Science, Service, Stewardship

NOAA Marine Negative Emission Strategies and Carbon Capture Research Initiative

presented to the NASEM Committee on Ocean CDR & Sequestration

Dwight Gledhill
NOAA OAP

Presented on behalf of the NOAA CDR Task Force
October 22 2020

About the Task Force

Join the Task Force

NOAA OAR mCDR Task Force

OAR Members

- **Dwight Gledhill (OAP),** Jim Butler (ESRL), Jessica Cross (PMEL), Richard Feely (PMEL), Chris Meinig (PMEL), Adrienne Sutton (PMEL), Brendan Carter (PMEL), Simone Alin (PMEL), Sophie Chu (PMEL), Jasmin John (GFDL), Denis Pierrot (AOML), Derek Manzello (AOML), Emily Osborne (AOML), Leticia Barbero (AOML),

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Advisory Members

- Libby Jewett (OAP Director), Kathy Tedesco (GOMO/UCAR), Jeff Payne (OCM), Michelle McClure (PMEL Director)

…and growing...

Science at NOAA is the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; integration of research and analysis; observations and monitoring; and environmental modeling...

Service is the communication of NOAA's research, data, information, and knowledge...

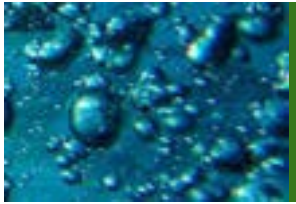
Stewardship is NOAA's direct use of its knowledge to protect people and the environment...

Where does NOAA fit?

Marine CDR methods are innovative techniques that have broad applications to a variety of ongoing NOAA mission objectives and legislative mandates.

Macroalgal Cultivation and Sequestration

Ocean Alkalinity Enhancement



Electrochemical CO2 stripping

- Coastal Blue Carbon
- NOS Coastal Zone Management
- NMFS fisheries, aquaculture and conservation activities
- OAR Carbon Monitoring
  - OA and GOSHIP Cruises
  - Advanced Monitoring Technologies
  - Earth System Modeling

Coastal Blue Carbon

The world's coastal ecosystems — coastal salt marshes, mangrove forests, and seagrass meadows — are incredibly efficient at capturing and storing large quantities of carbon.

Coastal blue carbon (CBC) is the carbon captured by living coastal and marine organisms and stored in coastal ecosystems. Salt marshes, mangroves, and seagrass beds providing for carbon sequestration and storage.

NOAA supports national Coastal Blue Carbon initiatives.

- Started in 2011
- Focused on coastal wetlands
- Sponsored CBC content in NAS, EPA Greenhouse Gas Inventory reports
- Sea Grant awards on CBC research topics

NOAA has already done some mCDR Research

Carbon Dioxide Removal Via Kelp Farming

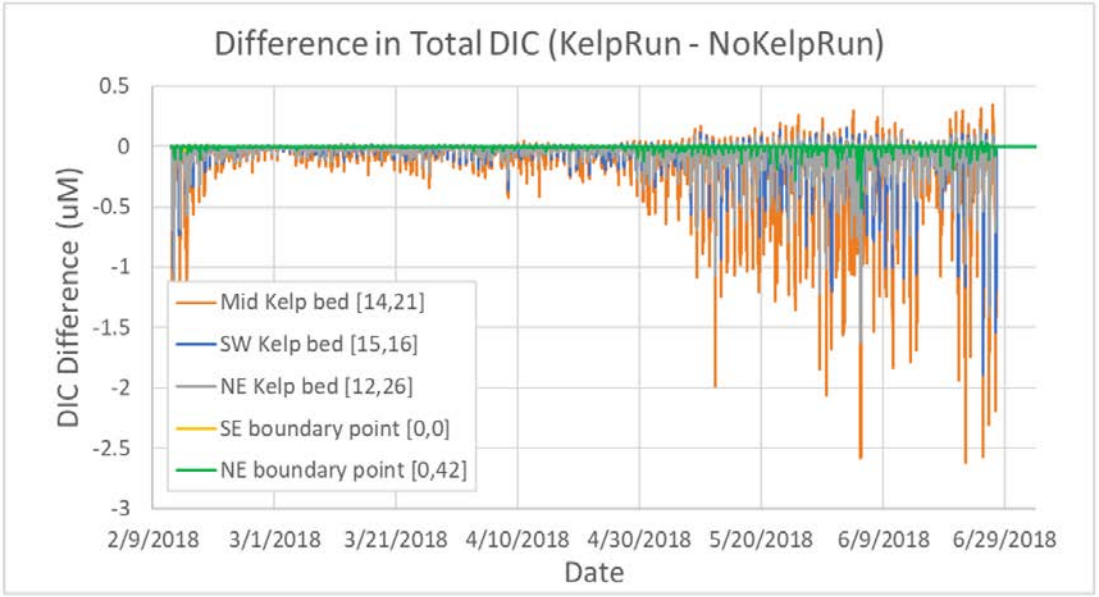


Figure 85. Difference between time series of model output of total DIC of a Year 2 'NoKelp' run and a 'Kelp' run. Plotted lines represent difference in data output from five capture cells.

Peabody et al 2019

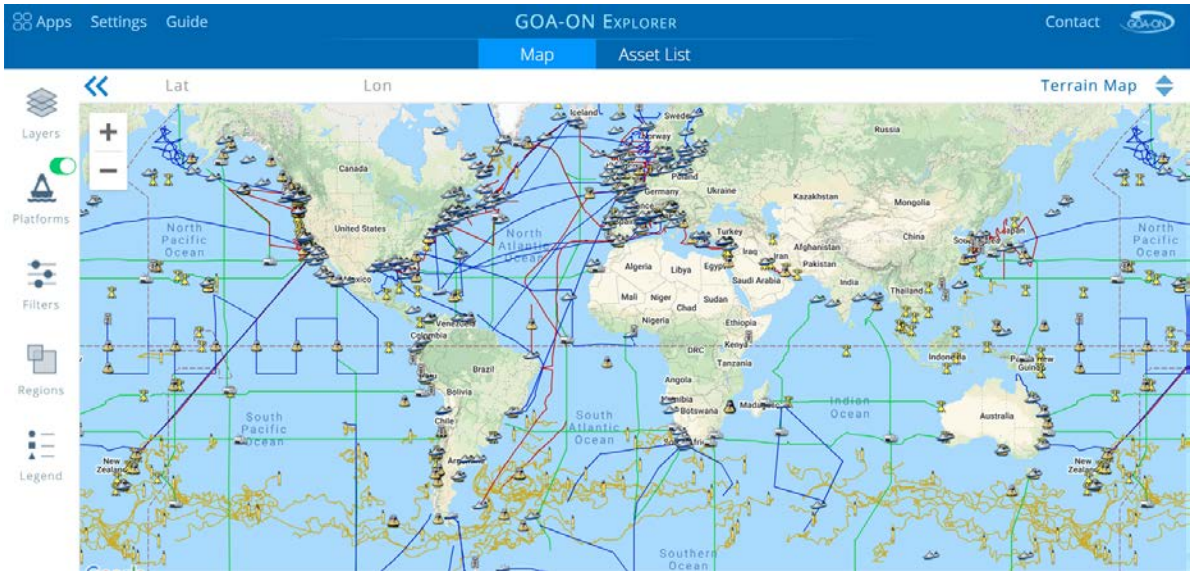
One example of many (PMEL study funded via Paul Allen)

NOAA, mCDR and Ocean Acidification

NOAA collates world-class global and regional carbon measurements through the Global Ocean Acidification Observing Network. Our **precision carbon observing capacity** is NOAA's most unique and valuable asset for mCDR research.

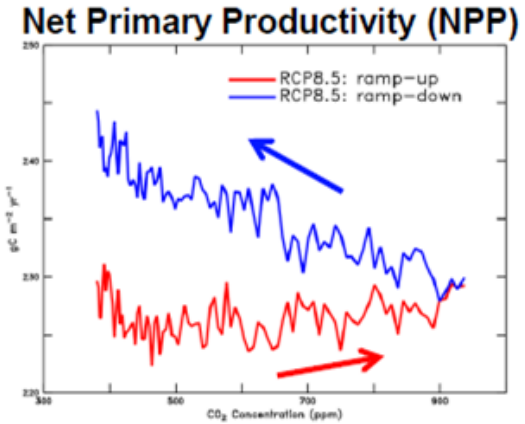
GOA-ON

Global Ocean Acidification Observing Network



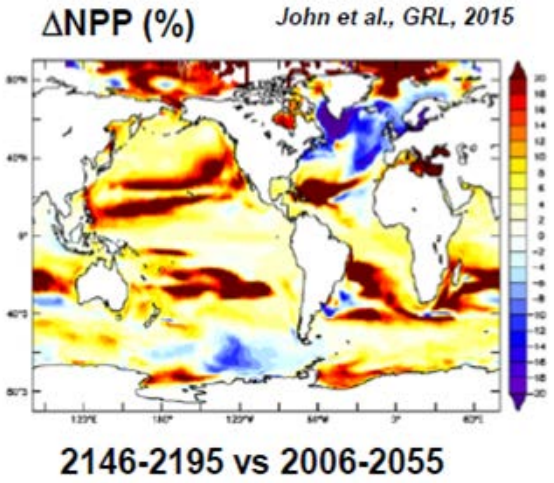
NOAA has already done some CDR Research

NOAA GFDL Reversibility Studies explore post-mitigation future



1. GFDL-ESM2M/RCP8.5 (100 Gt C pulse, ramp-up)
2. Ocean alkalinization 2020 (0.14 Pmol/yr, ramp-down)
3. Abrupt stop in 2070

- Marine primary productivity exceeds contemporary values after mitigation
- Legacy subsurface warming increases mixing and enhances surface nitrate



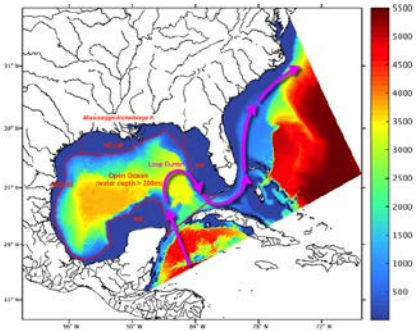
John, J. G., C. A. Stock, and J. P. Dunne (2015), A more productive, but different, ocean after mitigation, *Geophys. Res. Lett.*, 42, 9836–9845, doi:10.1002/2015GL066160.

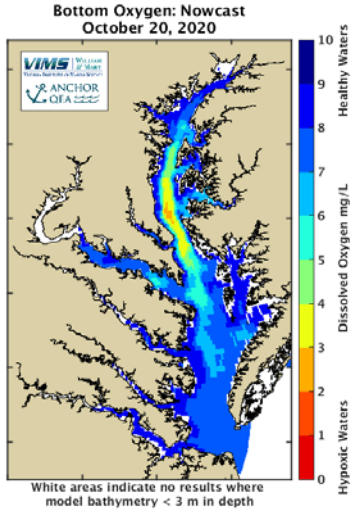
Modeling coastal mCDR impacts

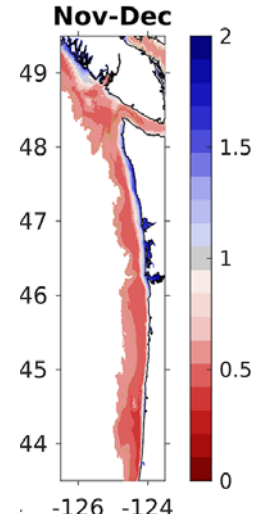
Estimating mCDR efficacy and impacts in the coastal zone will require support from regional modeling efforts.

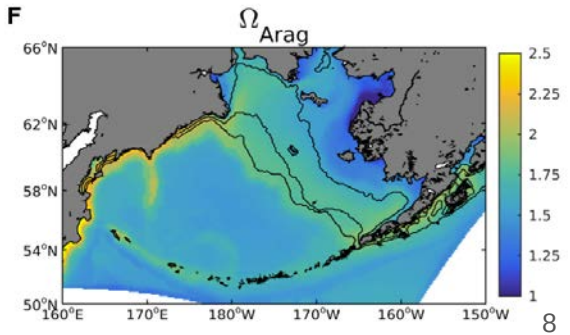
NOAA already supports biogeochemical modeling at the near-coastal zone in many locations.

Pictured here (L-R, top-bottom) are outputs from the Gulf of Maine, Chesapeake Bay, US West Coast, the Gulf of Mexico, and the Bering Sea.



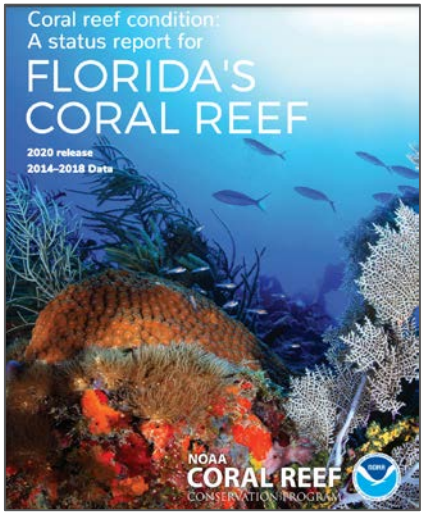


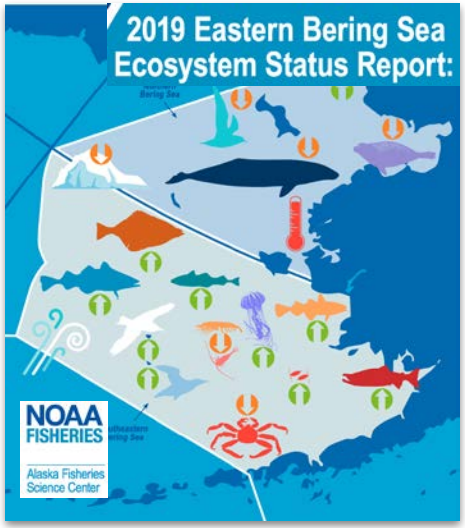


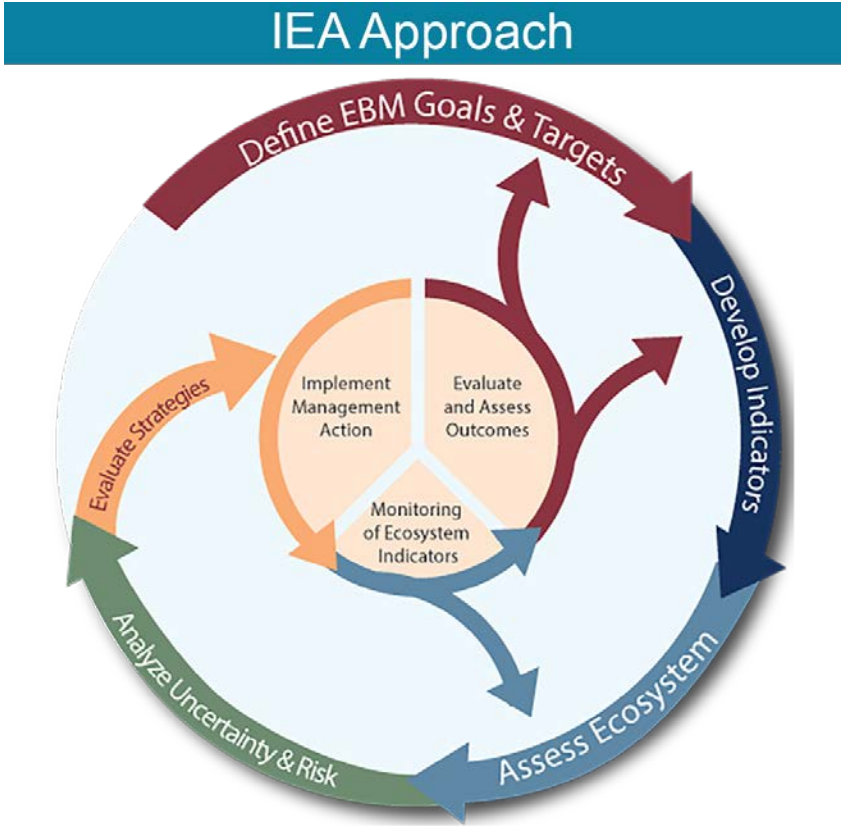


Monitoring coastal mCDR impacts

NOAA regularly conducts research, monitoring, modeling and forecasting from an **ecosystem assessment** perspective that is critical for understanding potential impacts of mCDR techniques.







NOAA Engagement of mCDR Key Points

- Understanding the potential efficacy, risk and/or co-benefits of mCDR tools and techniques clearly resides within **NOAA's mission space**.
  - A key goal at NOAA OAR is to *drive innovative science.*
  - Limited explicit legislative direction for NOAA engagement in CDR (FOARAM).
- Considerable **ongoing science** at NOAA connects to mCDR. **Coastal Blue Carbon** research has been a recent agency focus.
- NOAA is well-positioned to support ongoing and new **open-ocean and coastal zone mCDR** research through:
  - Global and regional biogeochemical observing programs
  - Global and regional biogeochemical modeling
  - Coastal zone ecosystem monitoring and management programs

Over the next year, the NOAA OAR mCDR Task Force will develop a draft mCDR research strategy.

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