EXOIS EXPLORING OCEAN IRON SOLUTIONS

WOODS HOLE OCEANOGRAPHIC INSTITUTION

Community engagement and governance of ocean iron fertilization mCDR field research in the Northeast Pacific

Katie Roche[1], Amanda Borth[2], Ken Buesseler[1], Wil Burns[3], Fei Chai[4], Jay Cullen[5], Jessica Drysdale[1], Mara Karageozian[6], Paul Morris[1], Ashwin Murthy[7], Sara Nawaz[3,8], Kilaparti Ramakrishna[1], Sarah Smith[9], Brad Warren[10], Romany Webb[5], Mark Wells[11], and Joo-Eun Yoon[12]

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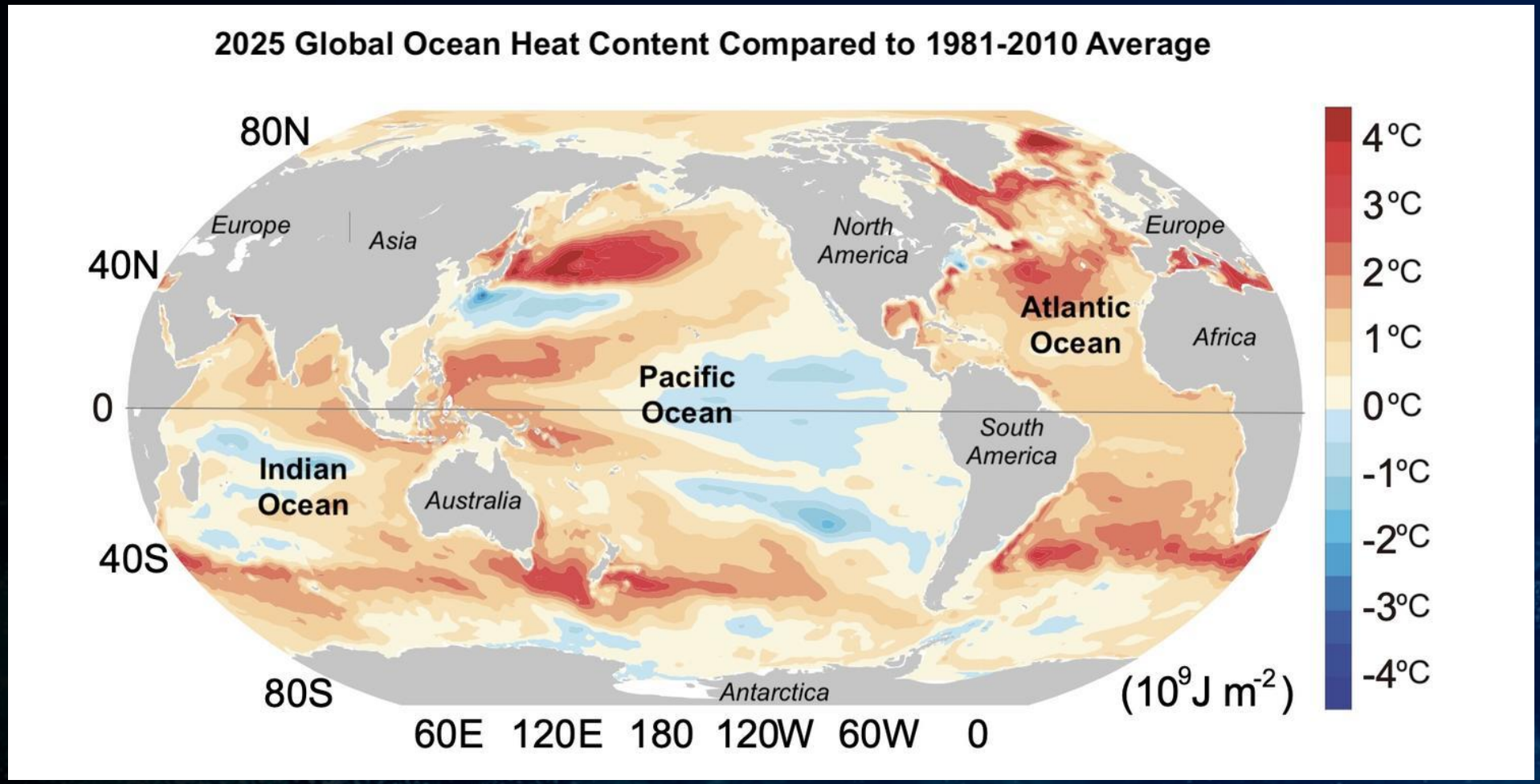
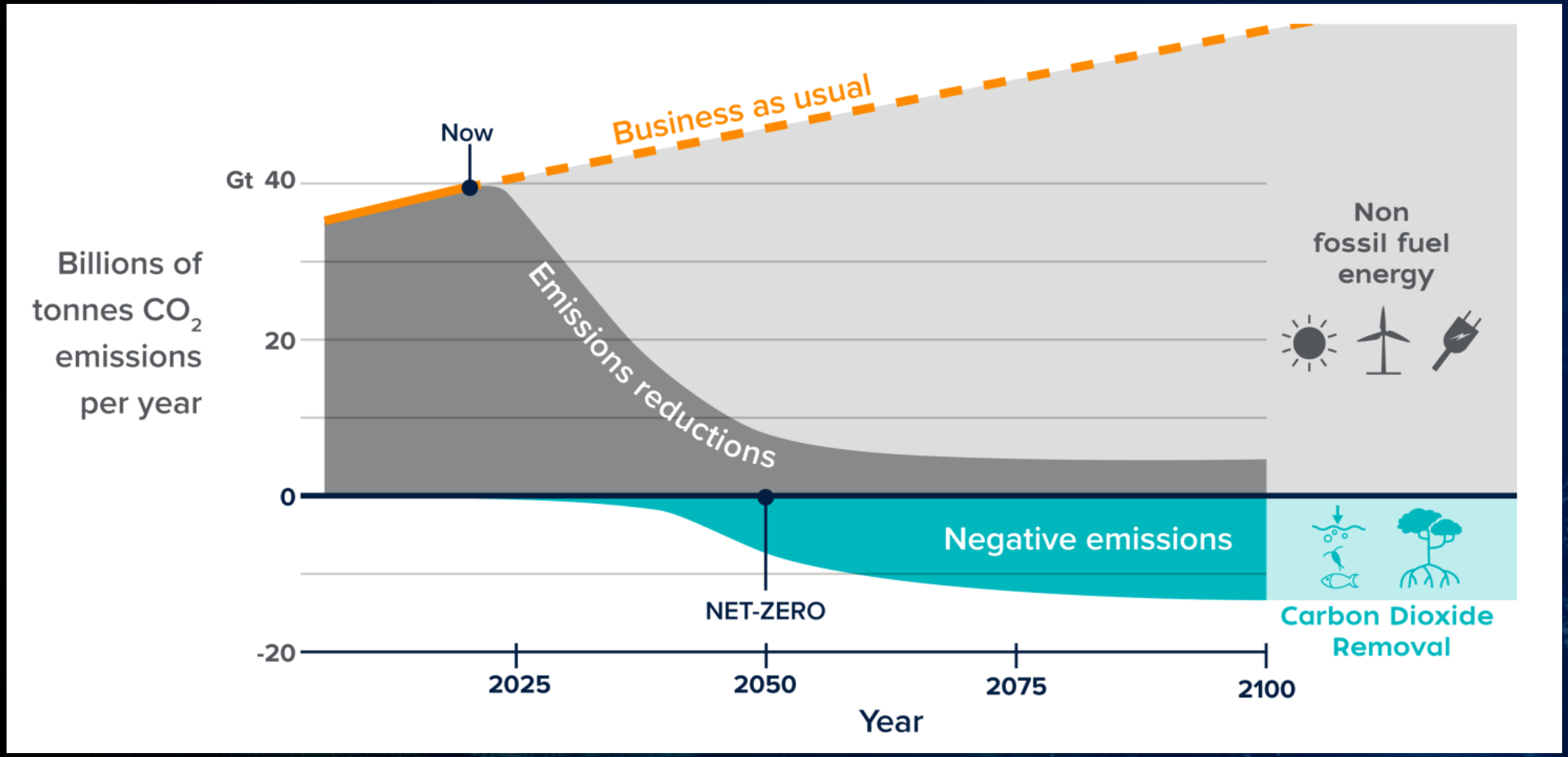
[11]School of Marine Sciences, University of Maine, Orono, USA
[12]Korea Polar Research Institute, Incheon, Republic of Korea

WE ARE ALREADY OBSERVING CHANGES TO OCEAN ECOSYSTEMS

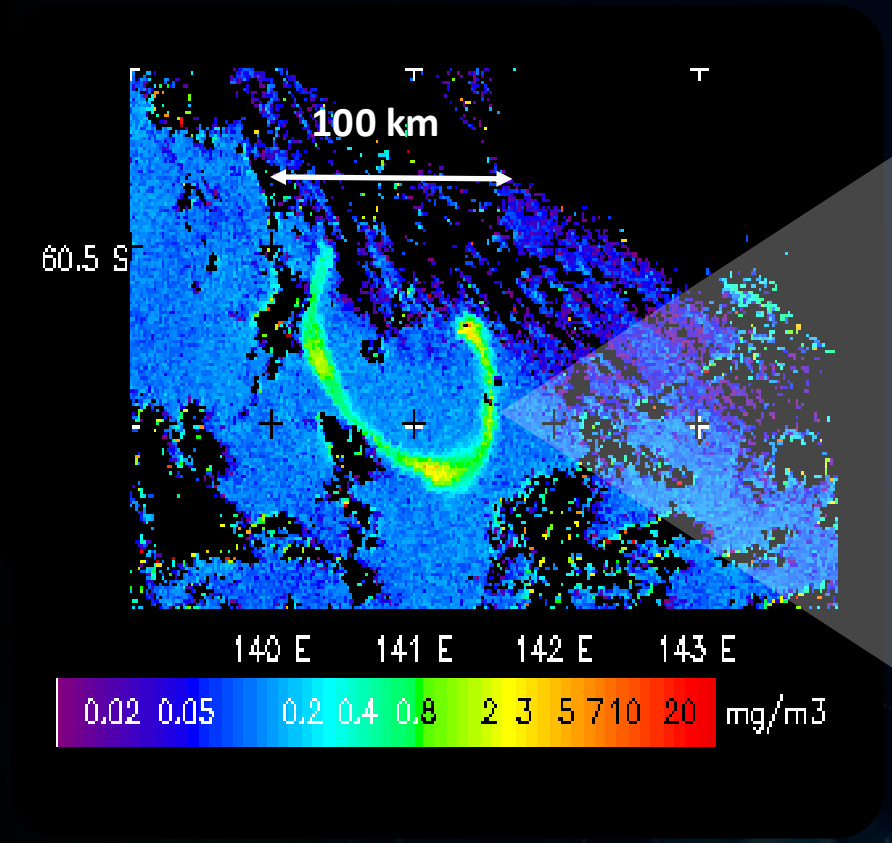


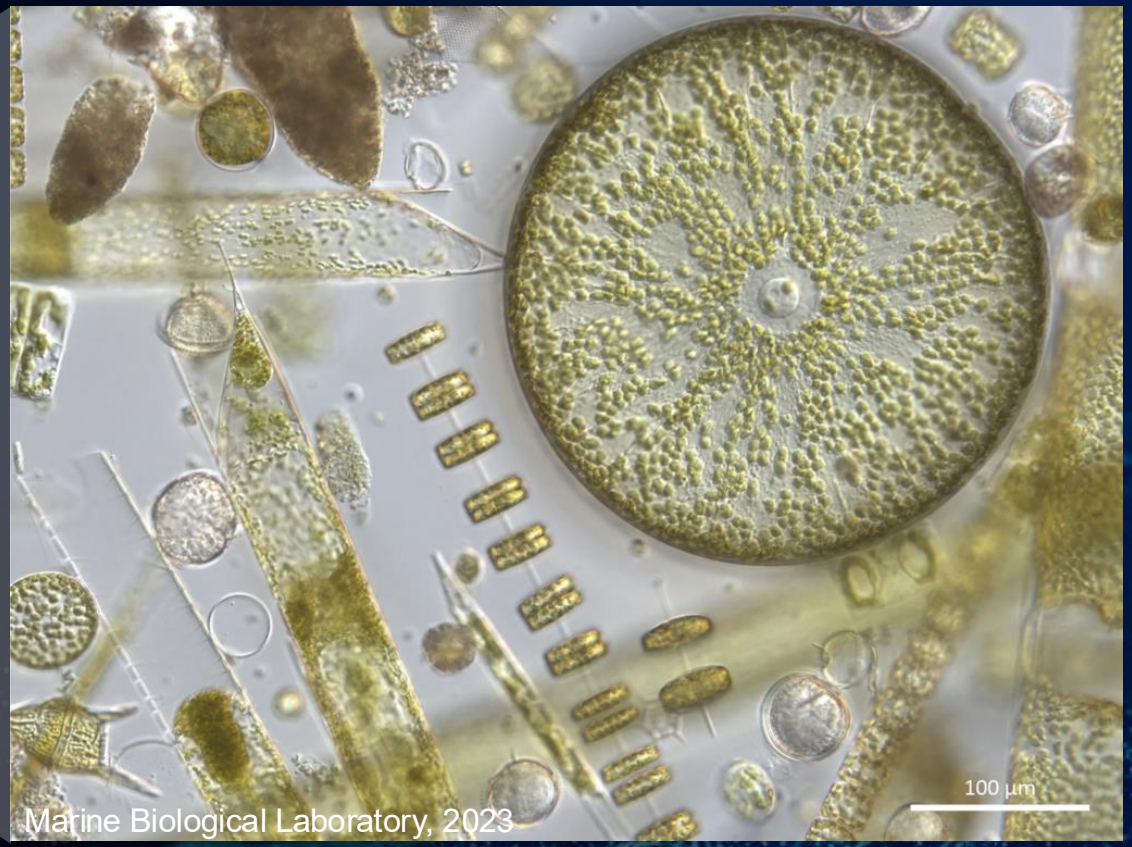
Pan et al. (2026), *Advances in Atmospheric Sciences*

EMISSIONS REDUCTIONS + CDR



ONE METHOD OF mCDR – OCEAN IRON FERTILIZATION





13 ocean iron experiments
1993-2009

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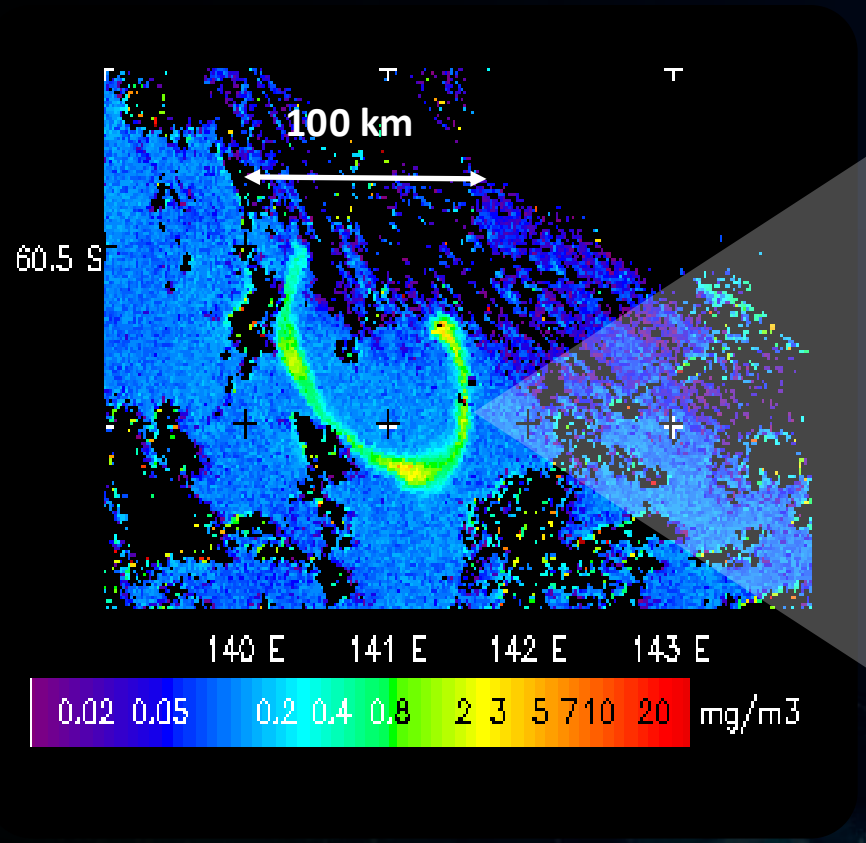

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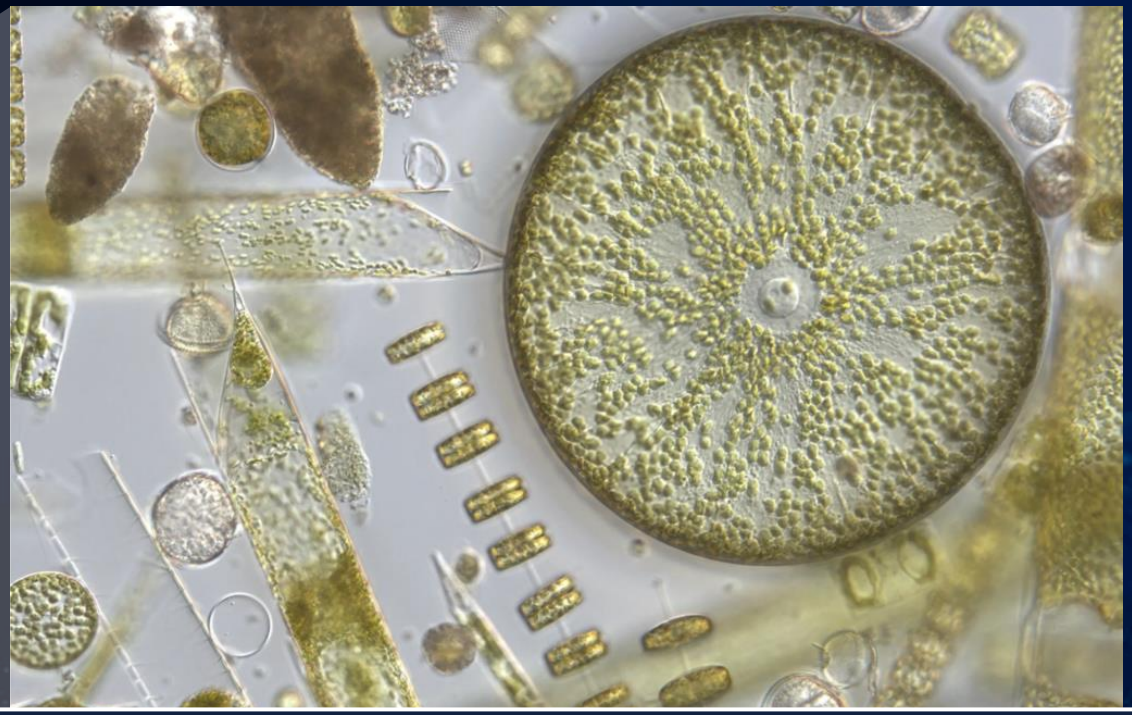

Past studies were not designed to assess two critical pieces:
carbon sequestration & ecological impacts

EXOIS

EXPLORING OCEAN IRON SOLUTIONS

International consortium of experts dedicated to studying ocean iron fertilization for marine carbon dioxide removal (mCDR)

- 60 members
- 37 institutions
- 9 countries

Housed at WOODS HOLE OCEANOGRAPHIC INSTITUTION

STEERING COMMITTEE



Ken Buesseler
Woods Hole Oceanographic Institution



Kilaparti Ramakrishna
Woods Hole Oceanographic Institution



Joo-Eun Yoon
Korea Polar Research Institute



Mark Wells
University of Maine



Sarah Smith
Moss Landing Marine Laboratories



Fei Chai
Xiamen University

PROGRAM OFFICE



Paul Morris
Woods Hole Oceanographic Institution



Katie Roche
Woods Hole Oceanographic Institution



Jessica Drysdale
Woods Hole Oceanographic Institution

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Marine Environmental Quality (MEQ) paper session this morning:

The next generation of mCDR ocean iron fertilization research studies in the western Gulf of Alaska

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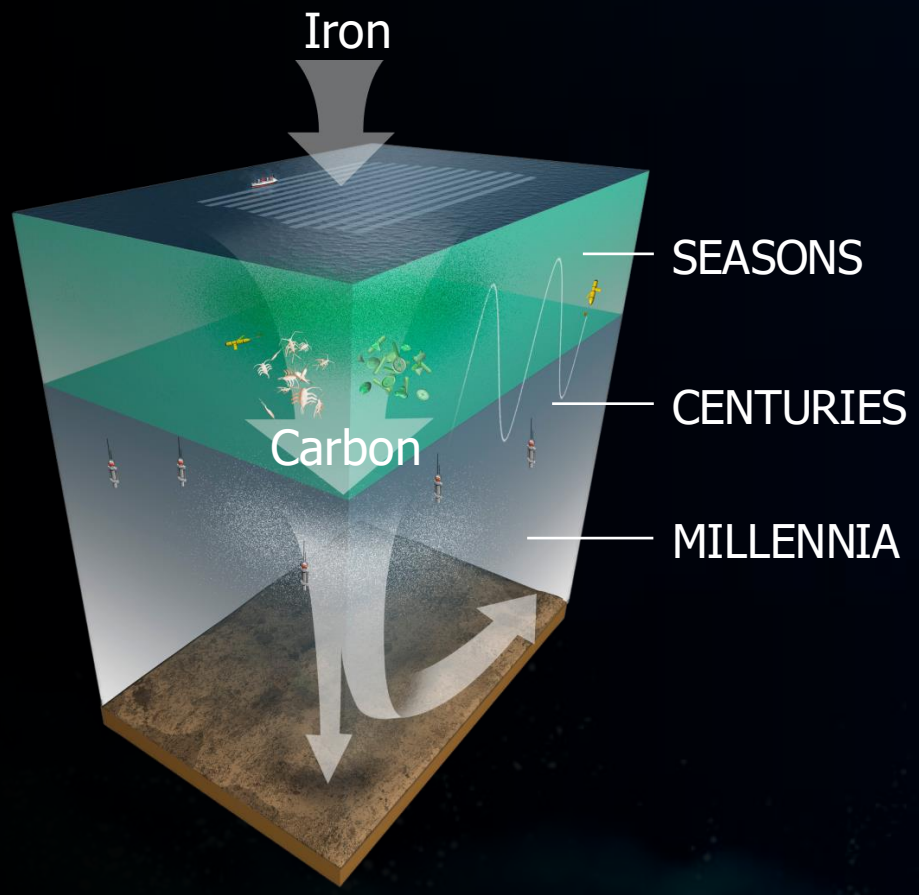
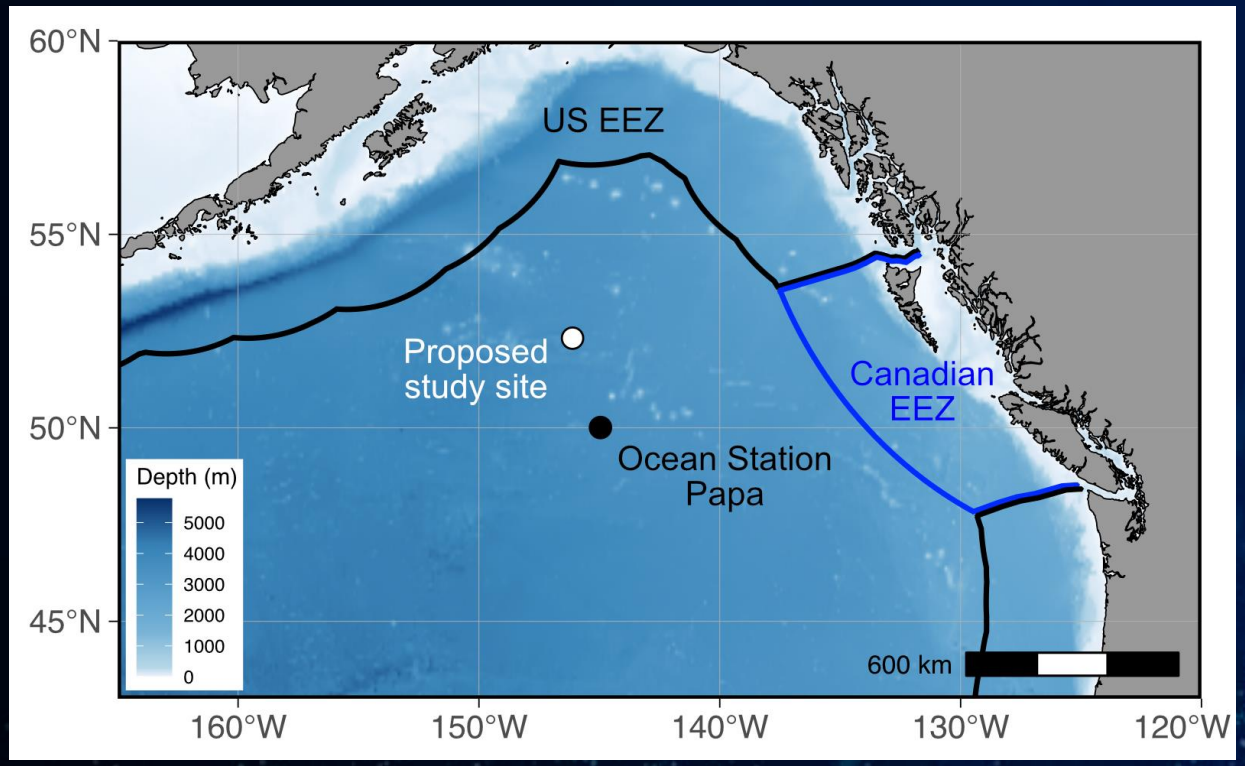
ExOIS's NORTH PACIFIC CARBON STUDY





Proposed field study to test the effectiveness, carbon storage potential, and environmental impacts of ocean iron fertilization

Learn more about the NPCS at oceaniron.org

HOW WE CONDUCT SCIENCE MATTERS

- **Prioritize** benefit for the environment and humans
- Establish clear lines of **responsibility**
- Commit to **open research** and risk assessments
- Perform iterative and independent **assessments**
- Engage the **public**



Ken Buesseler, Kilaparti Ramakrishna, Margaret Leinen, Nature Correspondence, 2022

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GOVERNANCE: U.S. EPA PERMITTING

ExOIS is seeking 1st ever high seas mCDR research permit

Preliminary application phase for a Marine Protection, Research, and Sanctuaries Act (MPRSA) permit

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- Preliminary permit application
- Once “complete”, move into interagency, tribal, and international consultations
- Public comment period
- Decision on whether to issue permit

GOVERNANCE: LONDON CONVENTION & LONDON PROTOCOL

LC/LP are international agreements for “ocean dumping”



Not originally designed for mCDR but applied to OIF, OAE, and biomass sinking “legitimate scientific research” on the high seas

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LC/LP is implemented in U.S. through the EPA MPRSA

Recent adoption of assessment frameworks

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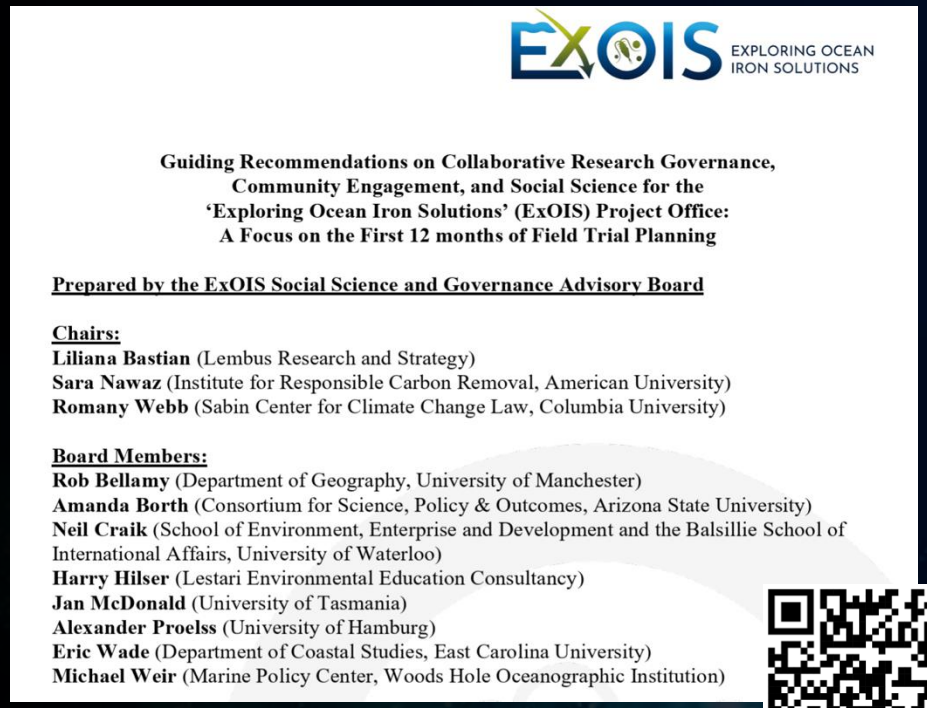
COLUMBIA LAW SCHOOL

SABIN CENTER FOR CLIMATE CHANGE LAW

COMMUNITY ENGAGEMENT: WHO? WHEN? WHERE? HOW?

Social Science and Governance Advisory Board report



EXOIS EXPLORING OCEAN IRON SOLUTIONS

Guiding Recommendations on Collaborative Research Governance, Community Engagement, and Social Science for the 'Exploring Ocean Iron Solutions' (ExOIS) Project Office: A Focus on the First 12 months of Field Trial Planning

Prepared by the ExOIS Social Science and Governance Advisory Board

Chairs:
Liliana Bastian (Lembus Research and Strategy)
Sara Nawaz (Institute for Responsible Carbon Removal, American University)
Romany Webb (Sabin Center for Climate Change Law, Columbia University)

Board Members:
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Amanda Borth (Consortium for Science, Policy & Outcomes, Arizona State University)
Neil Craik (School of Environment, Enterprise and Development and the Balsillie School of International Affairs, University of Waterloo)
Harry Hilser (Lestari Environmental Education Consultancy)
Jan McDonald (University of Tasmania)
Alexander Proelss (University of Hamburg)
Eric Wade (Department of Coastal Studies, East Carolina University)
Michael Weir (Marine Policy Center, Woods Hole Oceanographic Institution)

Key points:

- Early, inclusive, transparent, & iterative engagement
- Map interested & affected communities
- Respect Indigenous rights, knowledge systems, and data sovereignty
- Co-develop research and decision-making

COMMUNITY ENGAGEMENT: WHO? WHEN? WHERE? HOW?

Social Science and Governance Advisory Board report

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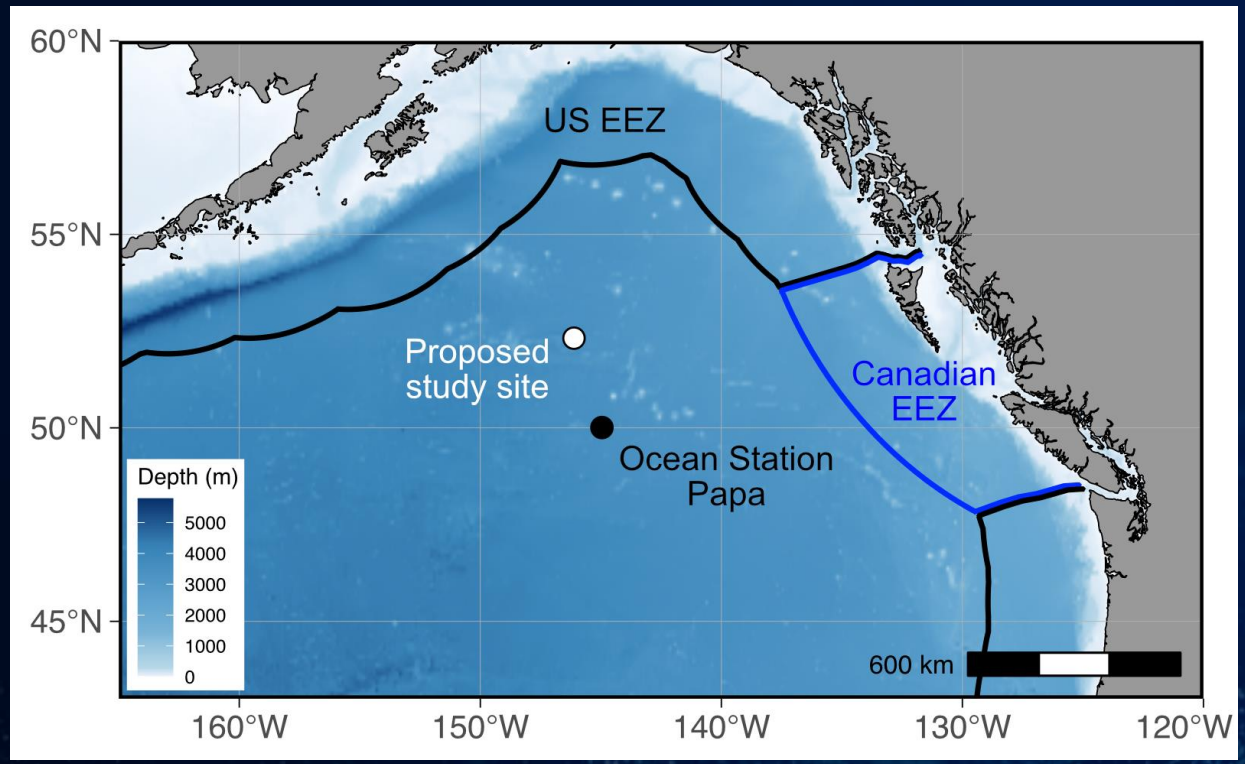

For a study >700 km offshore, who are these communities?

COMMUNITY ENGAGEMENT: INTERESTED COMMUNITIES

General public



News outlets, social media, podcasts, accessible resources, events open to public

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General public



News outlets, social media, podcasts, accessible resources, events open to public

Fishermen & fishing industry

Working Group for mCDR management, fishery management organizations, fishing expo events, fishing news outlets

GLOBAL OCEAN HEALTH

COMMUNITY ENGAGEMENT: INTERESTED COMMUNITIES

EXOIS

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GOH GLOBAL OCEAN HEALTH

Indigenous communities

PNW CLIMATE WEEK

Invite Indigenous perspectives & feedback. Kodiak, AK Indigenous leader spoke on our panel at PNW Climate Week

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ExOIS monthly forums

Federal agencies

NOAA FISHERIES

NOAA Fisheries, Canada DFO, worked with congressional offices on ReSCUE Oceans Act

COMMUNITY ENGAGEMENT: LEARNING FROM PARTNERS

Alaska Ocean Acidification Network

Alaska Dialogue on mCDR group

- Show up in-person
- Trust and relationship building
- mCDR education from trusted sources

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Fishery Friendly CLIMATE ACTION CAMPAIGN

- Research co-design
- Local knowledge
- Compensation for involvement

Fishery-sensitive mCDR reports

Schumann et al. 2026

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Lessons from theloc-nessproject

WOODS HOLE OCEANOGRAPHIC INSTITUTION

- Early & iterative engagement
- Incorporate & communicate community feedback

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Fishery-sensitive mCDR reports

Schumann et al. 2026

Field notes from LOC-NESS

Subhas et al. 2026

HIGH-INTEGRITY, INDEPENDENT, TRANSPARENT SCIENCE



HIGH-INTEGRITY, INDEPENDENT, TRANSPARENT SCIENCE



None of this can happen without public acceptance and appropriate governance frameworks

Learn more at

OceanIron.org

Informational One Pagers

Click on the images or the links below to read or download a PDF two sided explainer.

- EXOIS PROGRAM OVERVIEW
- THE NORTH PACIFIC CARBON STUDY
- OIF AND FISHERIES
- OIF AND ALGAE BLOOMS
- OIF AND NUTRIENTS
- OIF AND OXYGEN

