



Ocean Acidification

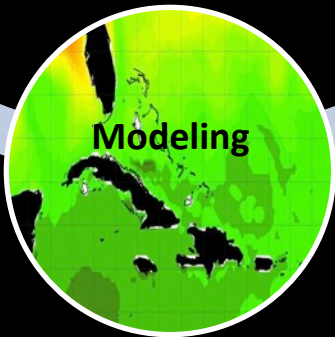
Dr. Libby Jewett

Director, NOAA Ocean Acidification Program

Chair, OA Interagency Working Group

Co-Chair, Global OA Observing Network

Presentation to NAML, March 2 2013



MONITORING OCEANS



Observing Network - Hydrography, Chemistry, and Biology

HYDROGRAPHIC CRUISES

DOCUMENTING CARBON DISTRIBUTIONS IN THE OCEAN INTERIOR



VOLUNTEER OBSERVING SHIPS

DOCUMENTING CARBON DISTRIBUTIONS IN THE SURFACE OCEAN



BUOYS AND OTHER AUTONOMOUS SYSTEMS

DOCUMENTING TEMPORAL CHANGES IN OCEAN CARBON



Ecosystem surveys



Ocean Acidification

Thermodynamic Threshold

Aragonite Saturation State



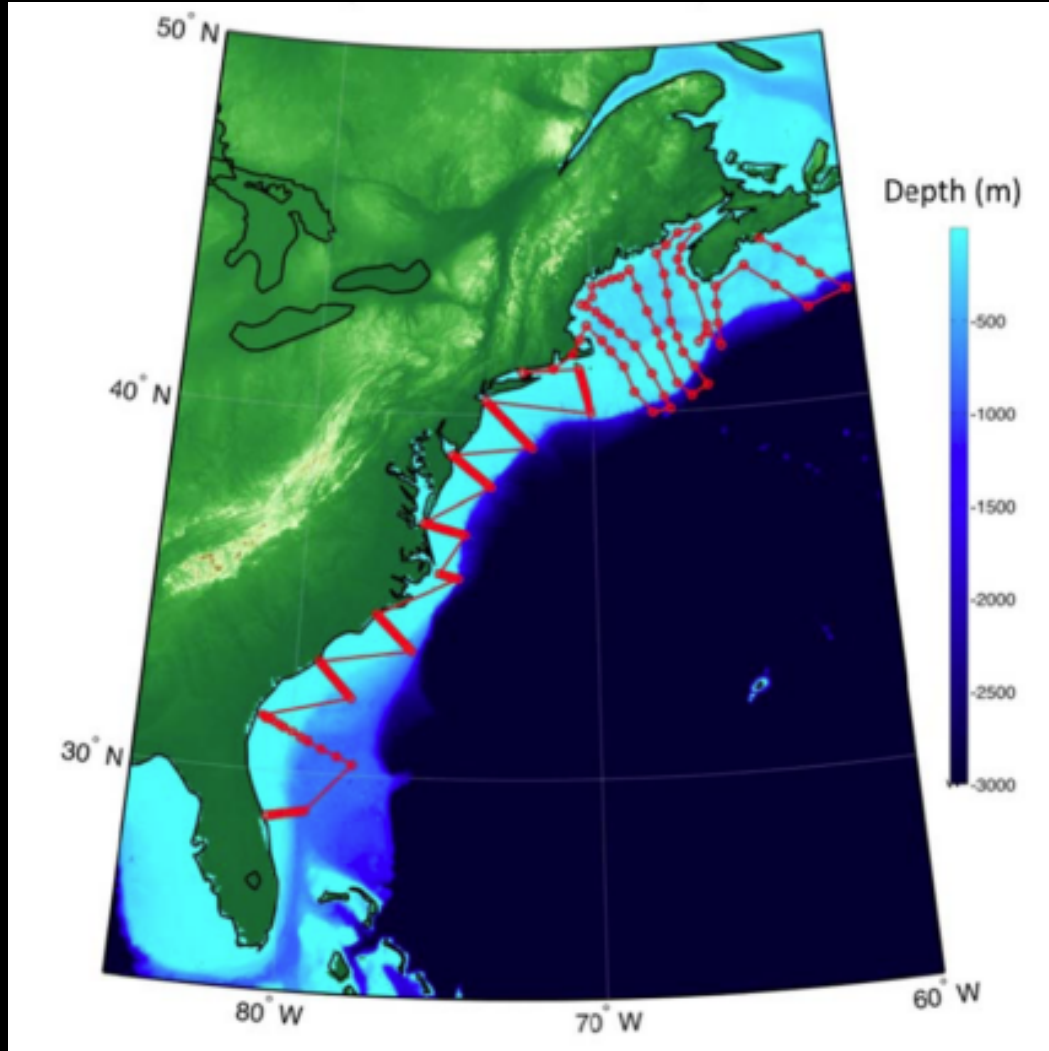
● De

● VOS

Time Series Station

Hydrographic Cruise

East Coast OA Cruise Summer 2016



Co-PIs

Joe Salisbury, UNH
Wei Jun Cai, Udel

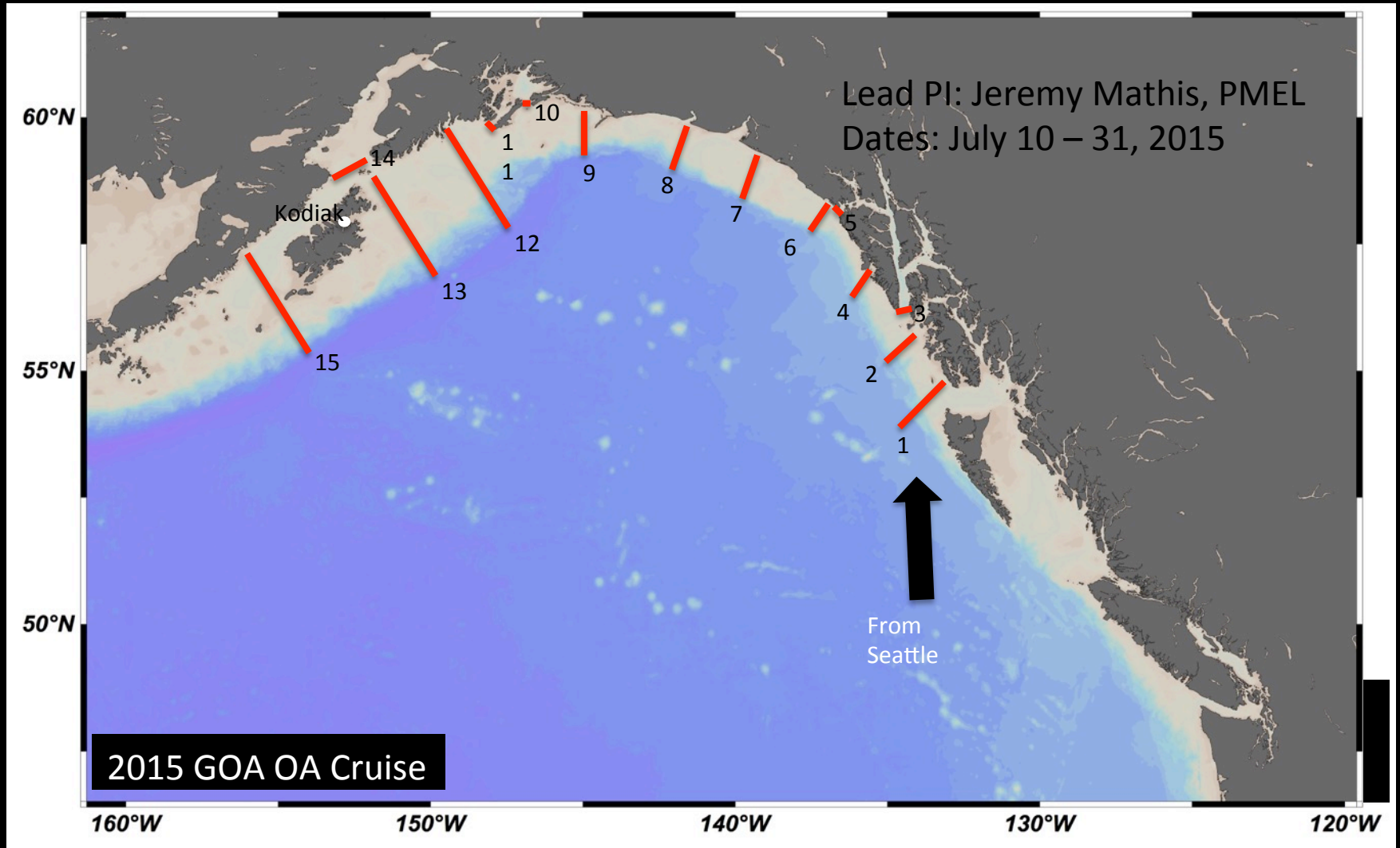
Dates

June 17 – July 24, 2016

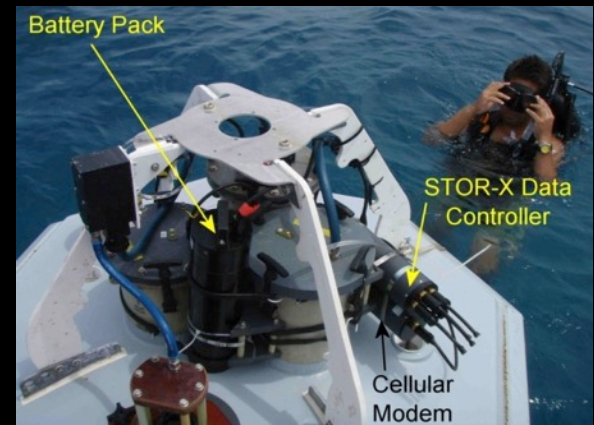
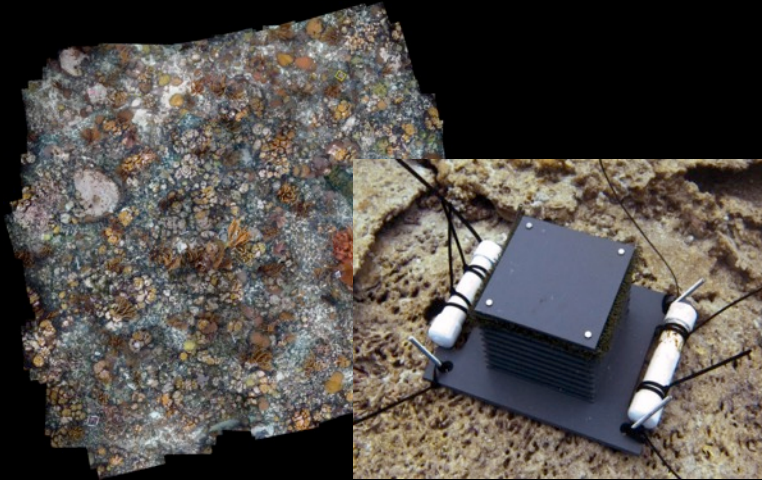
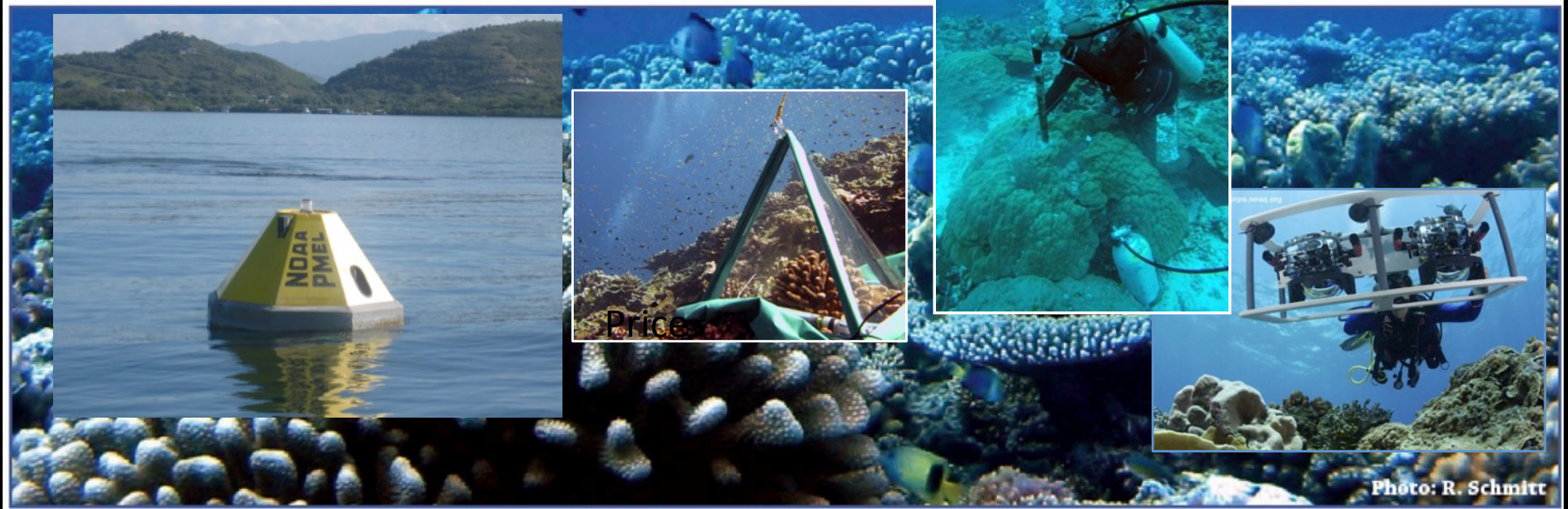
Ship

Gordon Gunther

Gulf of AK OA Cruise Summer 2016



Reef Monitoring Cross-disciplinary

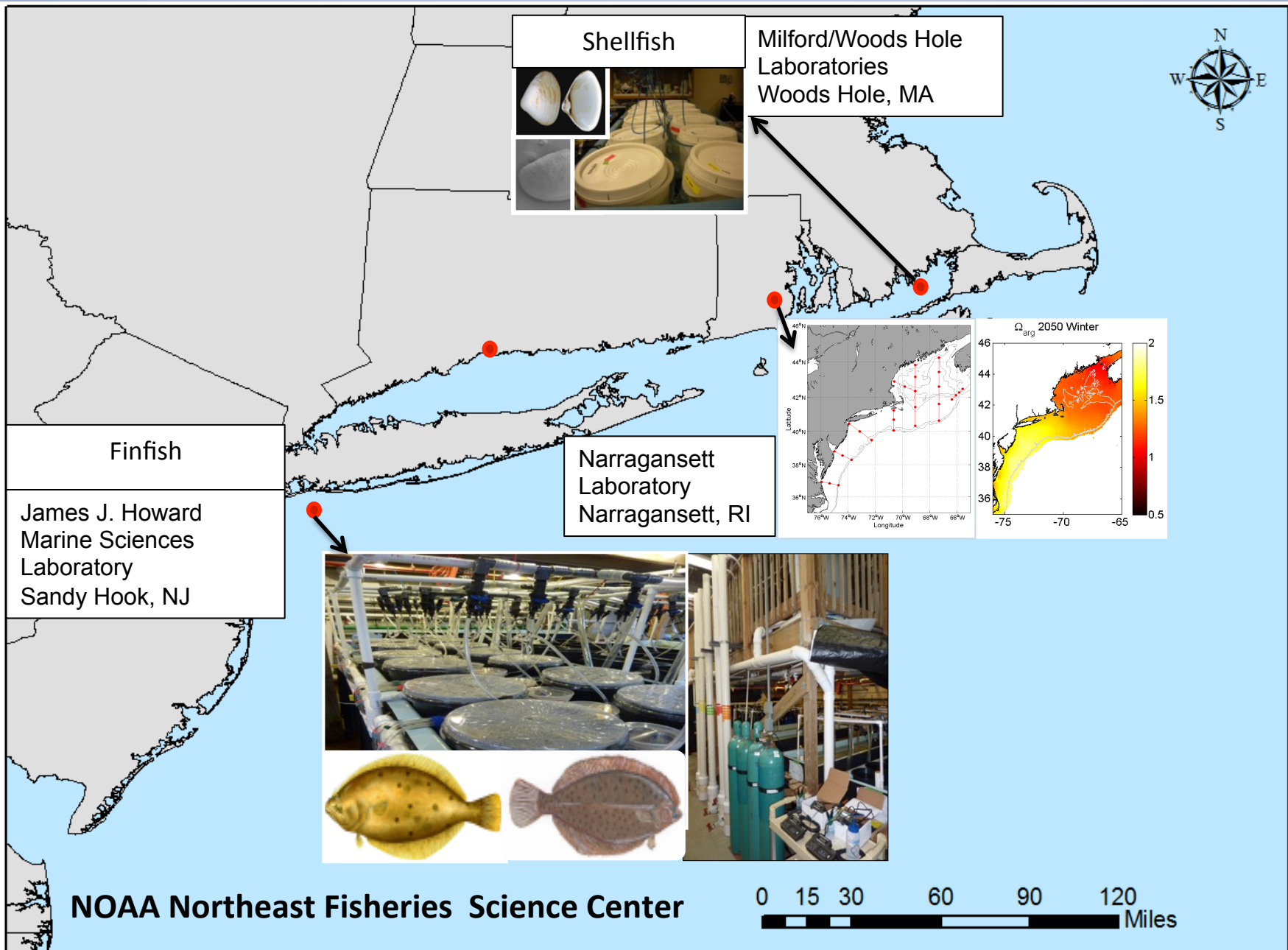


ECOLOGICAL TO SOCIOECONOMIC IMPACTS



Calcifying shellfish potentially vulnerable to ocean acidification along US East Coast

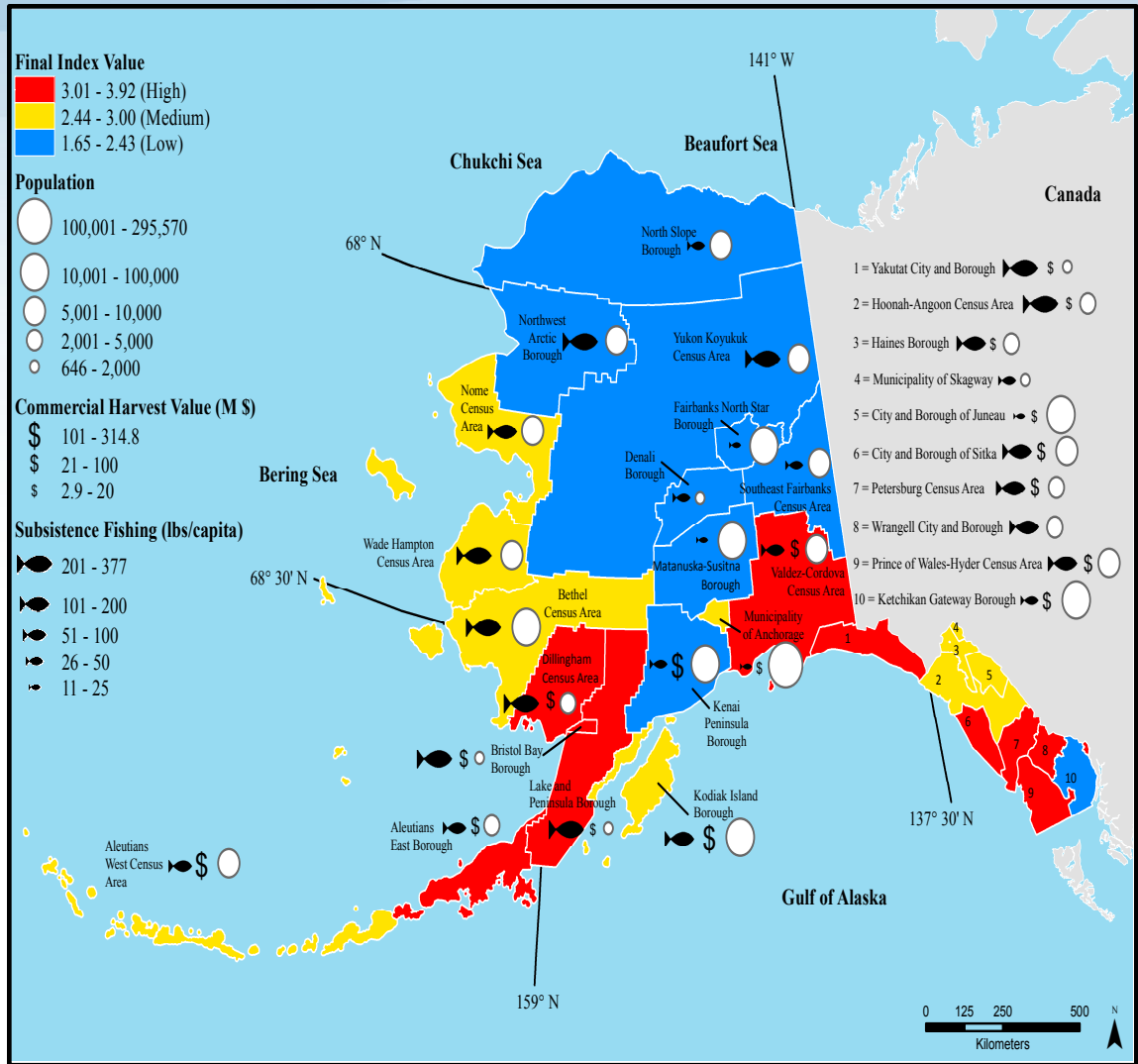




NOAA Northeast Fisheries Science Center

Evaluating the Risks of OA In Alaska

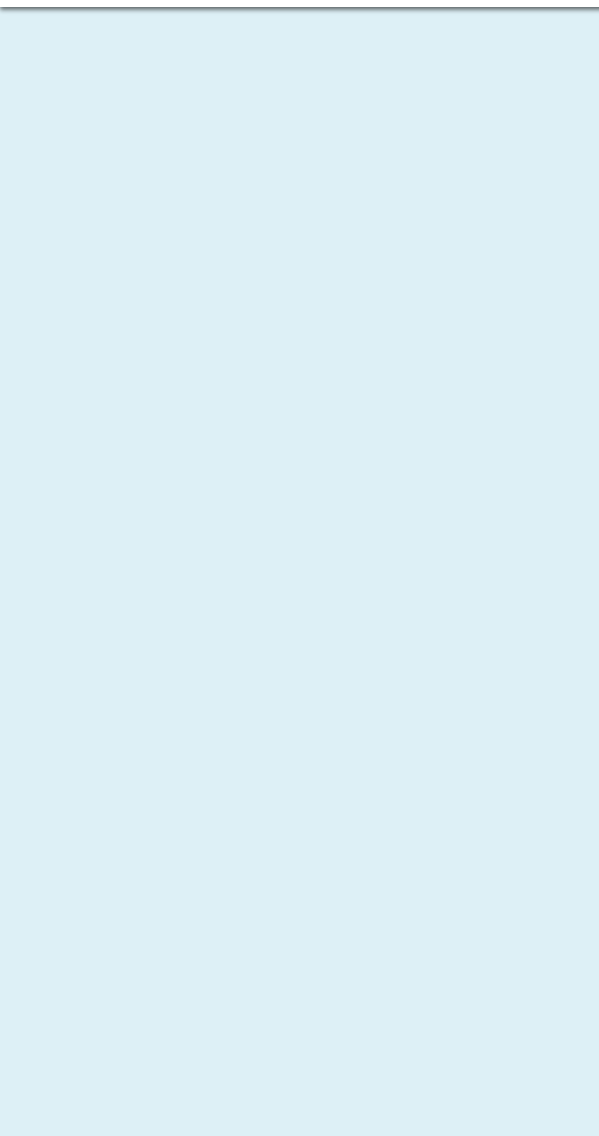
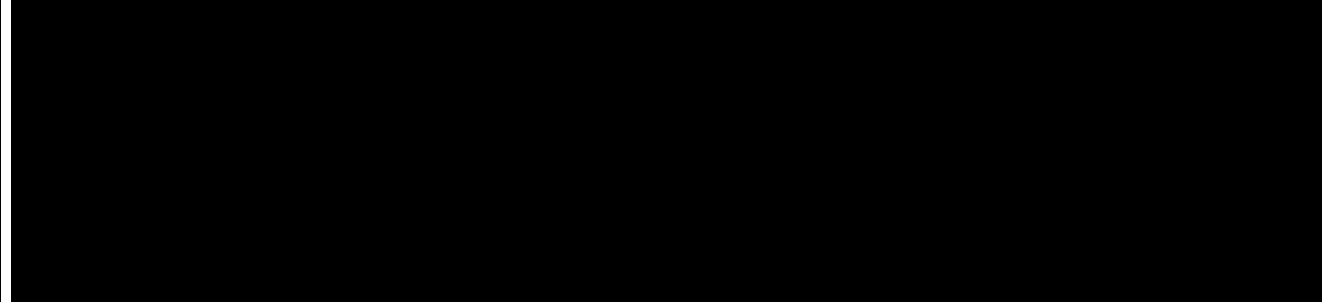
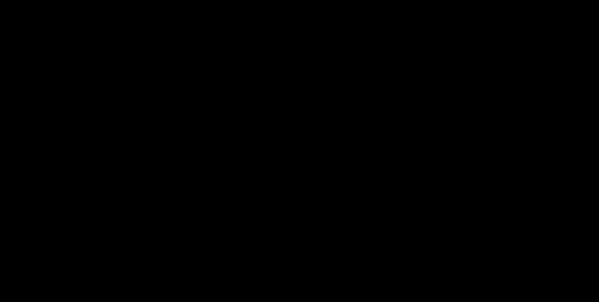
Census Area/ Borough	Rank
Lake and Peninsula Borough	1
Wrangell City and Borough	2
Prince of Wales-Hyder Census Area	3
Aleutians East Borough	3
Petersburg Census Area	5
Sitka, City and Borough of	6
Yakutat City and Borough	7
Bristol Bay Borough	7
Dillingham Census Area	7
Valdez-Cordova Census Area	10
Hoonah-Angoon Census Area	11
Bethel Census Area	11
Juneau, City and Borough of	13
Kodiak Island Borough	14
Aleutians West Census Area	14
Wade Hampton Census Area	16
Municipality of Anchorage	17
Haines Borough	17
Skagway, Municipality of	19
Nome Census Area	20
Yukon Koyukuk Census Area	21
Fairbanks North Star Borough	22
Matanuska-Susitna Borough	22
Northwest Arctic Borough	24
Ketchikan Gateway Borough	24
Kenai Peninsula Borough	26
Southeast Fairbanks Census Area	27
Denali Borough	28
North Slope Borough	29



Mathis et al., 2014
Progress in Oceanography

TECHNOLOGY DEVELOPMENT





New Technologies

Carbon Wave Glider



Adaptation Technologies

Beer bottle



Burkilator



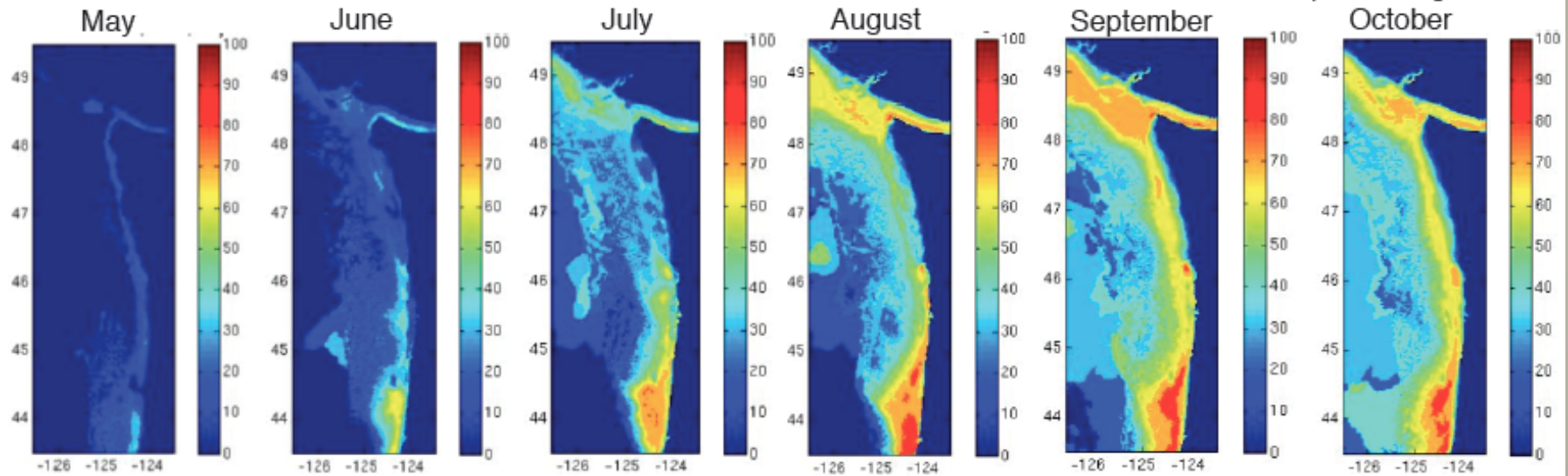
MODELS AND FORECASTS



West Coast Modeling Efforts

What does the 2013 Forecast say about Ω ?

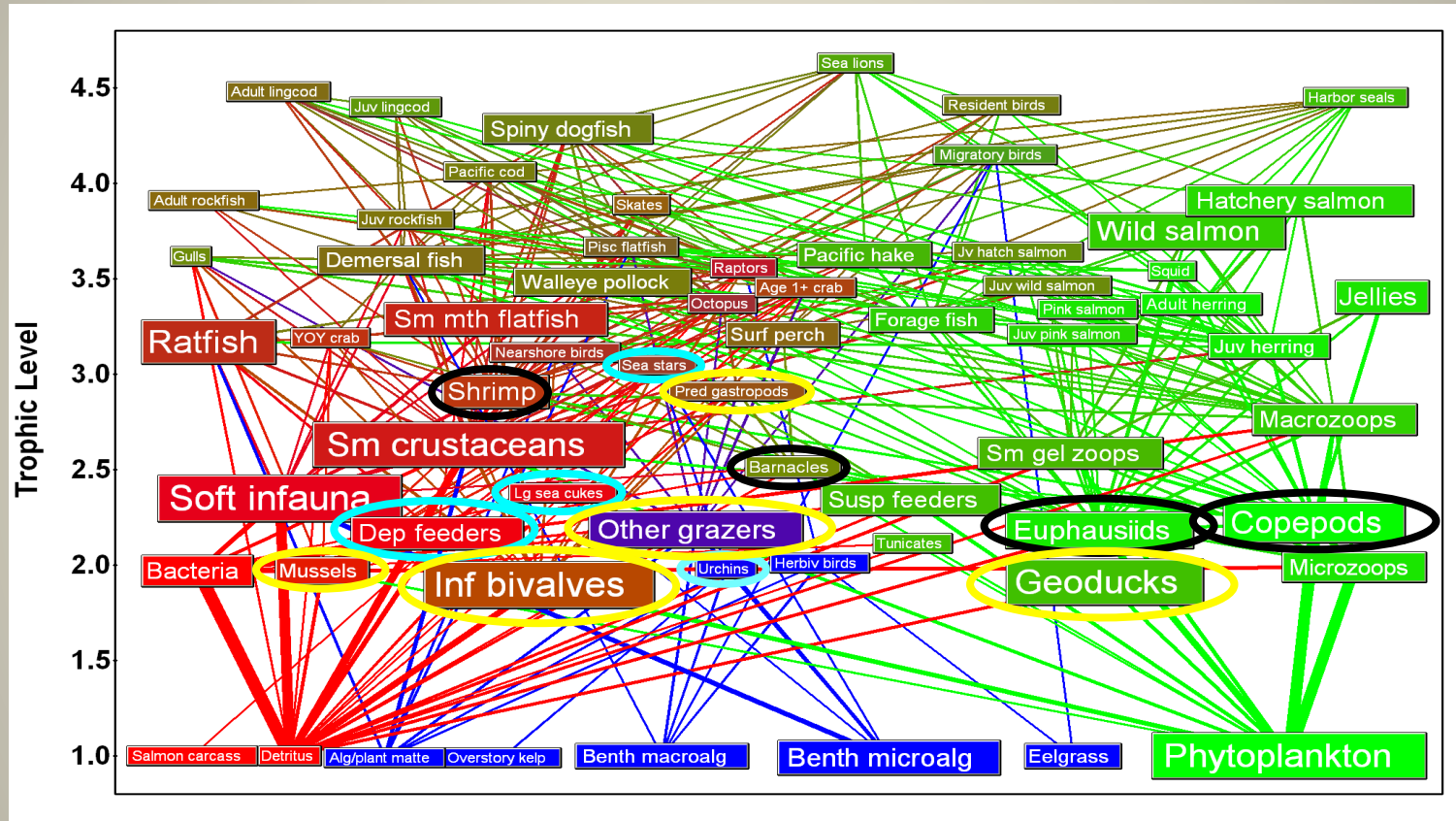
Figures below plot maps of the percent of the upper 100 m of water which is undersaturated with respect to aragonite.



Seasonal increase in undersaturated waters' presence on shelf, which varies regionally



Ecosystem Modeling



Potential impacts of ocean acidification on the Puget Sound food web.

(Busch, D.S., C. Harvey and P. McElhany. 2013. ICES Journal of Marine Science 70(4): 823-833.)

See also...

- Busch, D. S., C. Greene, T. Good. In press. Estimating impacts of tidal power and climate change on threatened and endangered marine species and their food web. Conservation Biology.
- Ainsworth, C., J. Samhuri, D. S. Busch, W. Cheung, J. Dunne, T. Okey. 2011. Potential impacts of climate change on Northeast Pacific marine fisheries and food webs. ICES Journal of Marine Science 68: 1217-1229.

DATA MANAGEMENT AND SHARING



Sharing Regional Data in real time...

IOOS PACIFIC REGION OCEAN ACIDIFICATION EXPLORER

Map Asset List Asset History Help

126.3867

Map data ©

Mac OS X dock with icons for Safari, Firefox, Chrome, and other applications.

IOOS PACIFIC REGION OCEAN ACIDIFICATION EXPLORER

Map Asset List Asset History Help

155.0391

CeNCOOS Burkolator at Hog Island Oyster Farm

Observations Details

Provider: Hog Island C

Data Updated: 26 Nov 2014 17:27 EST

COOS Hog Island Burkolator - Omega Arag. Sat. - 24 Hour

Omega Aragonite Saturation

2.800
2.400
2.000
1.600
1.200
0.800
0.400

24 Hours 7 Days 30 Days 60 Days

Download icon

Link

Mac OS X dock with icons for Safari, Firefox, Chrome, and other applications.

<http://www.ipacoa.org/>

Sharing quality controlled data...

The screenshot shows a web browser window displaying the NOAA National Oceanographic Data Center (NODC) website. The browser's address bar shows the URL <https://www.nodc.noaa.gov/oceanacidification/>. The page header features the NOAA logo and the text "NOAA NATIONAL OCEANOGRAPHIC DATA CENTER (NODC) UNITED STATES DEPARTMENT OF COMMERCE". Below the header, there are navigation buttons for "Welcome to NODC", "Access Data", "Submit Data", "Public Outreach", and "About NODC". A search bar is located on the right side of the header, with "NODC" selected and "All of NOAA" as an option. The main content area is titled "Ocean Acidification Scientific Data Stewardship (OADS)". The left sidebar contains a menu with "Ocean Acidification Stewardship Project (OADS)", "Access data", "Submit data", "Other Resources", and "Useful Pages". The "Useful Pages" section lists "NOAA Ocean Acidification Program" and "Global OA Observing Network". The main content area includes a description of the OADS project, a search bar, and buttons for "Access data", "Submit data", and "Need Help?". The footer contains contact information for NODC.Ocean.Acidification@noaa.gov, the last updated date (June 10, 2014 12:57 PM), and the maintainer (Hernan Garcia). The Windows taskbar is visible at the bottom of the screen.

U.S. NODC Ocean Acidific x

https://www.nodc.noaa.gov/oceanacidification/

NOAA NATIONAL OCEANOGRAPHIC DATA CENTER (NODC) UNITED STATES DEPARTMENT OF COMMERCE

Welcome to NODC Access Data Submit Data Public Outreach About NODC

NOAA Satellite and Information Service NODC All of NOAA Search Go

You are here: Home > Ocean Acidification Scientific Data Stewardship (OADS)

Ocean Acidification Stewardship Project (OADS)

Access data Submit data Other Resources

Useful Pages

- NOAA Ocean Acidification Program
- Global OA Observing Network

Ocean Acidification Scientific Data Stewardship (OADS)

The U.S. NODC serves as the data management focal point for the NOAA [Ocean Acidification Program \(OAP\)](#) through its Ocean Acidification Data Stewardship (OADS) project. The main goal of the OADS project is to serve the broader OA community by providing dedicated online data discovery, access to NODC-hosted and distributed data sources, long-term archival, and scientific stewardship for a diverse range of ocean acidification and other chemical, physical, and biological oceanographic data. OADS builds on a collaborative approach with shared responsibilities among scientists, data managers, [data partners](#), and NODC.

Access data

Submit data

Need Help?

For questions please contact NODC.Ocean.Acidification@noaa.gov

Web page last updated June 10, 2014 12:57 PM

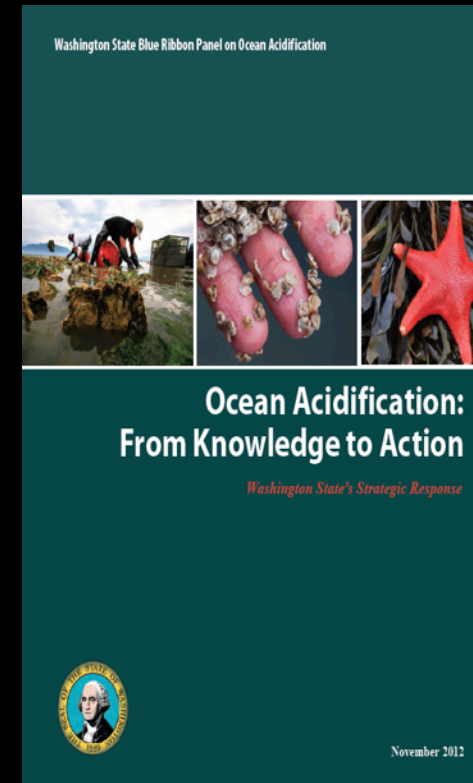
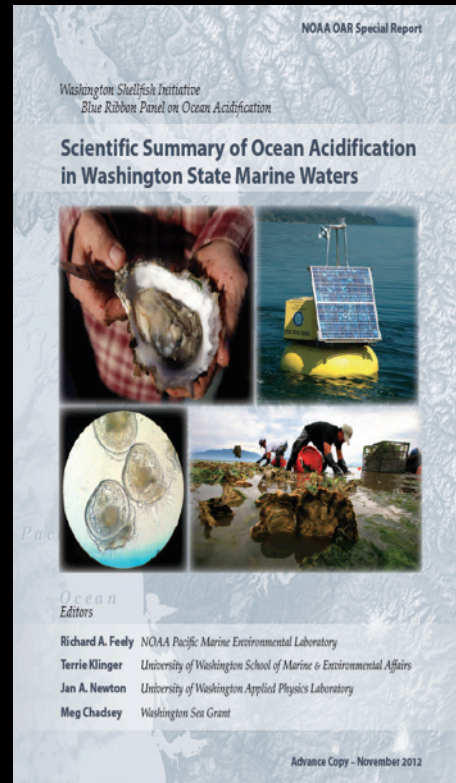
Web page maintained by [Hernan Garcia](#)

Upcoming Opportunities

- Marine Sensor Innovation RFP with IOOS
 - 2014. funded two projects. East and West coasts.
- Biogeochemical to ecological modeling with CSCOR/
NOS
 - 2015: funding three projects. Maybe more in 2016.
- Northeast “high priority” species RFP with Sea Grant -
2016
- Data Synthesis: Discussion at Woods Hole Mtg, June
- Regional RFPs (stay tuned)
 - Vulnerability Assessments
 - Observing Optimization
- Adaptation strategies RFP

States Taking Action

- Washington
- California
- Oregon
- Alaska
- Maine
- Maryland
- Massachusetts
- Rhode Island



Regional Networks

California Current Acidification Network (C-CAN)

<http://c-can.msi.ucsb.edu/>

Southeast Ocean and Coastal Acidification Network (SOCAN)

<http://secoora.org/SOCAN>

Northeast Coastal Acidification Network (NECAN)

www.neracoos.org/NECAN



The logo for GOA-ON features a stylized blue wave or ribbon shape that curves around the text. The text "GOA-ON" is written in a bold, blue, sans-serif font, centered within the wave.

GOA-ON

Global Ocean Acidification
Observing Network

GLOBAL APPROACH

How was GOA-ON made ?

- Two international workshops have been convened to establish a coordinated approach to build an integrated global observing network for ocean acidification that addresses the requirements of nations affected by this emerging environmental problem.
- The first workshop held at the University of Washington in June 2012, was attended by **62 participants from 23 countries**.
- The second workshop, held at St. Andrews, UK, in July 2013 was attended by **87 participants from 26 countries**.
- These participants input have defined the goals, details, and focus of the global ocean acidification observing network.

GOA-ON will provide:



The Global Ocean Acidification Observing Network (GOA-ON) is a collaborative international approach to document the status and progress of ocean acidification in open-ocean, coastal, and estuarine environments, to understand the drivers and impacts of ocean acidification on marine ecosystems, and to provide spatially and temporally resolved biogeochemical data necessary to optimize modeling for ocean acidification.



[Home](#) [References/Reports](#) [GOA-ON Activities](#) [Interactive Map](#) [Network Members](#) [Governance/Contact](#)

Approach and Goals

Detailed information about the GOA-ON background, design, implementation, and data strategy can be found here:

[Global Ocean Acidification Observing Network: Requirements and Governance Plan \(JA Newton, RA Feely, EB Jewett, P Williamson, J Mathis\)](#)

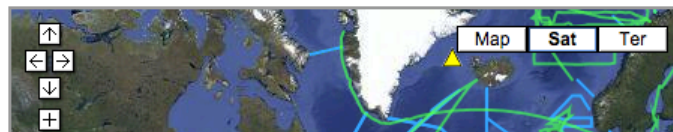
GOA-ON high-level goals:

Goal 1 - Improve our understanding of global OA conditions:

- Determine status and spatial / temporal patterns in carbon

Interactive Map of Ocean Acidification Platforms

Building on the existing global oceanic carbon observatory network of repeat hydrographic surveys, time-series stations, floats and glider observations, and volunteer observing ships, the interactive map below offers the best information available on the current inventory of global OA observing platforms. This is a strong foundation of observations of the carbonate chemistry needed to understand chemical changes resulting from ocean acidification.



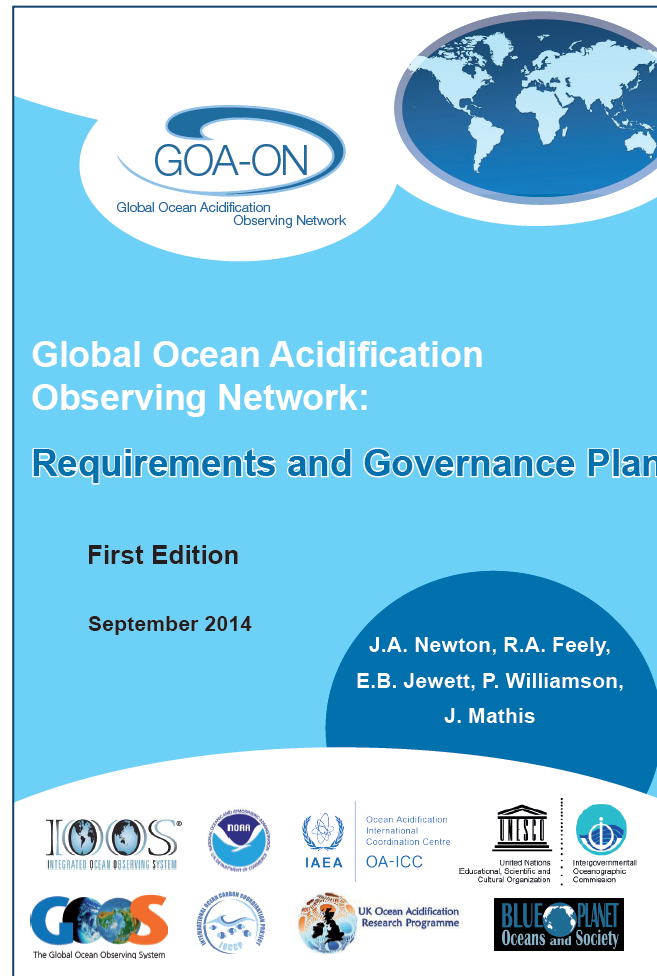
An International Effort

Network Members - Scientists from 30 countries are currently participating in the GOA-ON.

Workshops/Activities

- ▶ [GOA-ON 2012 Workshop, University of Washington, Seattle, WA](#) attended by 62 participants from 22 countries
- ▶ [GOA-ON 2013 Workshop, St. Andrews, UK](#) attended by 87 participants from 26 countries
- ▶ [GOA-ON Side Event](#) at the GEO-X Plenary Session & 2014 Geneva Ministerial Summit
[Flyer](#) [Leaflet](#)

GOA-ON Plan now available



GOA-ON has a nested system design

Coral reefs

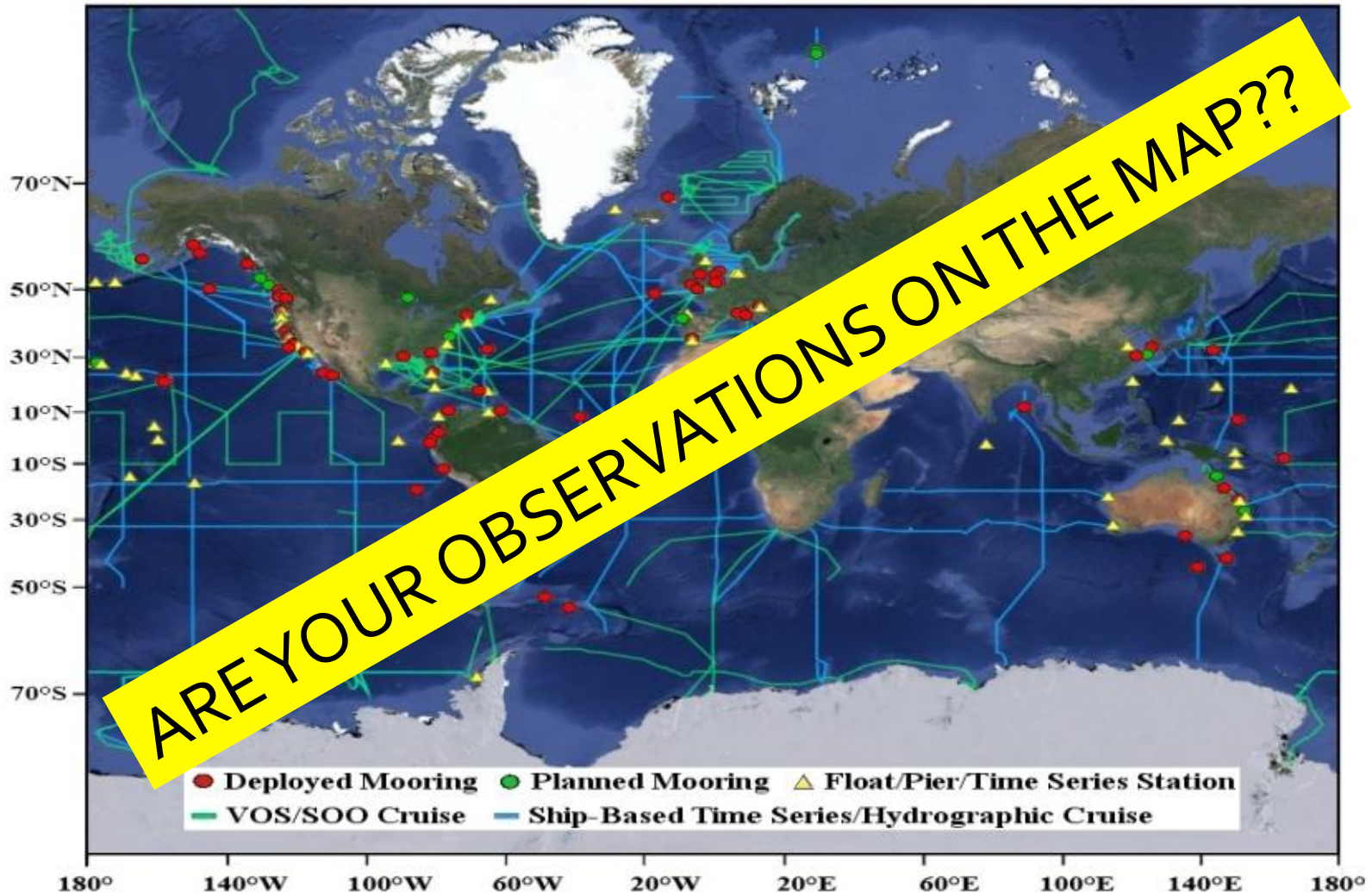
Coasts & shelf seas

Open ocean

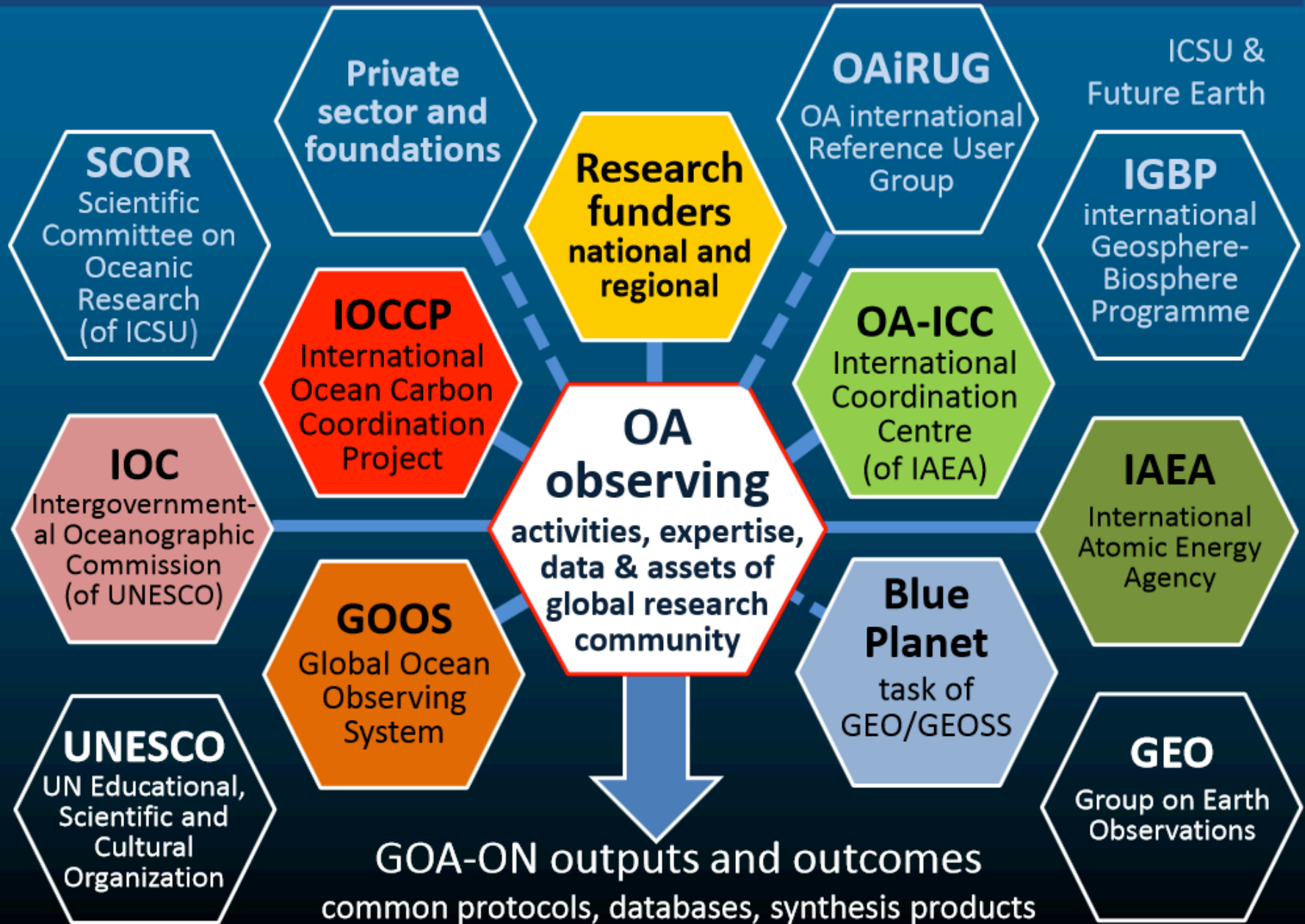
Goal 1 OA conditions	Goal 2 Ecosystem response	Goal 3 OA modeling
<p><u>L1:</u> carbonate-system constraint, T, S, O, fluorescence, irradiance</p> <p><u>L2:</u> nutrients, bio-optics, transport, meteorology, trace metals...</p> <p><u>L3:</u> capability-specific</p>	<p><u>L1:</u> biomass of functional groups (phytoplankton, zooplankton & microbes)</p> <p><u>L2:</u> species; processes incl. growth, grazing & respiration</p> <p><u>L3:</u> capability-specific</p>	<p>Inputs to models</p>

Global OA Observing Network

WWW.GOA-ON.ORG

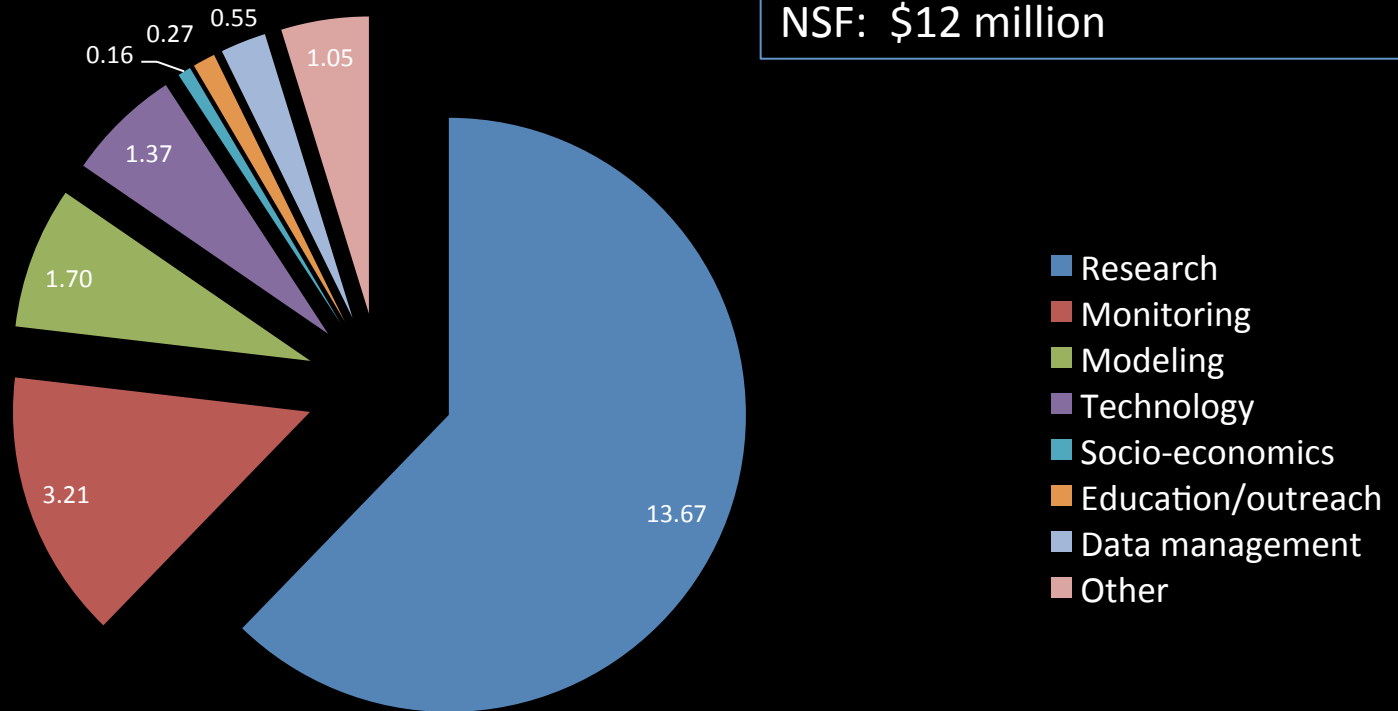


Global OA Observing Network *wider connections*



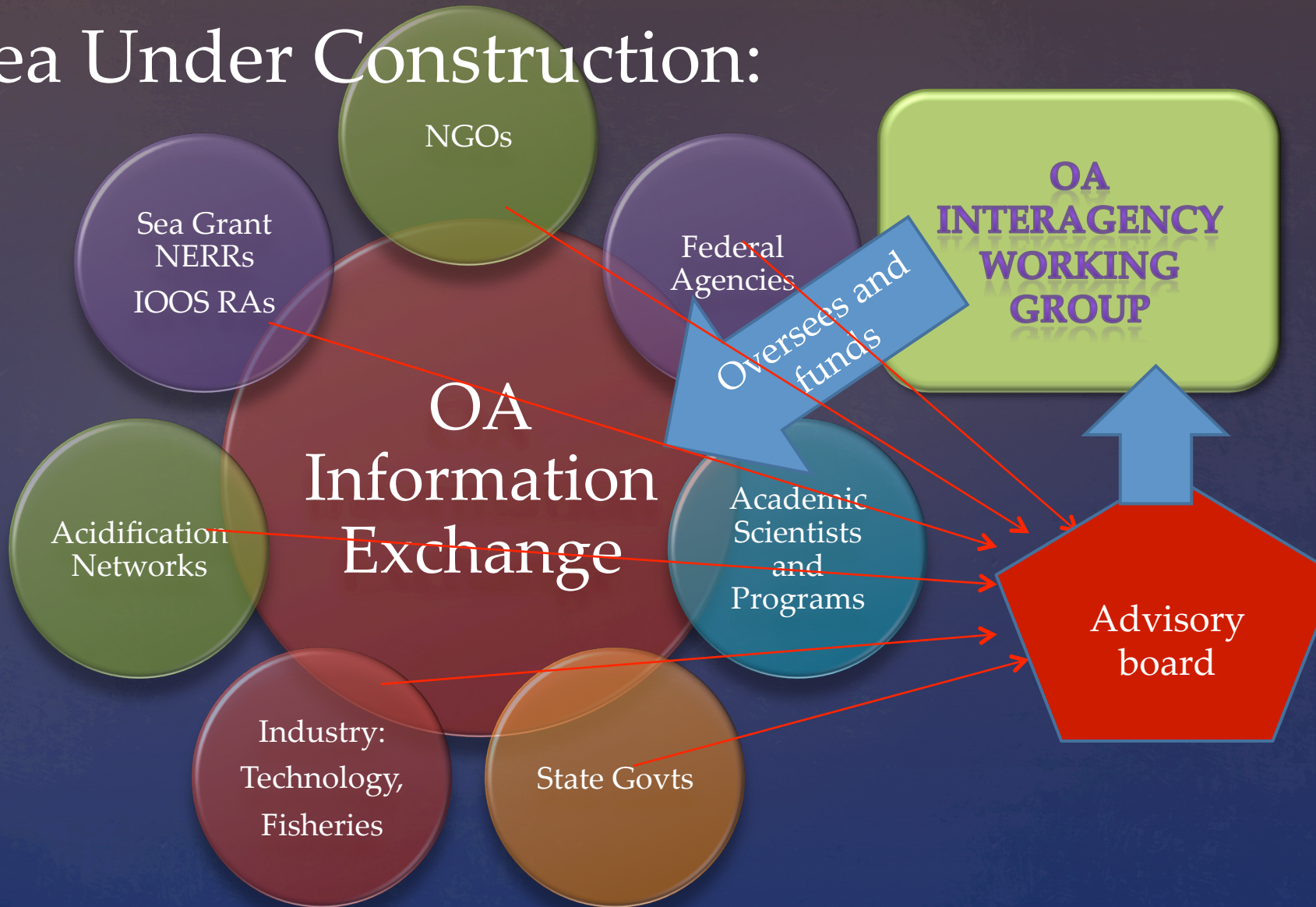
U.S. Federal OA Investment FY 13

NOAA: \$6 M (now \$8.5 M)
NSF: \$12 million



Approx Total for FY 13: \$22 M

Idea Under Construction:



Come visit us at:
OceanAcidification.NOAA.gov



For the Global Ocean Acidification Observing Network:
www.GOA-ON.org