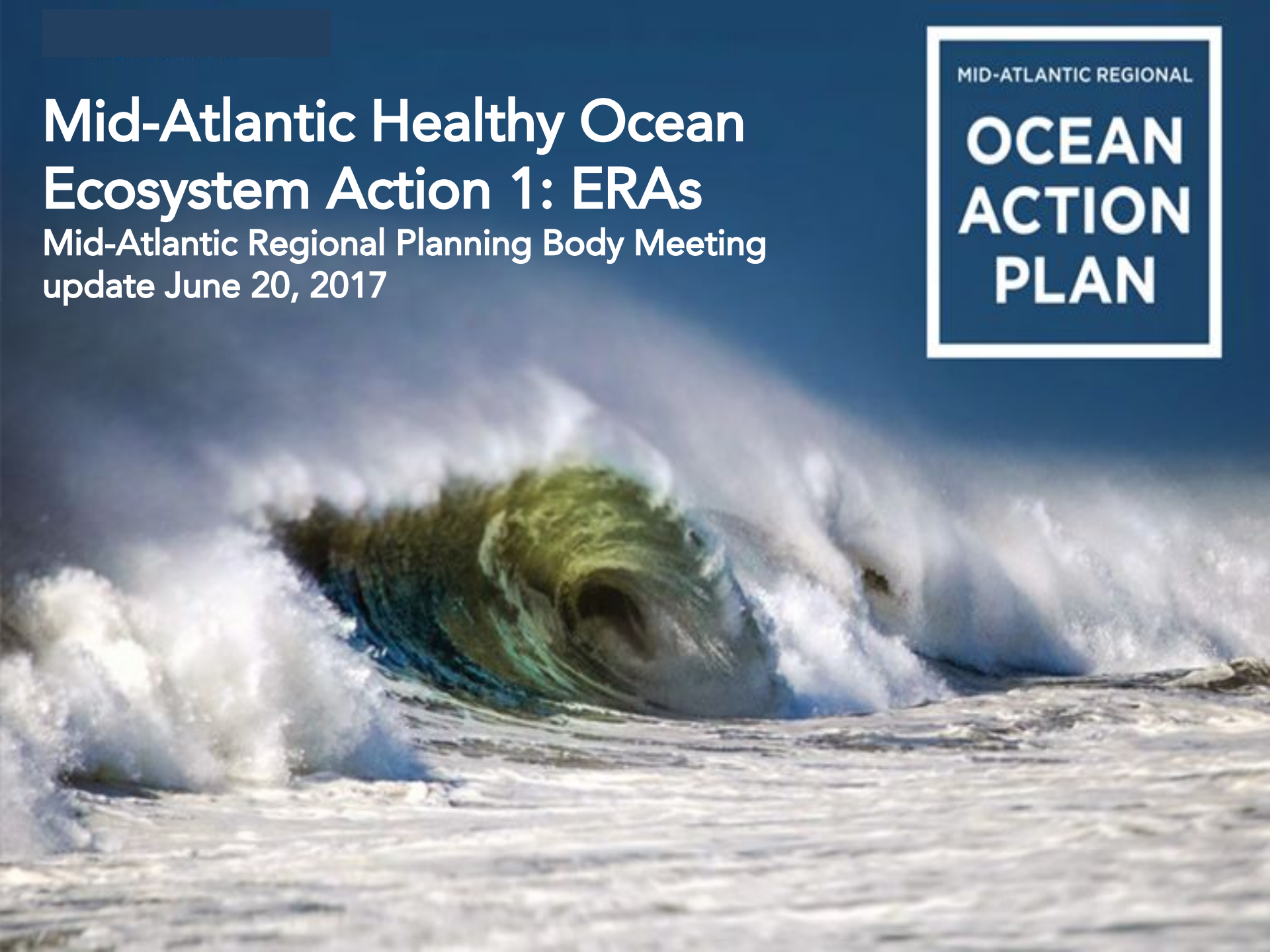
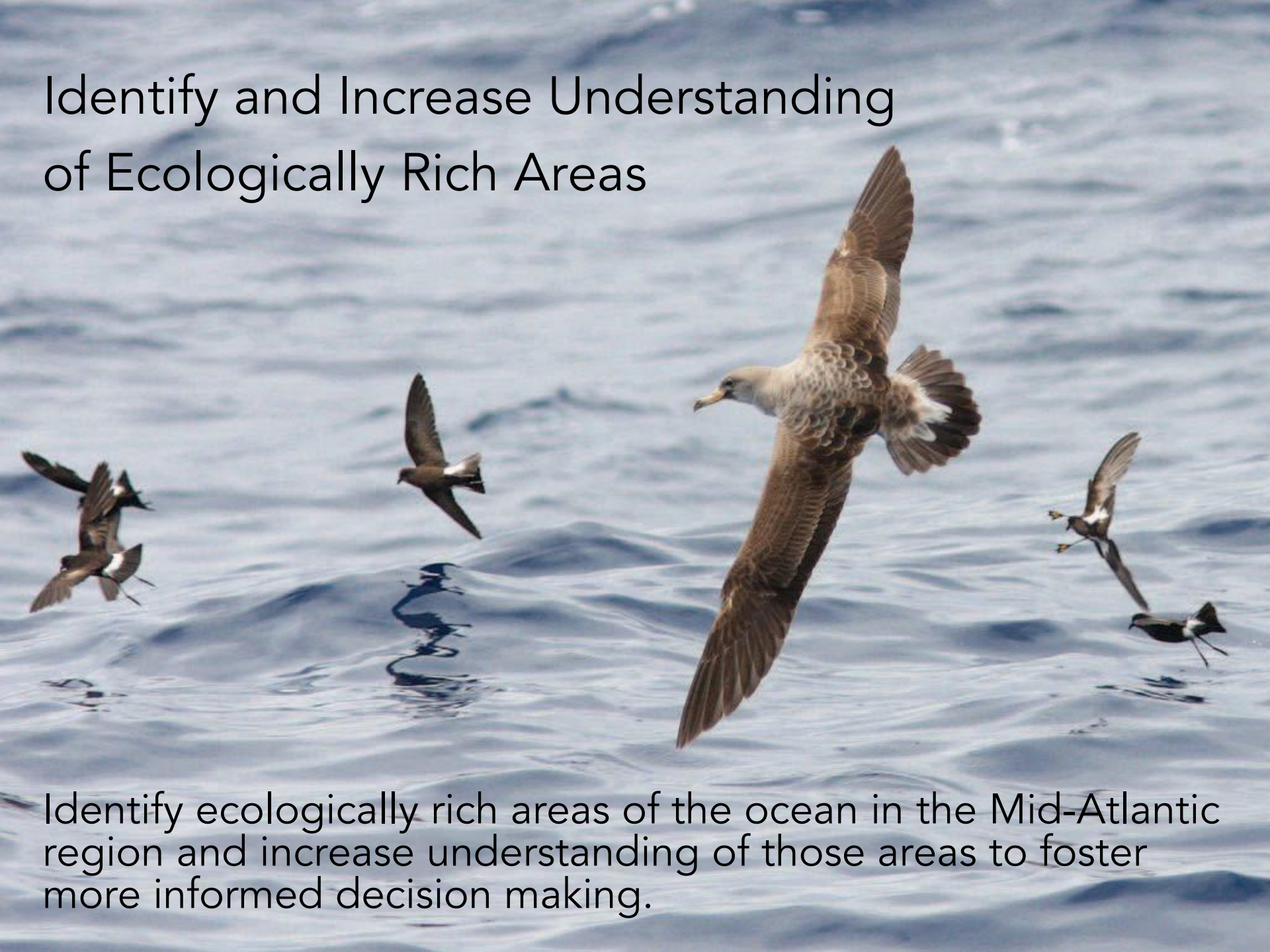
Mid-Atlantic Healthy Ocean Ecosystem Action 1: ERAs

Mid-Atlantic Regional Planning Body Meeting update June 20, 2017

MID-ATLANTIC REGIONAL OCEAN ACTION PLAN



Identify and Increase Understanding of Ecologically Rich Areas



Identify ecologically rich areas of the ocean in the Mid-Atlantic region and increase understanding of those areas to foster more informed decision making.

Presentation Overview

- Finalization of framework for identifying ERAs
- Update on marine life data synthesis products
- Report from ERA Workshop- May 19, 2017
- ERA Work Group recommendation for next steps

Framework for Identifying ERAs

- Draft Framework included in Draft Mid-Atlantic Regional Ocean Action Plan - Summer 2016

- Five ERA components:
  1. Productivity
  2. Biodiversity
  3. Species abundance
  4. Rarity
  5. Vulnerability

Framework for Identifying ERAs (cont'd)

- Additions to Draft Framework:
  - Data sets to be cross- checked with known species of Indigenous cultural importance
  - Four types of ERAs
    - Fixed
    - Clustered
    - Ephemeral
    - Ambulatory
- RPB approved March 21, 2017
- Presented for finalization today June 20, 2017

Marine-life Data Synthesis Products



Mid-Atlantic Regional Planning Body Update
June 20, 2017

Jesse Cleary

Marine Geospatial Ecology Lab, Duke University, Marine Life Data & Analysis Team (MDAT)

Pat Halpin (PI), Earvin Balderama (Co-I), Mike Fogarty (Co-I)

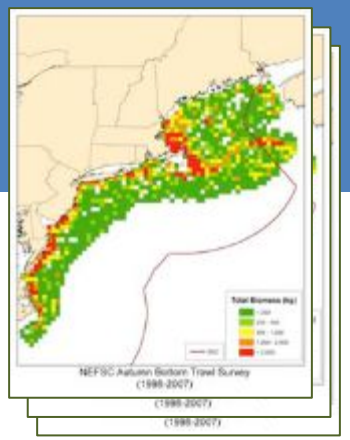
Jason Roberts, Arliss Winship, Corrie Curtice, Jesse Cleary, Emily Shumchenia, Charles Perretti



Overview

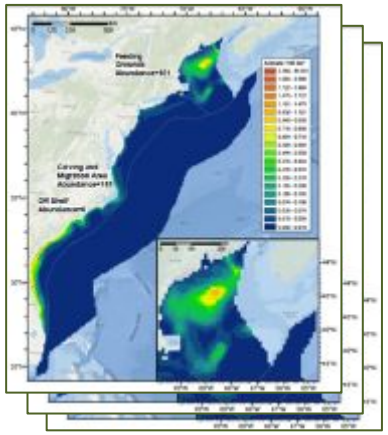
- MDAT Data Review and Update
- May 2017 ERA Workshop: Data Discussions

MDAT Data Review – Species Data



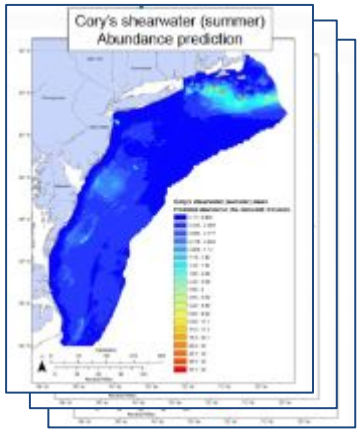
Fish

- 82 species
- Biomass
- 1979-2014; 2005-2014



Mammals

- 29 species / guilds
- Predicted density
- Monthly, Annual



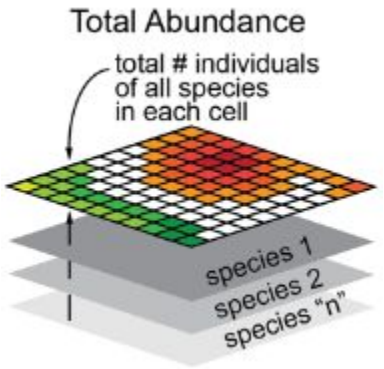
Avian

- 40 Species
- Predicted relative density and occurrence
- Seasonal, Annual

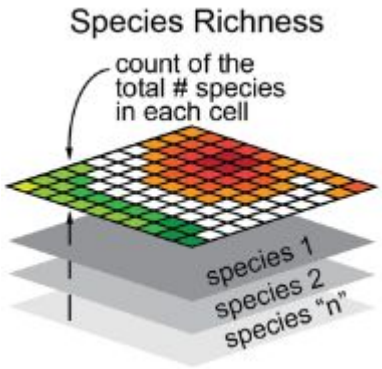
MDAT Data Review - Summary Products

For species groups:

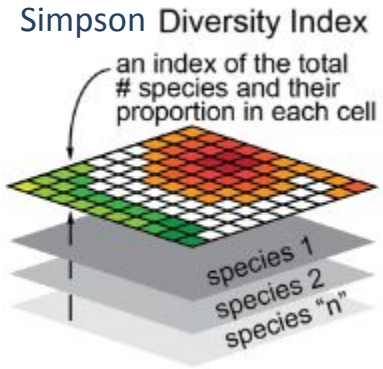
1. Group Abundance / Biomass



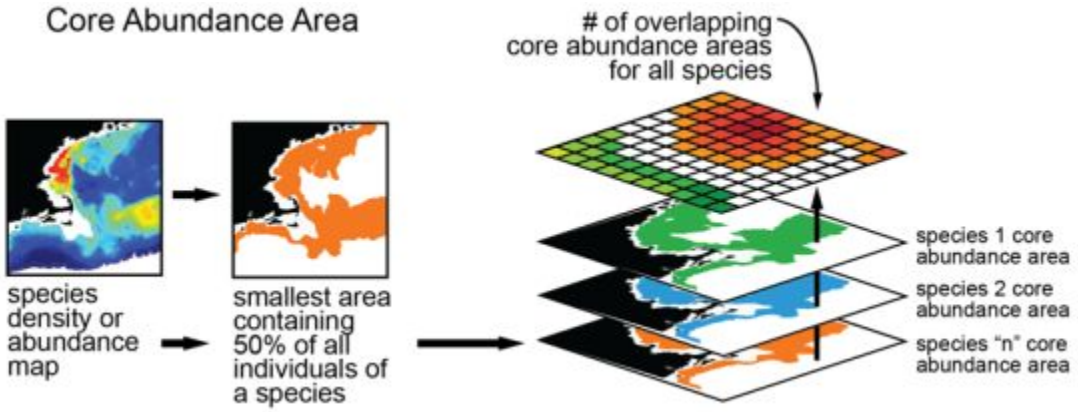
2. Species Richness



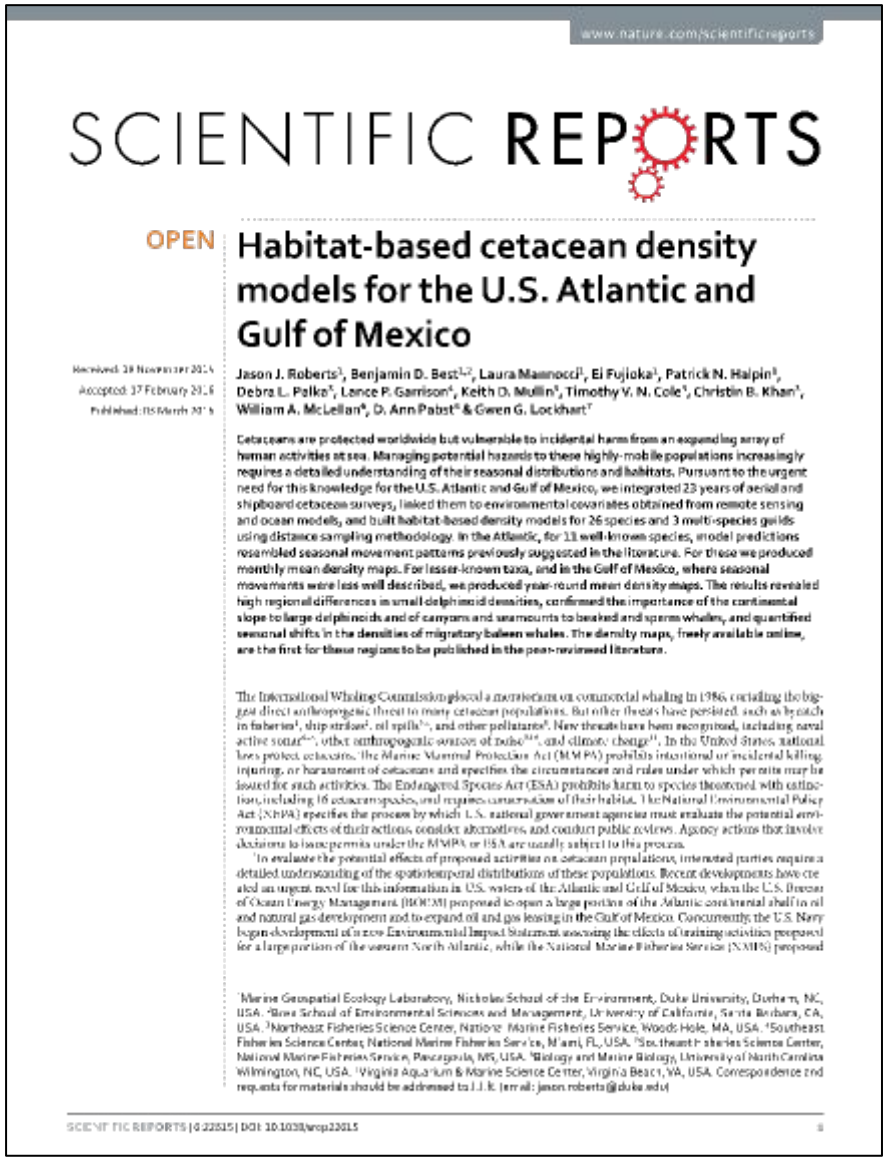
3. Biodiversity Index



4. Core Abundance / Biomass Area Richness



MDAT Peer Review



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SCIENTIFIC REPORTS

OPEN

Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico

Received: 28 November 2014
Accepted: 17 February 2015
Published: 05 March 2015

Jason J. Roberts[1], Benjamin D. Best[1,2], Laura Mannocci[1], Eli Fujioka[1], Patrick N. Halpin[1], Debra L. Palka[3], Lance P. Garrison[4], Keith D. Mullin[5], Timothy V. N. Cole[3], Christin B. Khan[1], William A. McLellan[6], D. Ann Pabst[6] & Gwen G. Lockhart[7]

Cetaceans are protected worldwide but vulnerable to incidental harm from an expanding array of human activities at sea. Managing potential hazards to these highly-mobile populations increasingly requires a detailed understanding of their seasonal distributions and habitats. Pursuant to the urgent need for this knowledge for the U.S. Atlantic and Gulf of Mexico, we integrated 23 years of aerial and shipboard cetacean surveys, linked them to environmental covariates obtained from remote sensing and ocean models, and built habitat-based density models for 26 species and 3 multi-species guilds using distance sampling methodology. In the Atlantic, for 13 well-known species, model predictions resembled seasonal movement patterns previously suggested in the literature. For these we produced monthly mean density maps. For lesser-known taxa, and in the Gulf of Mexico, where seasonal movements were less well described, we produced year-round mean density maps. The results revealed high regional differences in small delphinoid densities, confirmed the importance of the continental slope to large delphinoids and of canyons and seamounts to beaked and sperm whales, and quantified seasonal shifts in the densities of migratory baleen whales. The density maps, freely available online, are the first for these regions to be published in the peer-reviewed literature.

The International Whaling Commission placed a moratorium on commercial whaling in 1986, curtailing the biggest direct anthropogenic threat to many cetacean populations. But other threats have persisted, such as bycatch in fisheries[1], ship strikes[2], oil spills[3–5], and other pollutants[6]. New threats have been recognized, including naval active sonar[7–9], other anthropogenic sources of noise[10–14], and climate change[15]. In the United States, national laws protect cetaceans. The Marine Mammal Protection Act (MMPA) prohibits intentional or incidental killing, injuring, or harassment of cetaceans and specifies the circumstances and rules under which permits may be issued for such activities. The Endangered Species Act (ESA) prohibits harm to species threatened with extinction, including 16 cetacean species, and requires conservation of their habitat. The National Environmental Policy Act (NEPA) specifies the process by which U.S. national government agencies must evaluate the potential environmental effects of their actions, consider alternatives, and conduct public reviews. Agency actions that involve decisions to issue permits under the MMPA or ESA are usually subject to this process.

To evaluate the potential effects of proposed activities on cetacean populations, interested parties require a detailed understanding of the spatiotemporal distributions of these populations. Recent developments have created an urgent need for this information in U.S. waters of the Atlantic and Gulf of Mexico, when the U.S. Bureau of Ocean Energy Management (BOEM) proposed to open a large portion of the Atlantic continental shelf to oil and natural gas development and to expand oil and gas leasing in the Gulf of Mexico. Concurrently, the U.S. Navy began development of a new Environmental Impact Statement assessing the effects of training activities proposed for a large portion of the western North Atlantic, while the National Marine Fisheries Service (NMFS) proposed

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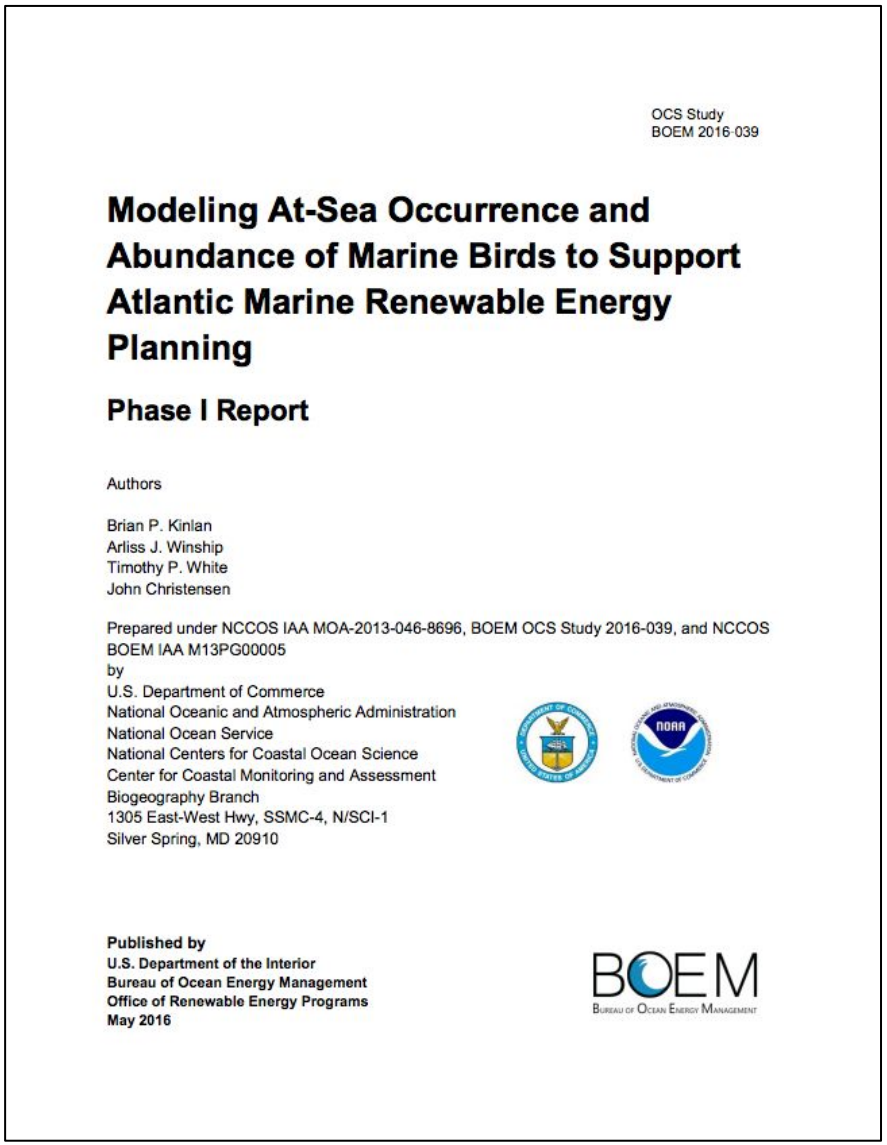


OCS Study
BOEM 2016-039

Modeling At-Sea Occurrence and Abundance of Marine Birds to Support Atlantic Marine Renewable Energy Planning

Phase I Report

Authors

Brian P. Kinlan
Arliss J. Winship
Timothy P. White
John Christensen

Prepared under NCCOS IAA MOA-2013-046-8696, BOEM OCS Study 2016-039, and NCCOS BOEM IAA M13PG00005
by
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
National Centers for Coastal Ocean Science
Center for Coastal Monitoring and Assessment
Biogeography Branch
1305 East-West Hwy, SSMC-4, N/SCI-1
Silver Spring, MD 20910

Published by
U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs
May 2016

MDAT Data – Current Use

Individual Species Models / Data

- NOAA - Marine Mammal Protection Act, Endangered Species Act
- Navy - Navy Acoustic Effects Model (NAEMO)
- BOEM – Wind energy planning
- NOAA NMFS – Stock assessment

MDAT Data – Engagement

NE and Mid-Atlantic Stakeholder & RPB engagement

- 2014-2015
  - 9 Expert Working Group meetings
  - 14 workshops, public webinars, and RPB meetings
- 2016
  - 10 workshops, work group meetings, webinars, and RPB meetings
- 2017
  - 7 workshops, work group calls, and conference presentations completed; ~7 tentatively scheduled

MDAT Data and Model Updates

- Update to Duke marine mammal models
- Update to NOAA NCCOS avian models
- NEW - Loyola avian models
- Update to MDAT summary products



Overview

- MDAT Data Review and Update
- May 2017 ERA Workshop: Data Discussions

May 2017 ERA Workshop: Data Discussions

- Continue to improve data communication
  - Individual Species Models / Data
  - Summary Products
- Continue linking data to ERA components
  - Rolling incorporation of survey results

Data Communication

Stakeholder feedback:

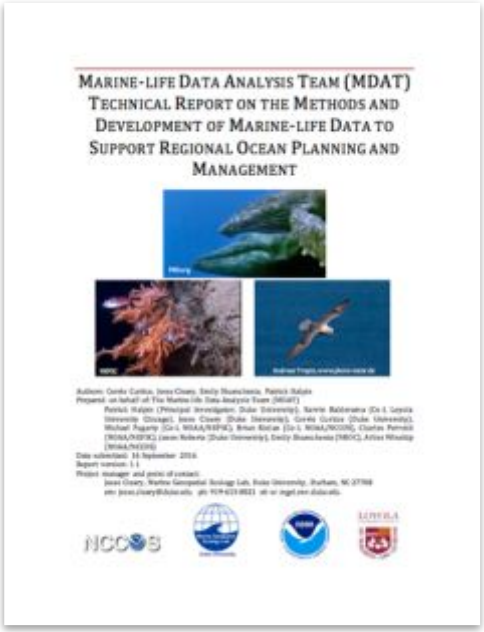
The need to better understand the individual species data and models

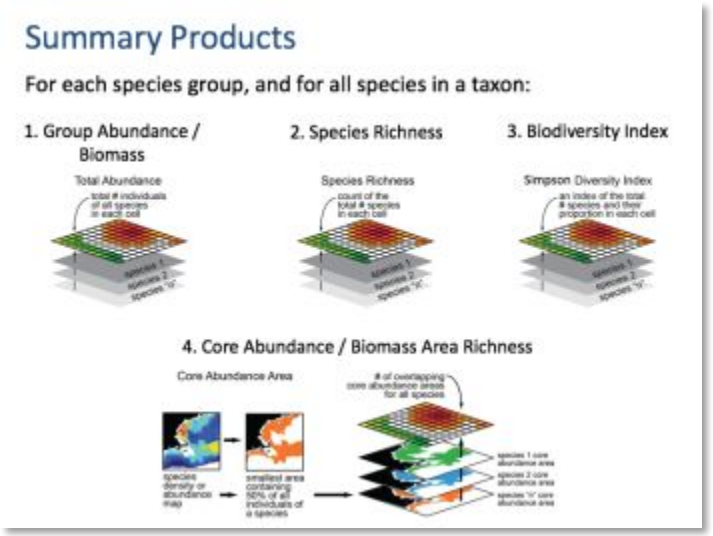
Stakeholders asked questions about input observations, modeling process, peer review, understanding uncertainty…

Data Communication - Existing

MDAT website

- MDAT Technical Report
- Data and model metadata PDFs
- Data download packages





http://seamap.env.duke.edu/models/mdat/

MDAT Peer Review – Mammal Models

SCIENTIFIC REPORTS

OPEN

Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico

Received: 18 November 2015
Accepted: 17 February 2016
Published: 03 March 2016

Jason J. Roberts[1], Benjamin D. Best[1,2], Laura Mannocci[1], Ei Fujioka[1], Patrick N. Halpin[1], Debra L. Palka[3], Lance P. Garrison[4], Keith D. Mullin[5], Timothy V. N. Cole[3], Christin B. Khan[3], William A. McLellan[6], D. Ann Pabst[6] & Gwen G. Lockhart[7]

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Region	Taxonomic group	Sightings retained for analysis: Fully resolved	Sightings retained for analysis: Ambiguous	Taxa modeled with: DSMs	Taxa modeled with: Mixed GAM models
EC	Small delphinoids	10174	944	6	6
	Large delphinoids	817	373	3	3
	Beaked and sperm whales	301	151	2	2
	Baleen whales	2662	640	3	2
GOM	Small delphinoids	1661	171	7	3
	Large delphinoids	<10	15	2	1
	Beaked and sperm whales	<12	10	3	
	Baleen whales	15	8	1	1

Table 2. Sightings reported and taxa modeled. Fully-resolved sightings had a complete taxonomic identification. Ambiguous sightings that were retained for analysis were classified into one of the 29 modeled taxa (see Methods). Taxa modeled with stratified models were sighted so infrequently that a DSM could not be fitted; instead, we produced traditional mean density estimates for the geographic strata they were likely to inhabit.

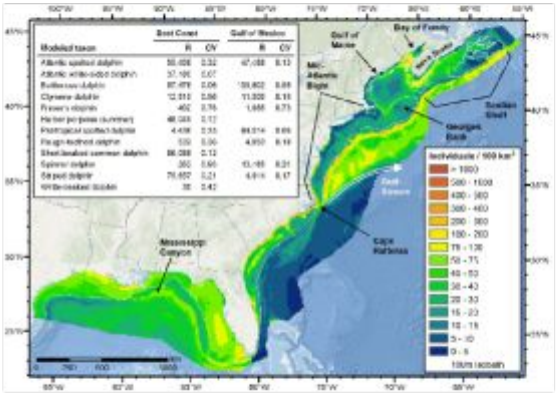
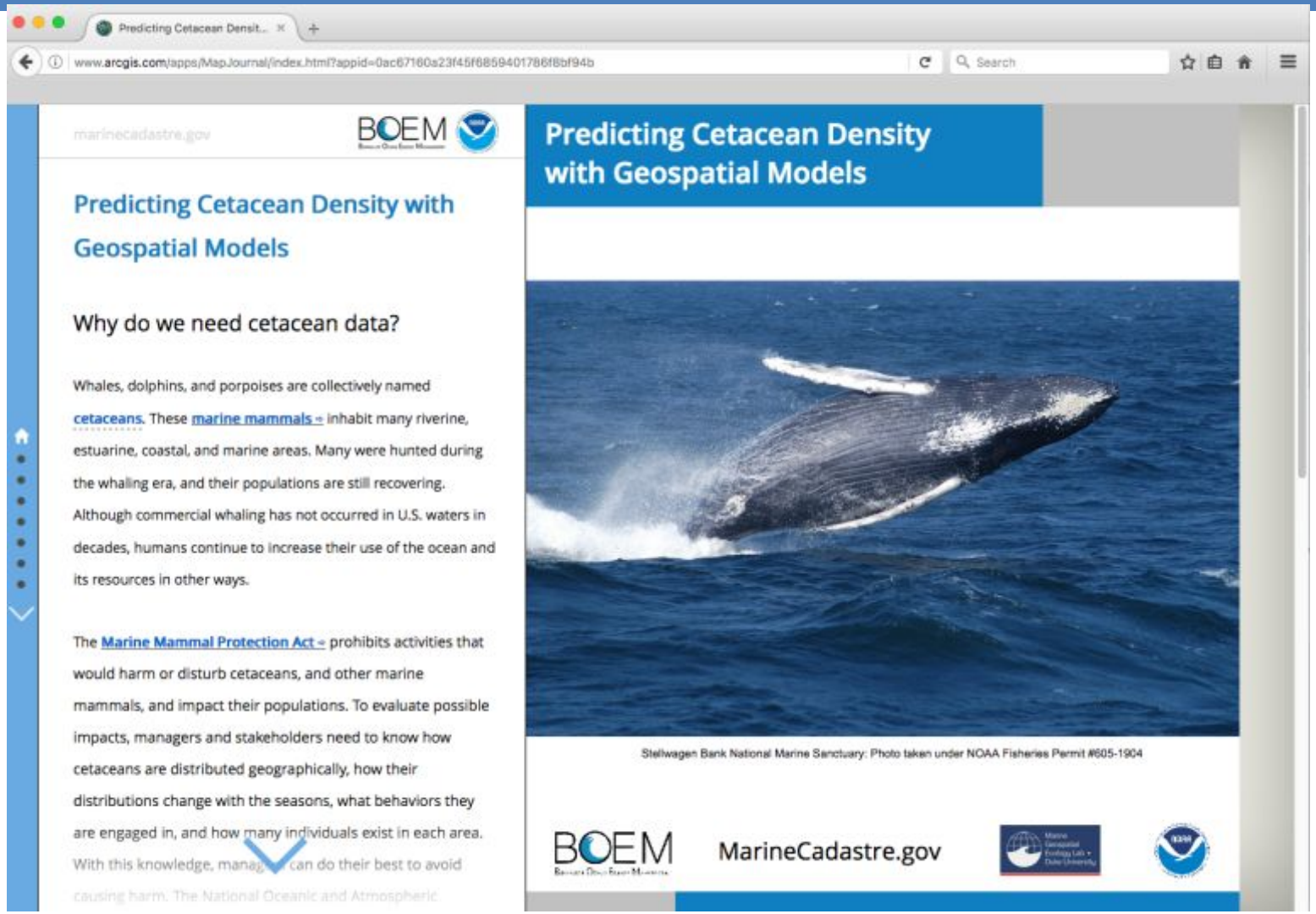


Figure 2. Predicted mean density of small delphinoids. The inset table lists the estimated mean abundance (number of individuals, N) and associated coefficient of variation (CV) for each taxon. The estimates are the year-round mean except for harbor porpoise. Harbor porpoise was modeled with two seasonal models instead of a year-round model; the estimates listed are for the summer model, defined as June–October for this species. Figure produced with ArcGIS 10.2.2 (http://www.arcgis.com/); bathymetry map credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors.

occur throughout oceanic waters, in highest density along the continental slope, consistent with prior reports[36,37]. Pilot whales were especially concentrated off Cape Hatteras, just north of where the Gulf Stream separates from the shelf. Both were also predicted in lower density over the shelf in northern, cold, productive waters. We modeled the remaining four species with stratified models. Killer and false killer whales were sighted and assumed to occur both on and off the shelf, while melon-headed and northern bottlenose whales were sighted and assumed to occur only in oceanic waters.

Beaked and sperm whales. For beaked and sperm whales, deep-diving toothwhales, our models predicted patchy distributions concentrated in deep waters over high relief bathymetry, in keeping with evidence of high prey density in these areas[38]. In the GOM, models predicted concentrations near off-shelf submarine canyons at the mouth of the Mississippi River and the central northern Gulf[39], and along the continental slope (Fig. 4). In the EC, the models predicted highest densities along the continental slope, in and around submarine canyons, and

Data Communication – Existing model story map



https://goo.gl/yTM9fH

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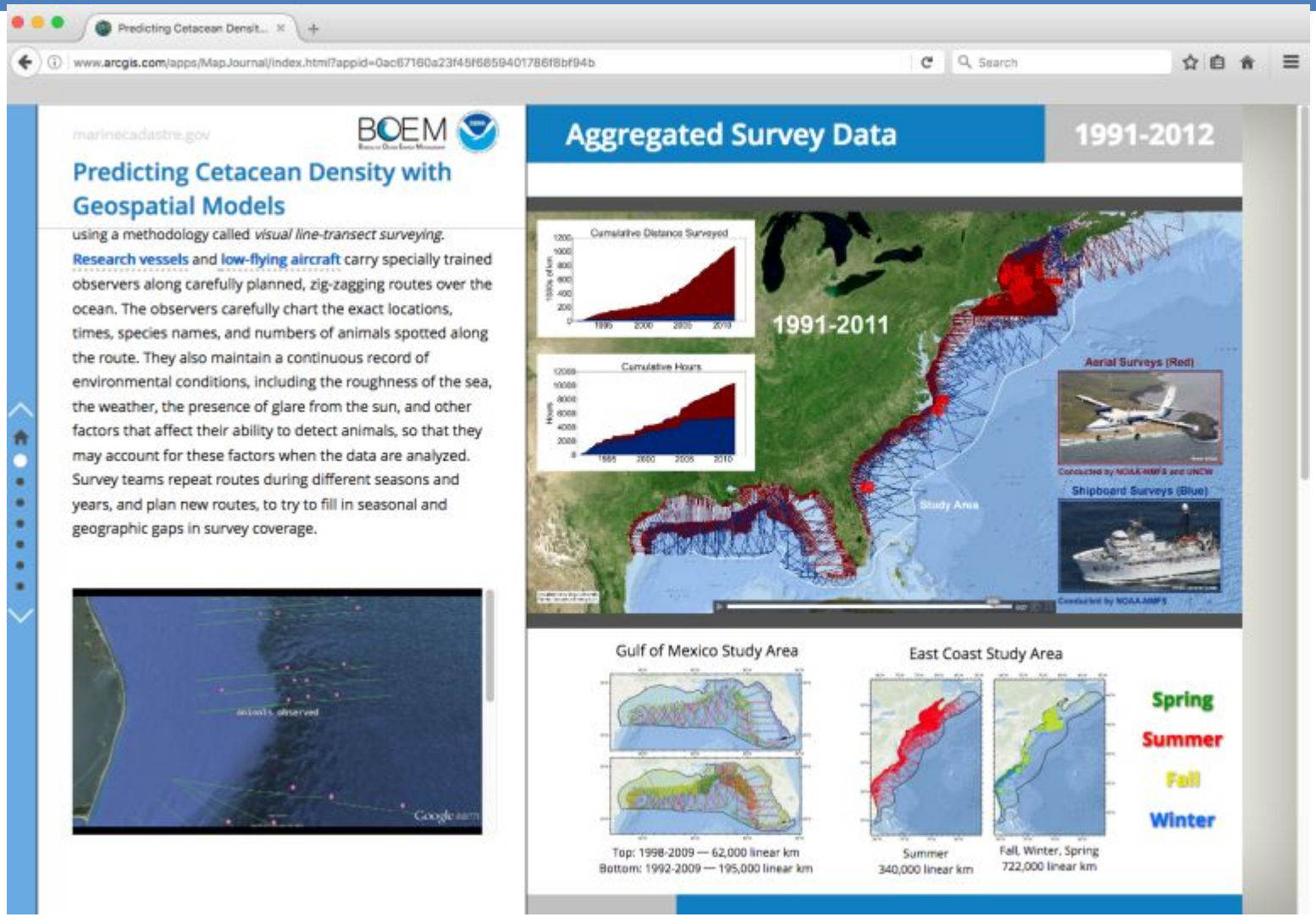

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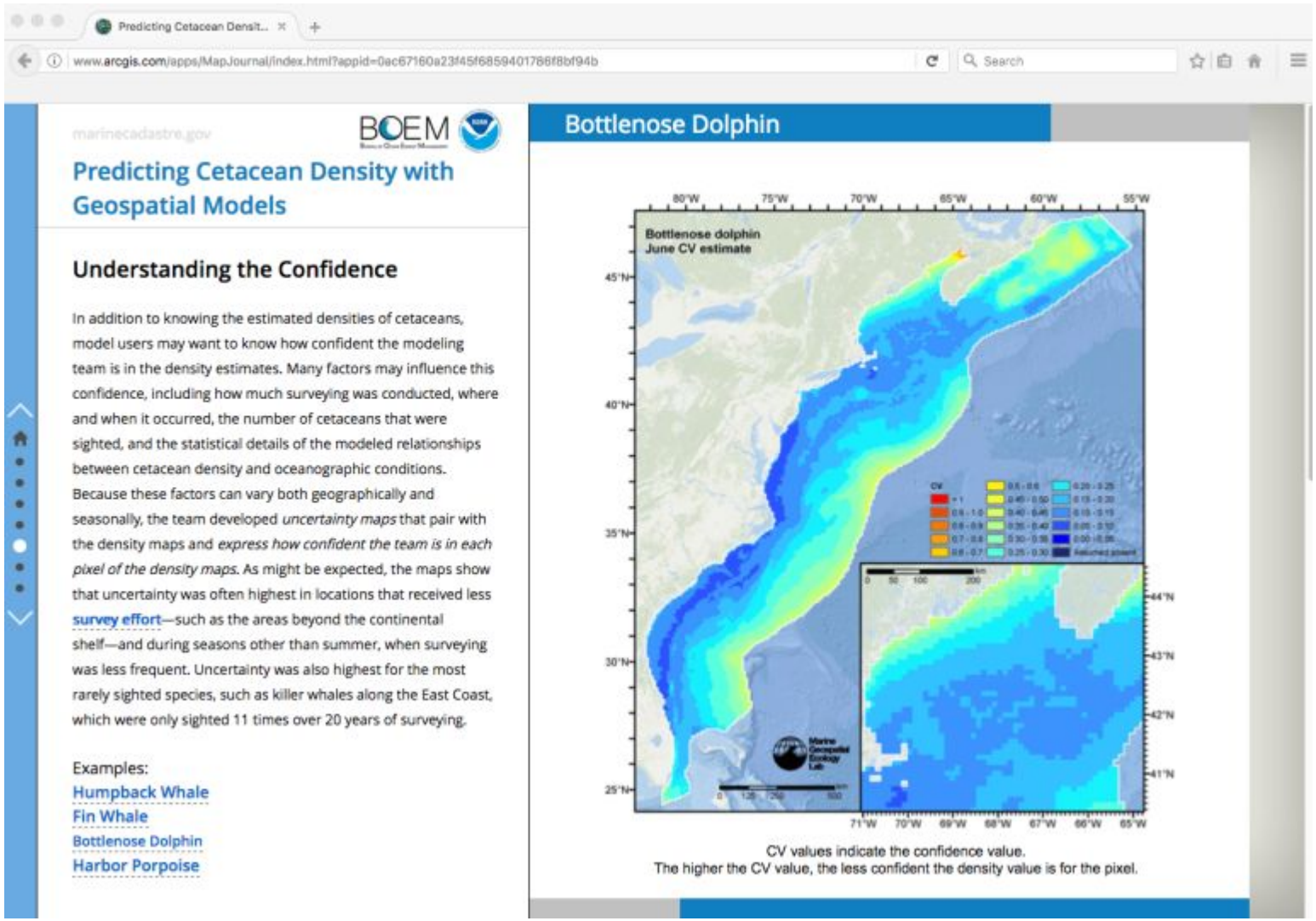


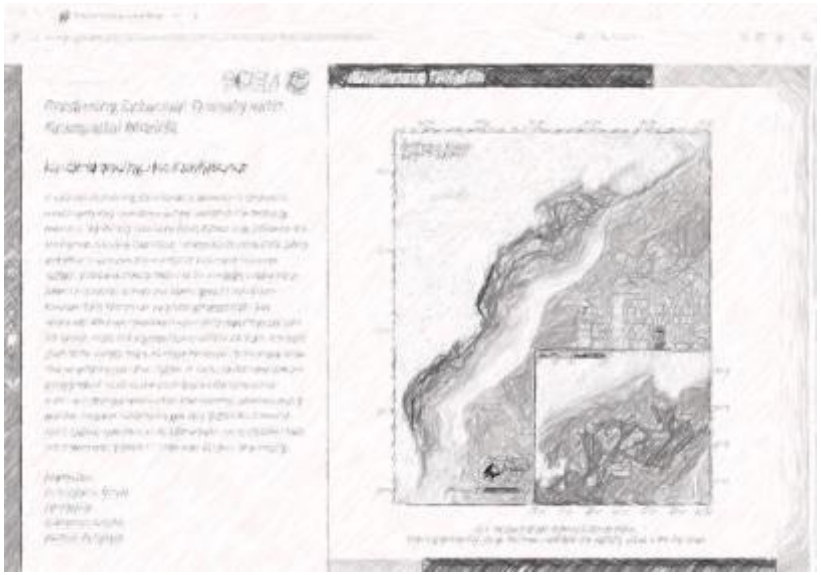
https://goo.gl/yTM9fH

Data Communication – Confidence/Uncertainty

Improve explanation and use guidance of existing confidence and uncertainty products

- Coefficient of Variation
- Standard Error
- 5% confidence level
- 50% confidence level
- 95% confidence level

5% CL
"No fewer animals than this"



Data Communication

Stakeholder feedback:

The need to better understand the composition of summary products

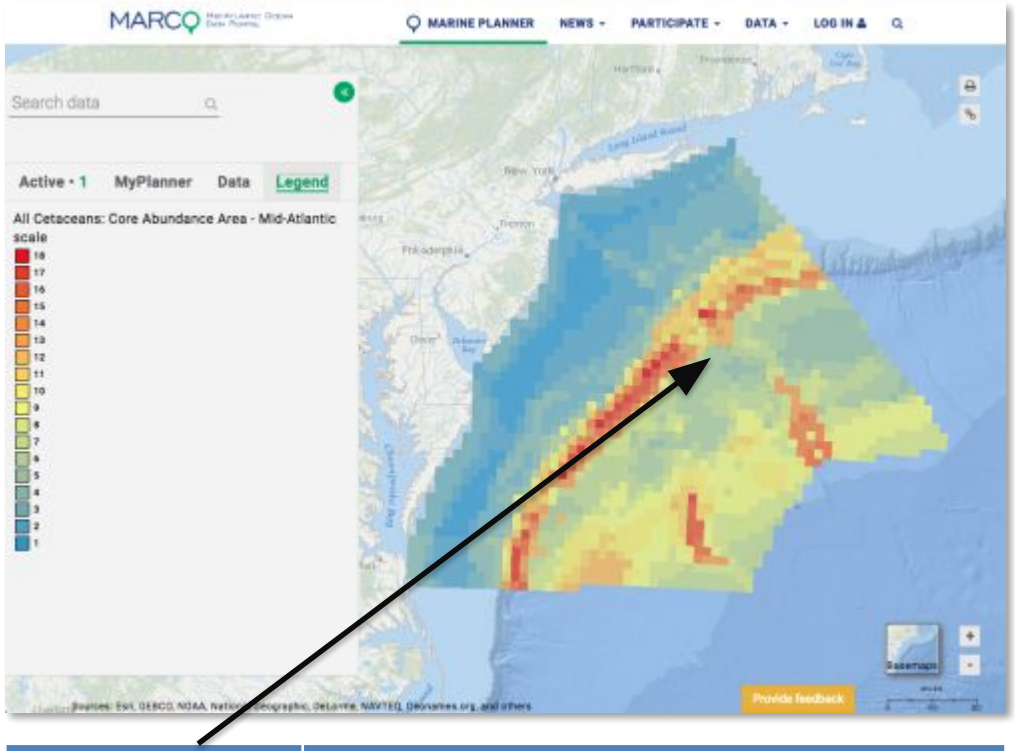
Stakeholders asked to be able to click on a map of species abundance or richness and see what species contributed to the value…

Data Communication – Summary Product Composition

Species making up the index values for each cell

- Abundance
- Species Richness
- **Core Abundance/Biomass Areas**

Portal updates will follow



Core Abundance Area Richness	Species List
7	Dwarf sperm whale, Pygmy sperm whale, Risso's dolphin, Rough-toothed dolphin, Short-finned pilot whale, Spinner dolphin, White-beaked dolphin

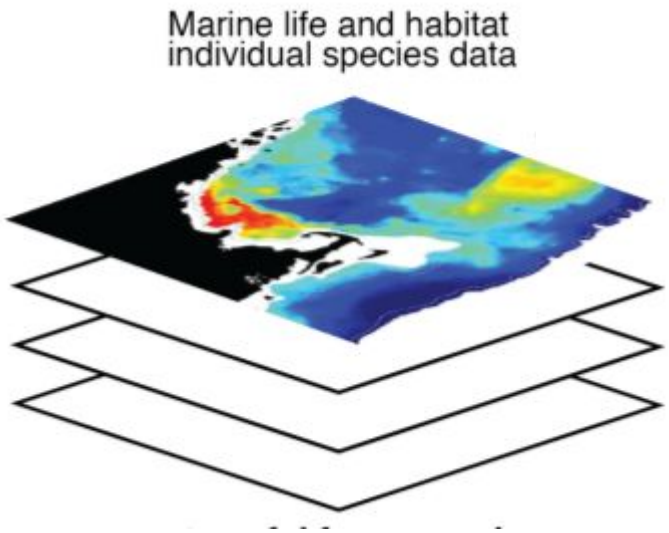
May 2017 ERA Workshop: Data Discussions

- Continue to improve data communication
  - Individual Species Models / Data
  - Summary Products

- Continue linking data to ERA components
  - ERA workshop guidance
  - Rolling incorporation of evaluation results

Linking data to ERA Components

What data best illustrate the components of ERAs?



1. Productivity
2. Biodiversity
3. Abundance
4. Vulnerability
5. Rarity

IEA/ERA Data Review Process

July 2016 — First presentation of draft data to support Components 1 and 2 to Northeast Ecosystem Based Management Work Group and public

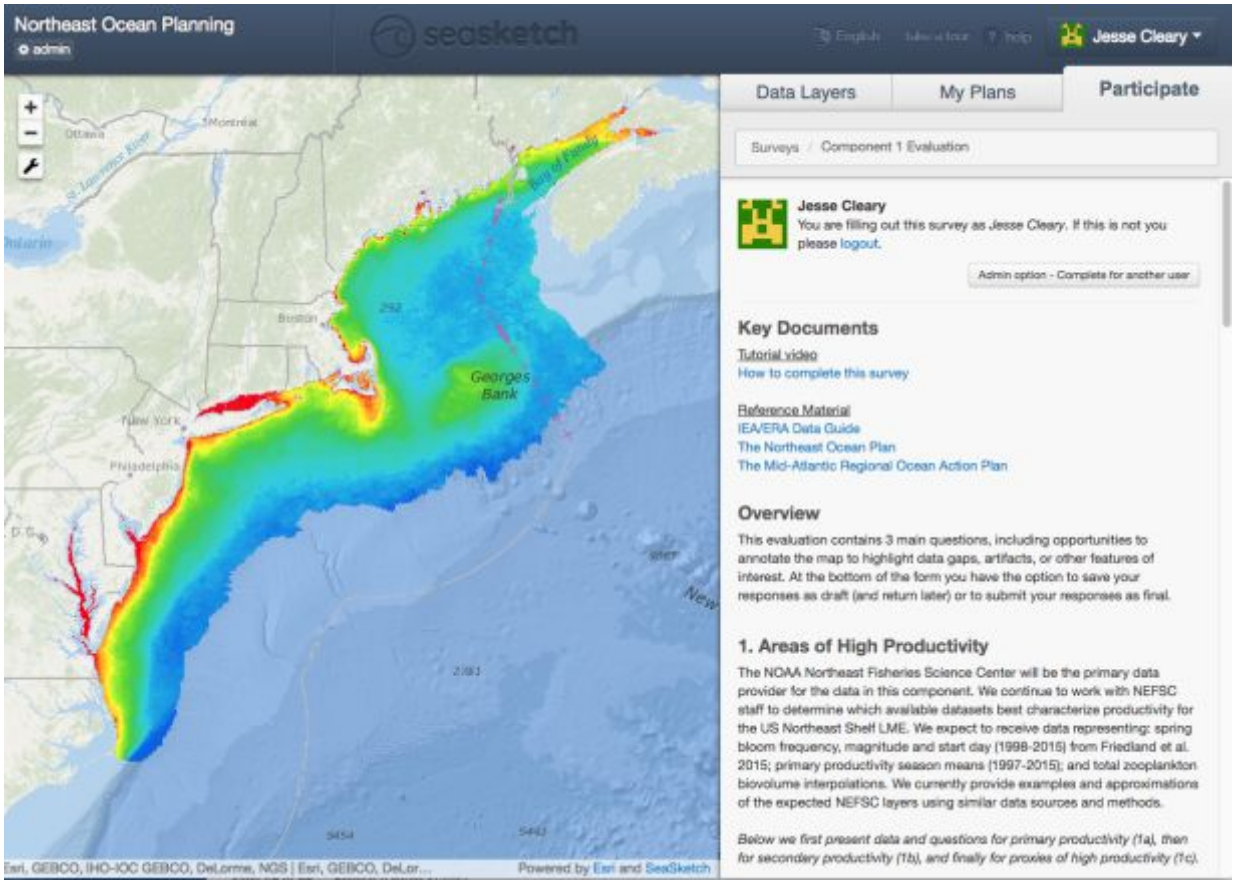
Aug 2016 — Initial draft data to support 5 Components presented at Mid-A public ERA workshop

Need to be able to explore the data and better understand underlying methods

Developed **IEA/ERA Data Guide** (now publicly available) and **Data Evaluation** tool using SeaSketch (a web-based mapping app)

SeaSketch Data Evaluation

1. Evaluate existing data applicability to components
2. New data review and applicability to components



ERA Component Data Guide

Data layer	Units	Resolution	Reference(s)
– Cyclonic eddy probability - fall			

Component 2: Areas of high biodiversity

Biodiversity products were produced as part of the MDAT mapping effort and include sampled/observed marine mammal, bird, and fish species. The intention for this component is to first display taxonomic metrics of biodiversity because 1) they are complete, and 2) they may adequately characterize patterns in biodiversity. Longer-term, we present the option to develop maps of functional diversity that include metrics of trophic richness (provided now as a proof of concept) but could also include metrics of mobility type, habitat preference, size, body form, and life span. There is a large body of functional trait research that could be used to choose metrics and assign taxa/species to trait categories (for example see http://www.marinespecies.org/traits/).

♦=presented on the Northeast Ocean Data Portal and in the Northeast Ocean Plan

Data layer	Units	Resolution	Reference(s)
Taxonomic metrics and indices of diversity			
– ♦All Cetacean Species Richness – ♦All Bird Species Richness – ♦All Fish Species Richness – NEFSC Fall surveys – All Fish Species Richness – NEAMAP surveys – All Fish Species – Gini-Simpson Index (NEFSC fall surveys) – All Cetacean Species – Gini-Simpson Index	# species (richness); probability that all individuals belong to different species (Gini-Simpson)	10km x 10km (cetaceans and fish) 2km x 2km (bird)	Curtice, C., Cleary J., Shumchenia E., Halpin P.N. 2016. Marine-life Data Analysis Team (MDAT) technical report on the methods and development of marine-life data to support regional ocean planning and management. Prepared on behalf of the Marine-life Data Analysis Team (MDAT). Accessed at:http://seamap.env.duke.edu/models/MDAT/MDAT-Technical-Report-v1_1.pdf Simpson, E.H. 1949. "Measurement of Diversity." ***Nature*** 163: 688. doi:10.1038/163688a0.
Functional metrics of diversity			
Richness of bird foraging guilds	# (out of 4) foraging guilds represented with at least 2 species	2km x 2km	Curtice, C., Cleary J., Shumchenia E., Halpin P.N. 2016. Marine-life Data Analysis Team (MDAT) technical report on the methods and development of marine-life data to support regional ocean planning and management. Prepared on behalf of the Marine-life Data Analysis Team (MDAT). Accessed at:http://seamap.env.duke.edu/models/MDAT/MDAT-Technical-Report-v1_1.pdf
Proxies for high biodiversity			
Coral gardens	habitat	~350m	NOAA NCCOS Deep Sea Corals modeling: https://coastalscience.noaa.gov/projects/detail?key=35

IEA/ERA Data Review Process

Feb 2017

Northeast scientists begin examining data on SeaSketch and responding via Data Evaluation

- Targeted outreach to explain/discuss data, methods, process
- Access requested and granted to ~100 individuals in Northeast

May 2017

Mid-Atlantic scientists begin examining data on SeaSketch and responding via Data Evaluation

- Targeted outreach to explain/discuss data, methods, process IN PROGRESS (Emily)
- Access requested and granted to ~100 individuals in Mid-Atlantic

IEA/ERA Data Review Process

Summer 2017

Continued review and evaluation of potential data and methods to support each of the 5 Components

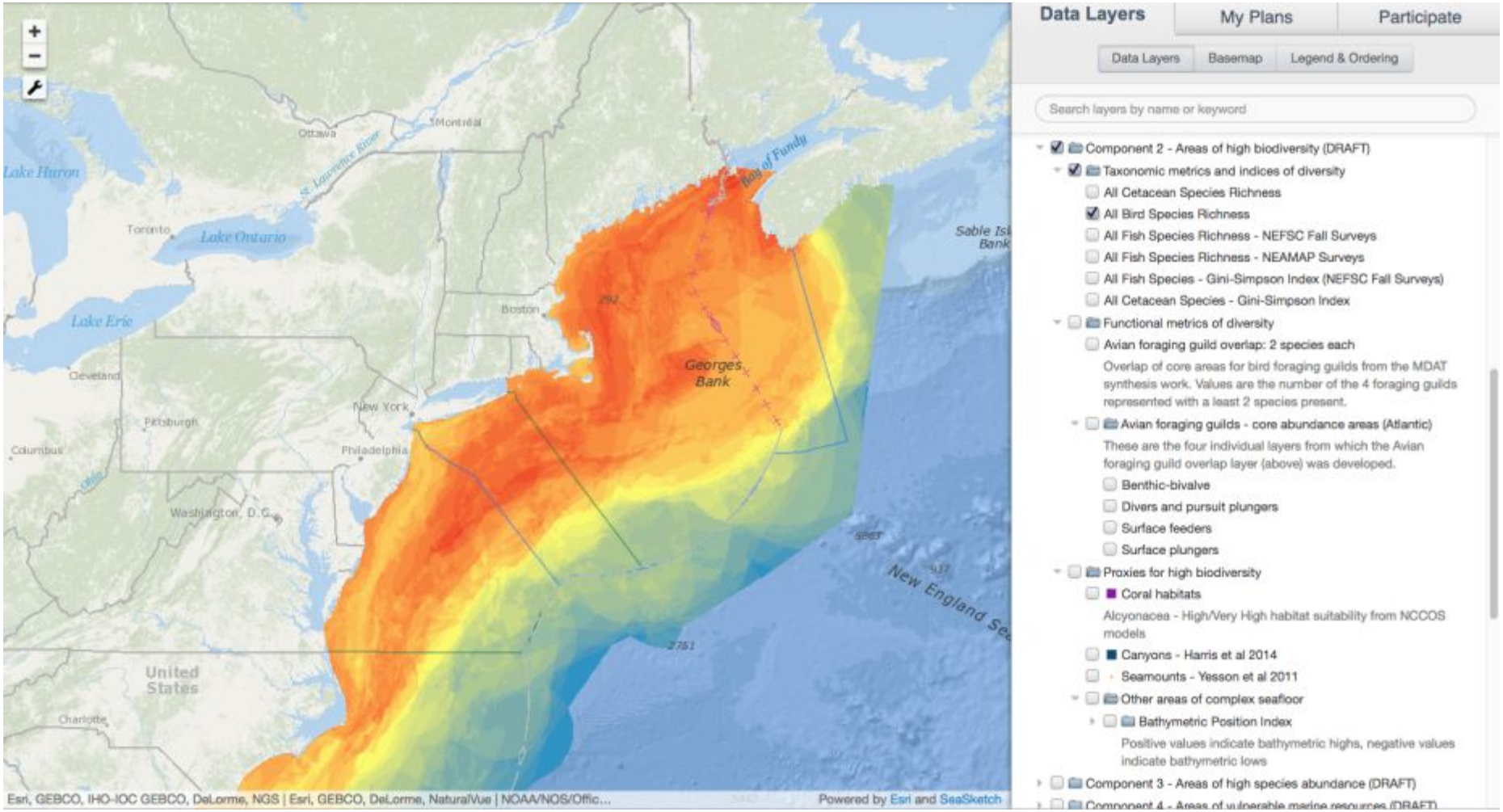
- Includes additional one-on-one **outreach and discussions** as needed
- Continued consideration of feedback/input as MDAT products are updated and new species groups are developed

Fall 2017

Summarize key methodological questions that arise, and potentially hold discussions via workshop(s) as RPBs deem appropriate

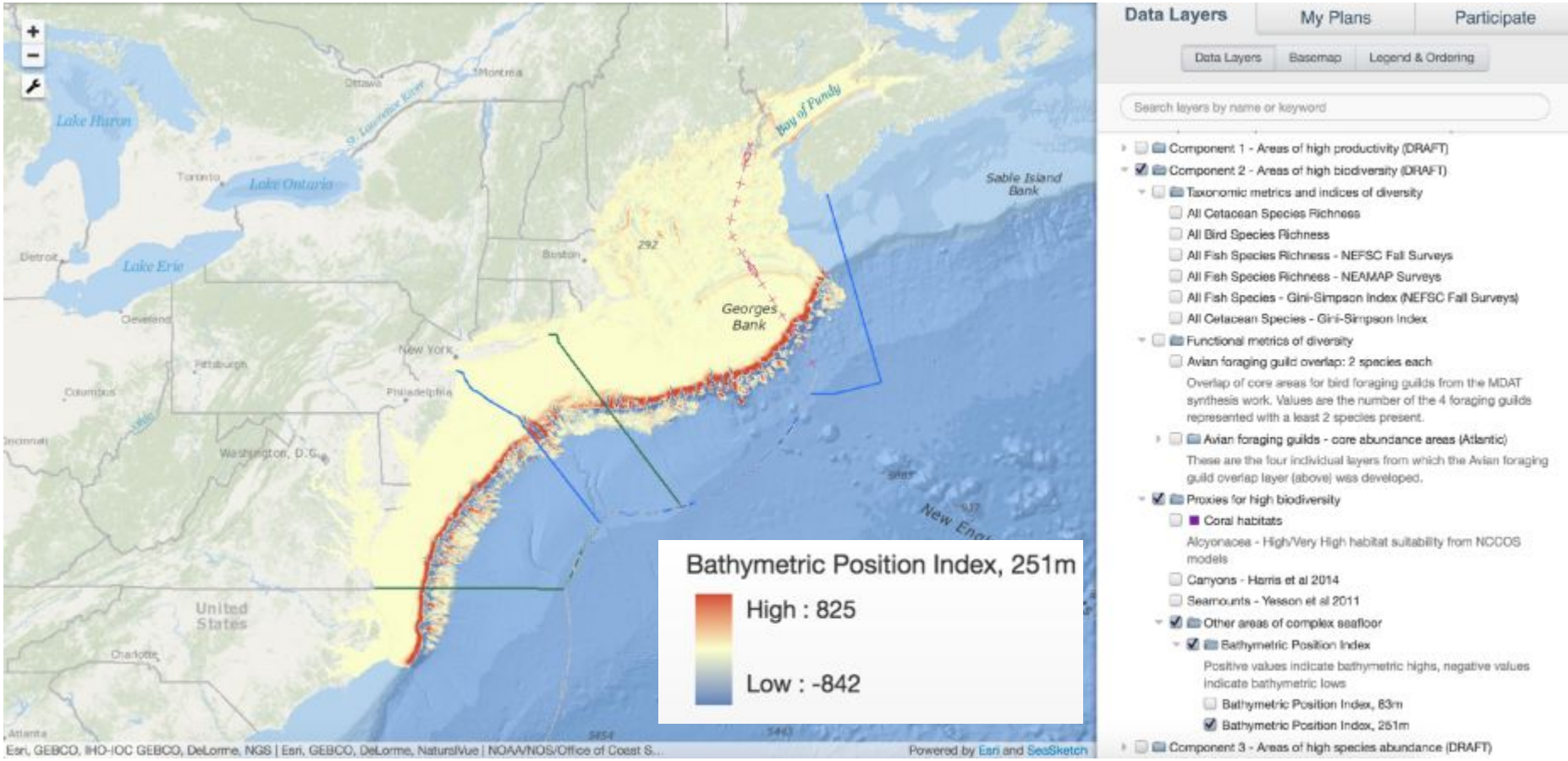
ERA Component Data and SeaSketch

Component 2: Areas of high biodiversity

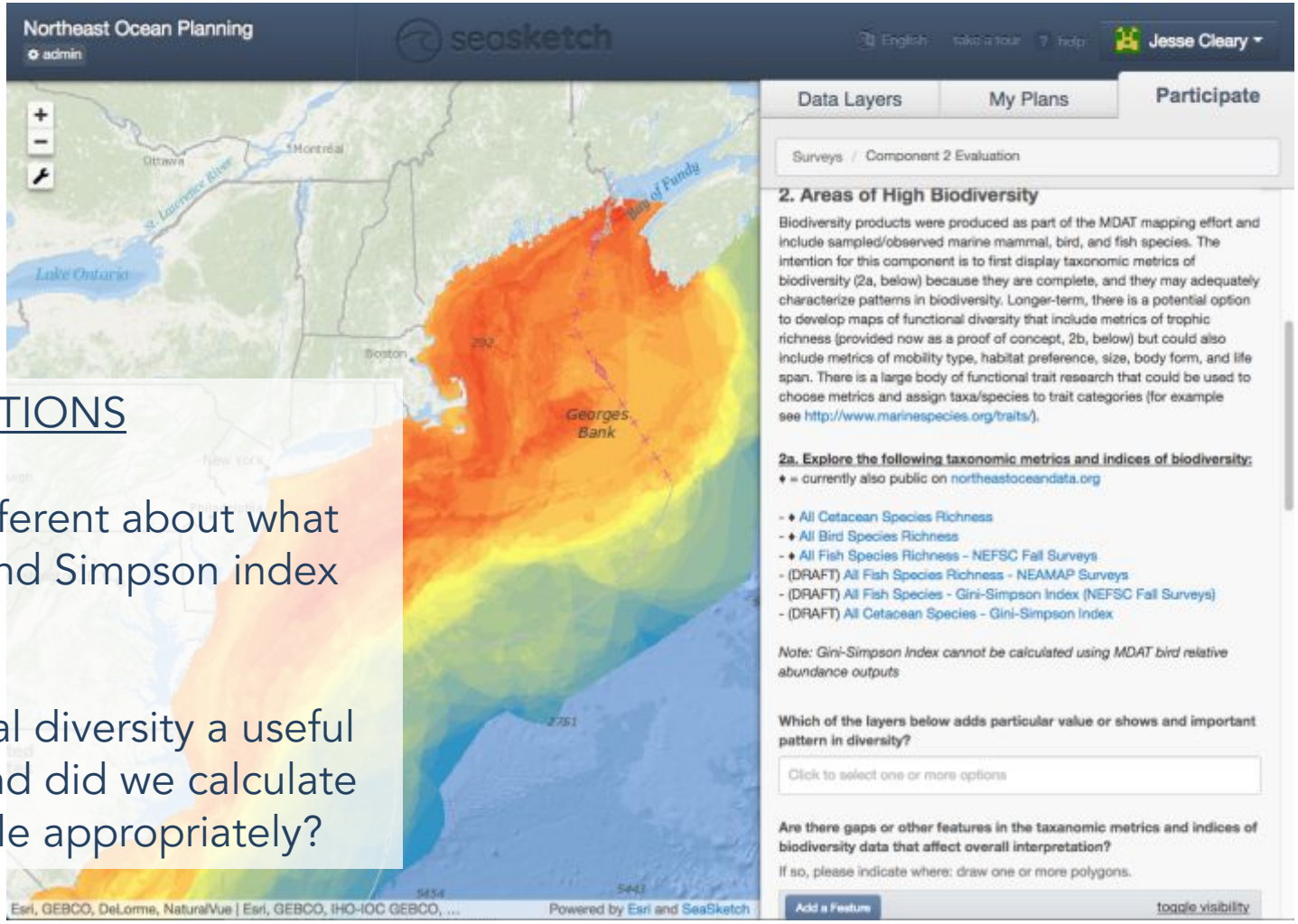


ERA Component Data and SeaSketch

Component 2: Areas of high biodiversity



ERA Component Data and SeaSketch



KEY QUESTIONS

What is different about what Richness and Simpson index tell us?

Is functional diversity a useful concept and did we calculate the example appropriately?

May 2017 ERA Workshop: Data Discussions

- Continue to improve data communication
  - Individual Species Models / Data
  - Summary Products

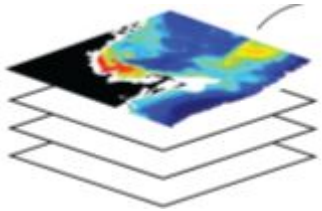
- Continue linking data to ERA components
  - ERA workshop guidance
  - Rolling incorporation of evaluation results

May 2017 ERA Workshop: Data Discussions

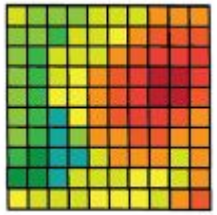
ERA work group discussion:

- May 2017 ERA Workshop
- MDAT biogeographic data exploration
- SeaSketch data evaluation

What level of component synthesis is useful?

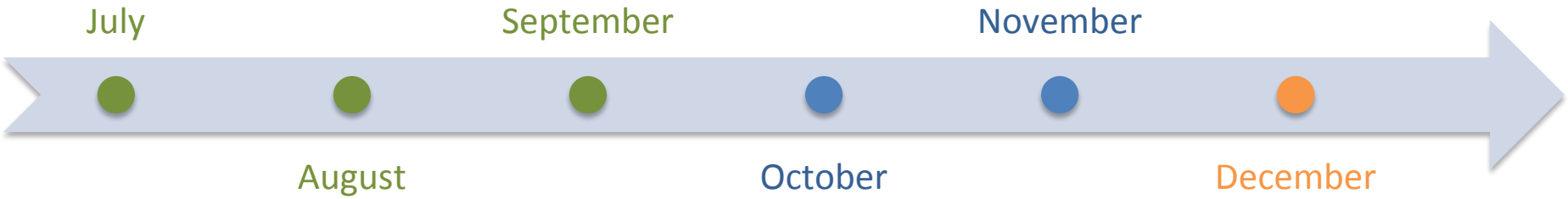


Component 1



Component 1

MDAT Summer and Fall Timeline



- MDAT summary product publication (see slide 9)
- Ongoing SeaSketch evaluation participation by regional stakeholders, gathering feedback on ERA components

- Summarize SeaSketch evaluation feedback on ERA components
- Other ERA component development (SeaSketch evaluations)
- ERA Workshop(s)

- RPB Meeting?

- Updated cetacean and avian base-layer model products
- New species group definitions, based on existing knowledge

- Bring new avian aggregation & persistence layers online
- MARCO Portal update for MDAT products

- Potential sea turtle models
- Potential abundance, richness composition products



MDAT Summary

- MDAT data updates this summer and fall
- Continue to improve data communication
- Continue to work on ERA components

ERA Workshop- May 19, 2017

- 49 participants (incl.10 RPB entities) at St. Jones NERR- Delaware

- Objectives:
  - Enhance **understanding of data product development to** characterize the components and types of ERAs
  - Obtain stakeholder input on **opportunities and challenges** in **identifying** ERAs and **criteria for selecting a pilot** ERA
  - **Review efforts to collect expert input via "SeaSketch" to help** guide ERA data development
  - Solicit ideas for obtaining additional stakeholder input

ERA Workshop Results

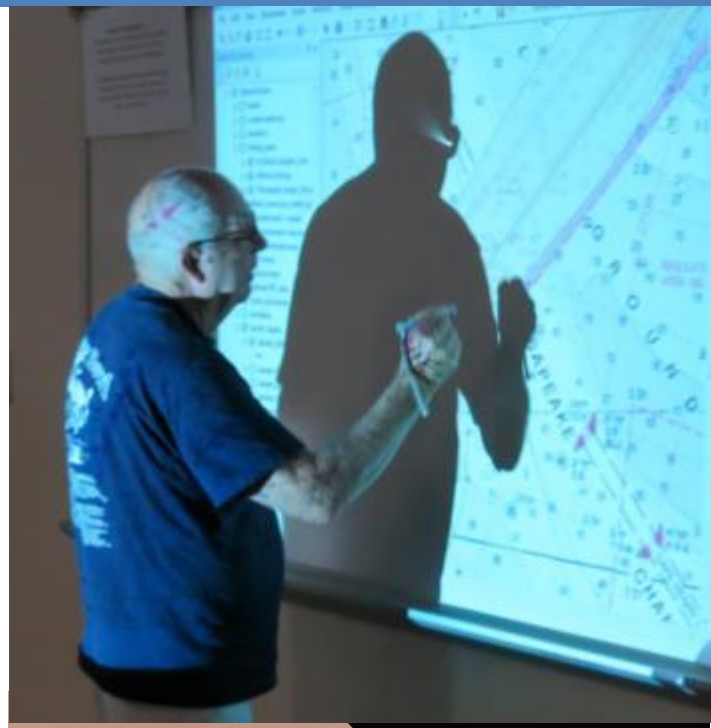
Communications Needs:

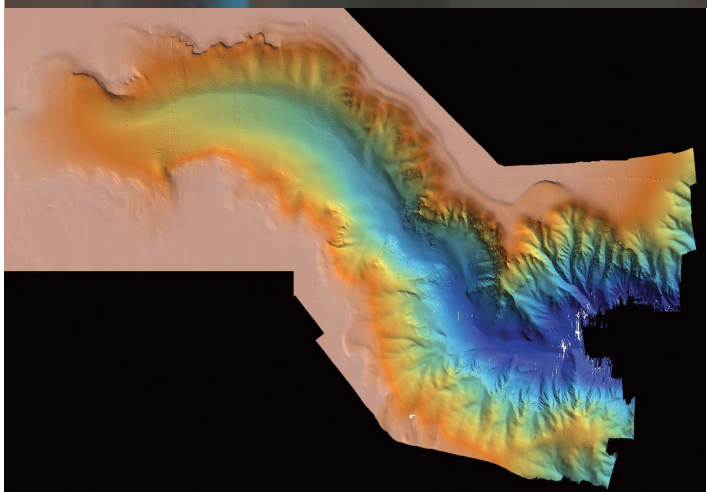
- Immediate need for FAQ Fact Sheet
- More intuitive ways to understand data sets and metadata for non-technical users
- More widespread availability of SeaSketch as a visualization tool and its companion Data Guide
- Call for more workshops, webinars and online tutorials

ERA Workshop Results

Data-related Questions:

- Are there still gaps in the core data and is the uncertainty level too high? Can we include opportunistic data?
- How will data be applied to each of the five ERA components?
- Can MDAT and ERA data development work be connected to Mid-Atlantic Fishery Management Council Essential Fish Habitat process?
- What level of synthesis is useful or not beyond the 5 components?





ERA Workshop Results

Process-related Needs/Questions:

- Clarity on peer review process for individual species models and data synthesis products
  - formal scientific peer review
  - stakeholder/public review
- Will all five ERA components be mapped for whole Mid-A before selection of a pilot?
- Does an ERA need to have at just one or all five of the components?
- Suggestion that pilot area should focus on complex area- with overlapping uses, resources, authorities
- When will human use information be considered?
- Clarity on content and intent of pilot area report

ERA Work Group Recommendation for Next Steps

Follow the HOE Action #1 steps in the order stated in the Mid-A Regional Ocean Action Plan, but ***extend the timeline through March 2018***:

- July 2017
  - Develop ***ERA fact sheet*** with FAQs
  - Develop ***outline for sample ERA Report***
  - Schedule ***additional stakeholder engagement*** opportunities for August (e.g., MAFMC meeting?) through October to review:
    - draft component maps
    - sample outline for ERA reports
    - fact sheet with FAQs

- July - October 2017
  - Continue monthly ERA Work Group calls to:
    - discuss to what extent ***further synthesis of map layers*** is useful to decision-making
    - discuss ***criteria for selecting first area*** for a sample ERA report

ERA Work Group Recommendation

- October 2017
  - Create ***draft maps illustrating the 5 components of ERAs***
- November 2017
  - Hold ***workshop*** to gather stakeholder input on data critical to characterizing components of and types of ERAs
- December 2017
  - Finalize and ***post ERA component maps*** on Ocean Data Portal
  - Finalize criteria for selecting first ERA on which to prepare a report
- March 2018
  - Select first ERA for report

Discussion