October 16, 2017

Mid-Atlantic Regional Ocean Action Plan: Actions to Promote a Healthy Ocean Ecosystem "Action 1: Identify ecologically rich areas of the ocean in the Mid-Atlantic region and increase understanding of those areas to foster more informed decision making."

Background

The Mid-Atlantic Regional Planning Body (RPB) is continuing its efforts under this action in partnership with the Mid-Atlantic Regional Council on the Ocean (MARCO) and its contractors. This action includes evaluation and refinement of over 6,000 marine life data layers for fish, birds, marine mammals and habitats and determining an approach to synthesizing these data layers into components that help managers understand where ecologically rich areas (ERAs) occur. An ERA could contain one or more of five different components: productivity, abundance, biodiversity, rarity and vulnerability. Understanding where these areas are and how they change seasonally and over longer periods of time is expected to result in better-informed management decisions. The RPB seeks to reach agreement, with careful consideration of input from stakeholders, as to which option is most useful to managers and others while retaining scientific validity. Numerous types of syntheses may be possible however, the RPB will strive to select the best approach possible over the next few months as outlined below.

Timeline for Action Steps October 2017 – January 2018

The Mid-Atlantic Regional Ocean Action Plan describes the initial steps under the ERA action to identify ERAs as "short term," meaning within two years of certification of the plan (by end of 2018). The RPB plans to take the following steps over the next three months:

- Sep 14 – "Save the Date" notice posted on RPB and MARCO websites
- Oct 4 – ERA Work Group call to discuss description of data synthesis approach options
- Oct 5 - ERA Workshop invites and registration link emailed to 177 invitees
- Oct 16 – Full RPB call to review updated data products, discuss and finalize options paper and Nov 2 workshop agenda
- Oct 17 – Posting of Nov 2 workshop agenda, updated data products and synthesis options paper
- Nov 2 – ERA Workshop in Crownsville, MD
- Nov 30 - Deadline for public input on ERA data synthesis approach options.
- Dec 4 - ERA Work Group call to review stakeholder input and draft a recommendation on data synthesis approach for the RPB
- Dec 19 – RPB call to discuss and approve materials to be posted 30 days in advance of the in-person RPB meeting
- Dec 20 – Above materials posted
- Jan 22-25 (exact dates TBD) RPB meeting to consider work group recommendations for next steps

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Technical Context for Synthesis Approach Options

Since May of 2017, feedback has been solicited on datasets that may contribute to the illustration of ERA components in the Mid-Atlantic. This feedback has come from a process, run in collaboration with the NE RPB, that included discussions with the Mid-Atlantic ERA work group, a regional workshop on ERA components held in May 2017, a data and methods evaluation which was available online, and a series of individual and group webinars held for staff from RPB entities, stakeholders, and scientists in the region. The final summary of this feedback is still being collated and summarized. It will be presented at the November 2 ERA Workshop. The input provided through this evaluation period is leading directly to revisions and improvements to data products and methods that will be reflected in an amended set of data products for each ERA component that will be presented at the November 2 workshop. This includes fewer data products for some ERA components and more data products for others. It also includes suggestions that some methods, while promising, may be longer term science priorities. The feedback also contained a variety of guidance and suggestions about next steps.

Given the diversity of input collected from these outreach efforts, the MidA RPB is considering several options for additional synthesis. This document outlines several possible options. The question is broadly, "What level of data synthesis under each ERA Component is useful and desired to foster more informed decision making?"

As we discuss illustrating ERA components, recall that the individual species data layers and existing MDAT summary layers remain important, foundational information that will continue to be applied in regional planning and management decisions. These layers are not discarded or replaced by datasets illustrating each component. Original data will remain on the MARCO portal in the Marine Life library and under the Marine Life theme.

To help think through this question, MDAT has outlined several options that may be considered. These are broadly illustrated below with map examples to help make this discussion more concrete. The examples below are intended to illustrate each approach option, and are not a final set of map layers or results. It is also important to remember that each of these options would be followed by additional technical decisions on the implementation of the approach, then followed by additional work to include materials in the MARCO Mid-Atlantic Ocean Data Portal. Each option may require different amounts of time and resources to reach the end point, however each in its way could create a usable set of map layers from which ERAs could be derived either as single components or some combination of the five components.

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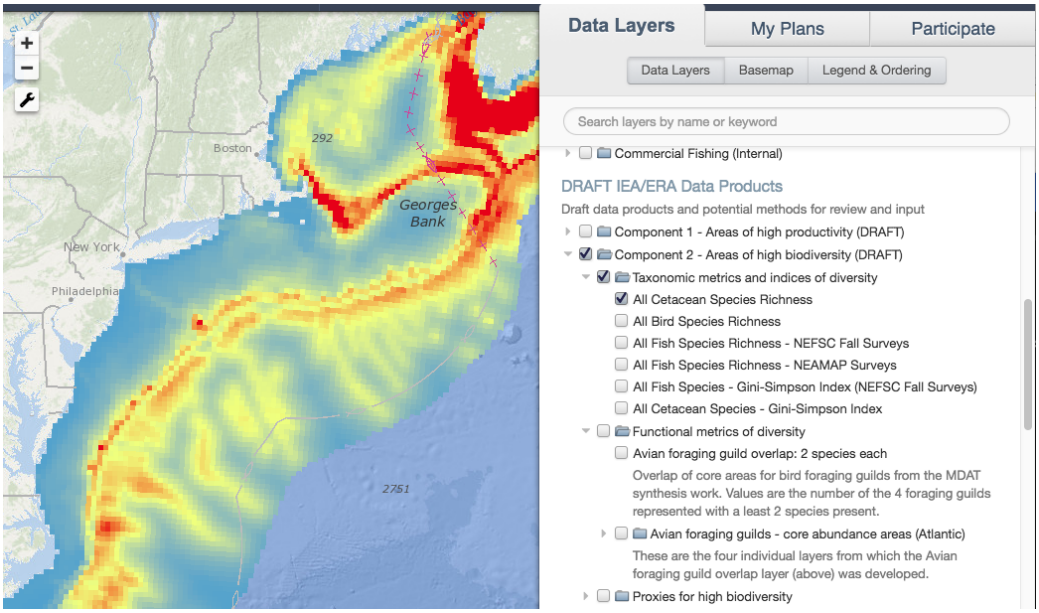
Option 1 – No immediate data synthesis under the ERA components

In this option MDAT will continue to follow the specific guidance from the data evaluations (survey and webinars) toward a set of data layers under each component. These layers could then be flagged or inserted into the MARCO portal as a layer illustrating an ERA component(s). Additional user support graphics and visualization development should accompany these layers, some of which are new to the planning process.



SeaSketch view of datasets under Component 2: "Areas of High Diversity"

The benefits of this option are that it does not create a new set of data to be interpreted and understood, but instead provides thematic focus on the existing datasets, which have already been through extensive review, through the lens of the ERA components. A potential challenge is that this approach will likely result in greater than 50 data layers to consult when considering ecological richness and not create a set of specific ERAs.

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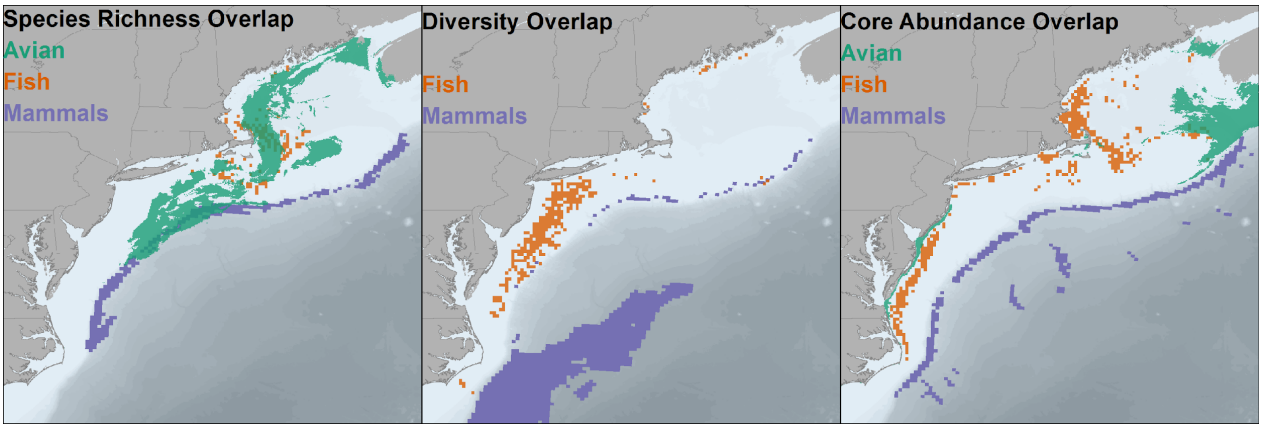
Option 2 – Classify and Overlay

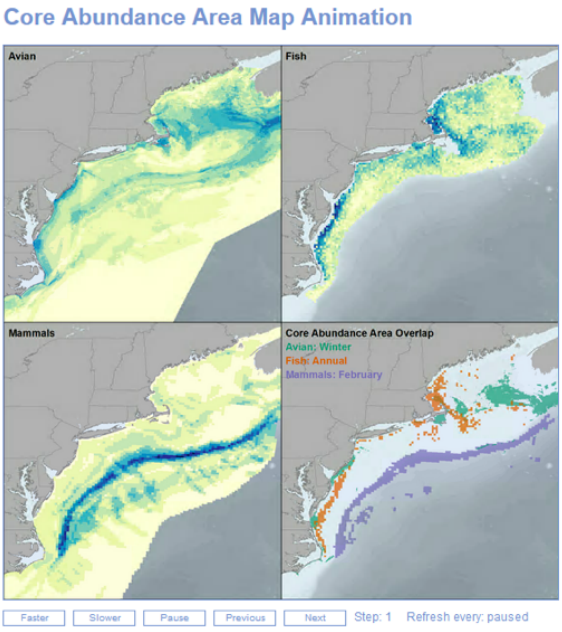
A second option takes datasets identified under each component and classifies them to identify areas with high values. These datasets could be examined together to identify areas with high values across several of the layers under each component.



Example maps of areas with high values from annual models for birds, fish and mammals

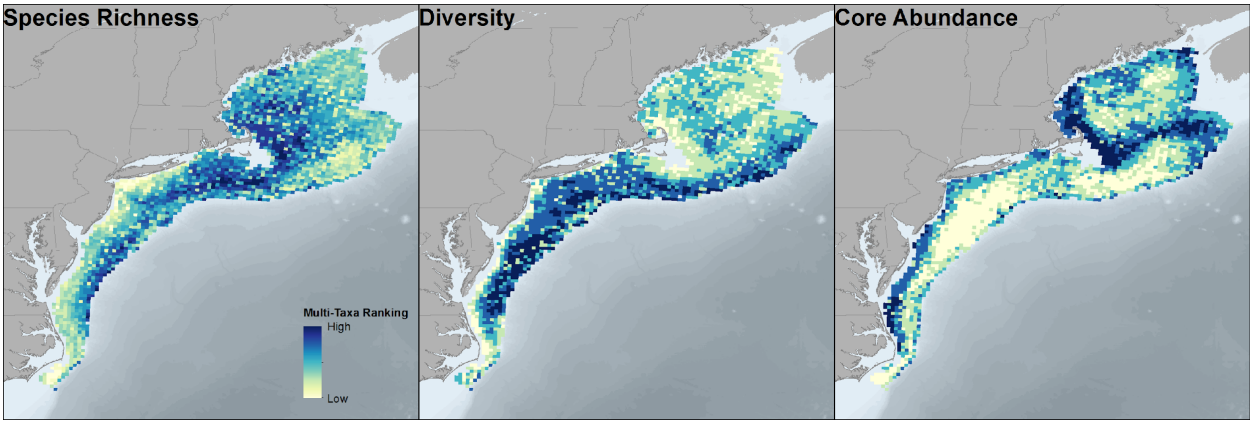
The benefits of this option are that we identify areas where existing data layers show overlapping high values. In other words, one could overlay the high value fish/mammals/birds areas over habitat and this could provide important context. An additional benefit is that we can include many types of data, such as habitat layers, along with species distribution data. As in the maps above, we retain information about which species groups and datasets are driving the overlaps. This option also avoids any data weighting decisions. A challenge under this approach is how to define areas as "high" (above the mean or top 10% of values or one of many other methods). This approach does not contain any combination rules to identify ERAs, but rather just shows the overlap of high value areas visually.

It is helpful to animate these data to examine the changes in high value areas over time. These animations also highlight the disparate time steps used in the input models. The map at right is part of an animation of Core Abundance/Biomass Areas for Birds, Fish, and Mammals with an additional panel showing high value areas for all 3.



Option 3 – Classify and Combine

A third option is to use key datasets identified under each component to create a new index of importance for that ERA component. There are many methods that could be applied here, so a very simple approach might be to take each relevant summary dataset (species richness or core abundance areas for each taxa group), classify them on a 1-10 scale, and then add them together. There are many other approaches under this option that increase the synthesis complexity.



Example maps of Species Richness, Diversity, and Core Abundance Richness index for Birds, Fish and Mammals combined.

The benefits of this option are that it would result in simple indices for a given component that can be used to identify the very highest overlap areas. However, only MDAT species in the index - fish (from NEFSC trawl)/birds/mammals would be included. Scoring or ranking each individual summary dataset also allows for a more nuanced overlay result as compared with Option 2. A central challenge is that these indices can only be calculated for the footprint where all of the input data overlap, basically the extent of the Fish data as shown in the maps above. In addition, since this approach combines mixed data types, it requires careful thinking about tradeoffs to simplify each different data layer for use in the combination algorithm. Another key challenge is in disentangling the resulting index to see what's driving a given output value. For example, in the maps above a value of "30" means that the cell scored in the highest class for all 3 MDAT taxa, however a value of "15" could result from a variety of possible input combinations.

The methods proposed for options 2 and 3 become more complicated when thinking about ERA components 1, 4, and 5. In other words, the examples and approaches presented here lend themselves well to biodiversity (component 2) and abundance (component 3) – but an index for vulnerability or rarity components is probably much more challenging to develop.

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Glossary of existing MDAT summary data products
(For additional details see the MDAT Technical Report)

Total Abundance - For all species together and for each group of species, total abundance maps are calculated in a Geographic Information System (GIS) by stacking each individual species' predicted annual abundance layers and summing the values of the pixels in each resulting "column". The result is the total predicted abundance of all individuals (of the included species) in that cell.

Species Richness - For all species together and for each group of species, species richness maps are calculated in a Geographic Information System (GIS) by stacking each individual species' predicted presence or absence and counting the total number of species present in each cell.

Diversity - For all species together and for each group of species, diversity maps are calculated in a Geographic Information System (GIS) by stacking each individual species' predicted abundance and running two diversity algorithms, the Shannon Index and the Gini-Simpson Index. The resulting indices are driven by both species richness and species abundance/biomass evenness.

Core Abundance/Biomass Area Richness - For all species together and for each group of species, core abundance / biomass areas are calculated in a Geographic Information System (GIS) by analyzing each individual species' predicted abundance to represent the smallest area containing 50% of the predicted abundance of each species. This product is a count of the number of different species-level core areas represented in each cell.