Ocean Alkalinity Enhancement and the LOCNESS project

Adam V Subhas

NASEM mCDR Standing Committee Meeting 2, Open Session
September 17, 2025

WOODS HOLE **OCEANOGRAPHIC** INSTITUTION

THE WHOI LOCNESS PROJECT:

Locking Ocean Carbon in the Northeast Shelf and Slope

20 WHOI scientists and engineers from five departments
Colleagues from:

- Rutgers University
- Monterey Bay Aquarium Research Institute
- MRV Systems
- EDF
- UC Santa Barbara

Funding from: Carbon to Sea Initiative, ICONIQ Impact, NOAA-NOPP (enhanced monitoring and lab studies), ClimateWorks (engagement)

What we are (and are not)

LOCNESS IS:

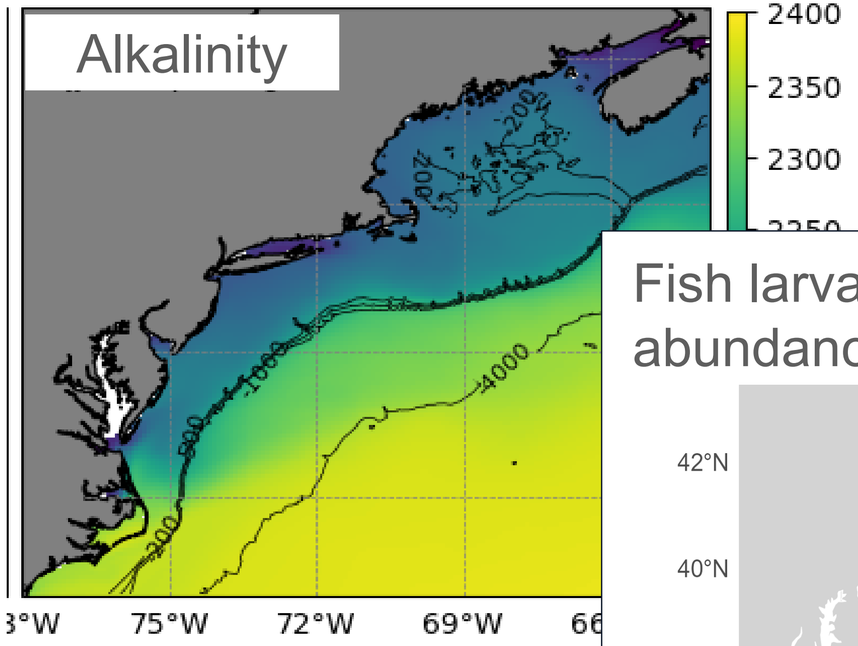
- An interdisciplinary team of scientists, engineers, and communicators
- Committed to rigorous, transparent scientific evaluation of OAE
- Answering key questions about the effectiveness and potential environmental impacts of OAE

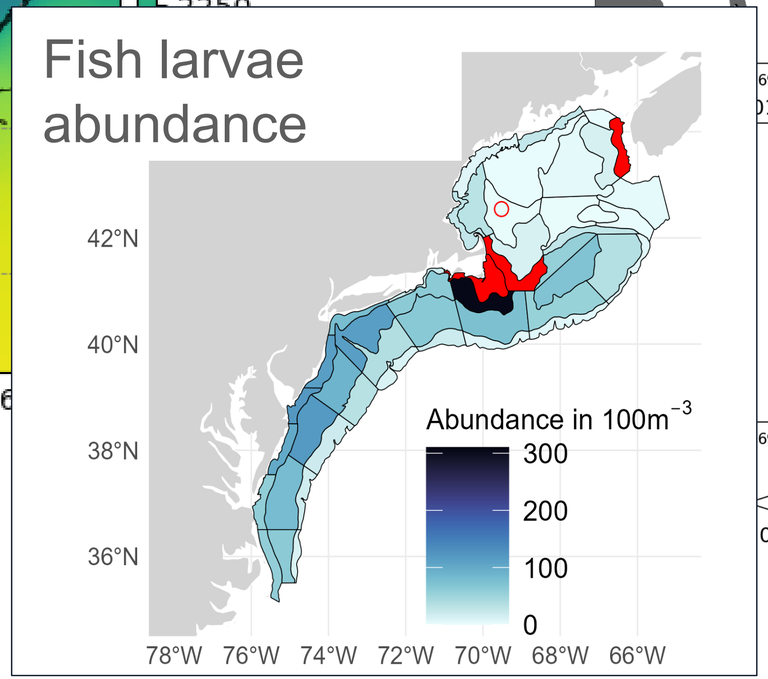
LOCNESS IS NOT:

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

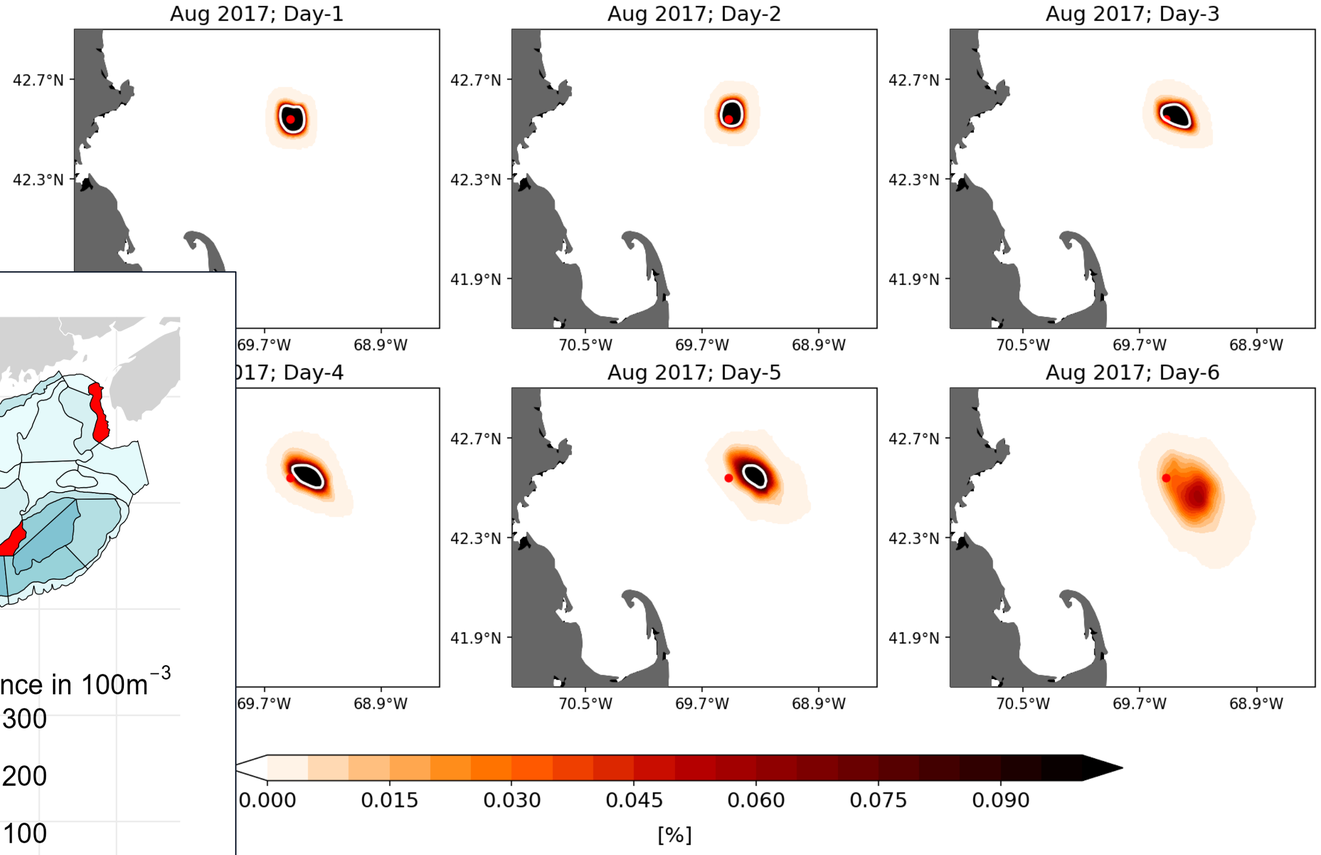
Modeling

Chemistry, biology, physics





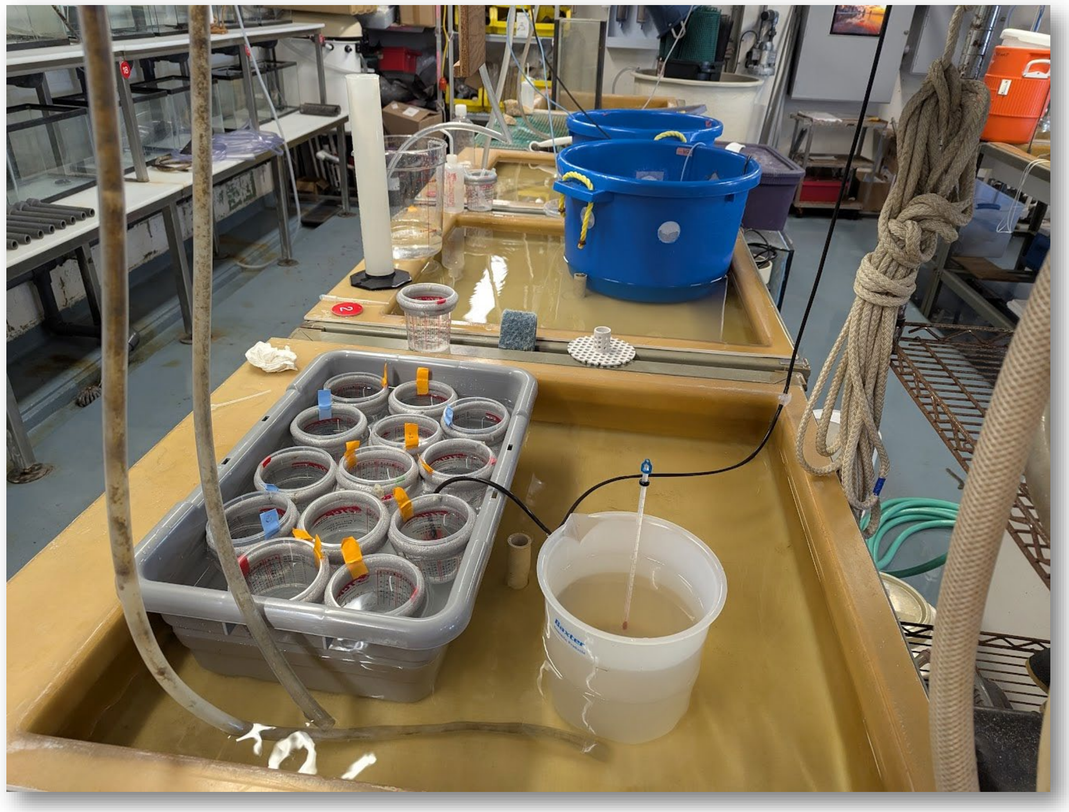
Rheuban et al., *in review*
Marx et al., *in revision*
Guo et al., 2025

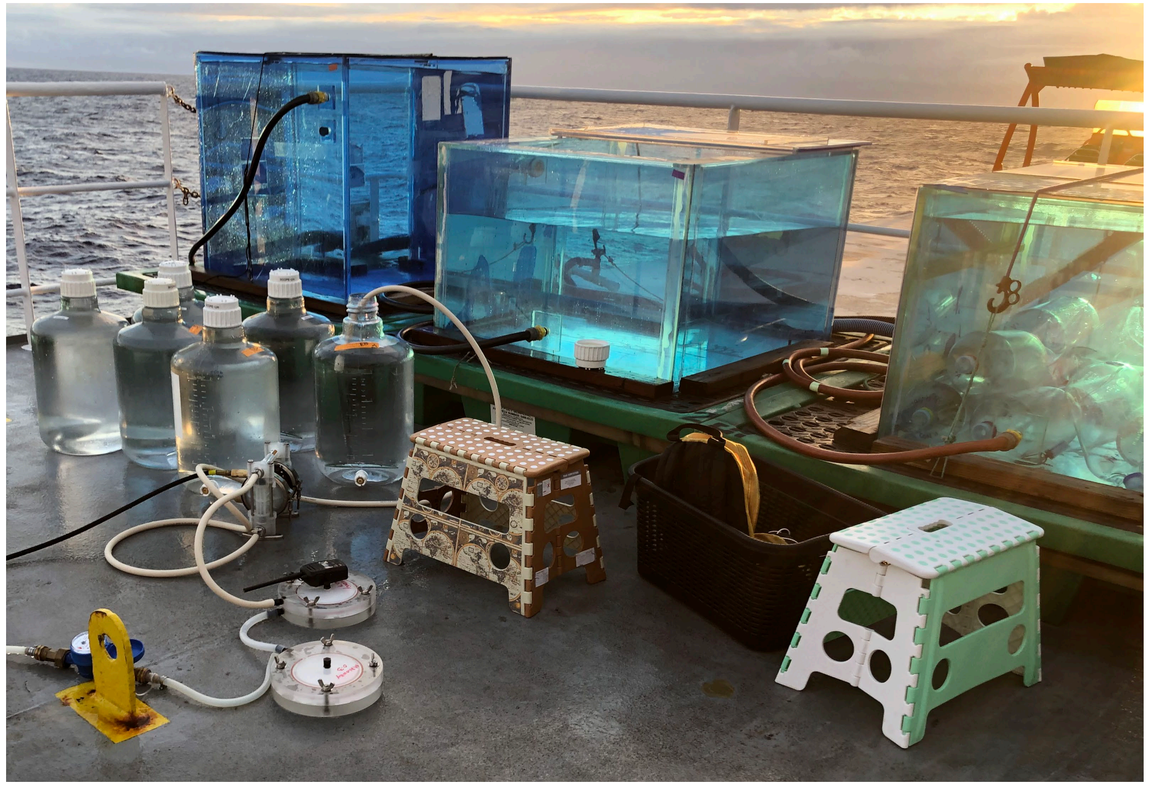


Predicted patch motion and dispersal

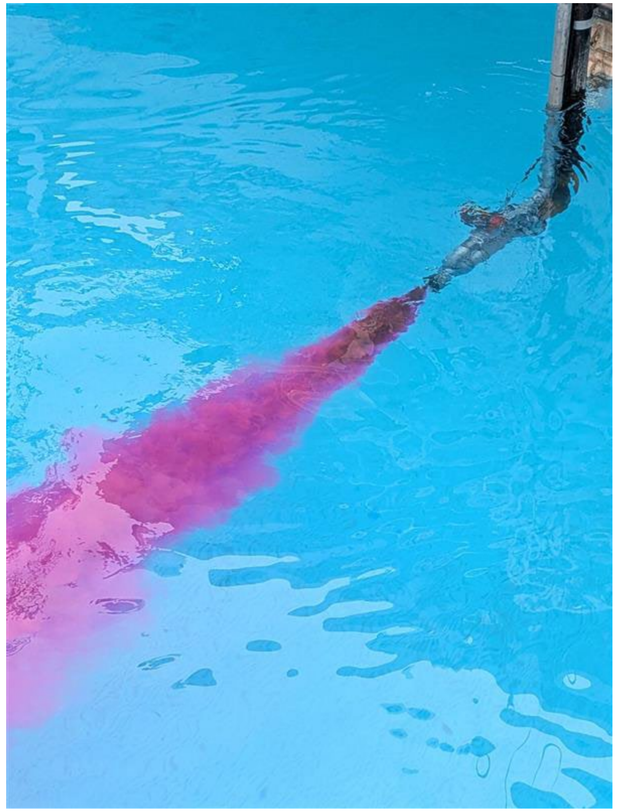
Biological impact studies

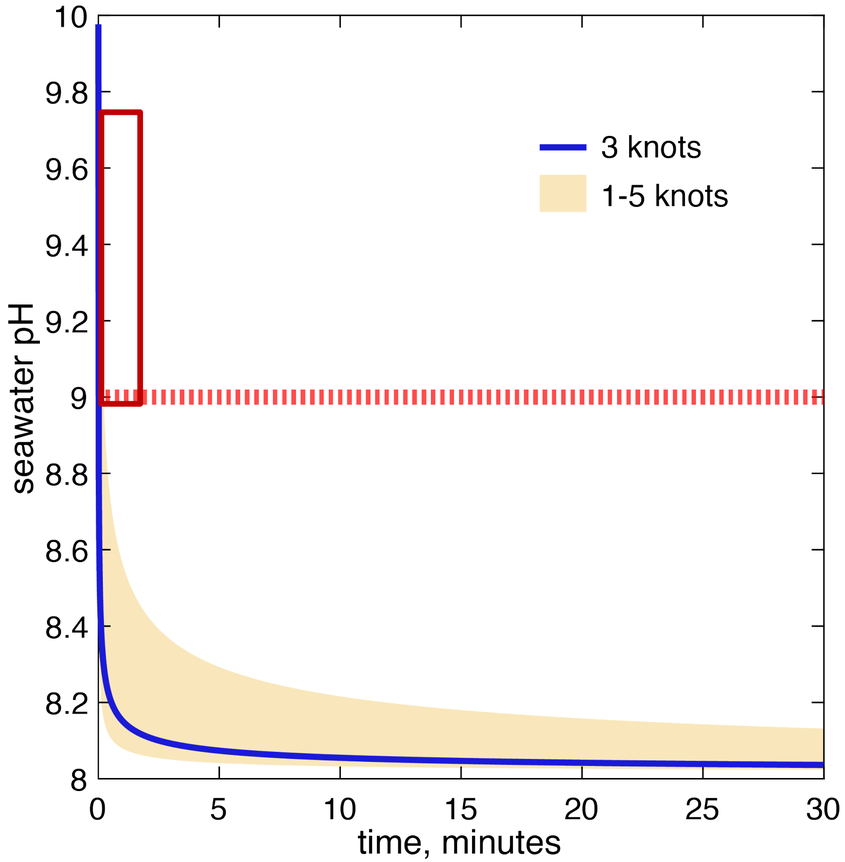
in the lab and via shipboard experiments.



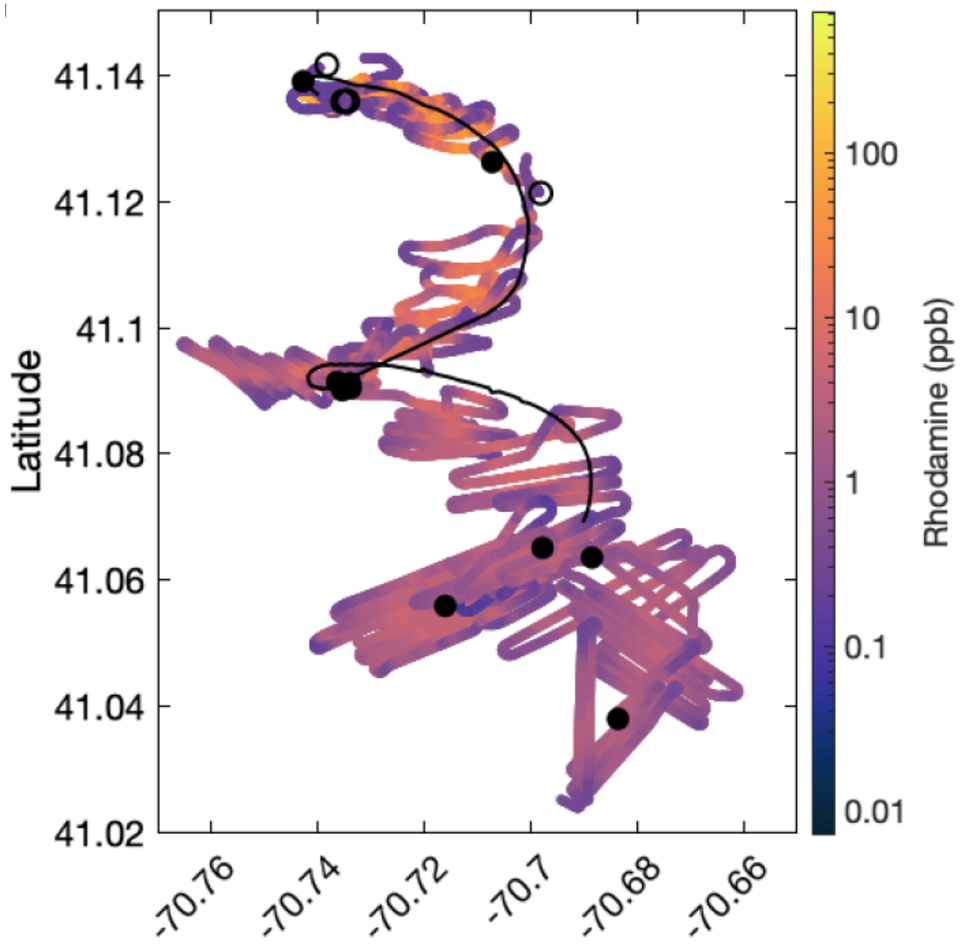


Engineering tests and modeling





“LOC-01” Tracer Study Synthesis

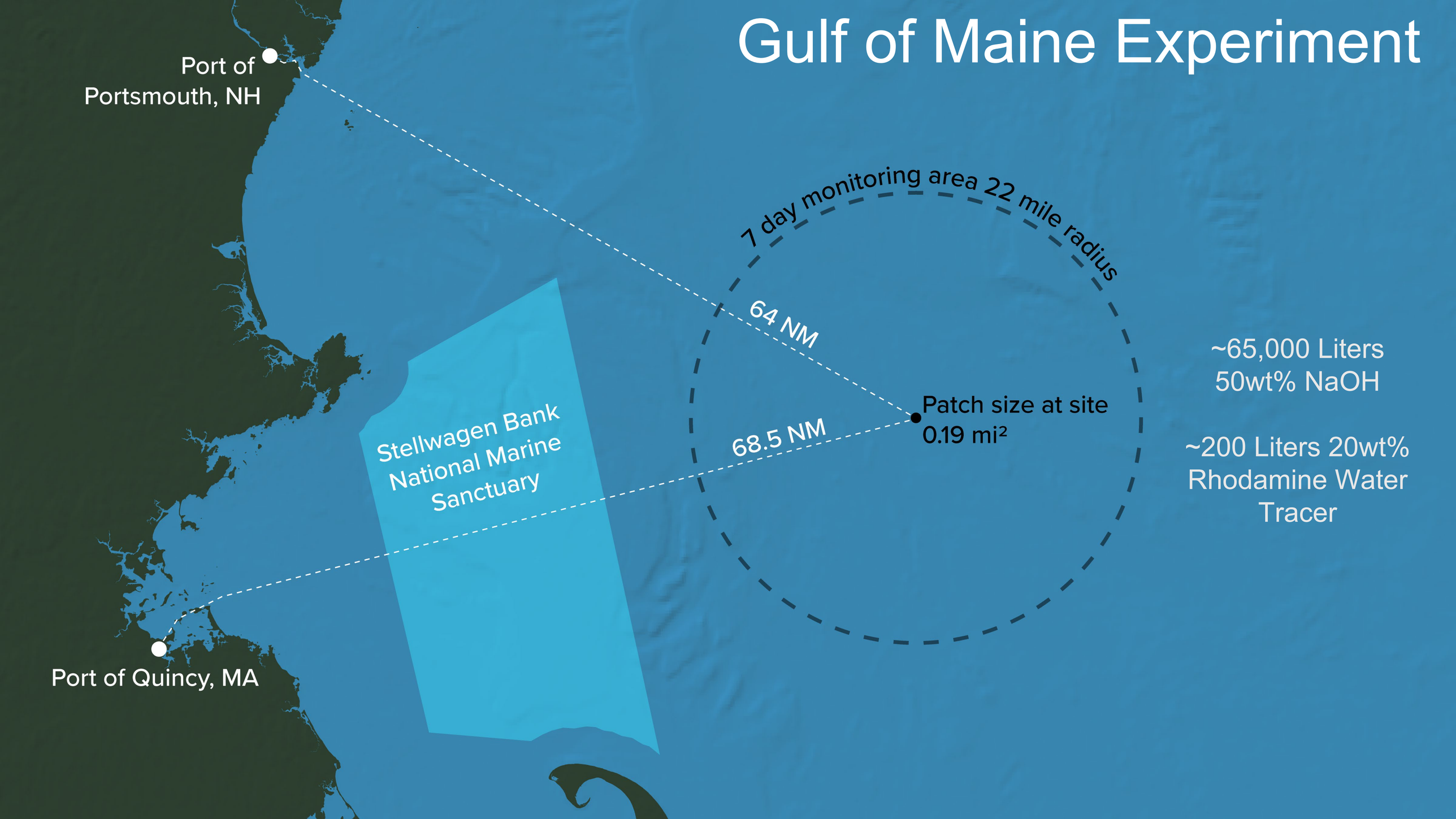


Subhas et al., *accepted*

Public outreach and engagement

Subhas et al., *in prep* (with EDF colleagues)

Gulf of Maine Experiment



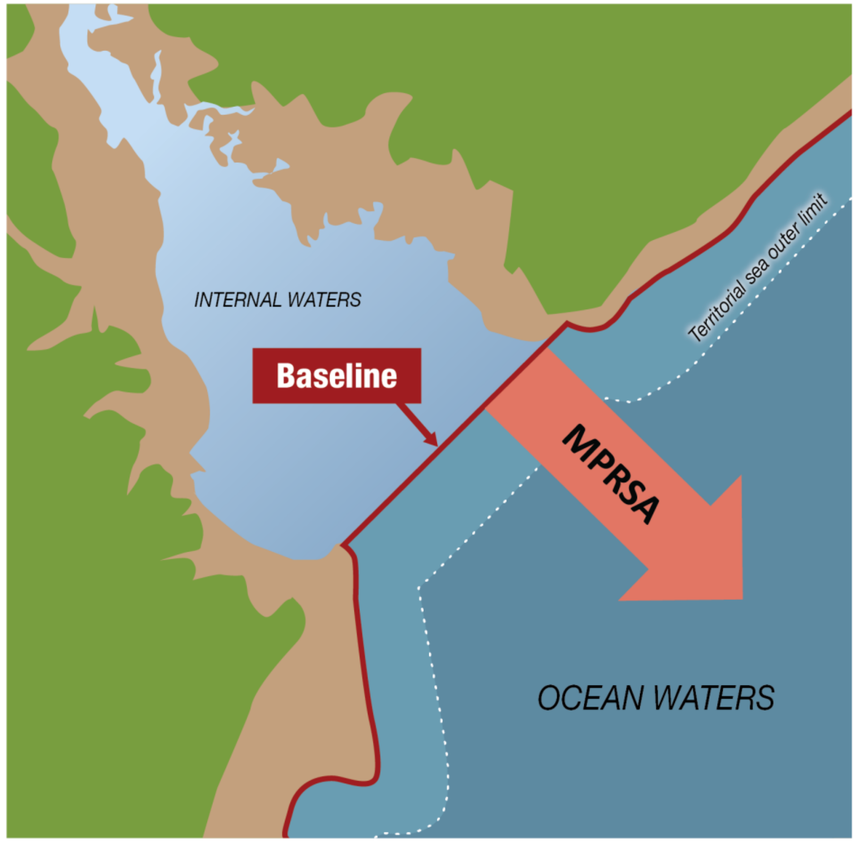
~65,000 Liters
50wt% NaOH

~200 Liters 20wt%
Rhodamine Water
Tracer

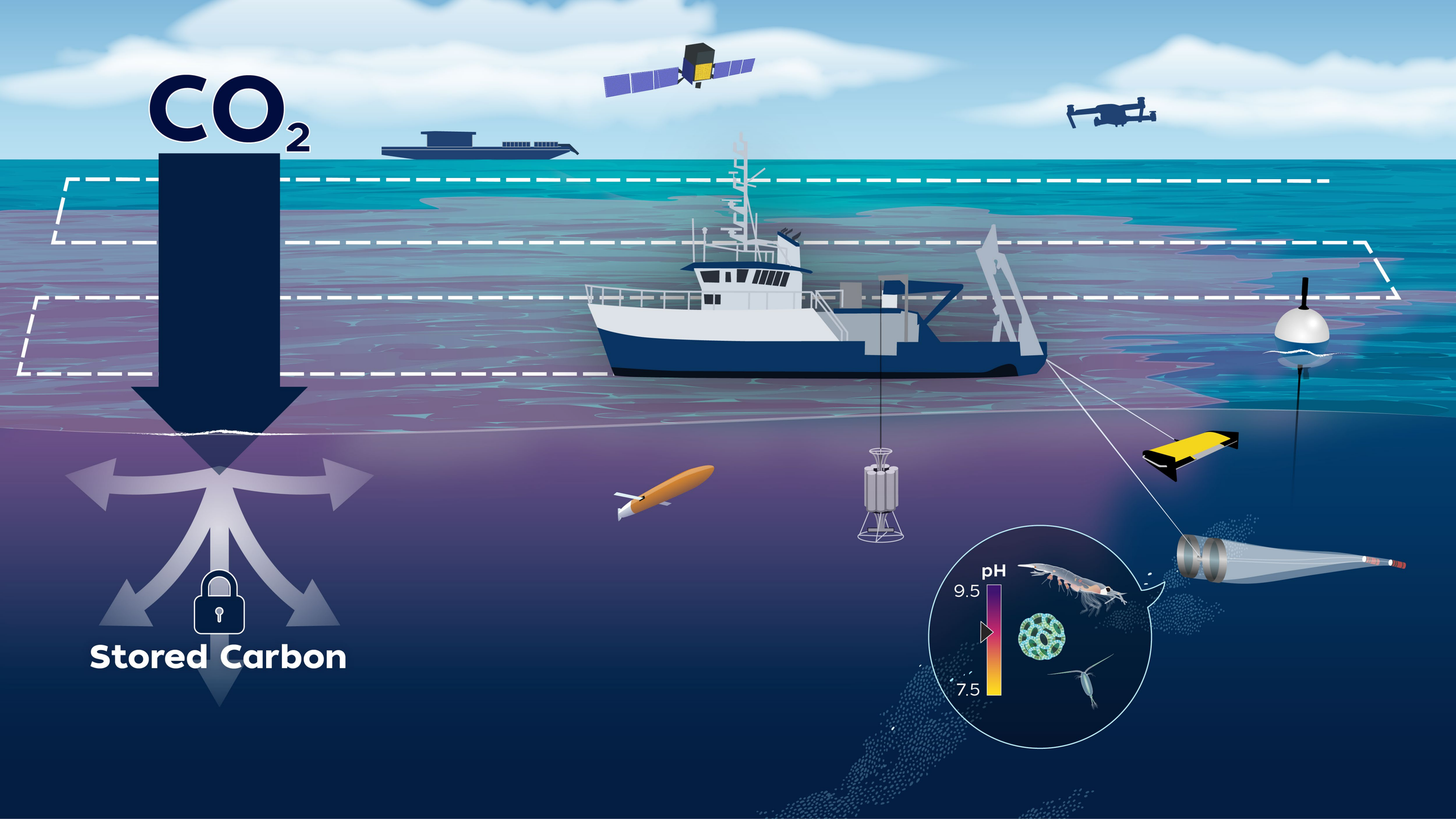
EPA Permitting through MPRSA

- Two rounds of public comment (Summer 2024, Spring 2025)
- Modifications based on public engagement and comments
- Consultation with NOAA for EFH and ESA, USFWS for ESA
- Federal Consistency Review with MACZM
- Permitting discussions began January 1, 2023
- **Final permit issued late April 2025**

EPA Project Page



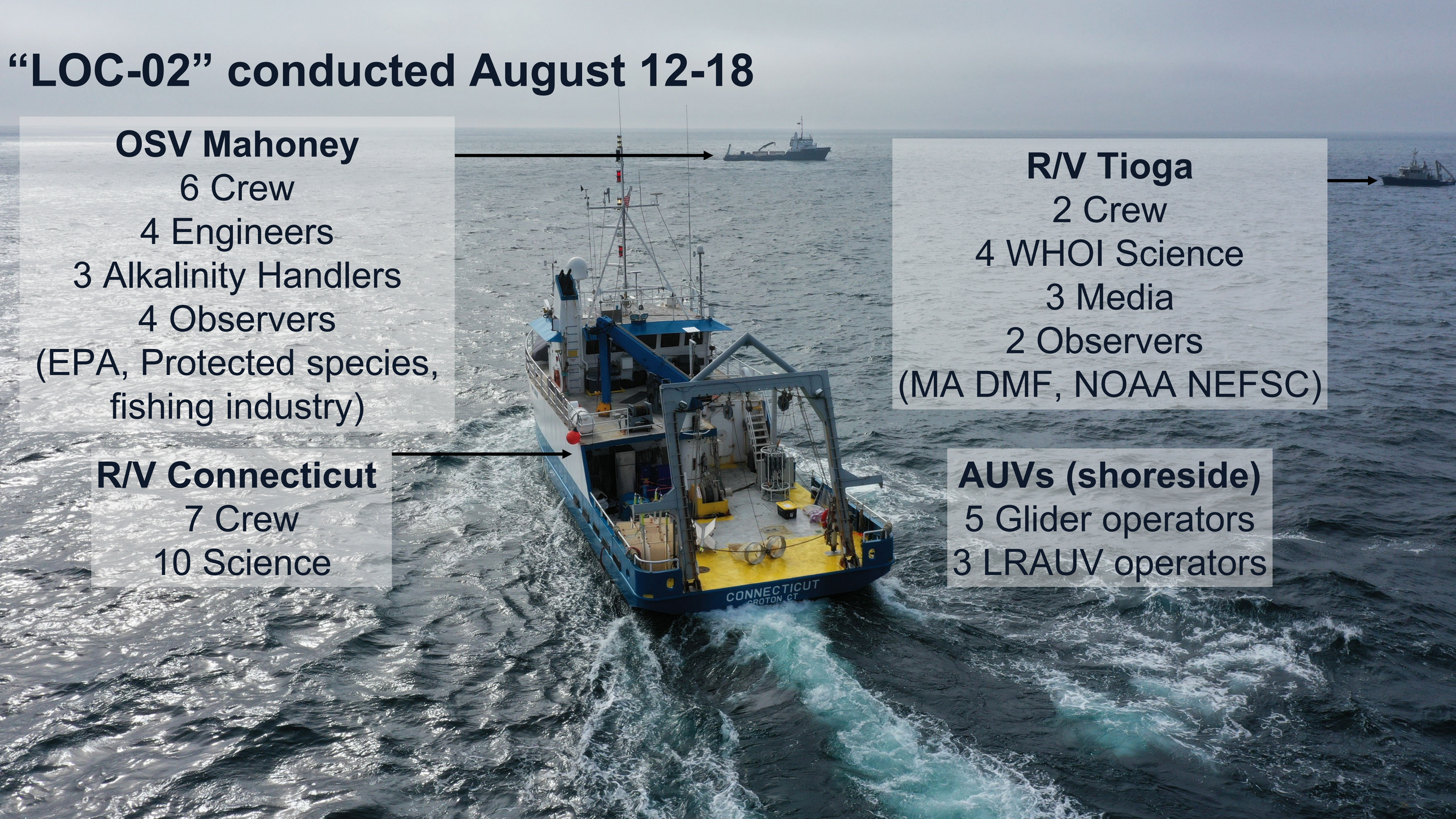
The geographic jurisdiction of the Marine Protection, Research, and Sanctuaries Act (MPRSA) begins at the U.S. baseline from which the territorial sea is measured and extends seaward. The baseline consists of the closing lines across bays, harbors, and river mouths and the mean lower low water line (MLLW) along the coast.


CO_2
Stored Carbon
pH
9.5
7.5

“LOC-02” conducted August 12-18

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

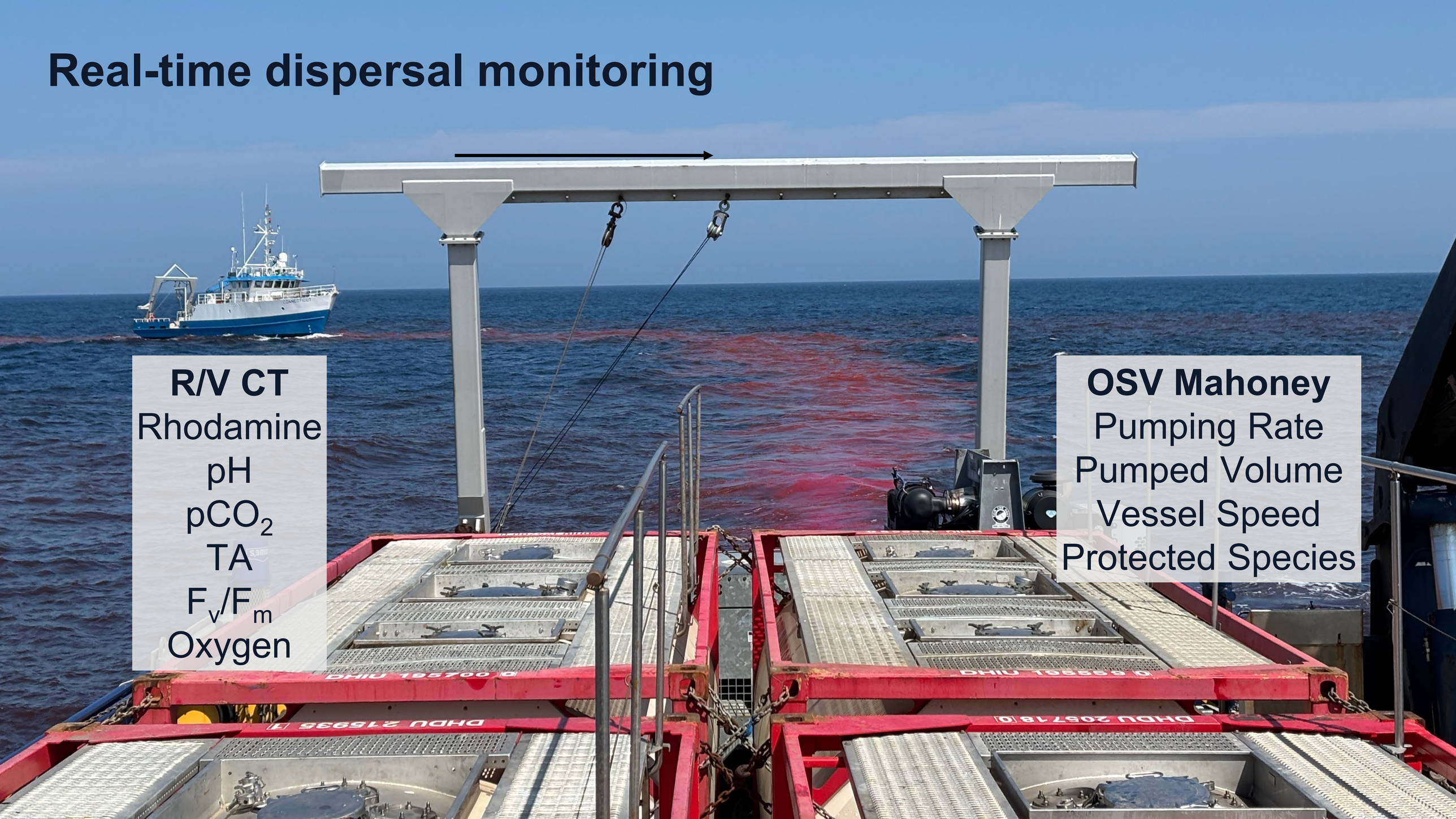
R/V Connecticut
7 Crew
10 Science



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

AUVs (shoreside)
5 Glider operators
3 LRAUV operators

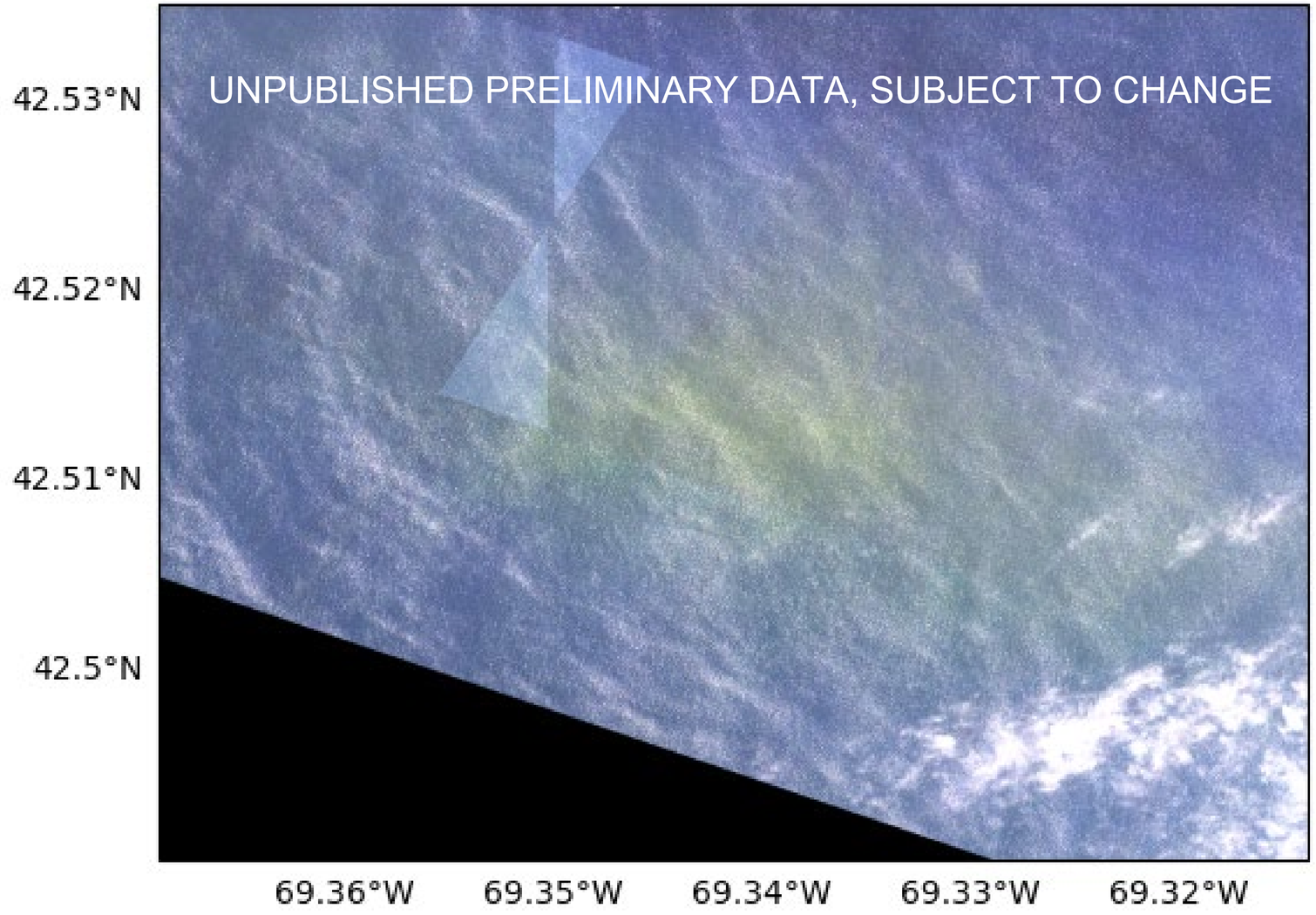
Real-time dispersal monitoring



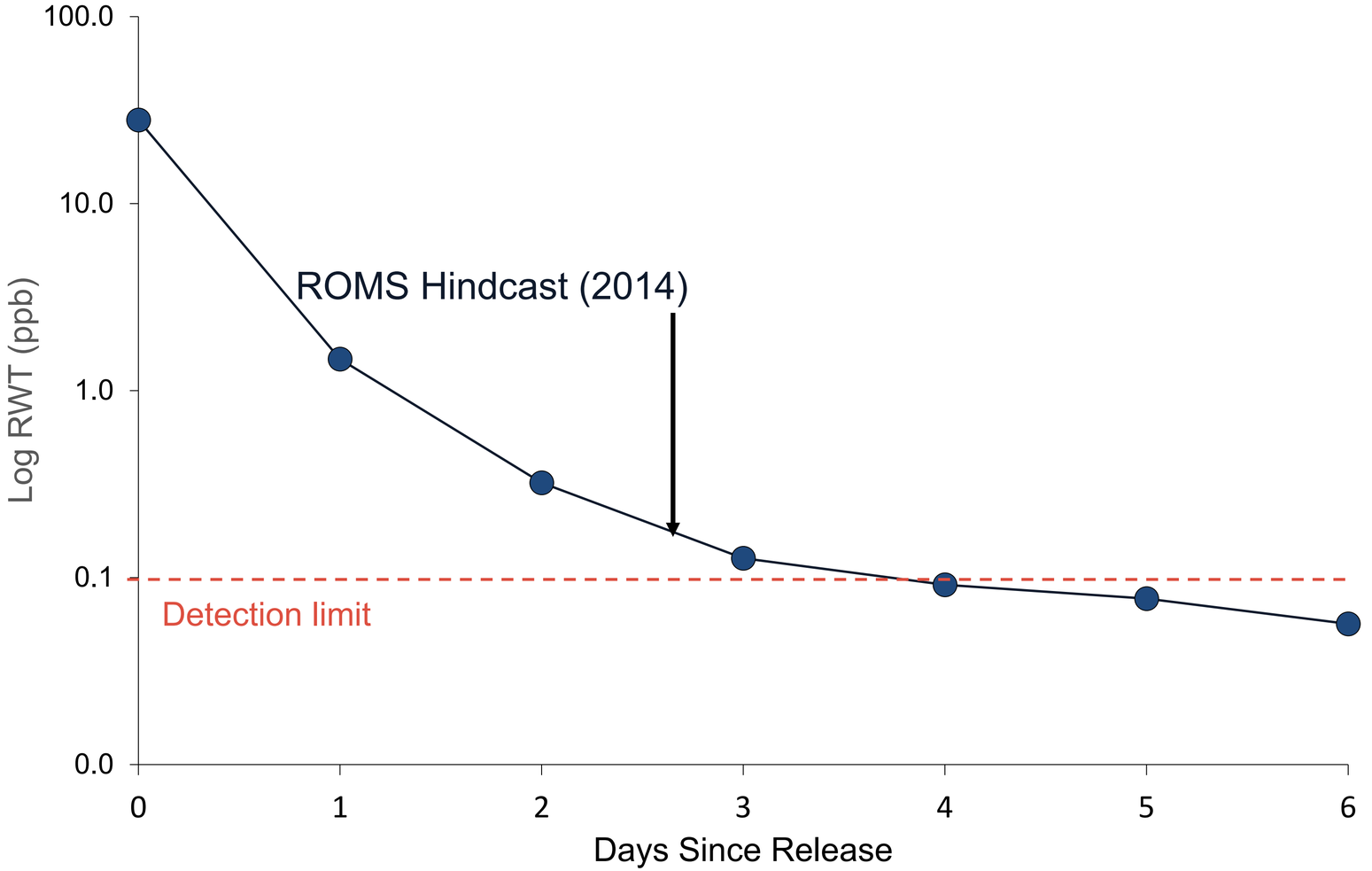
R/V CT
Rhodamine
pH
pCO_2
TA
F_v/F_m
Oxygen

OSV Mahoney
Pumping Rate
Pumped Volume
Vessel Speed
Protected Species

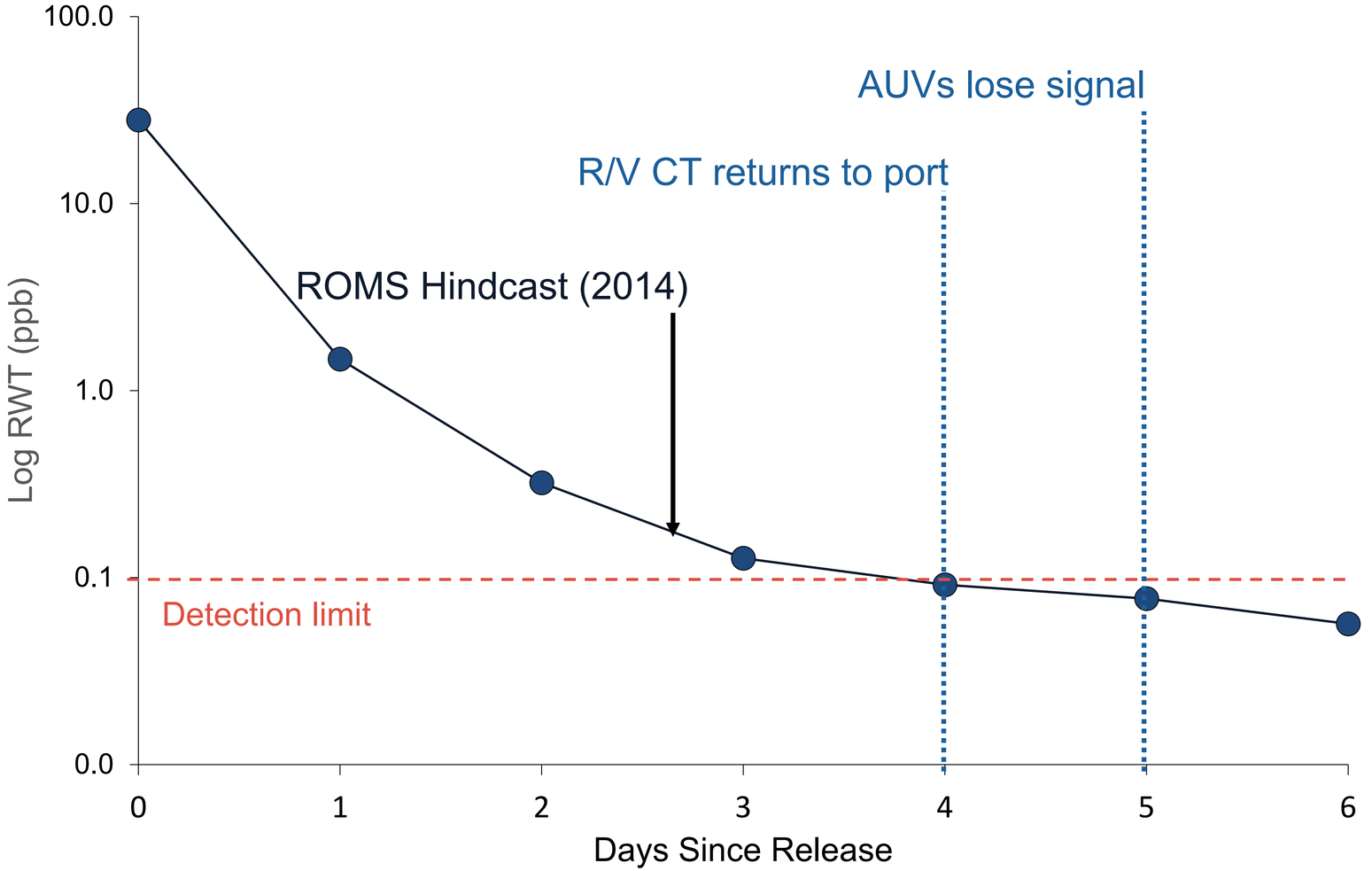
Patch captured by satellite imagery (8/14)



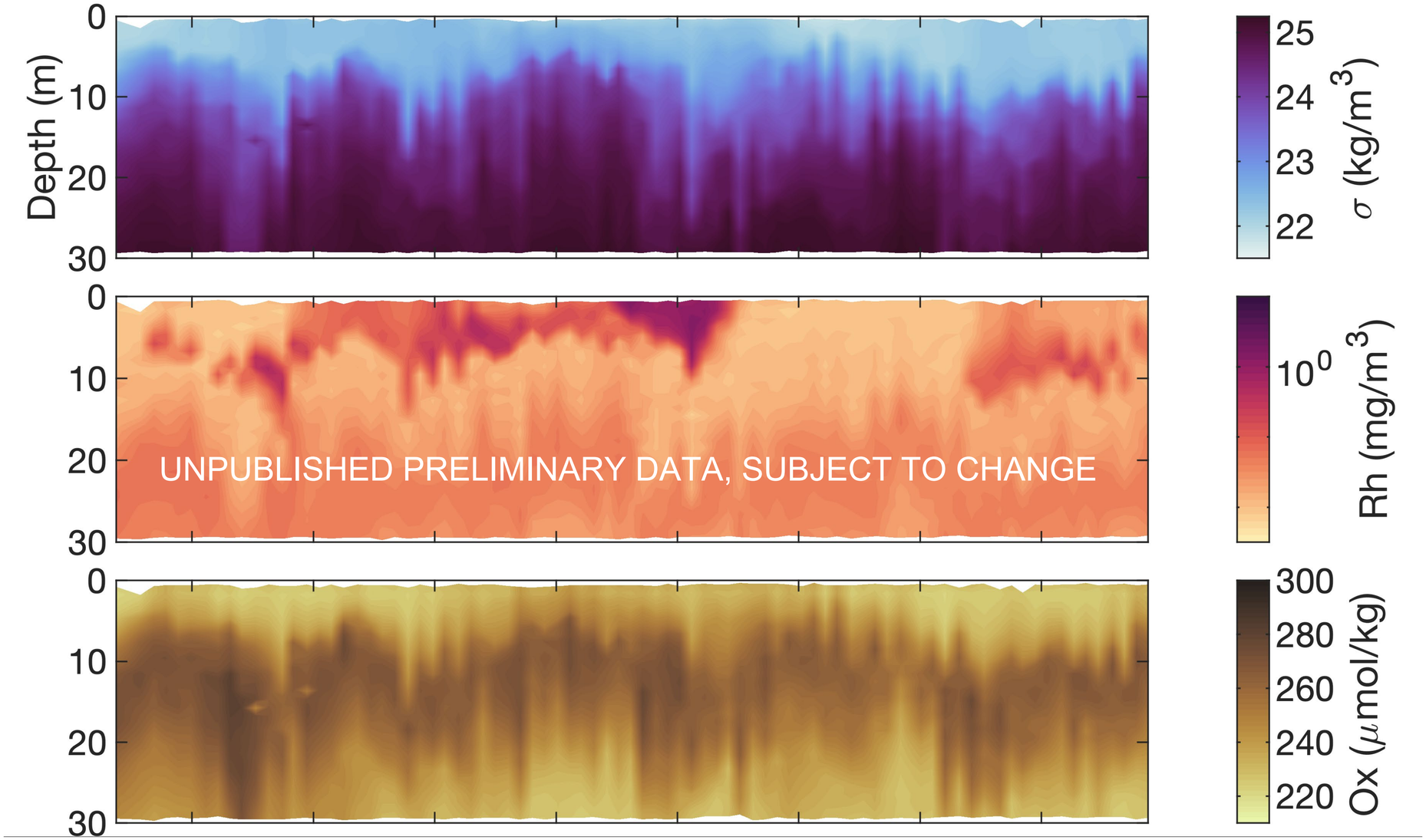
ROMS Model accurately predicts tracer signal dispersion



ROMS Model accurately predicts tracer signal dispersion



>2,000 glider profiles giving unprecedented resolution



Thank you

Adam Subhas
LOCNESS team