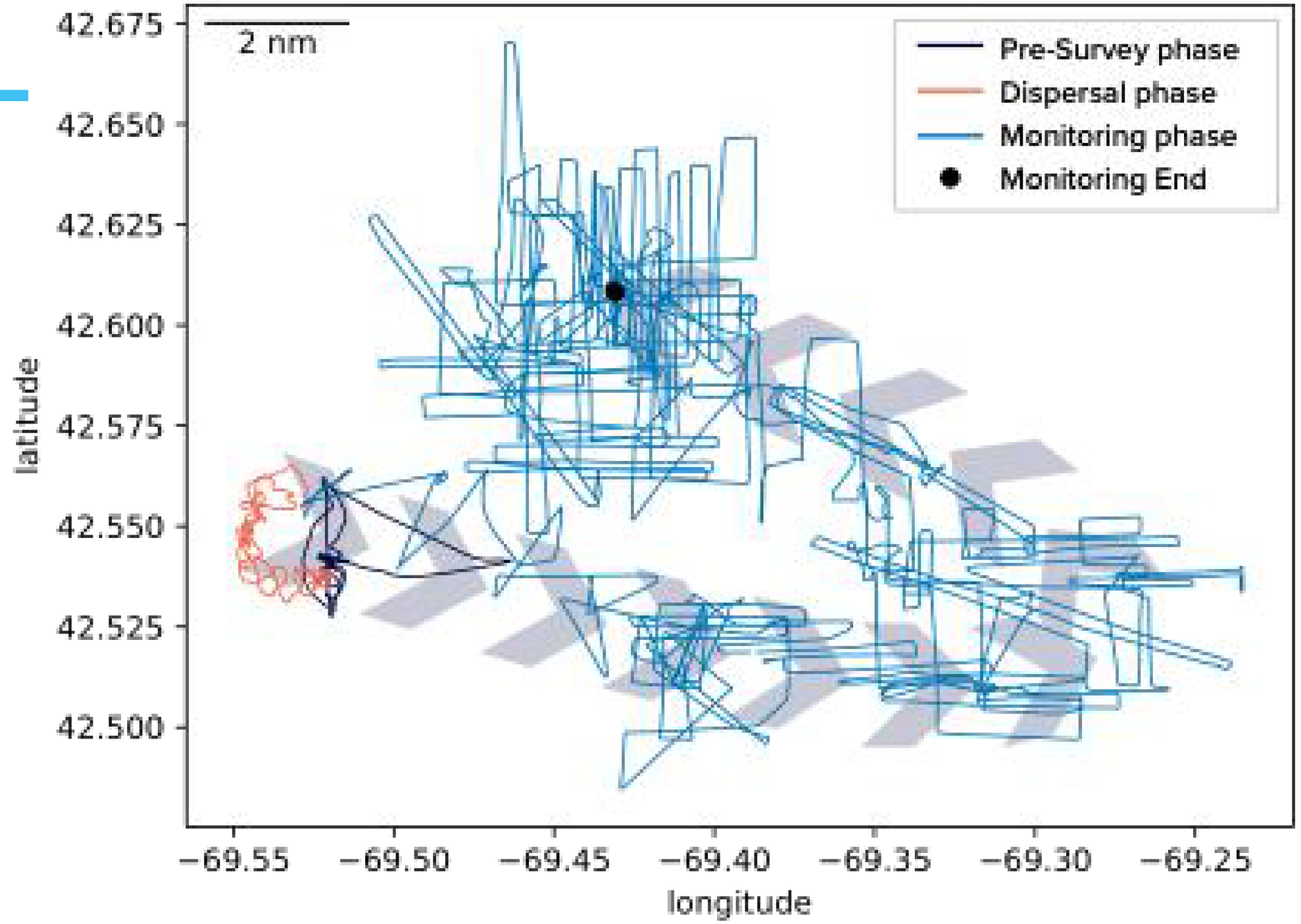


R/V CT
Rhodamine
pH
pCO_2
TA
F_v/F_m
Oxygen

OSV Mahoney
Pumping Rate
Pumped Volume
Vessel Speed
Protected Species


CO_2
Stored Carbon
pH
9.5
7.5

Ship track during the experiment



Pre-survey pH: **7.95**

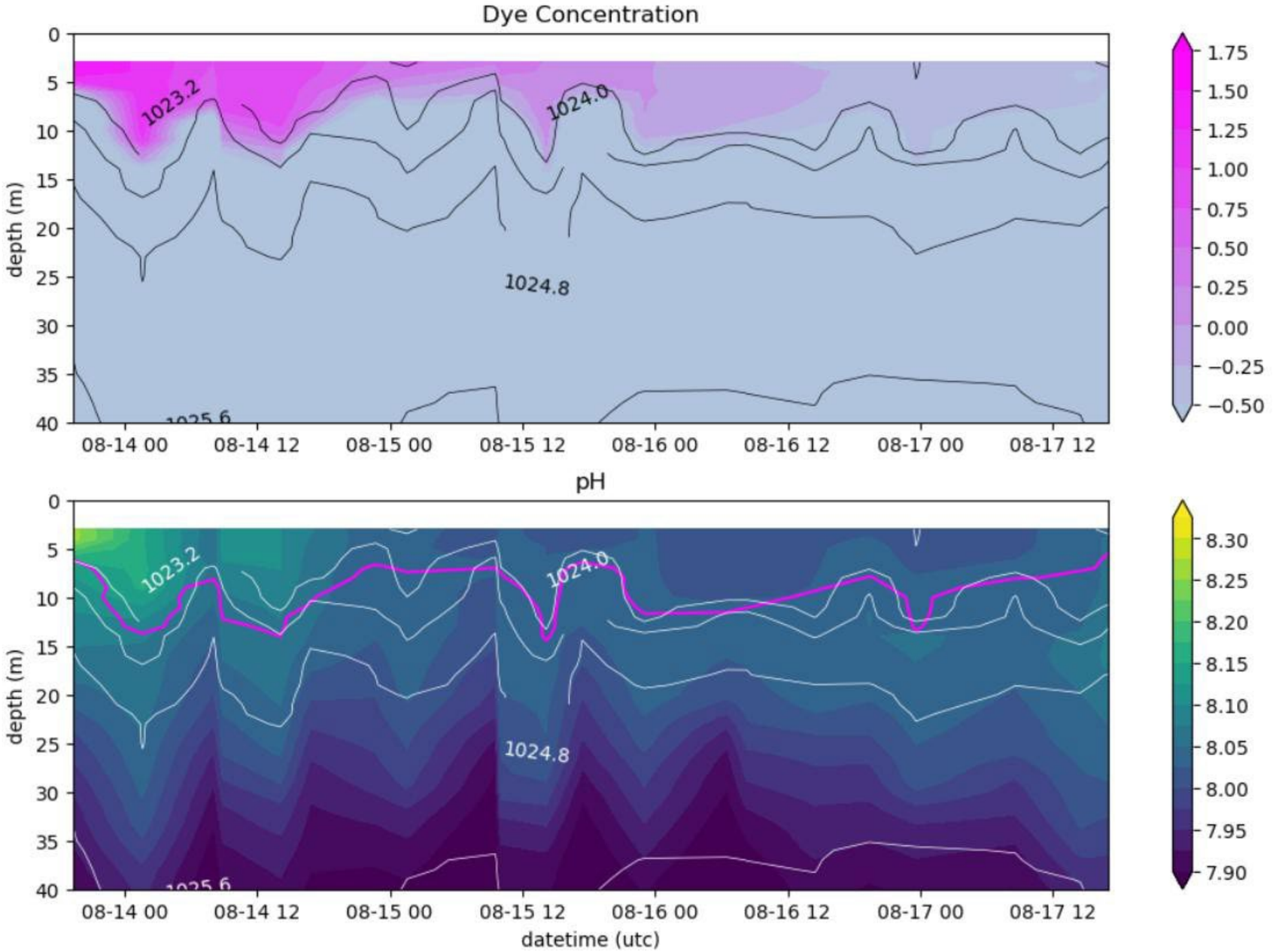
Dispersal pH: Stayed within permitted limits

Monitoring pH: Start **8.3**, end **7.95**

*UNPUBLISHED, PRELIMINARY DATA SUBJECT TO CHANGE

RWT stays at the surface, ~follows density contour

pH is higher at 10-20 meters due to phytoplankton productivity



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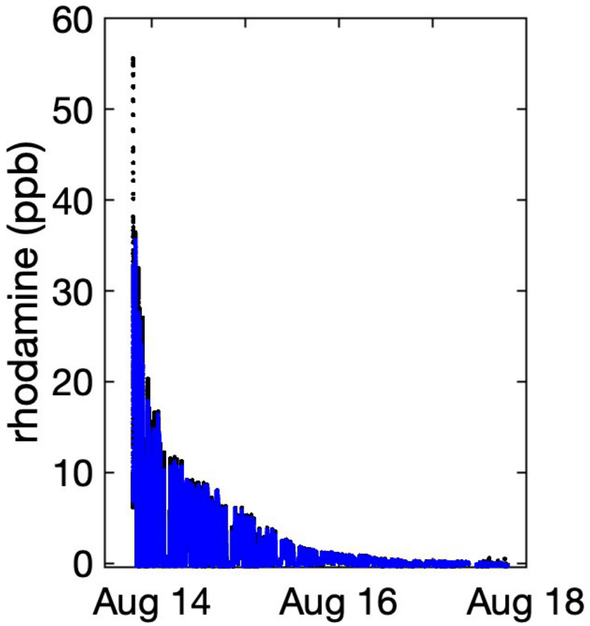
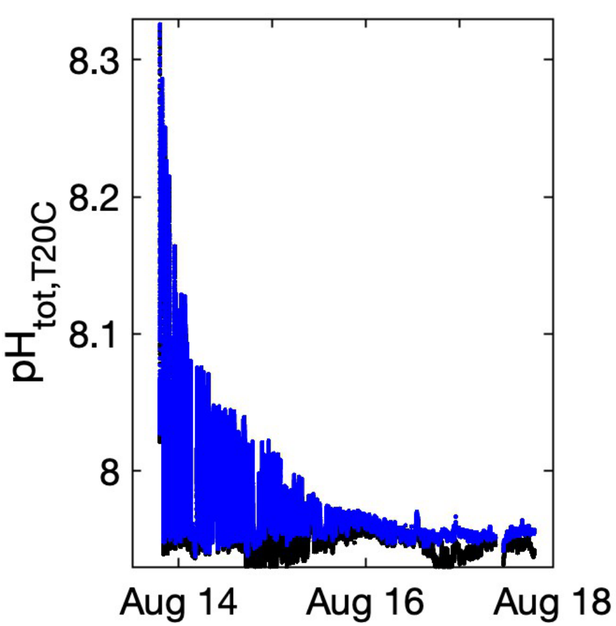
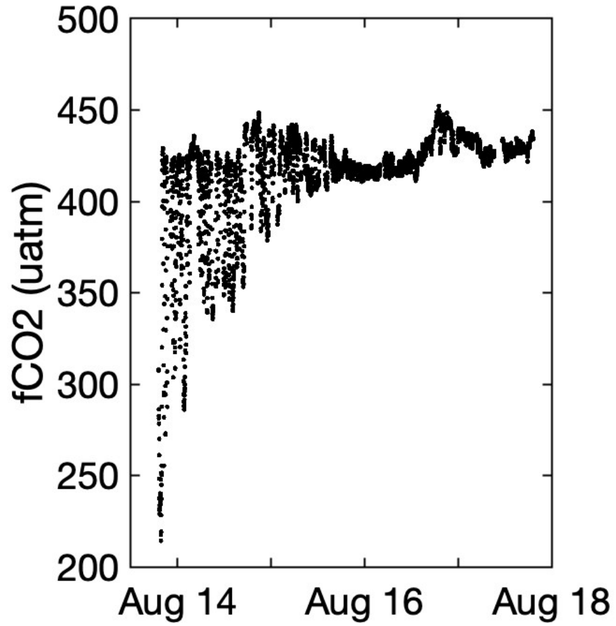
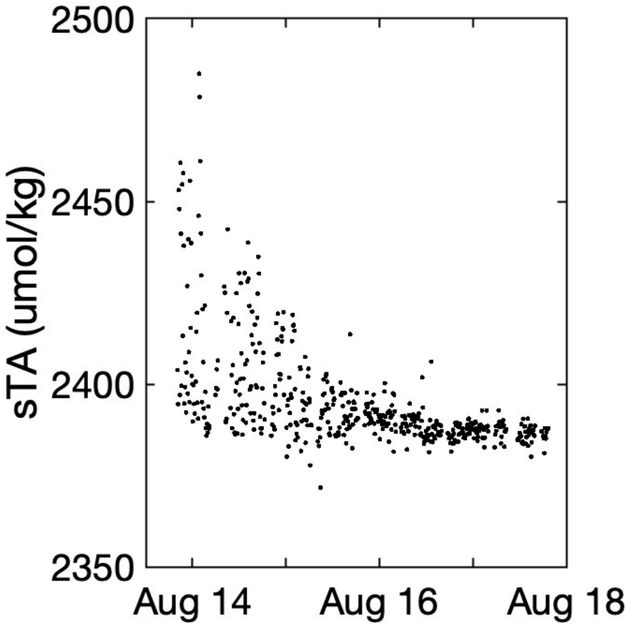
The OAE patch rapidly dissipated back to background in ~4 days









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CDR is measurable in ~2 days

All calculations require rhodamine. A physical tracer is a fundamental component for early field trials.

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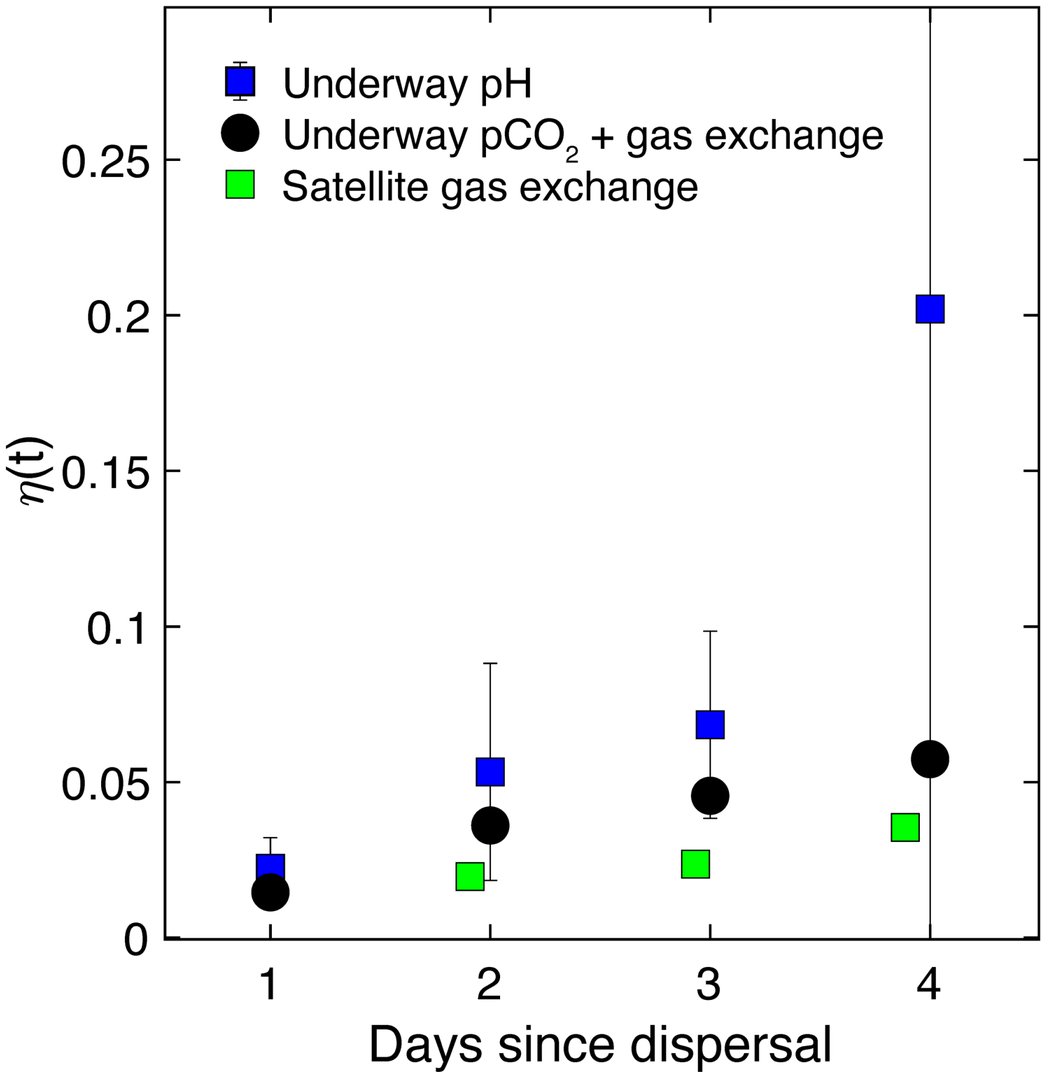
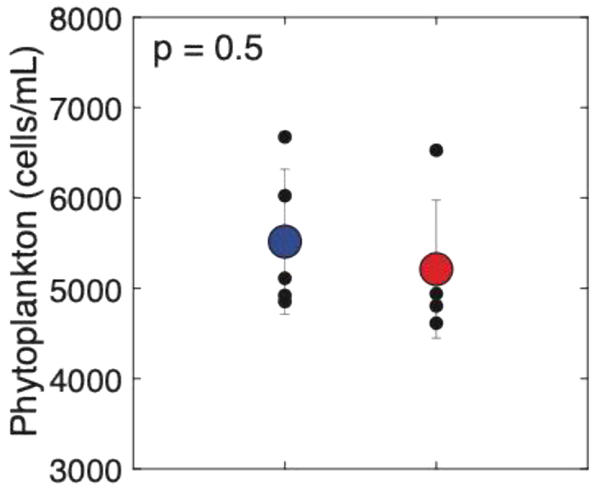


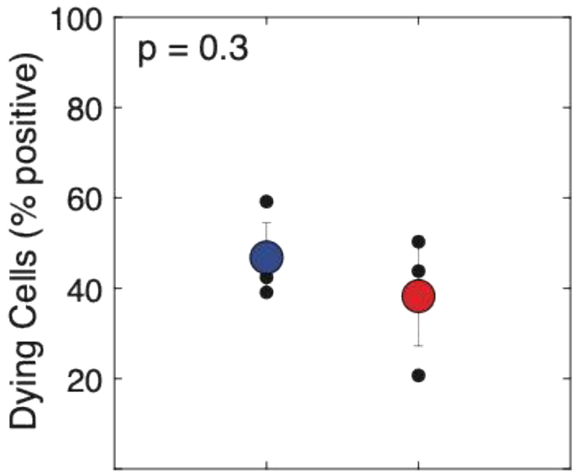
Early analysis suggests that in 4 days, the patch absorbed ~3 (2-10) tonnes of CO_2 from the air (out of 50)

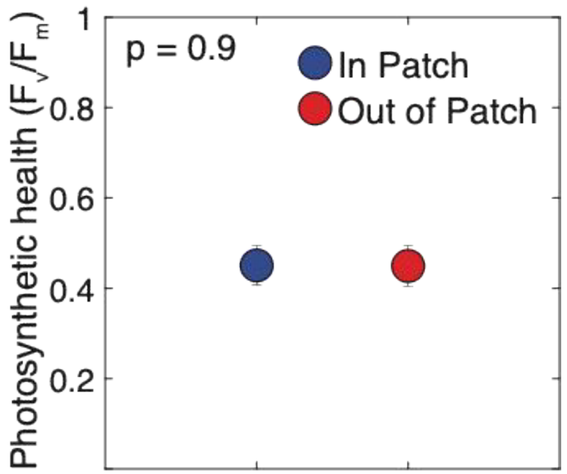
This storage would offset driving a car for ~7,500 miles.

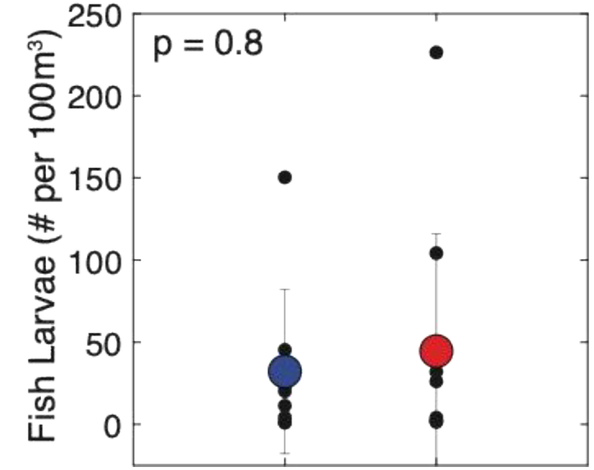
Carbon uptake kept happening after we left

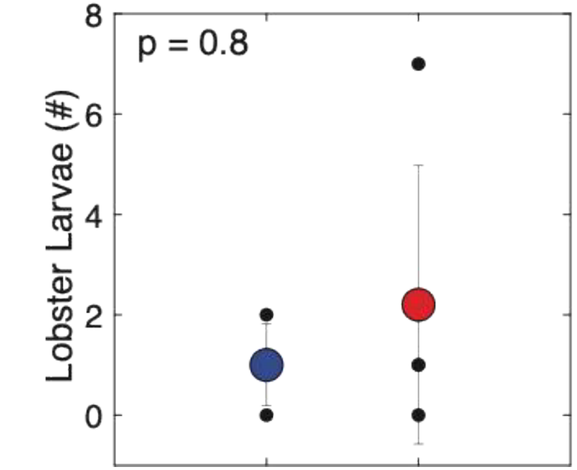
No biological differences between in and out of patch

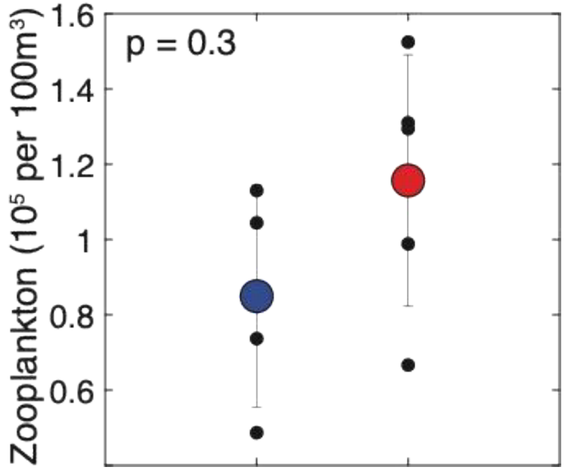












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Stay tuned for more…

Thank you!

Jennie Rheuban
Dan McCorkle
LOCNESS team

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Carbon to Sea Initiative

climateworks FOUNDATION

ICONIQ

Woods Hole Oceanographic Institution