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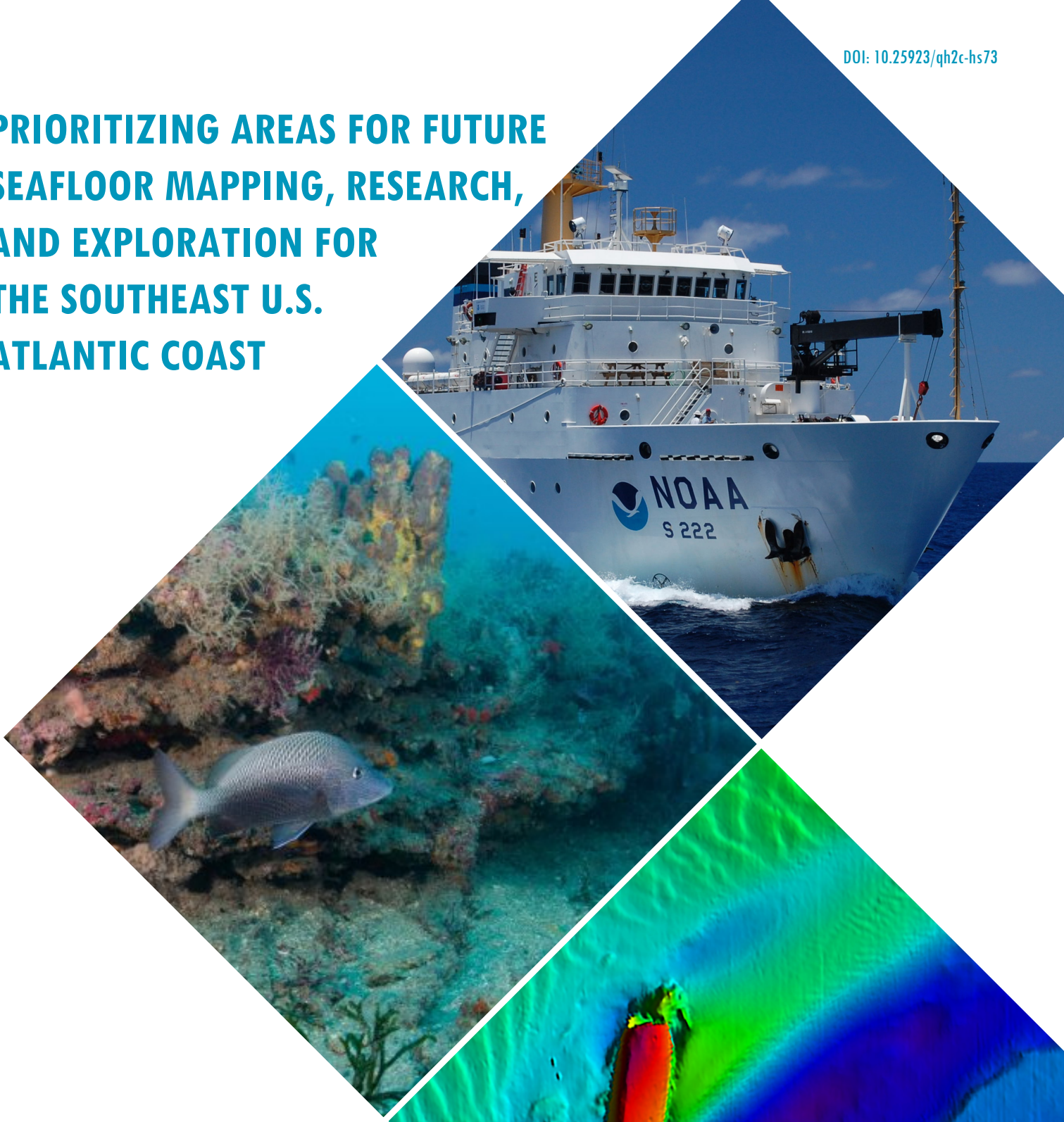
PRIORITIZING AREAS FOR FUTURE SEAFLOOR MAPPING, RESEARCH, AND EXPLORATION FOR THE SOUTHEAST U.S. ATLANTIC COAST



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Prioritizing Areas for Future Seafloor Mapping, Research, and Exploration for the Southeast U.S. Atantic Coast

Authors

Christine A. Buckel
NOAA National Ocean Service, National Centers for Coastal Ocean Science

J. Christopher Taylor
NOAA National Ocean Service, National Centers for Coastal Ocean Science

Maria Bollinger
Consolidated Services, Inc.
NOAA National Ocean Service, National Centers for Coastal Ocean Science

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NOAA National Ocean Service, National Centers for Coastal Ocean Science, Marine Spatial Ecology Division

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The framework for the prioritization approach was developed by T. Battista, K. Buja and J. Christensen with NOAA NCCOS. We recognize the numerous participants in the two NOAA SECART Habitat Mapping Workshops that helped define the need and scope for a seafloor mapping prioritization in the southeast U.S.

The prioritization technical advisory team included A. Chappell with the NOAA Integrated and Ocean Coastal Mapping Program, M. Conley with The Nature Conservancy, K. Ward with the NOAA Office of Coast Survey, A. Bode and J. McCombs with the NOAA Office for Coastal Management and C. Hapke with the U.S. Geological Survey and University of South Florida.

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About this report

The mission of the National Oceanic and Atmospheric Administration (NOAA) is for science, service, and stewardship, specifically to 1) understand and predict changes in climate, weather, oceans, and coasts; 2) share that knowledge and information with others; and 3) conserve and manage coastal and marine ecosystems and resources. The National Centers for Coastal Ocean Science (NCCOS) provides federal partners and coastal managers with the information and tools they need to balance society's environmental, social, and economic goals. NCCOS is the primary coastal science arm within NOAA's National Ocean Service (NOS). NCCOS works directly with managers, industry, regulators, and scientists to deliver relevant, timely, and accurate scientific information and tools.

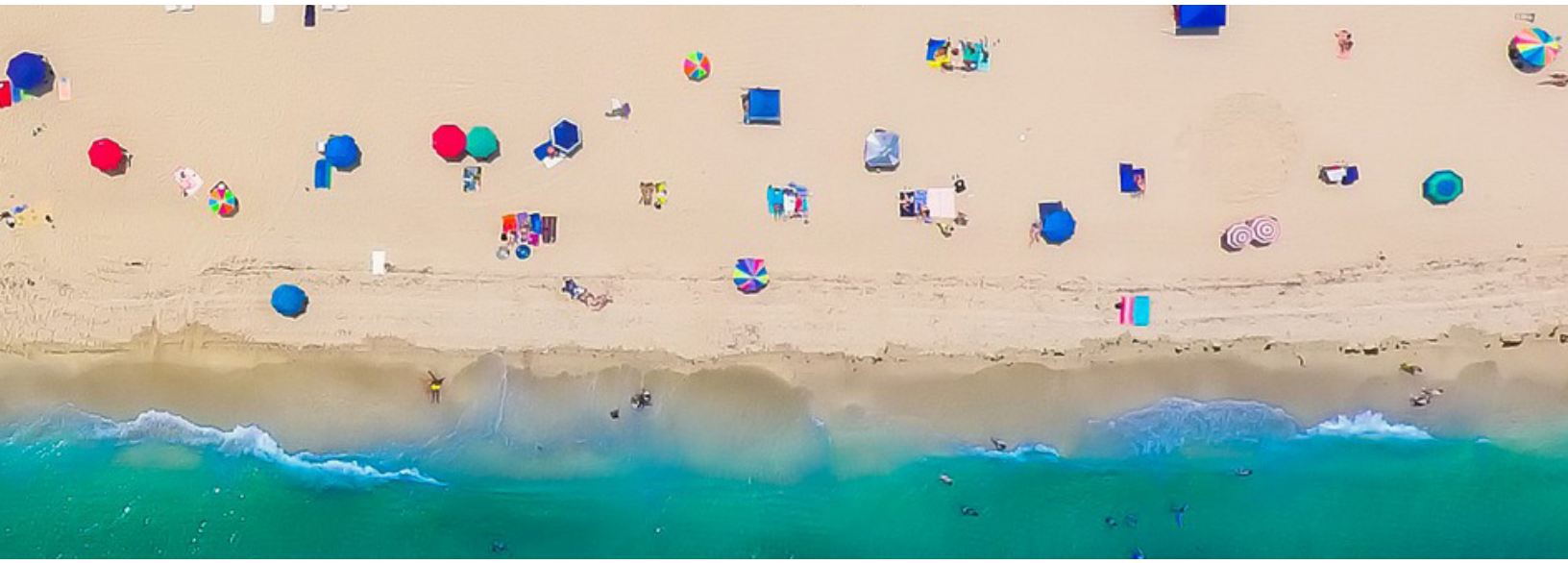
For more information on the NOAA's National Centers for Coastal Ocean Science, please visit:
https://coastalscience.noaa.gov

For more information on the southeast U.S. Prioritization Project, please visit:
https://coastalscience.noaa.gov/project/prioritizing-areas-for-future-seafloor-mapping-research-and-exploration-in-the-southeast-us-atlantic/

And

https://www.regions.noaa.gov/secar/index.php/highlights/improving-seafloor-habitat-mapping-coordination-on-the-southeast-us-coast/

Or direct questions and comments to:
Christine Buckel
NOAA/NOS/NCCOS Beaufort Laboratory
101 Pivers Island Road
Beaufort, North Carolina 28557
Christine.Addison@noaa.gov

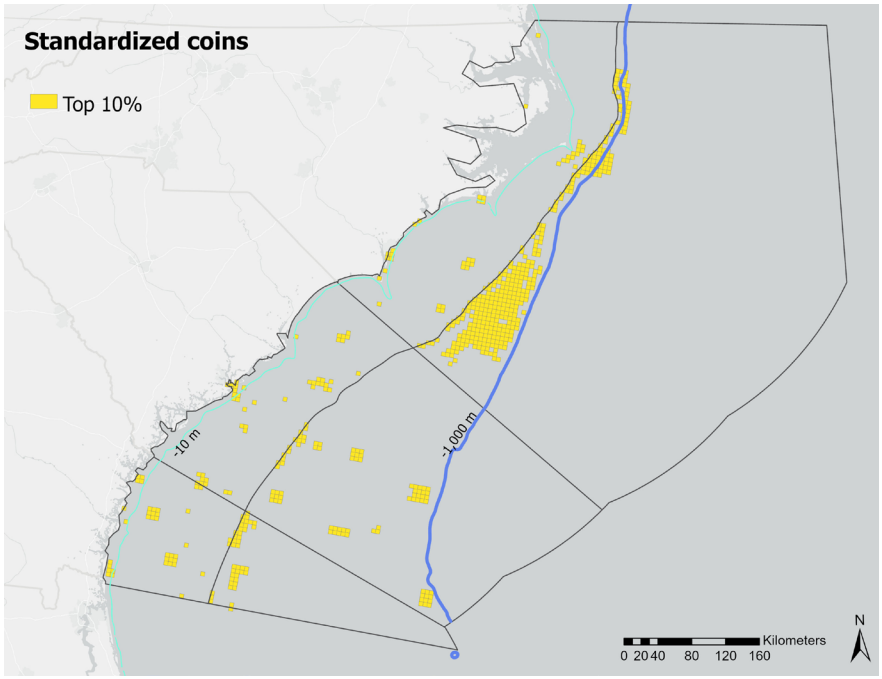


Executive summary

Spatial information on the arrangement of geological features, habitats, and living marine resources on the seabed are often the foundation for decision-making in ecosystem management and ocean planning. Government agencies, non-governmental conservation organizations, and the private sector require details on the location of seafloor types for identifying hazards to navigation, allocating living marine resource assessments, identifying sensitive seafloor habitats, siting offshore energy infrastructure, or identifying suitable seabed minerals for extraction. Collecting information on the seabed depths and geomorphology is an expensive operation requiring airborne platforms like satellites, planes or drones, or small vessels to large research ships.

NOAA's Southeast and Caribbean Regional Collaboration Team identified a need for improved coordination in seafloor mapping across agencies and organizations for supporting ecosystem management and ocean planning in the region. A core technical team identified key stakeholders as program offices within federal agencies, state agencies, academic institutions, and non-governmental conservation organizations. NOAA's National Centers for Coastal Ocean Science developed a participatory mapping application to display existing seafloor mapping and other spatial data and to collect seafloor mapping priorities in estuarine and outer shelf waters of North Carolina, South Carolina, and Georgia from participants. Florida is in the Southeast Region, but the state had recently conducted their own state-wide prioritization exercise and was therefore excluded from this effort. A spatial grid of 5 km x 5 km cells was defined as the spatial domains for identifying mapping needs. A quantitative approach using "coins" assigned relative value to grid cells and defined the urgency of need, along with the justification or management driver, and the types of mapping products required.

Twenty-five representatives designated seafloor mapping priorities for their organizations using an online prioritization tool. Several common areas of interest were identified in the spatially explicit analysis of the responses. Nearshore surfzone areas along Georgia, South Carolina, and North Carolina were highlighted by several agencies and organizations interested in sediment and sand resources as well as potential for rocky reef habitats. Inshore estuarine areas were highlighted by state agencies and conservation groups interested in monitoring change in managed areas like National Estuarine Reserves. On the outer continental shelf, areas near Blake Plateau off South Carolina and the continental shelf break off North Carolina were identified by federal agencies and conservation organizations as areas of sensitive habitats or historically significantly shipwrecks and maritime resources.



Grid cells identified as the highest priority locations for future data collection, these cells were within the Top 10% of standardized coins across the study region. Shown for reference are the 1,000-m and 10-m isobaths and dark grey boundaries identifying study subregions.

The seafloor mapping prioritization results described in this report are already being used by NOAA to focus planned seafloor mapping missions. Furthermore, the outcomes from this regional exercise contribute into a National Mapping Prioritization under the lead of NOAA to coordinate mapping activities across the entire U.S. Exclusive Economic Zone. Organizations charged with mapping the seabed for navigation, commerce, and/or resource management can harvest the priorities outlined in this report to improve coordination and more efficiently allocate resources needed to conduct mapping.

Contents

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List of Acronyms

AUV	Autonomous underwater vehicle
EEZ	Exclusive Economic Zone
EFH	Essential fish habitat(s)
HAPC	Habitat area(s) of particular concern
IOCM	Integrated Ocean and Coastal Mapping Program (NOAA)
MBES	Multibeam echosounder
MNMS	Monitor National Marine Sanctuary
MPA	Marine protected area
NCCOS	National Centers for Coastal Ocean Science (NOAA)
NERR	National Estuarine Research Reserve System
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration
OCM	Office of Coast Management (NOAA)
OCS	Office for Coast Survey (NOAA)
ONMS	Office of National Marine Sanctuaries (ONMS)
ROV	Remotely operated vehicle
SECART	Southeast and Caribbean Regional Collaboration Team
SERFS	Southeast Reef Fish Survey
USGS	U.S. Geological Survey

Introduction

Spatial information on the arrangement of geological features, habitats, and living marine resources on the seabed are often the foundation for decision-making in ecosystem management and ocean planning. Government agencies, non-governmental conservation organizations, and the private sector require details on the location of seafloor types for identifying hazards to navigation, allocating living marine resource assessment surveys, identifying sensitive seafloor habitats such as corals for protection, determining suitable substrates for offshore energy infrastructure, or identifying suitable seabed minerals for extraction. Collecting information on seabed depths and geomorphology with modern techniques is expensive. Mapping shallow coastal areas requires aerial imaging or lidar (light detection and ranging), whereas acoustic echosounders and multibeam sonars integrated into vessels or large research ships are required for deeper water.

In regions like the Southeast U.S. Atlantic Coast, existing modern seafloor mapping on the continental shelf (depths between 5–200 m) accounts for less than 15% of the estimated total area of 100,000 km^2 (Figure 1). Limited resources across government agencies and non-governmental organizations permit continued but slow progress toward complete coverage of the continental shelf and out to the Exclusive Economic Zone (EEZ).

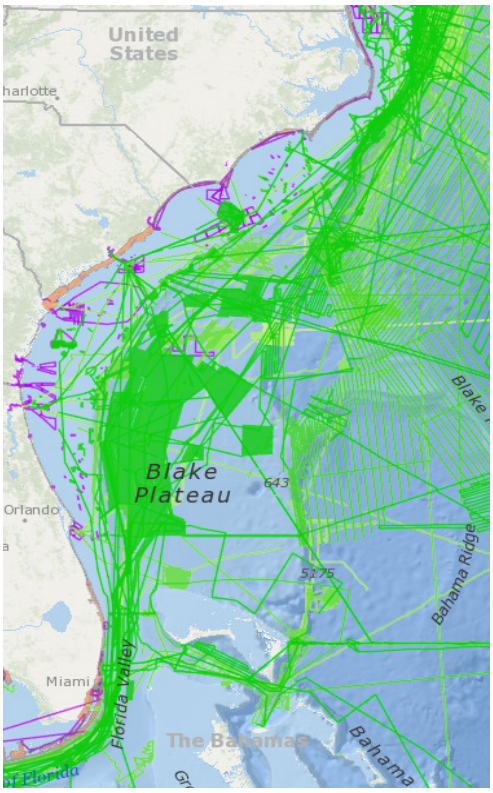


Figure 1. Example map of the current extent of bathymetric data (green and purple lines) within NOAA's National Centers for Environmental Information illustrating less than 15% of the shallow (5–200 m) southeast U.S. Atlantic Coast seafloor has been mapped. These data can be found within the Bathymetric Data viewer (https://maps.ngdc.noaa.gov/viewers/bathymetry/), and contains multibeam data from the earliest surveys (circa 1980) through today's modern high-resolution collections.

To determine the level of effort remaining in the U.S. EEZ, NOAA's Office for Coast Survey (OCS) developed a Linear Nautical Mile Estimator tool to estimate the number of ship days required to map a defined area (Greenaway et al. 2020). Assuming a hydrographic survey vessel would be able to map 24 hours a day, 365 days a year, and traveling at a survey speed of 6 knots, it would take 17 years to map the remaining gaps on the continental shelf of the Southeast United States. This is due to relatively shallow water on the shelf and the swath coverage of multibeam echosounders used on survey vessels. By contrast, while gaps still remain in large areas of the deeper outer continental shelf, the seafloor deeper than 200 m has been surveyed more extensively in recent years, owing to efficiencies of mapping using multibeam sonars where the swath of a multibeam sonar is wider with increased depth and can extend kilometers across a survey vessel's path. Improved coordination across agencies charged with mapping would allow for more strategic allocation of mapping assets and resources to target areas of highest priority for use by a broader stakeholder group.

Spatial prioritization process overview

NOAA's National Centers for Coastal Ocean Science (NCCOS) developed an online, participatory process to prioritize areas for future seafloor mapping (Buja and Christensen 2019). This process relies on mapping recommendations provided by stakeholders, ranked by level of need, and categorized by management driver and data required. To date, seafloor mapping prioritization efforts have been conducted throughout the Continental U.S. and the U.S. Caribbean (Battista and O'Brien 2015; Freedman et al. 2016; Battista et al. 2017; Kendall et al. 2018a; 2020; Hapke et al. 2019a, 2019b; Kraus et al. 2020). These prioritization exercises provide quantitative and actionable intelligence for targeting areas where and when contemporary seafloor surveys are needed. The results of these studies have helped organizations more efficiently coordinate and map priority seafloor locations in their regions. For example, soon after publication of prioritization outcomes from previous projects (Washington, the Great Lakes, southern California, and Florida), areas of interest were targeted for surveys by NOAA, the U.S. Geological Survey (USGS), and the private sector.

For each prioritization effort, five core questions were answered:

1. **Where? –Where are the most important locations**
2. **Why? –Why are these locations important**
3. **When? –When are the data needed**
4. **What? –What types of data products are required**
5. **Who? –Who are the potential partners to conduct mapping or users of the data**

There are six primary steps in the prioritization process we used here (Figure 2). First, a technical team identifies partnering organizations and key stakeholders. Organizations are presented with an overview of the process and asked to identify a single representative to serve as the primary contact to enter in their priorities. In order to fully understand mapping needs and priorities within the study region (which included federal and state waters) a diverse list of key stakeholders is identified including: state, federal, academic, and non-governmental conservation groups. Second, the technical team assembles existing spatial data that may be useful references for participating organizations. These data layers can include regulatory boundaries and managed areas, existing seafloor mapping data, and other environmental data. Third, the representative of each organization enters areas of interest as priorities in the online mapping tool. Fourth, prioritization coordinators collate and summarize the spatial priorities. Fifth, coordinators present preliminary outcomes from the prioritization process, highlighting key overlapping areas of interest. Sixth, final priority areas are presented in online maps, summarized in technical reports or white papers, and distributed to stakeholders, agencies, and other organizations charged with allocating mapping resources.

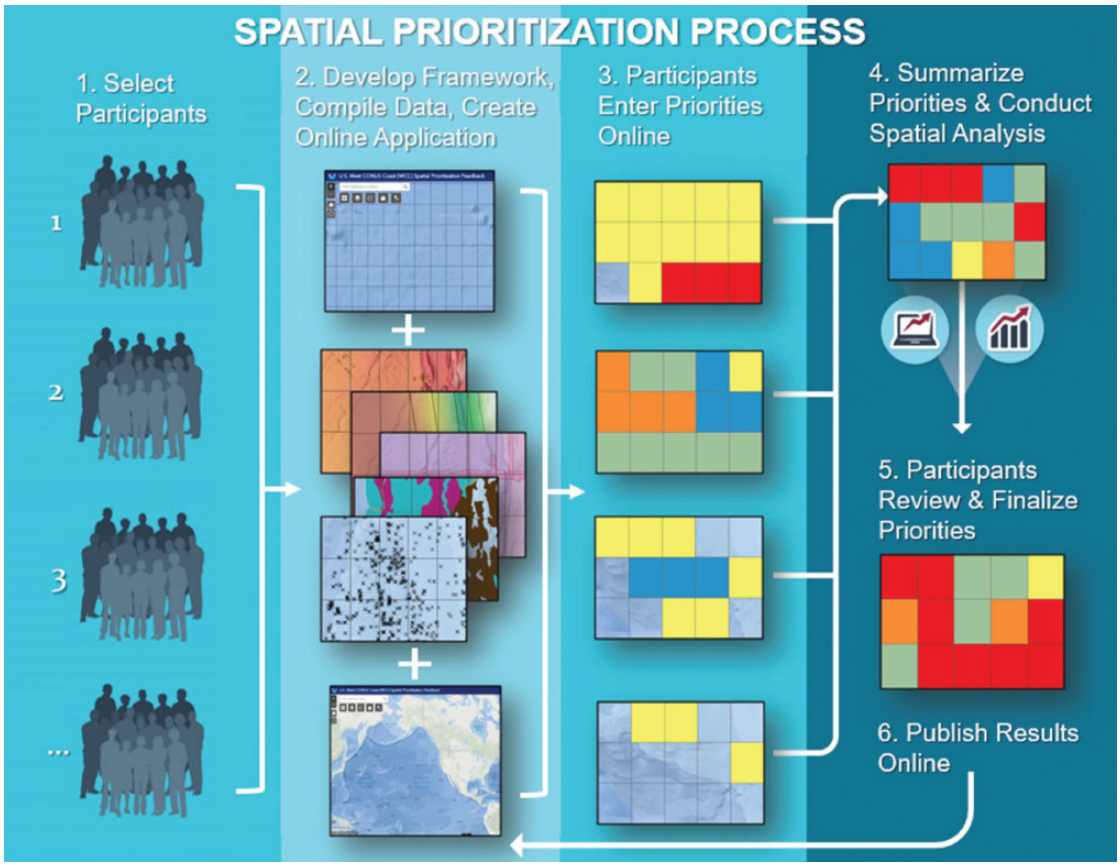


Figure 2. Graphical representation of the six steps in the seafloor mapping prioritization process. (Image source: Costa et al. 2019)

Several approaches can be used to assign value or rank mapping priorities. Battista et al. (2017) applied the method of assigning high, medium, and low values to all cells in the grid, limiting the number of high and medium values to 30% of total area. Kendall et al. (2018a, 2018b) adopted a more quantitative method in Lake Michigan, allowing participants to "spend" 100 coins across the domain with a pre-defined maximum number of coins in per cell. This method allows for more rigorous quantitative statistical analyses of the outcomes to identify areas of mutual interest across participating organizations, management drivers, and required data products; however, 100 coins is limiting over a larger prioritization domain. Most recently, the coin method has been adapted to include larger

geographic areas with larger numbers of coins (Costa et al. 2019; Hapke et al. 2019a, 2019b; Kraus et al. 2020). Participants were provided coins equivalent to 30% of the total number of grid cells available in the spatial domain. The distribution of coins allows for standardization and quantitative analysis using parametric statistics and clustering algorithms to define high priority areas of interest, for this reason, this study used the coin method to identify priorities.

Seafloor mapping prioritization in the southeast U.S.

In 2014, NOAA's Southeast and Caribbean Regional Collaboration Team (SECART) identified improving coordination in seafloor mapping as a top ecosystem management priority in the region. SECART hosted two workshops (2016 and 2018) to define key management needs for seafloor mapping products and the requirements for those maps in terms of data types, resolution, and extents. Key management needs included improved characterization of seafloor habitat for fisheries assessments, identification of sand resources for sediment use and coastal resiliency projects, exploration and conservation of significant historical shipwrecks, and planning or siting offshore renewable energy infrastructure. With less than 15% of the region mapped, participants at these workshops identified prioritizing future seafloor mapping and coordinating among agencies as the most efficient means to fill data gaps in seafloor data (NOAA SECART 2019). At the conclusion of the 2018 workshop, a technical team was assembled to design and execute a prioritization for mapping in the southeast.

This report summarizes the processes and outcomes from a seafloor mapping prioritization exercise conducted for the southeast U.S. (North Carolina, South Carolina, and Georgia). The exercise was funded, in part, by NOAA's SECART, NCCOS, Office for Coastal Management (OCM), and NOAA's National Marine Fisheries Service (NMFS) Southeast Regional Office Habitat Conservation Division. The southeast prioritization was conducted immediately preceeding a nation-wide prioritization effort led by NOAA's Integrated Ocean and Coastal Mapping program. The results of this prioritization were incorporated into the national effort.

Methods

Technical team and participating organizations

The core technical team consisted of individuals from NOAA's Integrated Ocean and Coastal Mapping Program (IOCM), OCS, OCM, and USGS, and University of South Florida. The technical team identified forty-five organizations or program offices as potential users of seafloor mapping data and thus potential participants in this prioritization effort. The goal was to reach all relevant stakeholders in the southeast region who are mapping practitioners or users of seafloor mapping data for research, monitoring, exploration, regulatory authority, or provide other decision-making and management support. These groups included a range of federal partners including various offices within the Department of Interior, Department of Defense, and the Department of Commerce (i.e., NOAA), and state and regional fisheries and coastal zone management agencies. The technical team also identified academic institutions who conducted ecosystem or geological studies in the coastal ocean and non-governmental conservation groups involved in ocean planning or marine resource conservation. A comprehensive list of the invited organizations can be found in Appendix A.

Geographic scope

The geographic scope of this prioritization covered a total area of 365,709 km^2, including some coastal estuaries and out to the continental slope and EEZ off the coast of North Carolina, South Carolina, and Georgia. Florida was excluded from this exercise as a consortium of agencies and universities had recently conducted a state-wide prioritization effort using the NCCOS prioritization Web Application as part of the Florida Coastal Mapping (FLCMap) Initiative in 2018–2019 (Hapke et al. 2019a, 2019b).

The project's geographic area was partitioned into six subregions delineated by using approximated offshore extensions of state boundary lines and the 100 m bathymetry contour (the approximate location of the steepest slope of the continental shelf break). These subregions are: North Carolina nearshore, North Carolina offshore, South Carolina nearshore, South Carolina offshore, Georgia nearshore, and Georgia offshore (Figure 3). Use of subregions allowed for the maximum amount of flexibility when analyzing results and minimized the burden on participants when entering their priorities, particularly for state agencies who are likely most interested in their managed waters.

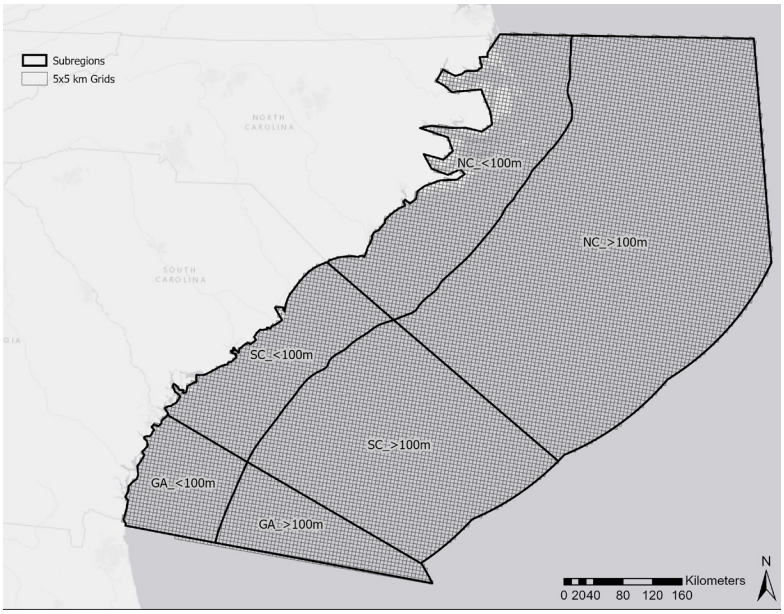


Figure 3. The project area was divided into six subregions delineated by state lines and the continental shelf break which is steepest near the 100-m bathymetry contour: North Carolina nearshore (NC <100 m), North Carolina offshore (NC >100 m), South Carolina nearshore (SC <100 m), South Carolina offshore (SC >100 m), Georgia nearshore (GA <100 m), and Georgia offshore (GA >100 m). The subregions were further divided into a total of 14,724 5 km x 5 km grid cells.

The six subregions were further subdivided into a total of 14,724 5 km x 5 km grid cells (Figure 3) in which participants identified their priorities. The size and shape of these grid cells were selected to align with the 3D Elevation Program national grid. A National Mapping Prioritization led by the Interagency Working Group on Ocean and Coastal Mapping effort initially adopted the same grid, but later modified their final grid to 10 km x 10 km. Although the southeast prioritization retained the 5 km x 5 km grid system, the results were easily aggregated and ingested into the national prioritization effort, thereby minimizing time required by participants and analysts associated with the National Mapping Prioritization.

Existing data

Relevant mapping and other spatial data sets were compiled to help participants understand existing information and data gaps used to identify priority areas for future data collections. The spatial data layers included existing political and administrative boundaries, ecosystem management boundaries such as marine protected areas (MPAs), essential fish habitat (EFH), and deepwater coral habitat areas of particular concern (HAPC). These spatial data layers included a wide range of information about the marine environment offshore of the southeast coast, including seafloor mapping information that describes the geographic extent, type, and quality of acoustic survey data currently available (Figure 4). These datasets allowed participants to distinguish previously mapped areas when identifying priority locations for future seafloor mapping, sampling, and surveys. These relevant spatial datasets were then added to the online application where participants would submit their priorities (see section below). Participants were also able to add their own spatial datasets to the online application.

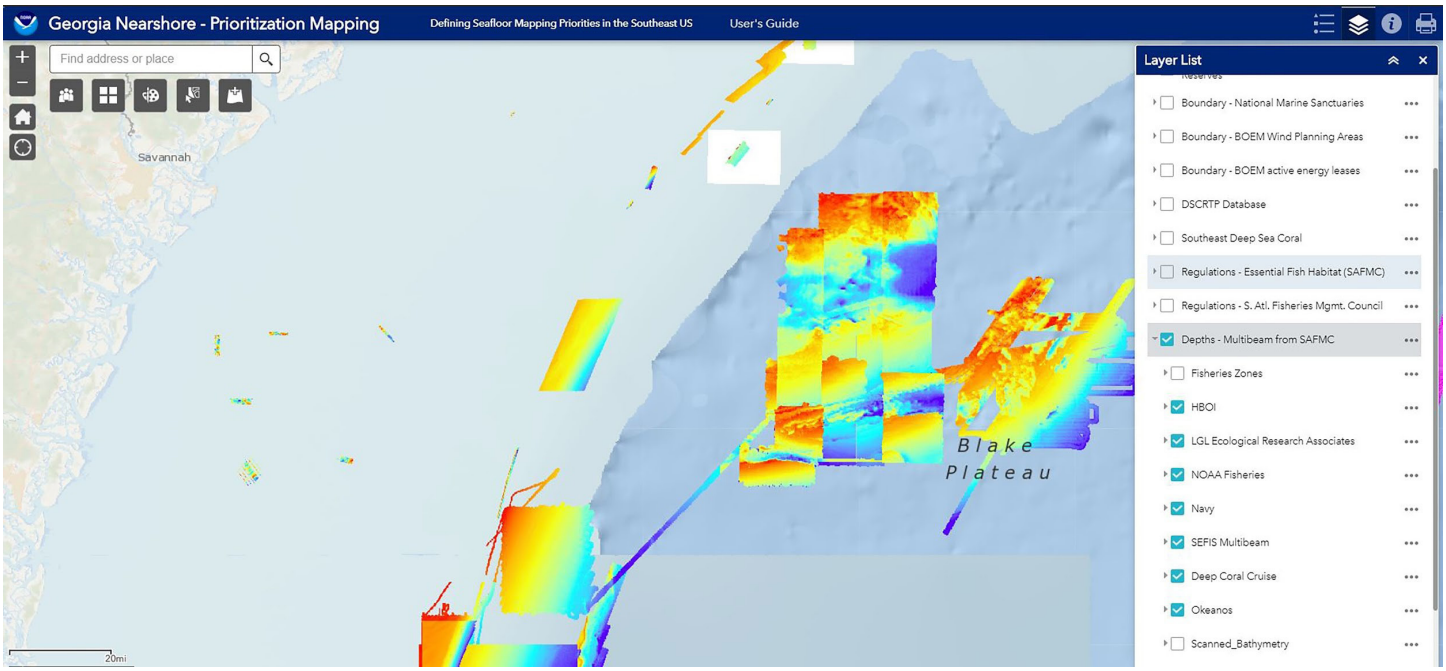


Figure 4. An example of the relevant relevant spatial datasets within the mapping interface that allowed users to see, for example, where acoustic survey data were already available. Many of the data sources included within the application were suggested by or provided by the participants and the technical team.

Participatory mapping interface and data submission

An online application was created using Esri's Web App Builder to allow participants to view and interact with the existing spatial datasets, and to enter their priorities for seafloor mapping, sampling, and visual surveys. A total of six applications were created, with each application representing an individual subregion. These applications were modeled off of past NCCOS prioritization efforts (Battista and O'Brien 2015; Battista et al. 2017; Kendall et al. 2018a; Costa et al. 2019; Kraus et al. 2020) but customized to meet the regional needs of the southeast coast. Each application consisted of two main components: (1) an online map with compiled regional data (described in section above), and (2) the spatial prioritization tool (Figure 5; Buja and Christensen 2019). The online prioritization tool was the interface participants used to identify and submit their priorities. By using a customized suite of selection tools and pull-

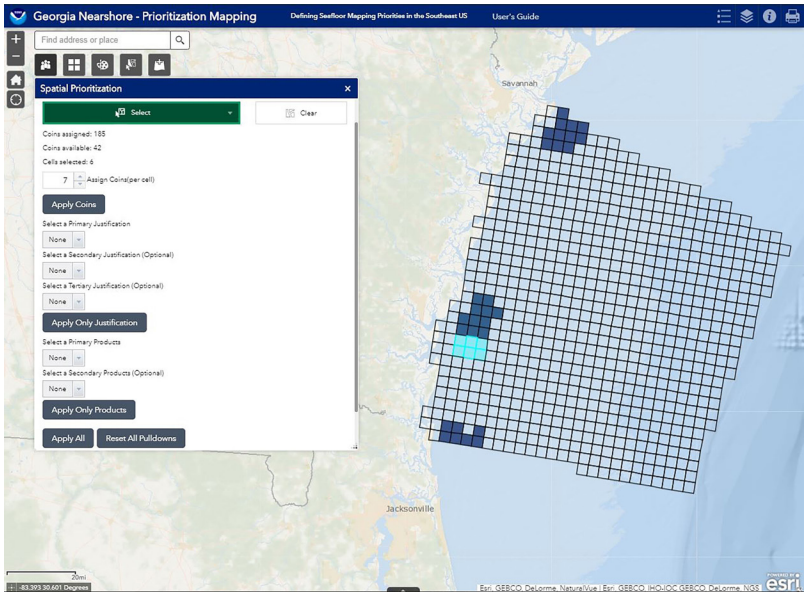


Figure 5. An example of the spatial prioritization tool (left) and 5 km x 5 km grid (right) participants used to allocate coins and identify seafloor mapping priorities..

down menus, representatives were able to easily submit and edit organizational needs and priorities. Customized pull-down menus are described in more detail in the section below.

Each participant entered their data needs and priorities in the online application for each relevant subregion (Figure 5). Participants were trained to use these applications during a webinar hosted by SECART and NCCOS in December 2019 along with additional tutorial materials and a user manual for the tool. Users were subsequently sent a web link and a unique login ID. This link and login ID let participants enter their priorities at their convenience from any computer with an internet connection. Participants were originally given three weeks to enter their seafloor data and mapping needs along the southeast Atlantic coast. This deadline was later extended to three months (January 27–April 24, 2020), to accommodate participants' needs and adjust for changes in work schedules related to mandatory telework from COVID-19.

To identify priorities, each participant was given virtual coins to "spend" on the 5 km x 5 km cells. The number of coins available varied by subregion and was equivalent to 30% of the cells in the subregion (Table 1). While participants had no restrictions on where to place their coins, they were required to allocate all of their coins and restricted to placing no more than a maximum of 10% of their coins in a single grid cell. This maximum number differed by subregion because some subregions were larger and had more cells (e.g., North Carolina offshore) than others (e.g., Georgia nearshore). These two rules were designed to ensure that participants' needs were comparable (i.e., everyone spent the same number of coins) and that their needs were distributed more broadly than in just one or two areas (i.e., increasing the chance of overlap among participant needs) within the subregion.

Table 1. Number of cells, coins, and maximum coins allocated for each geographic subregion in the SECART prioritization effort. Nearshore and offshore were delineated by the 100-m depth contour.

Prioritization Subregion	Abbreviation	Total # Cells	Total # of Coins	Max # coins per cell (10%)
North Carolina Nearshore	NC <100 m	1,994	598	60
North Carolina Offshore	NC >100 m	6,971	2,091	209
South Carolina Nearshore	SC <100 m	1,222	366	37
South Carolina Offshore	SC >100 m	2,941	882	88
Georgia Nearshore	GA <100 m	758	227	23
Georgia Offshore	GA >100 m	838	251	25

The timeframe in which participants needed data was indicated by assigning more coins to a cell, up to the 10% limit. Specifically, participants were given the guidance that cells with 8–10% of their coins indicated an immediate need (within a year), 4–7% of coins indicated a need in the next two to four years, 1–3% of coins indicated a need in next 5 to 10 years, and zero coins indicated data were not needed within 10 years. Cells with more coins were considered a higher and more urgent priority than cells with fewer coins. Once coins were assigned to a cell, the prioritization tool displayed the number of coins participants had remaining. Participants could edit their selections as often as they liked until the prioritization deadline.

In addition to choosing how many coins to allocate, participants were also asked to justify why these areas were of interest to their organization. Participants could choose from a list of 18 pre-defined justifications (Table 2), which were aligned with justifications used in the national prioritization process. They could choose up to three (primary, secondary, and tertiary) justifications using pulldown menus in the prioritization tool. The default justification was *None* and was only used if participants did not select a justification. An *Other Justification* was also available, if the reason for a data need was not adequately described by the list provided.

Lastly, participants were asked to describe what type of seafloor information and datasets were needed in their areas of interest, referred to here as data products. Using the prioritization application, participants could choose up to two (primary and secondary) data products from a list of sixteen (Table 3). These products were also aligned with those used in the national prioritization process.

Table 2. List of 18 pre-defined justifications participants could choose from to rationalize why an area was of interest to them and their organization.

Justification Label	Justification Description
Benthic Exploration	Targeted benthic exploration for seafloor characterization
Water Column Exploration	Targeted water column exploration for water column characterization (e.g., upwelling, seeps)
Commercial and Recreational Fishing	Fisheries management and regulation (e.g., commercial/recreational fishing locations, aquaculture siting, fisheries sampling stations, high bycatch areas, sport/charter fishing)
Cultural/Historical Resources	Shipwrecks, tribal use areas and other archaeological/cultural/historic resources
Energy	Energy permitting, siting, management, transmission (e.g., oil/natural gas platforms, wind turbine, tidal/hydropower, cables, pipelines, etc.)
Habitat/Biota/Natural Area	Includes Essential Fish Habitat, Critical Habitat (for marine mammals and other protected species), spawning/nursery areas, feeding grounds, key benthic habitats, habitat mapping, coastal geomorphology and other ecologically significant areas.
Coastal/Marine Natural Hazards	Detection, forecast and management of coastal and marine hazards, including weather/storm surge, flooding, tsunamis, earthquakes, geologic faults
Infrastructure (non-energy)	Existing or potential infrastructure development, includes port facilities, bridges, telecommunication cables, roads, etc.
Protection/Management Areas	Marine protected area, sanctuaries, conservation areas, restoration sites, dynamic management areas for marine mammals and other protected species
Monitoring	Monitoring of a specific study area for scientific or other purposes (e.g., coral health monitoring)
Navigation Safety	Safe navigation in U.S. waters, such as shipping lanes, ferry routes, harbors/approaches, port facilities and marinas; includes detection of hazards to navigation (rocks, wrecks, other obstructions)
Scientific Research	General scientific research, not including monitoring of a specific area
Seabed/Sediment Resources (non-living)	Critical minerals and other geologic resources; sediment movement and management needs, such as sand/gravel assessments, managing beach erosion/renourishment or sediment buildups in channels and ports
Maritime Domain Awareness and Enforcement	Department of Defence/Department of Homeland Security security operations, countermine measures, border patrols, law enforcement
Recreational Activities (other than fishing)	Recreational activities (e.g., boating, ecotourism, swimming and diving)
General Knowledge Gap	Default/general option; select if none of the other criteria meet your needs
Other Justification	The reason for a data need was not adequately described by this list
None	None

Respondents were able to apply up to three justifications for each prioritized grid cell. Justifications spanned a range of topics including commercial fishing, habitat, and energy.

Table 3. List of 16 products participants could choose from to describe the type of seafloor information and datasets that were needed in their areas of interest.

Product Title	Product Description
Elevation (bathymetry/topography)	Collected using multibeam echosounder (MBES) sonar, airborne lidar or other methods. Processed into bathymetric grids or Digital Elevation Models for a wide variety of downstream products, including modeling (e.g. marine/coastal/ecological/numerical modeling)
Backscatter Intensity or Reflectivity	Collected simultaneously with acoustic bathymetry, a gray-scale raster of the strength of the acoustic echo returned or light reflectance from the seabed for location and distribution of different substrate types and habitat.
Magnetometer Surveys	Ferrous object detections/magnetic anomalies
Underwater Photographs/Videos	Collected using remotely operated vehicle (ROVs), autonomous underwater vehicles (AUVs) or other camera platforms
Substrate Type, Hardness/Roughness/Thickness	Collected using high resolution sidescan sonar and subbottom profiling techniques
Biological, Chemical or Physical samples	Collected using divers, AUVs, ROVs, cores, grabs, CTDs [Conductivity, Temperature, and Depth], rosettes, etc.
Sub-bottom Geology	Collected using sub-bottom profiling sonar
Water Column	Collected with multibeam or single-beam sonar systems
Shoreline Characterization	Delineation and characterization of shoreline/coastal infrastructure and features (port facilities, boat ramps, docks, etc.)
Habitat Map/Characterization	Synthesized using MBES, underwater photographs/video, ground truthing and other methods
Nautical Map and Chart Products	Electornic navigational charts (ENCs), other products for navigation
Human Use Statistics	Socioeconomic, demographic, and other statistics regarding human use of ocean areas
Wildlife Population Characterization	Includes marine mammal, bird, sea turtle surveys; stock assessments
General Lakebed or Seafloor Map Products	Default/general option; select if none of the other products meet your needs
Other Mapping Product	A product need was not adequately described by this list
None	None

The default product was *None* and was only retained in the analyses if participants did not select a product. While the focus of this effort was the seafloor, an *Other Product* was also available, if a product need was not adequately described by this list.

Data summaries and spatial analysis

Throughout the response period, participants' data were continuously saved to an online database. At the conclusion of the response period, these data were downloaded, inspected for completeness and errors, summarized, and analyzed. The final products of the study include collective exploration, monitoring, and mapping priorities across the U.S. coastline from North Carolina to Georgia.

Data compilation and quality control

All quality control and data summarizations were performed in R (version 3.6.3; R Core Team 2020). Priority data from each participant was inspected for the following five basic criteria to ensure the highest quality data:

1. Each participant allocated all their coins for each subregion
2. Each participant allocated no more than 10% of the subregion's coins to a single cell. Where grid cells did not have coins allocated but justifications and/or data products were listed, these were reset to *None*. This occurred in 0.4% of the grid cells and was primarily due to participants fine-tuning their coin allocation within the prioritization tool; when changing initial coin allocations back to 0 the justifications and data products, by default, are not reset to *None*.
3. Grid cells with coins were checked that at least a primary justification and primary product were specified. In cases where participants did not specify a justification or product, follow up emails and calls were made to give them an opportunity to fill in this information. In nearly all cases primary justification and data products were defined. If these could not be defined, the default answer of *None* was retained for analysis.

4. Grid cells were checked to ensure no justifications and/or products were listed twice for the same cell by a single participant. If this occurred, the repeated justification or data product was replaced with *None*, the default value. For example, if a justification was repeated between primary and secondary in a single grid cell, the secondary value was changed to *None* for that grid cell.

Summarizing data by subregion, justification, and data product

The analysis-ready data were then summarized in R (version 3.6.3, R Core Team 2020) using methods consistent with previous studies (Kendall et al. 2018a, 2018b; Costa et al. 2019). All summary maps were uploaded to the NOAA GeoPlatform and made available for participants to review (https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=04cdd2a68c4f427f893f2042f326dc80). To examine the distribution of coins across regions the following analyses were completed:

1. Summing and standardizing coin totals for each grid cell. Due to variability of subregion sizes, coin numbers, and number of participants, coin totals per grid cell had to be standardized to allow comparison across the study domain. To standardize, the total coins per grid cell was divided by the total coins allocated in that subregion to calculate a proportion of total coins per cell. This proportion was then multiplied by the total number of grid cells for that subregion to adjust for the difference in sizes among subregions. This standardization process was also completed for each justification and data product.
2. Summing and standardizing coins for each grid cell by justification and data product. All levels of justification and data products were retained to calculate total coins and weighted equally. For example, if a participant assigned five coins to a grid cell and specified *Elevation* as the primary justification a second participant assigned three coins to that cell with *Elevation* as a secondary justification, the coin total for *Elevation* in this cell would be eight coins. To evaluate spatial patterns, coin totals for each justification and data product were then standardized using the approach described in step 1.
3. Calculating proportion of total coins per data product and justification. Per subregion and for all subregions combined, coins were totaled for each data product and justification and divided by the total coins for that subregion (or across all subregions) to calculate the proportion of coins per product and justification.
4. Exploring differences in coin allocation and data product and justification assignment by participant type. Four different participant type categories were used to explore the data: federal agencies/programs, state agencies, academic institutions, and mixed. Mixed participants included groups like non-governmental organizations (NGOs), conservation groups, or from programs that are collaborations of the other three participant types (e.g., Southeast Reef Fish Survey (SERFS), which is made up of a combination of state, federal, and academic organizations). Proportion of total coins for each product and justification were calculated by participant type.
5. Identifying regions of need by multiple participants. Participant counts were tallied for each grid cell.
6. Highlighting diversity of justifications and products. Count of unique data products or justifications per cell was completed. This is similar to a species richness measure and was not standardized because participants had the same number of justifications and products to choose from in each subregion.
7. Ranking data to highlight priority areas. Standardized coins across the study area were ranked using the ***quantile()*** function in R (R Core Team 2020). Data rankings were categorized using the following quantile probabilities: Low (<30%), Mid (30–<60%), High (60–<90%), and Top 10% (90–100%), regions of no coins are shown in results as empty grid cells
8. Exploring spatial patterns of participant needs. Maps of ranked standardized coin values were created for overall coins (highlighting urgency of data needs), by participant type (n = 4, Appendix B), for each justification (n = 14, Appendix C), and for each data product (n = 14, Appendix D). Additional summary data plots were created showing the percent of total coins by justification, data products, and differences across regions and participant user groups.



Respondents were able to apply up to two products for each prioritized grid cell. Products spanned a range of topics including elevation, photographs/videos, and charting.

Examining data combinations using cluster analysis

Along with assigning coins to a grid cell, participants were able to identify three justifications and two products for each grid, allowing up to five different characteristics to be assigned for each grid cell. Seeing combinations among these justifications and products is difficult when examining the data one product or justification at a time. Hierarchical cluster analysis was used to identify grid cells with similar characteristics.

Grid cells with very low coin values (less than 0.2% of coins) were eliminated as those cells are relatively unimportant and including them can obscure the clustering patterns for cells with a moderate or large number of cells. The remaining grid cells with their corresponding justifications and products were then analyzed using cluster analysis. A matrix of euclidean distances between all cells were analyzed using the ***hclust()*** function in R (R Core Team 2020) assuming Ward's Minimum Variance method. This method was chosen because it produced stable, representative clusters and was consistent with other similar studies (Kendall et al. 2018a, 2018b; Costa et al. 2019). Clusters were defined when the dissimilarity among groups was large and multiple algorithms showed similar groupings. The mean and standard error of standardized coins were calculated for each justification and data product and describe the unique characteristics of each cluster. This analysis combined data from unique justifications and unique products into a single map, highlighting clusters of grid cells with similar characteristics.

Participant feedback and narratives of needs

Informally throughout the prioritization process, and directly during the presentation of draft results (May 14, 2020), participants were asked to provide any additional feedback on the prioritization tool and ease of use, as well as comments on the identified priorities and clustered areas in the compiled results. Feedback was provided to the project team via email and phone conversations. This information was used to aid interpretation of the summary grids and describe the possible influences on the compiled results.

Results

Response rates and spatial patterns

Twenty-five organizations or programs participated in the southeast seafloor mapping prioritization effort, allocating a total of 57,944 coins in 6,108 unique grid cells. Organizations that did not participate indicated they were not able to meet the deadline, were capacity limited, or were working closely with participating organizations and therefore did not identify their own priorities. A list of participating organizations and invited organizations is available in Appendix A. There were responses from 15 federal agencies/programs, three state organizations, three academic institutions, and four were from a participant type referred to as 'Mixed'. Five different organizations, two federal and three mixed, identified priorities for all six subregions. On average, participants identified priorities to three subregions.

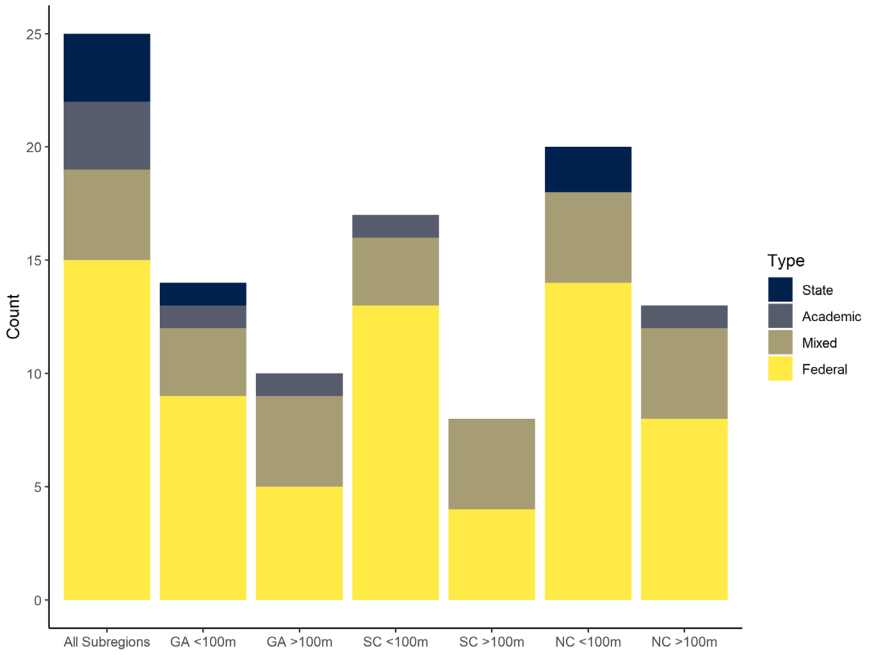


Figure 6. Count of the number of respondents by type (Federal, Academic, State, and Mixed [NGOs, conservation organizations, etc.]), across the entire study area and for each subregion.

Participant numbers per subregion ranged from 6–21, with at least two different participant types being represented in each subregion (Figure 6). Coins were allocated by state agencies in only the <100 m subregions and all other participant groups were represented in both depth zones. Academic and state organizations tended to target coin allocation to focused areas of interest while federal and mixed groups distributed coins over a larger spatial area. Maps of where each participant group type assigned coins can be found in Appendix B.

Less than half of the grid cells within the study area had coins allocated (6,108 of 14,724 total grid cells, or 41%). Extensive areas without coins were within the NC >100 m and SC >100 m subregions (Figure 7). Cells with coins were distributed evenly between the shallow (<100 m, 48% of grid cells with coins) and deep (>100 m, 52%) subregions. Areas within 10 km of the shoreline were of particular interest to participants, this area is typically within the 10-m isobath. Coins were allocated to 558 of the 660 grid cells adjacent to the shoreline and within

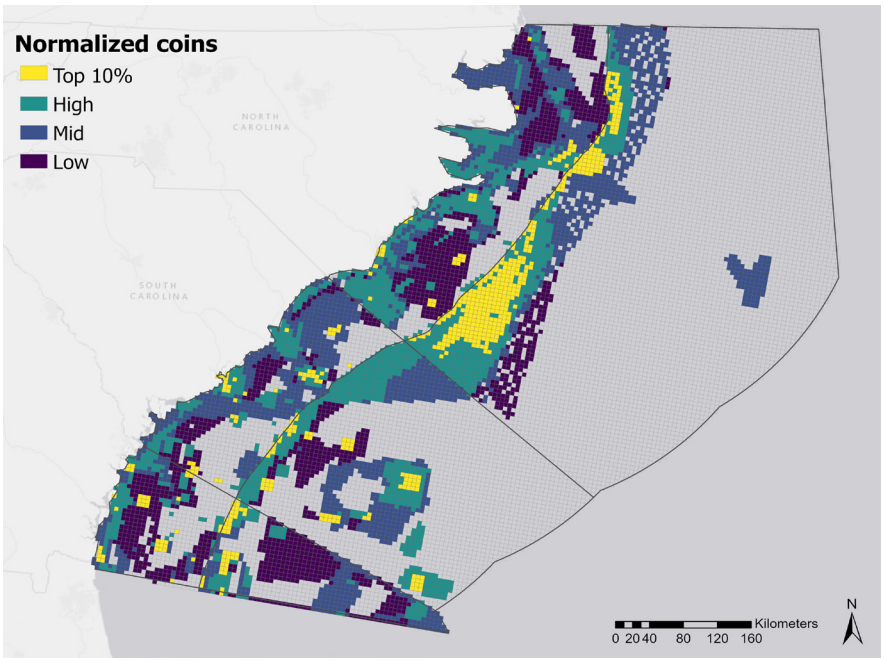


Figure 7. Map showing standardized and ranked total coins across the study region for each grid cell. Cells with the top 10% of coins denote the highest priority for participants. Dark grey boundaries identify study subregions with lighter grey grid cells identifying cells without coins.

the estuaries. The majority of the shoreline grid cells were ranked mid and high in total coin allocation, with higher coin rankings (Top 10%) near coastal cities with economically important inlets (such as Charleston, SC and Wilmington, NC). Within the estuaries of North Carolina, grid cell ranking ranged from low to high with two isolated cells ranked within the Top 10%. Areas along the continental shelf break, aligning with the 100 m depth contour were also identified as highest priority in all three states (NC >100m, SC >100m, GA >100m). With prioritized cells extending across the entire subregion, there was a greater interest spanning the entire >100 m GA subregion compared to South Carolina and North Carolina. However, there were some isolated prioritized areas, within the deepest and farthest offshore area of North Carolina and South Carolina subregions, one area was within the Top 10% in the farthest offshore area of SC >100 m.

Based on the standardized and ranked total number of coins, some high priority locations for future mapping were identified (Figure 7). The Top 10% locations are distributed across the study area and vary in sizes from the largest (approximately 208 grid cells) region off of North Carolina and smaller (single grid cell) areas within each subregion. More than half of the Top 10% grid cells were within the North Carolina subregions (66% of total), followed by South Carolina (20%) with the remaining 13% of grid cells in Georgia. There were fewer Top 10% cells, in the shallow subregions compared to the deeper subregions (20% in the <100 m and 80% in the >100 m subregions).

After counting the number of unique participants allocating coins to a cell (Figure 8), there was a large region with 5–8 participants in the NC >100 m subregion and within the Pamlico Sound estuary of NC (NC <100 m). The large group of cells within the NC >100 m subregion, just offshore the 100-m contour off North Carolina between Cape Fear and Cape Lookout, was a region of particular interest to stakeholders, with 62% of the subregion's participants allocating coins within these cells. This area has many diverse interests including *Commercial and Recreational Fishing* (or *Fishing*), *Navitation Safety*, *Coastal/Marine Natural Hazards* (or *Hazards*), and *Habitat/Biota/Natural Area* (or *Habitat*; see Appendix C and Appendix D) and overlaps with known rocky reef and deep coral habitat. There were smaller groups of grid cells near port cities within each subregion where 5–8 participants allocated coins. Also of note were two regions in the SC >100 m subregion, near the 100-m isobath and further offshore in the Blake Plateau region. These cells were of interest to 3–4 participants which is half of the participants to this region (n = 6 participants in SC >100 m).

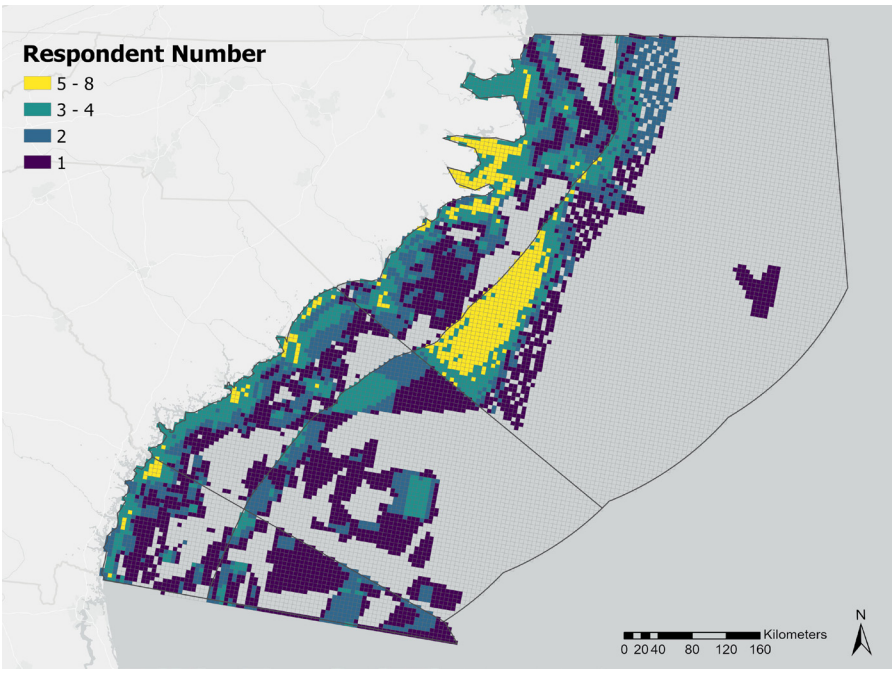


Figure 8. Map showing the number of respondents allocating coins to each grid cell across the study region. Dark grey boundaries identify study subregions with lighter grey grid cells identifying cells that participants did not identifiy as priority.

Justifications

Three justifications made up a combined 50% of the total coins allocated across the study area: *Habitat* (22%), *Benthic Exploration* (16%), and *Scientific Research* (11%). These three justifications were among the top for each subregion as well (Figure 9). Fourteen out of the 17 unique justifications were used by at least one participant. Justifications available within the web application that were not utilized by participants were *Maritime Domain Awareness and Enforcement* (or *Enforcement*), *Recreational Activities*, and *Other*.

In addition to the top three justifications, *Protection/Management Areas* (*Managed Areas*) and *Fishing* were also identified within every subregion. *Seabed/Sediment Resources* (or *Sediment*), *Hazards*, and *Energy* were more often identified within the <100 m subregions, while *Water Column Exploration* was primarily within the >100 m subregions. Infrastructure was rarely identified, with grid cells only within NC <100 m subregion (New River Inlet and Bogue and Pamlico Sound estuaries) being assigned to this justification. Maps highlighting the spatial distribution of standardized and ranked coins for the two most common justifications, *Habitat* and *Benthic Exploration*, are shown in Figure 10; additional maps of each justification are available in Appendix C.

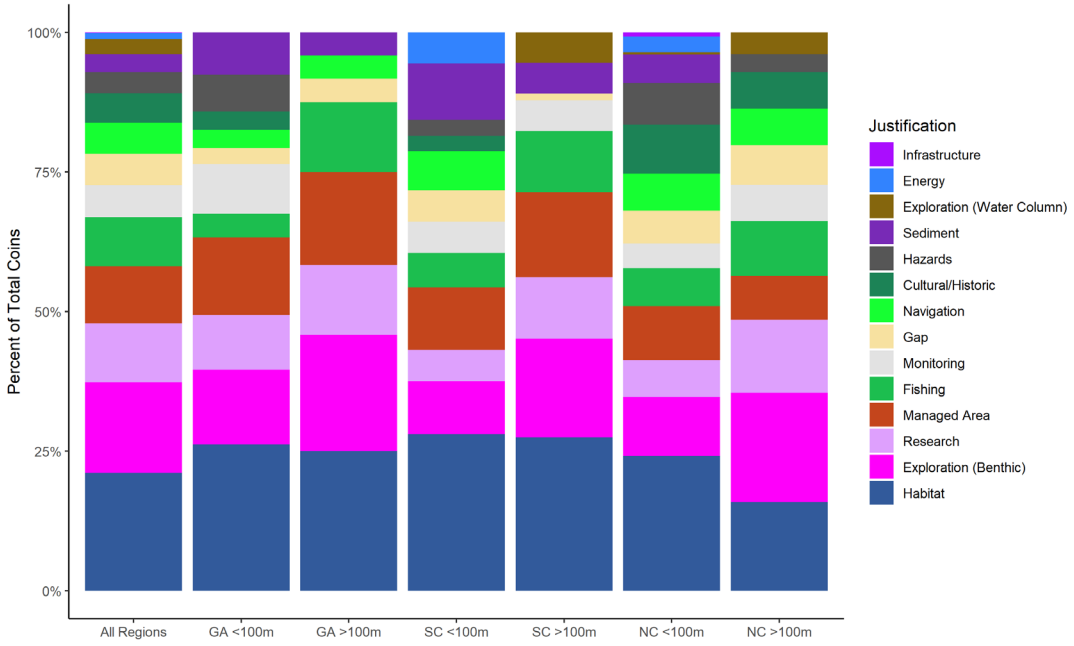


Figure 9. Percent of total coins allocated by justification for all subregions combined and for each subregion. Primary, secondary, and tertiary justifications were included in this analysis.

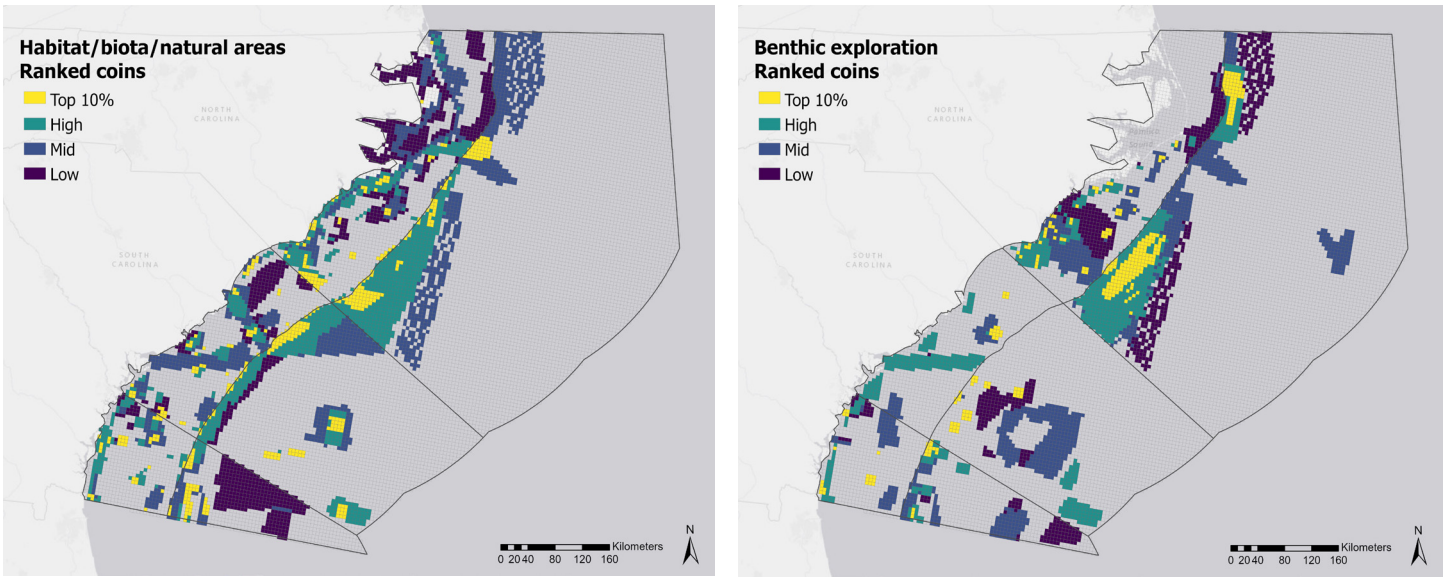


Figure 10. Standardized and ranked coins across the study region for the top two justifications: *Habitat/Biota/Natural Area* and *Benthic Exploration*. Dark grey boundaries identify study subregions with lighter grey grid cells identifying cells that were not assigned coins by participants. Additional maps for each justification identified in the study are available in Appendix C.

There were also differences in coin allocation across justifications by participant type. Federal (n = 15) and Mixed (n = 4) participant types identified more justification categories than Academic and State participant types (Figure 11). This is likely due to the diverse nature of these two groups and their broad range of interests. Academic organizations (n = 3) were less interested in *Habitat*, while *Monitoring* was a more important justification. In addition to the top three most common justifications, state organizations (n = 3) also identified *Fishing* and *Hazards* as important justifications for their priority areas.

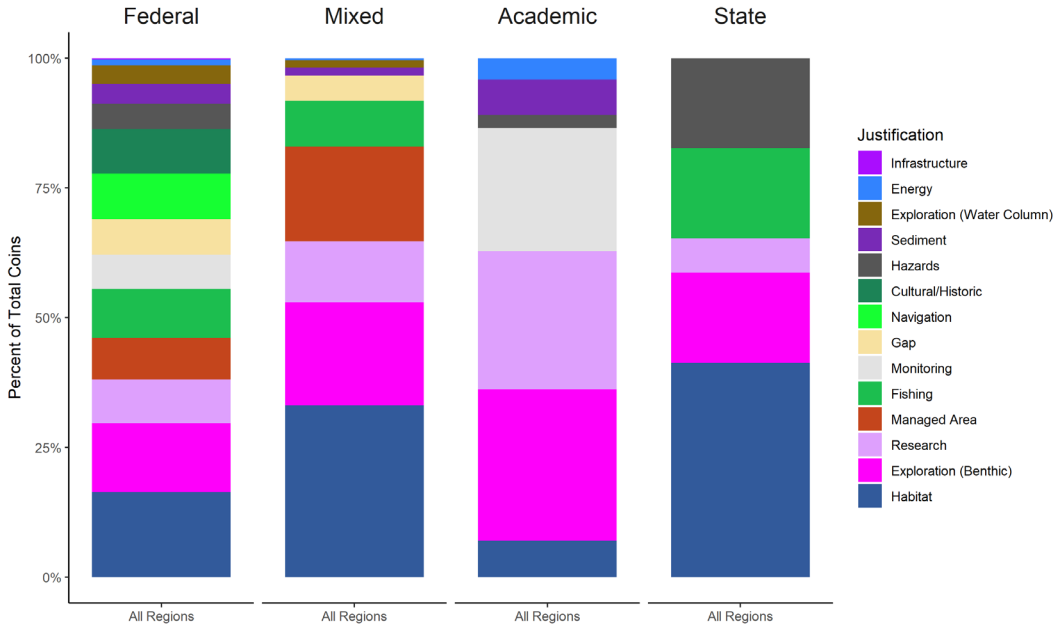


Figure 11. Percent of total coins allocated by justification category and participant type for all subregions. Number of participants by type were: Federal (15), Mixed (4), Academic (3), and State (3).

Regions of many different justifications (i.e., richness) were found in <100 m subregions, particularly near Savannah, GA, Charleston, SC, North Carolina estuaries, and in the NC >100 m subregion (Figure 12). The area in NC >100 m with 10–11 justifications was also an area where many participants allocated coins (Figure 8), with some grid cells having up to eight participants allocating coins. The justifications assigned to this region included: *Benthic Exploration*, *General Knowldedge Gap*, *Habitat*, *Water Column Exploration*, *Navigation Safety*, *Hazards*, *Managed Area*, *Monitoring*, *Scientific Research*, *Cultural/Historical Resources*, and *Fishing*. The four grid cells off Charleston, SC, with ten different justifications is an area of diverse needs and multiple responsdents. These grid cells had 5–6 respondents, which is approximately half of all respondents to this subregion, justifications assigned to these cells were: *Habitat*, *Monitoring*, *Cultural/Historical Resources*, *Fishing*, *Benthic Exploration*, *General Knowldedge Gap*, *Hazards*, *Navigation Safety*, *Sediment*, and *Scientific Research*. These justifications were also assigned to the grid cells with the greatest number of justifications elsewhere along the South Carolina shoreline.

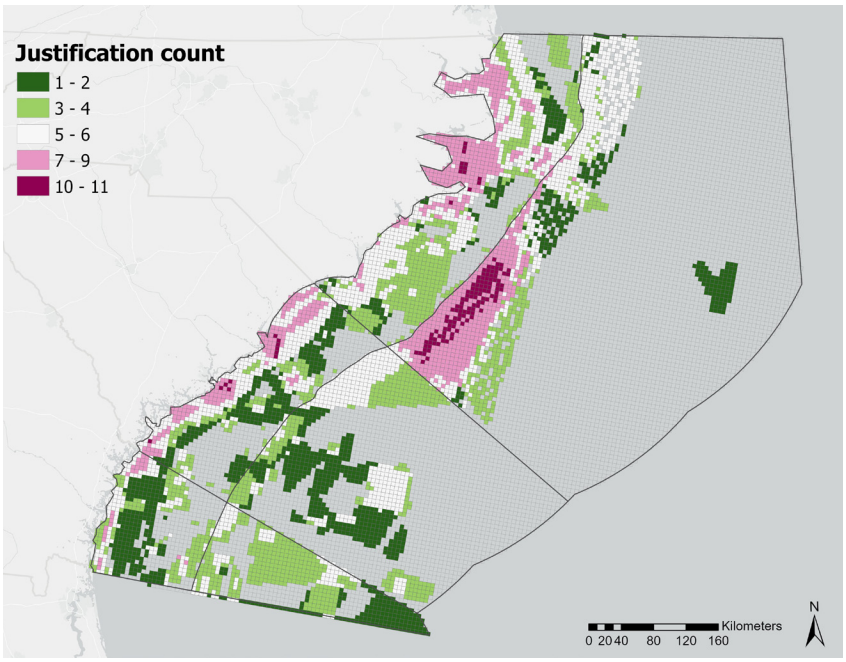


Figure 12. Number of justifications assigned to each grid cell highlighting the variability of needs across the study region. These data were not standardized or ranked because all possible justifications were available to all participants and subregions. Dark grey boundaries identify study subregions with lighter grey grid cells identifying cells that were not prioritized by participants.

Data products

All of the available data products (n = 14) were used by at least one participant. Over 71% of the total coins assigned had three data products identified: *Elevation* (38%), *Habitat Map/Characterization* (18%), and *Backscatter Intensity or Reflectivity* (or *Backscatter*) (15%). These three data products were among the top four in each of the six subregions (Figure 13). Some data products, such as *Shoreline Characterization*, *Substrate Type, Hardness/Roughness/Thickness* (or *Substrate Type*), and *Nautical Map and Chart Products* (or *Charting*), were identified more often in the <100 m subregions. Although a small percentage (4%) of coins identified *Substrate Type* as a data product needed in the NC >100 m subregion. While *Underwater Photographs/Videos* (or *Video/Image*) data was selected more often in the >100 m subregions, there were two grid cells within the NC <100 m subregion, making up 5% of the total coins of that subregion. Some data products were assigned to targeted areas within a single subregion; examples include *Human Use Statistics* within the NC <100 m subregion and *Magnetometer Surveys* within the SC <100 m subregion. Maps of the top two most common data products are shown in Figure 14; additional maps of standardized and ranked coins for each data product are available in Appendix D.

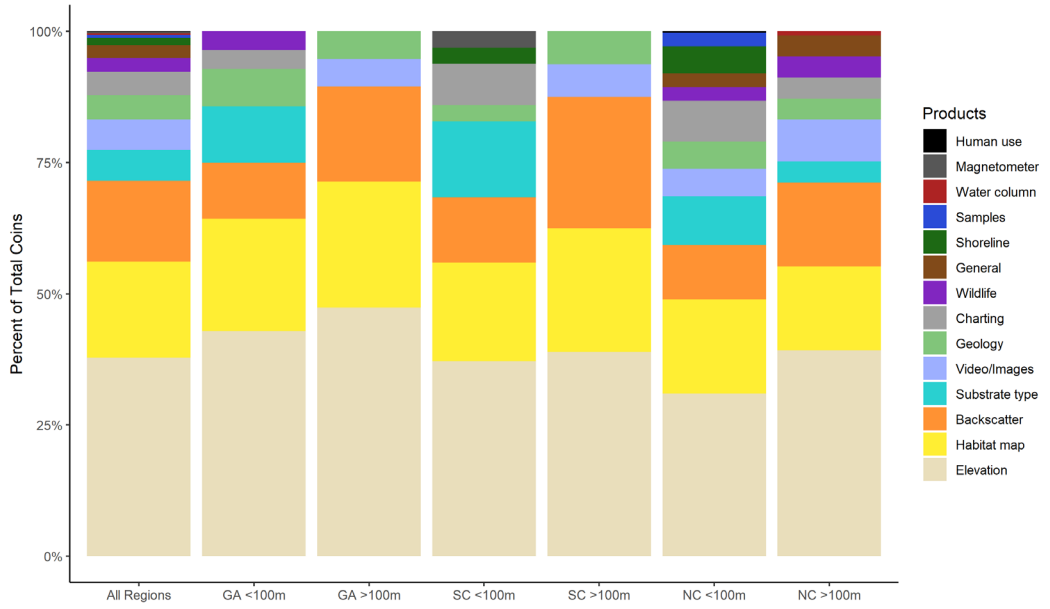


Figure 13. Percent of total coins allocated by data products for all subregions combined and for each subregion. Both primary and secondary data products were included in this analysis.

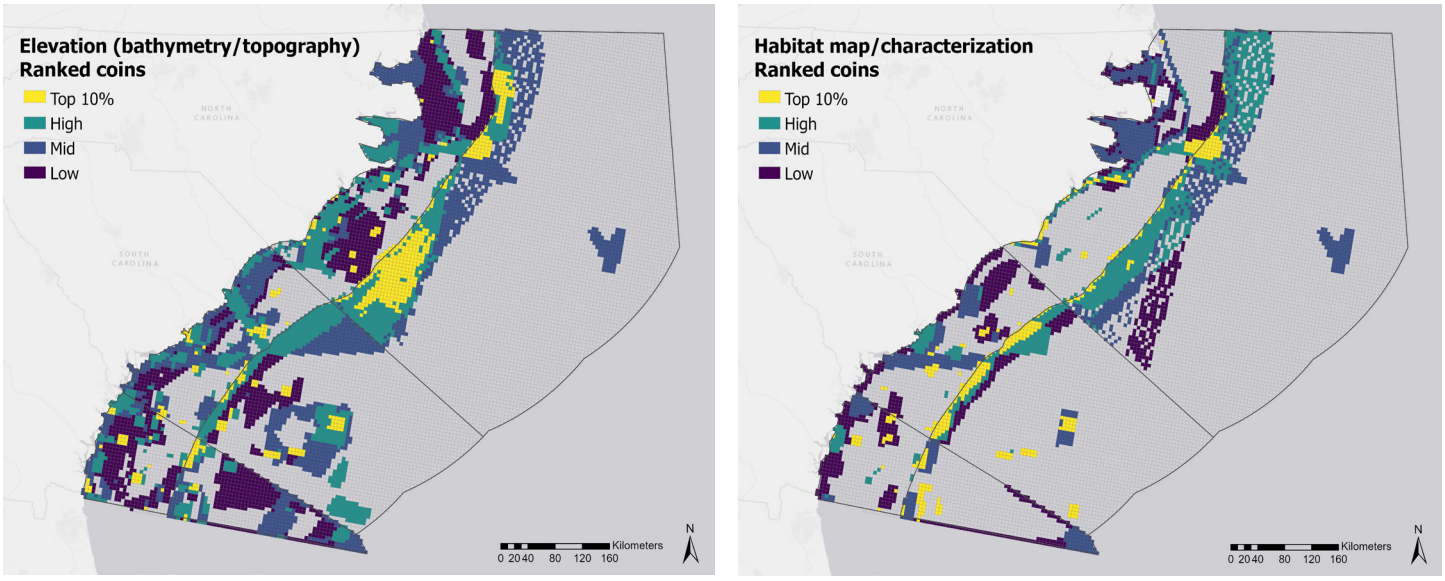


Figure 14. Standardized and ranked coins across the study region for the top two data products: *Elevation* (bathymetry and topography) and *Habitat Map/Characterization*. Dark grey boundaries identify study subregions with lighter grey grid cells identifying cells that were not prioritized by participants. Additional maps for each data product identified in the study are available in Appendix D.

Data product patterns by participant type were similar to justifications, with Federal (n = 15) and Mixed (n = 4) participants identifying a diversity of needed data products. Academic (n = 3) and State (n = 3) participants assigned a more targeted set of data products. For all participant types, *Elevation* was a primary data product needed (Figure 15). Academic participants also required data products focused on *Sub-bottom Geology* and *Wildlife Population Characaterization* which was less of a priority for the other participant types. State participants identified *Habitat Map/ Characterization*, *Backscatter*, and *Wildlife Population Characaterization* as their needed products.

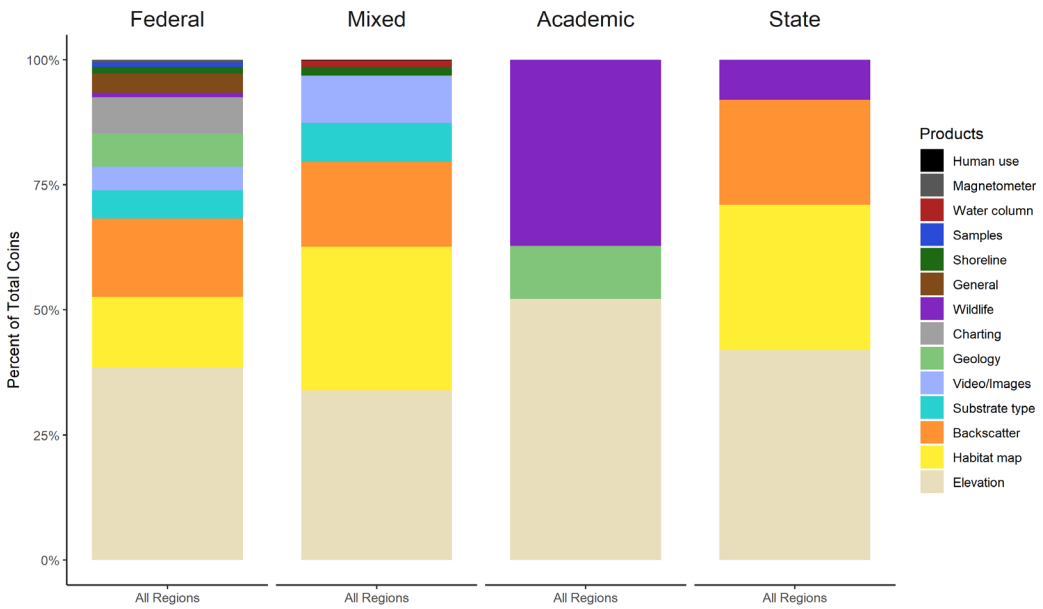


Figure 15. Percent of total coins allocated by data products and participant type for the entire study area. Number of participants by type were: Federal (15), Mixed (4), Academic (3), and State (3).

Regions with many different data products (i.e., richness) were found along the coastline within NC <100 m, SC <100 m, and GA <100 m subregions, as well as targeted areas in NC >100 m (Figure 16). The area along the 100-m isobath of NC >100 m with five or more data products was also an area where many participants allocated coins, with some cells having eight participants. There are multiple regions along the shorelines of the study area with many (7–8) data products identified. One particular area is near Georgetown, SC, and had 5–6 participants, or one third of subregion participants, allocating coins. Products identified in this region are: *Substrate Type*, *Shoreline Characterization*, *Elevation*, *Charting*, *Habitat Map/Characterization*, *Sub-bottom Geology*, *Backscatter*. These products were also assigned to the region near Charleston, SC, with 4–5 participants.

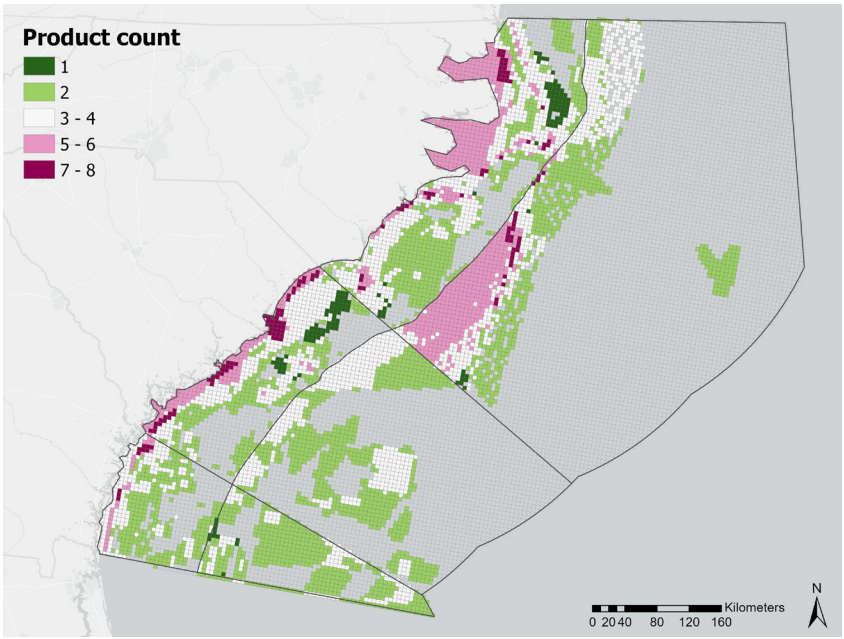


Figure 16. Count of the number of data products assingned to each grid cell highlighting the variability of data product needs across the study region. These data were not standardized or ranked because all possible data products were available for all participants and subregions. Dark grey boundaries identify study subregions with lighter grey grid cells identifying cells that were not prioritized by participants..

Cluster analysis

Cluster analysis of the participants' justifications (n = 14) and data products (n = 14) resulted in four unique groups (Figure 17). Cells within each cluster had similar combinations of justifications and data products (Figure 18). Cluster 1 contained 548 grid cells and was the largest cluster with cells identified within each subregion. This cluster can be described as an area of broad uses and needs, with the more common justifications and data products such as *Elevation*, *Habitat*, *Benthic Exploration*, and *Backscatter* being specified in these grid cells (Figure 18). Cluster 2 is an area of 27 grid cells spanning two specific areas: near Cape Hatteras, NC and in the Blake Plateau region offshore South Carolina. Within these cells participants selected *General Knowledge Gap*, *Fishing*, and *Video/Images* together.

Within the region offshore North Carolina between Cape Lookout and Cape Fear, previously identified with urgent data needs (many coins, Top 10%) by many participants, there was a unique cluster of 11 grid cells identified in the analysis. Here, Cluster 3, *Fishing*,

Habitat, *Video/Images*, and *Substrate Type* were selected together. Located near the 100 m bathymetric contour off Cape Hatteras, NC, Cluster 4 is a small area (11 grid cells) that overlaps with the Monitor National Marine Sanctuary (MNMS) boundary and is characterized by *Cultural/Historical Resources* and *General Knowledge Gap* justifications and *General Lakebed or Seafloor Map Products* (or *General*) data product needs.

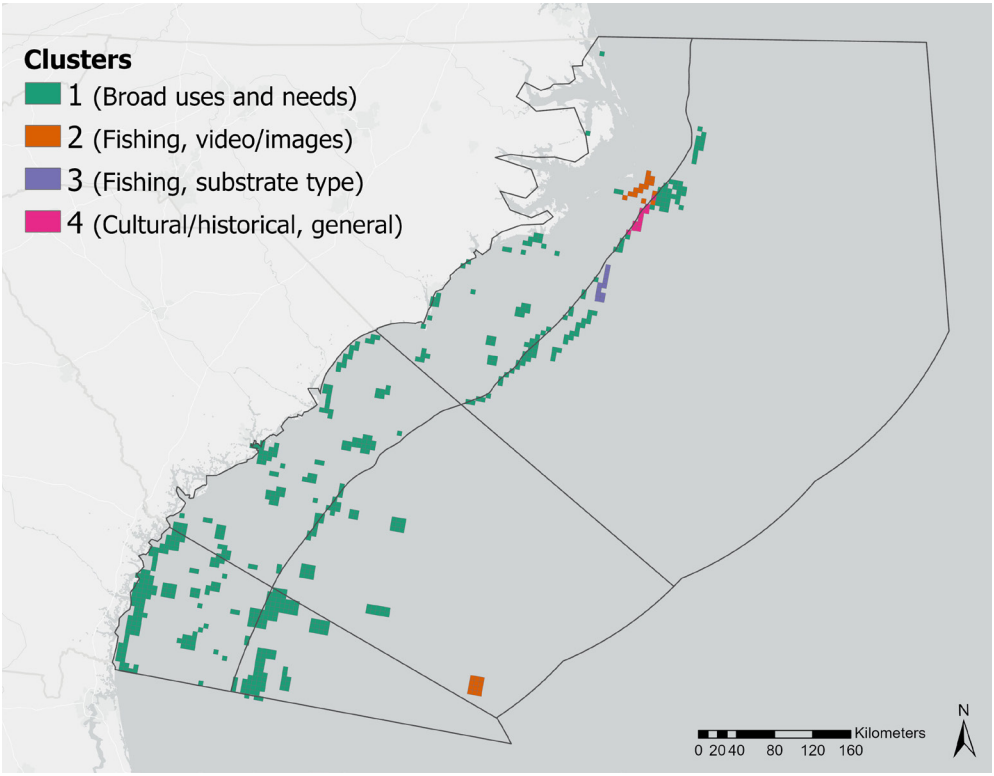


Figure 17. Justifications and data products were examined for regions of similarities. Using a hierarchical clustering approach, four clusters with similar attributes were identified.

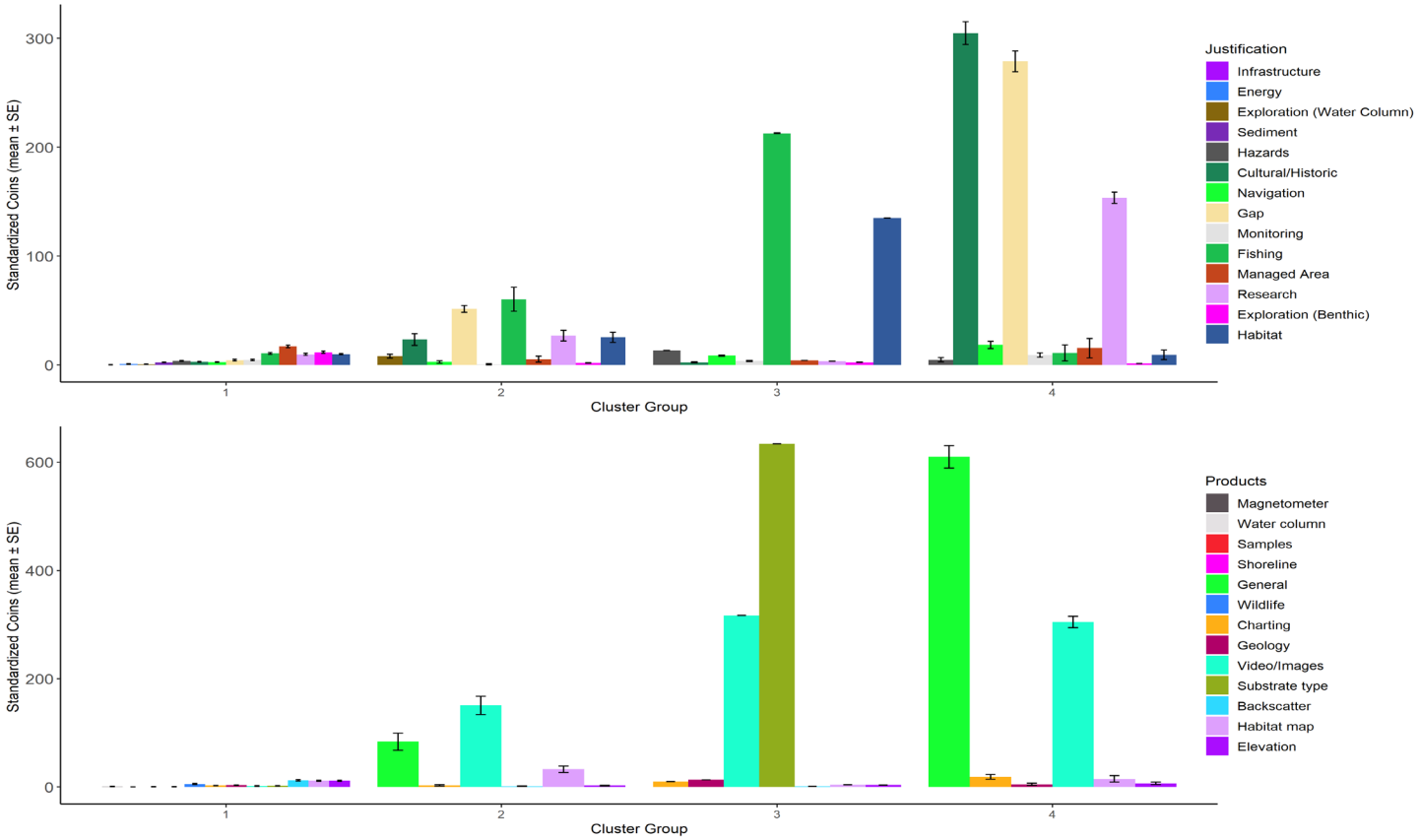


Figure 18. Bar graphs showing the average standardized coins and standard error for each justification (top) and product (bottom) from grid cells within each cluster. The x-axis indicates the cluster group number as shown in Figure 17. The number of grid cells within each cluster are as follows: Cluster 1 = 548 cells, Cluster 2 = 27 cells, Cluster 3 = 11 cells, and Cluster 4 = 11 cells.

Discussion

The purpose of this prioritization exercise was to gather needs for seafloor mapping data across a diverse group of stakeholders in the southeast U.S. Atlantic outer continental shelf. The analysis from this project identified several areas of overlap and mutual interest across multiple organizations and user groups. These priority areas serve as recommendations for where agencies might allocate or combine resources to accomplish multiple mission goals, not just for individual organizations, but for more end-users. Additional prioritization within those organizations, considering mission requirements and budgetary constraints will take precedence when allocating resources and conducting seafloor mapping missions. Future engagement among the stakeholders from this exercise will help ensure mapping is conducted efficiently with minimal duplication of effort.

> *"With significant storm impacts and changing conditions over the past several decades, maps are needed to inform proposed studies and to allow researchers to observe long term trends in changing community structure."*
>
> – SE Prioritization Participant

Highest priority regions

Data compilation from 25 participants who allocated 57,944 coins across 6,108 unique grid cells identified a number of high priority locations for future mapping, sampling, and surveying. These priority locations, ranked in the Top 10%, were distributed across the study region predominantly in depths less than 1,000 m (Figure 19). These results suggest that the highest priority areas are located on the continental shelf and rise to the coastline and into depths less than 10 m, roughly within three miles of the coastline. With the exception of two solitary grid cells in Albemarle Sound, NC, these areas of the highest priority within three miles of the coastline are broadly focused near ports and urban areas and were identified by several organizations as regions of data needs. Georgia coastal zone management groups identified cells within this area as high priority due to poorly characterized rocky reefs. Other users identified this coastal area as important for sand and sediment management, storm surge modeling and mitigation, and issues related to coastal resiliency. Specifically in North Carolina, increased calls for beach nourishment are requiring new assessments of available sand resources in the coastal ocean and outer continental shelf. High resolution digital elevation models contribute to important sediment transport and ocean circulation models that are used to predict storm surge risks.

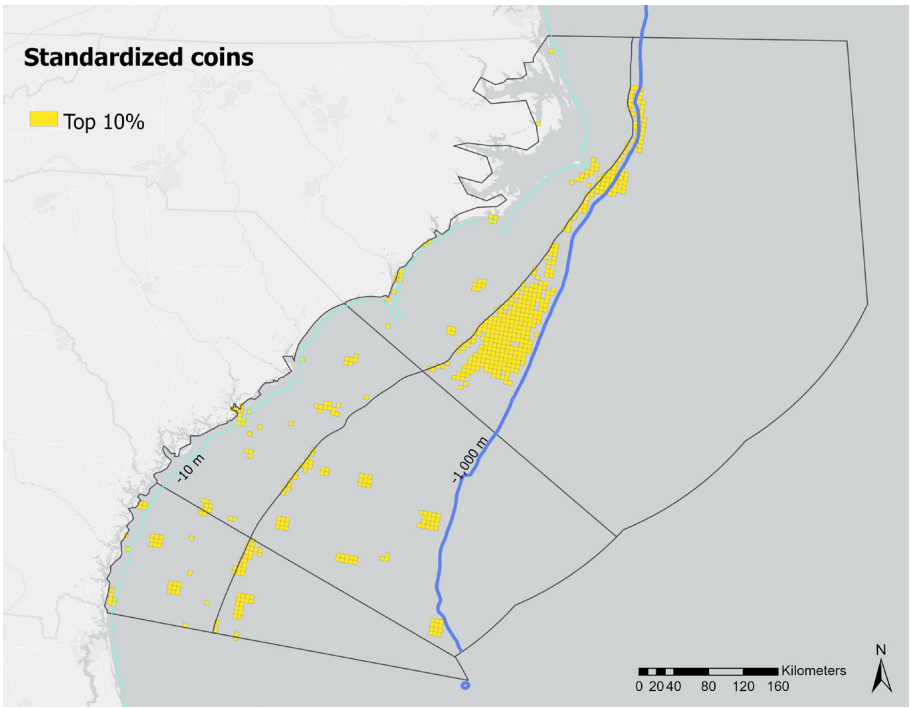


Figure 19. Grid cells identified as the highest priority locations for future data collection, these cells were within the Top 10% of standardized coins across the study region. Shown for reference are the 1,000-m and 10-m isobaths and dark grey boundaries identifying study subregions.

In North Carolina, these highest priority regions extend into estuarine waters. Two solitary grid cells within Albemarle Sound, NC overlap two NC Department of Environmental Quality designated reserves (Currituck Banks and Buckridge) and were designated as areas of data need by the National Estuarine Research Reserve (NERR), USGS, the PEW charitable trust, and U.S. Fish and

Wildlife Service. Pamlico Sound estuary in North Carolina was a region of interest for many participants as well (Figure 8), although coin allocations did not place it within the Top 10%. Existing data in these estuary regions are typically coarse (90 m resolution) and greater than 20 years old.

Offshore of Cape Hatteras, NC, near the continental shelf break (about 100-m isobath), were highlighted as areas of interest by both MNMS and NMFS. This region was also identified as a unique group of justifications and data products in the cluster analysis (Cluster 4, Figure 17). This region contains a concentration of emergent rocky reefs that serve as habitat for economically valuable snapper and grouper fishes. The region is also rich with wartime and maritime history with sunken shipwrecks of interest to the NOAA's Office of National Marine Sanctuaries (ONMS) Maritime Heritage Program.

> *"These prioritization outcomes will be very useful for the expansion plans for the Monitor National Marine Sanctuary"*
>
> – T. Casserley, NOAA MNMS

Many of the highest priority data need areas between 10 m and 1,000 m water depth are aligned with regions of known rocky reef habitat. For example, an area with emergent rock and habitats that support reef-associated fish and fisheries aligns with the large area of highest priority cells in the NC >100 m subregion along the 100-m isobath (western border of the subregion). Eight participants identified this area as important for *Charting*, *Elevation*, and *Navigation Safety*. In deeper waters, two areas of greatest interest were near the 1,000-m isobath offshore of South Carolina in the Blake Plateau region (Figure 19). This area has been the focus of resource managers and conservation organizations with deep coral communities at potential risk from bottom fishing activities. Habitat suitability models suggest these areas support deep coral communities, but mapping that validates these models is lacking, particularly near Blake Plateau.

> *"Predictive models show areas of deep corals, but new bathymetry and seafloor maps are critical to validate these models."*
>
> – L. Clarke, The Pew Charitable Trust

In addition to the large area along the western boundary of the NC >100 m subregion there were additional smaller regions in both South Carolina and Georgia along this shallow/deep boundary. All of these priority cells are on the deep side of the 100-m isobath, this is an area of rapid depth change and includes essential fish habitat but it is also possible that putting this subregion boundary line where we did and subdividing the applications contributed to the higher interest along this boundary line and the lack of interest on the landward side of the 100-m isobath. Participants were encouraged to provide priorities to all subregions where they had data needs, but only five of the 25 participating organizations assigned priorities to all six subregions. It is possible that there may be areas of interest on the landward side of the 100-m isobath but were outside the domain of the >100 m subregion respondents. While subregion division made responding to the application easier for participants focused on nearshore regions and also reduced the coins to allocate to a seemingly 'easier' amount (30% of grid cells), this study highlights some of the complications of subdividing the study are especially when subregions are significantly different in size. We suggest future prioritization studies consider these pros and cons prior to subdividing study areas.

Similar to the concentration of interest along the 100-m isobath, there was interest along the boundary lines of the GA >100 m subregion, although these were generally ranked mid to low (Figure 7). It is likely there is a continuation of interest within the South Carolina subregions as well as into Florida adjacent to this area. Participants may have identified data needs in only one subregion due to time constraints. Another feature worth discussing is the 'patchy' low to mid interest in the NC >100 m subregion. We believe this patchiness is an artifact of the prioritization application. Within the prioritization application, if a participant selects a large area while at a large map extent this type of 'patchy' cell selection can occur. Thus we suggest all the cells without coins in this region should be considered to be of similar priority.

Encouraging participation by diverse user groups

NCCOS has led or facilitated several seafloor mapping prioritization exercises and each successive attempt has been improved using feedback from participant experiences. Key elements to a successful prioritization outcome began with a technical team to ensure stakeholders and participants were engaged. One of the greatest challenges in identifying key stakeholders is understanding the organizational structure within federal and state agencies and ensuring the representative who enters in the organizational priorities is speaking on behalf of that level of the organization. Similarly, academic institutions may be organized by science departments, whereas faculty particularly involved in seafloor mapping may be part of interdisciplinary laboratories or centers. It was important to convey to the participant the expectations and what level of organization they are intended to represent.

Hosting webinars and providing robust tutorials/manuals were critical to the efficient use of the prioritization application by participants and provided consistent communication on the study's purpose and methods. These resources further aided in minimizing errors in data during quality assessments. Examples of the communication and training materials provided to participants are in Appendix E.

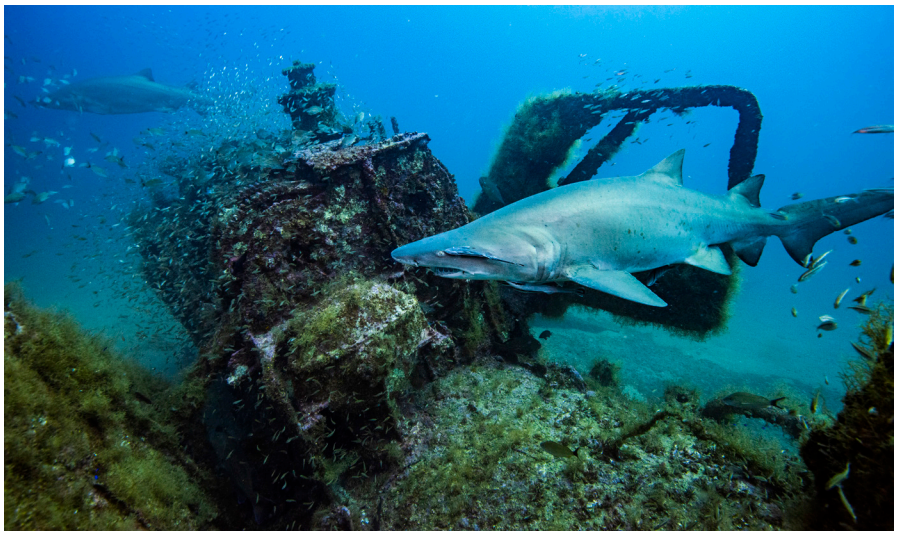
> *"This process was easy to follow with very clear instructions. It is an excellent method that provides quantifiable needs across users (using the "coins" method really was helpful in our own prioritization of research target areas)."*
>
> -W. Sassarossi, NOAA MNMS

A primary barrier to participation in this study was the perceived time required to provide mapping priorities. Participants' willingness to contribute to this study can be grouped into three general categories: experienced participants, new participants, and uncertain participants. Participants who engaged in prioritization efforts in other regions were almost universally interested in participating and required little or no further assistance or reminders. This highlights the importance of keeping the application interface similar across study regions and the ease of use of the prioritization application once a user is familiarized with the interface. A few new participants, those with no prior prioritization experience, did require additional assistance beyond the previously mentioned tutorials and webinar. We easily worked through problem areas with these individuals through phone calls and online screen sharing. The most common problem areas were related to login/access to the NOAA geoplatform and assigning justifications and data products. We also followed up with organizations that did not respond using emails and phone calls. After more detailed discussions on the importance of this exercise, some organizations then submitted seafloor mapping priorities. However, in some cases, organizations were unable to participate due to staffing limitations. We recognize this effort falls outside the standard responsibilities of many staff and we're working to better understand these barriers and reduce them. For example, we aligned this prioritization effort with the national prioritization effort to use respondents' time efficiently. By prioritizing their needs for the southeast U.S. region once and then using it multiple times we hope organizations recognize the small time required to share their priorities, which can result in a potential benefit (e.g., funding and/or ship time) for multiple stakeholders.

Sharing prioritization outcomes and informing mapping efforts

The outcomes from this exercise are available through the NOAA Geoplatform as a webservice for agencies to incorporate layers into their mapping planning (https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=04cdd2a68c4f427f893f2042f326dc80). The layers are also available in NOAA's IOCM U.S. Mapping Coordination website in the Seasketch application (https://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4). This site also tracks progress of federal and some non-federal mapping efforts around the nation so other agencies can reduce potential duplication of effort. NOAA's IOCM plan to host outcomes from these prioritizations as well as updates on mapping efforts on their website in the coming months.

The priorities identified in this exercise have already improved planning and resource allocation by conducting surveys in specific regions for immediate use by stakeholders. Indeed, as this report is published, outcomes are being incorporated into planning for new surveys by NOAA in 2020 and 2021. Specifically, areas off Georgia and offshore over Blake Plateau were part of a joint mapping mission with NOAA ONMS, OCS, and Ocean Exploration and Research in summer 2020. Additional mapping campaigns are using outcomes from this exercise to continue to fill gaps in seafloor mapping data, particularly in the outer shelf and deep slope areas off South Carolina.



Sand tiger shark on the ex-USS Tarpon. Credit: Tane Casserley, NOAA MNMS

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Appendices

Appendix A. List of participant organizations.

The table below identifies the participating organizations as well as the regions in which they identified seafloor mapping priorities.

Table A.1. List of participating organizations and identified priority regions.

Organization	Type	GA <100 m	GA >100 m	SC <100 m	SC >100 m	NC <100 m	NC >100 m	# Regions Responded
Coastal Carolina University	Academic			X				1
Duke University	Academic						X	1
University of Georgia	Academic	X	X					2
Bureau of Ocean and Energy Management (BOEM) – renewable resources	Federal			X		X		2
BOEM – minerals	Federal	X		X		X		3
U.S. Geologic Survey (USGS)	Federal	X	X	X	X	X	X	6
Environmental Protection Agency (EPA)	Federal	X		X		X		3
U.S. Navy	Federal	X		X		X		3
NOAA/Integrated Ocean Observing System (IOOS)/Southeast Coastal Ocean Observing Regional Association (SECOORA)	Federal	X		X		X	X	4
NOAA/National Geodetic Survey (NGS)	Federal			X		X		2
NOAA/Office of National Marine Sanctuaries (ONMS)	Federal	X		X		X	X	3
NOAA/National Centers for Coastal Ocean Science (NCCOS)	Federal		X	X	X	X	X	5
NOAA/NMFS/Southeast Regional Office (SERO)	Federal	X	X	X		X	X	5
NOAA/Ocean Exploration & Research (OER)	Federal		X		X		X	3
NOAA/Office of Coast Survey (OCS)	Federal	X		X		X	X	4
NOAA/Office of Response and Restoration	Federal	X	X	X	X	X	X	6
U.S. Coast Guard	Federal			X		X		2
U.S. Fish and Wildlife (USFWS)	Federal					X		1
PEW Charitable Trusts	Mixed		X		X	X	X	4
South Atlantic Fisheries Management Council	Mixed	X	X	X	X	X	X	6
Southeast Reef Fish Survey	Mixed	X	X	X	X	X	X	6
The Nature Conservancy (TNC)	Mixed	X	X	X	X	X	X	6
National Estuarine Research Reserve (NERR) – Georgia	State	X						1
NERR – North Carolina	State					X		1
State Fisheries –North Carolina	State					X		1

**The following are additional organizations who were invited to participate but were unable to submit seafloor mapping priorities: Academic (College of Charleston; East Carolina University; North Carolina State University; and University of North Carolina), Federal (DOI/Bureau of Ocean and Energy Management –strategic resources division; NOAA/NMFS/Office of Habitat Conservation/Deep Coral; National Park Service for all three states; NOAA/NMFS/Restoration Center; NOAA/NMFS/Southeast Fisheries Science Center; U.S. Army Corps. of Engineers), State (Coastal Zone Management for all three states; South Carolina & Georgia Division of Marine Fisheries; National States Geographic Information Council for all three states; South Carolina National Estuarine Research Reserve).*

Appendix B. Maps by participant type

These maps highlight variations of participation data by participant type. Four different participant type categories were used to explore the data: federal agencies/programs, state agencies, academic institutions, and mixed. Mixed participants included groups like NGOs, conservation groups, or from programs that are collaborations of the other three participant types (e.g., Southeast Reef Fish Survey (SERFS), which is made up of a combination of state, federal, and academic organizations).

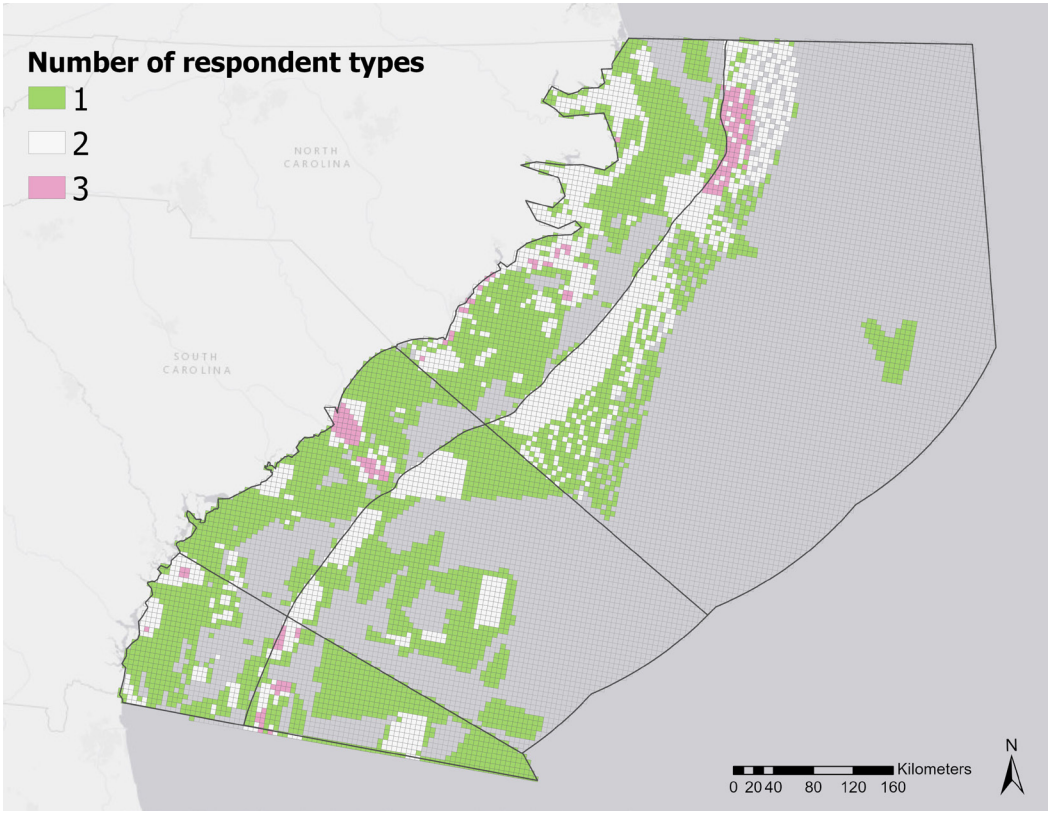


Figure B.1. Count of type of participants (federal, academic, state, and mixed [NGOs, conservation organizations, etc.]), across the study area.

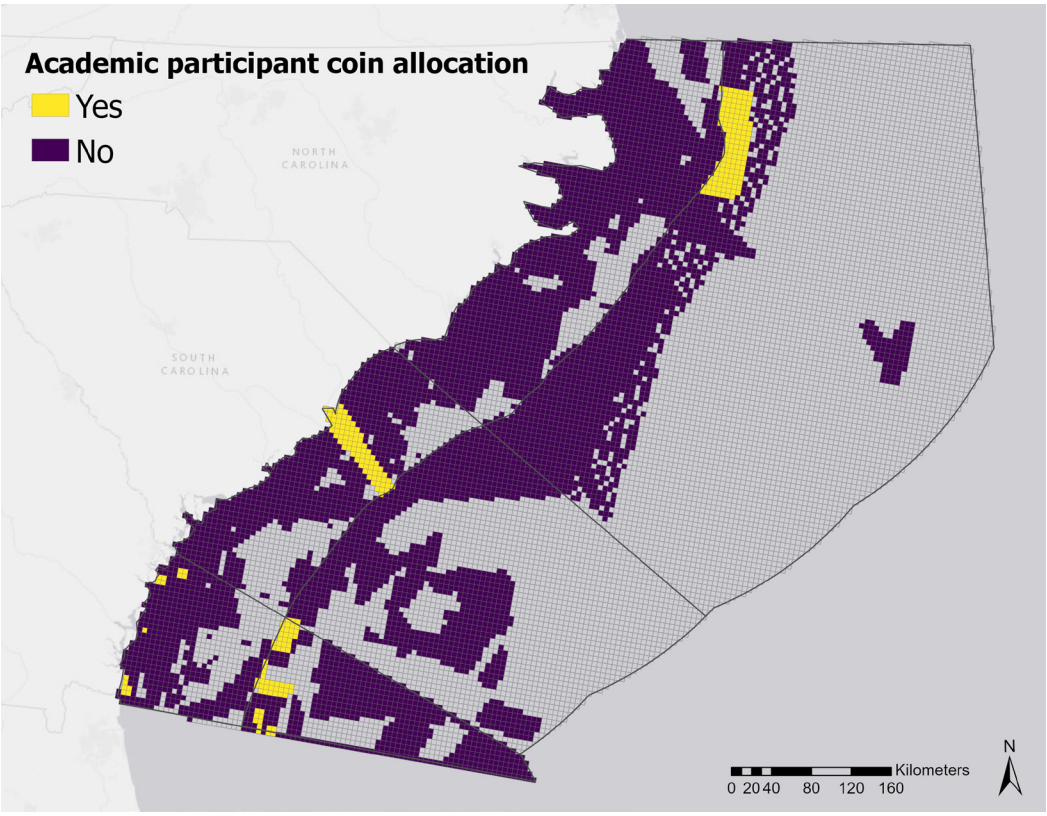


Figure B.2. The location of the responses made by academic participants across the study area (yellow). Purple grids indicate areas where other types of participants (e.g., state, federal, and mixed) allocated coins.

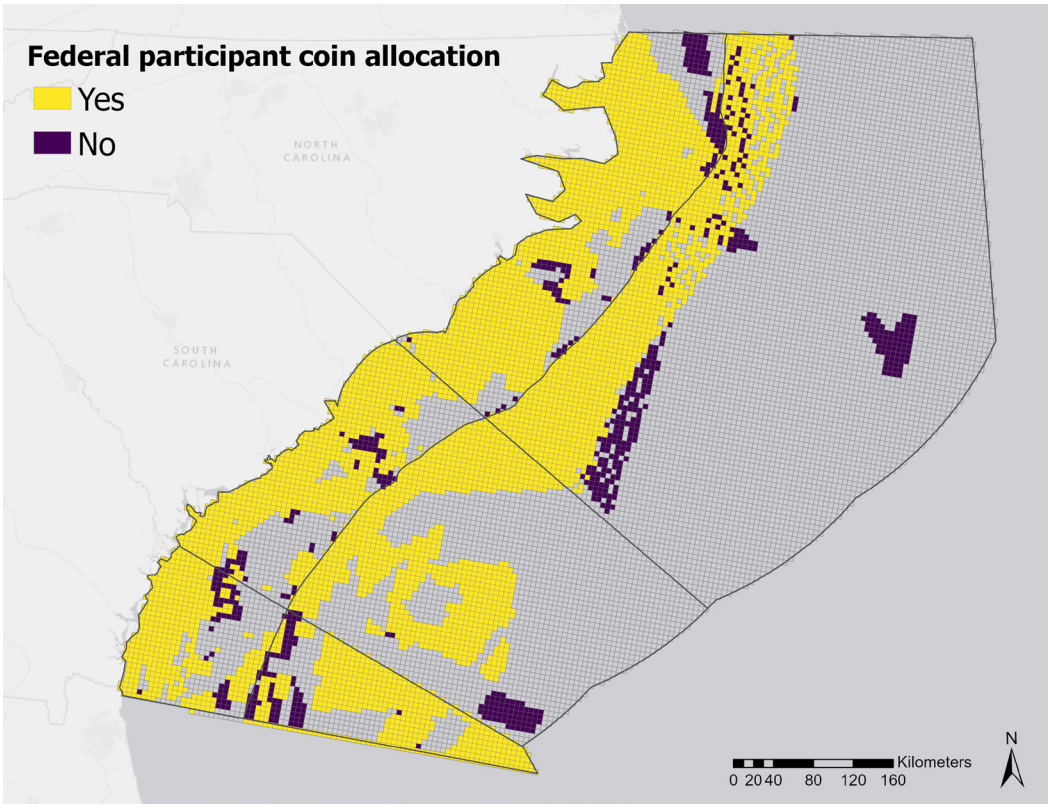


Figure B.3 The location of the responses made by federal participants across the study area (yellow). Purple grids indicate areas where other types of participants (e.g., state, academic, and mixed) allocated coins.

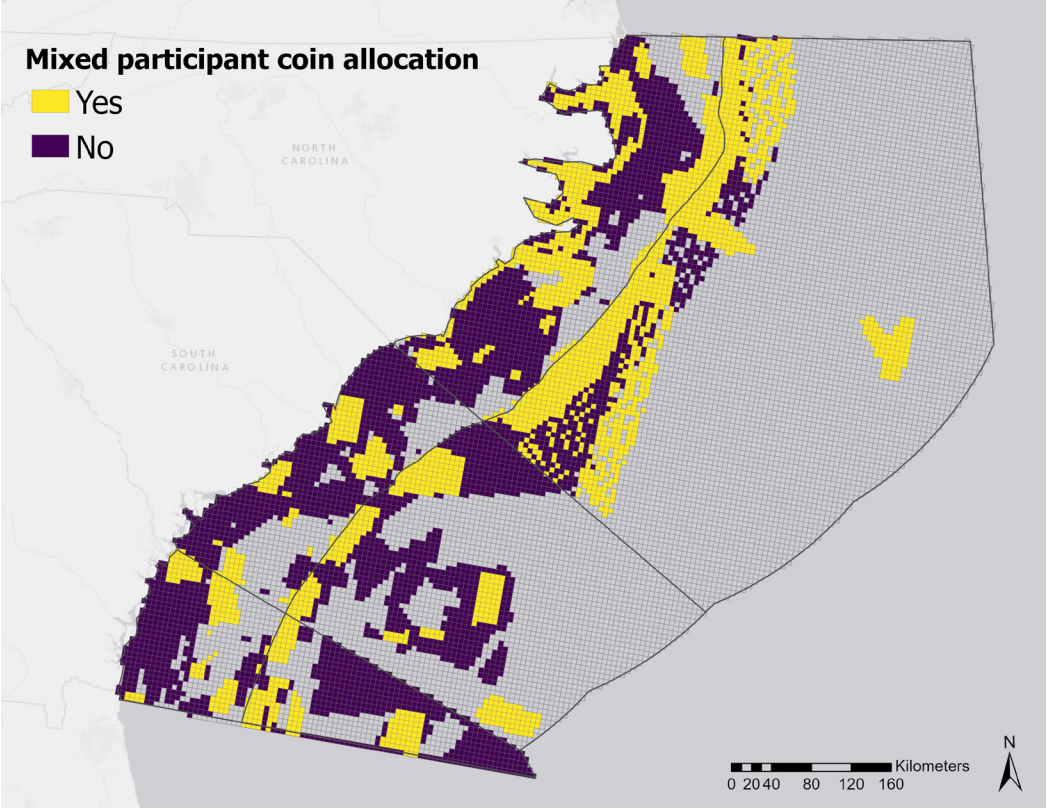


Figure B.4. The location of the responses made by mixed participants (NGOs, conservation organizations, etc.) across the study area (yellow). Purple grids indicate areas where other types of participants (e.g., state, academic, and federal) allocated coins.

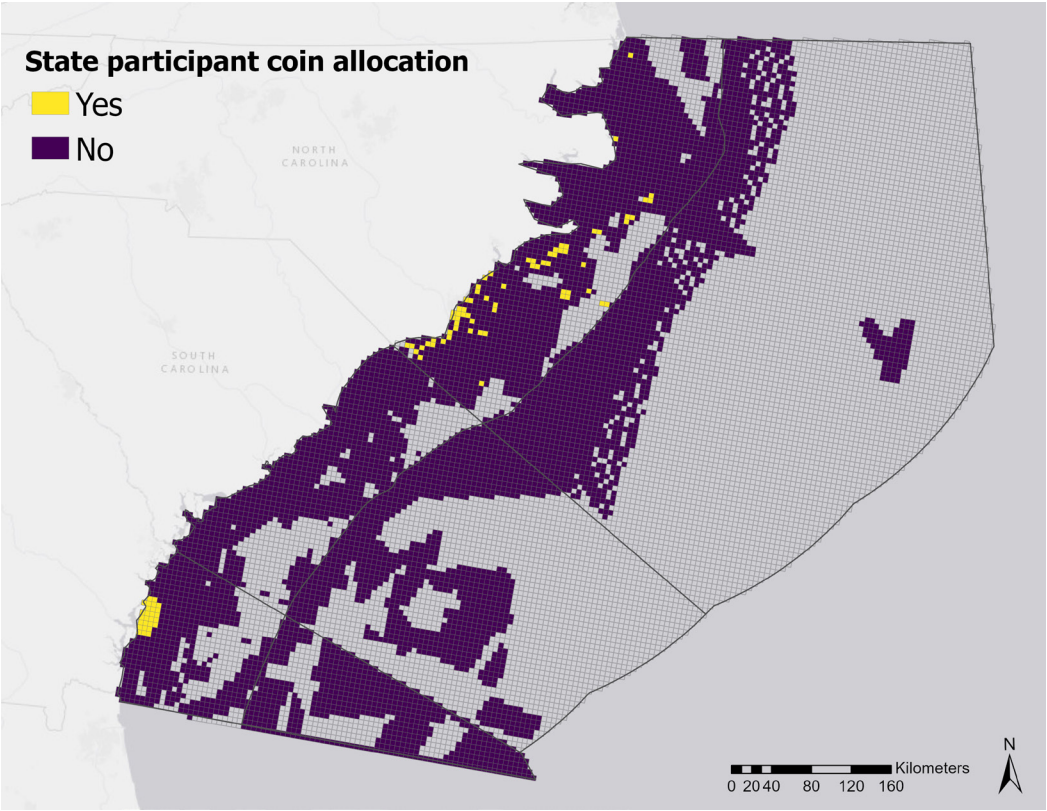


Figure B.5. The location of the responses made by state participants across the study area (yellow). Purple grids indicate areas where other types of participants (e.g., federal, academic, and mixed) had allocated coins.

Appendix C. Maps for each justification

These maps identify normalized and ranked coins for each justification used within this study. A complete list of justifications and definitions is within Table 2.

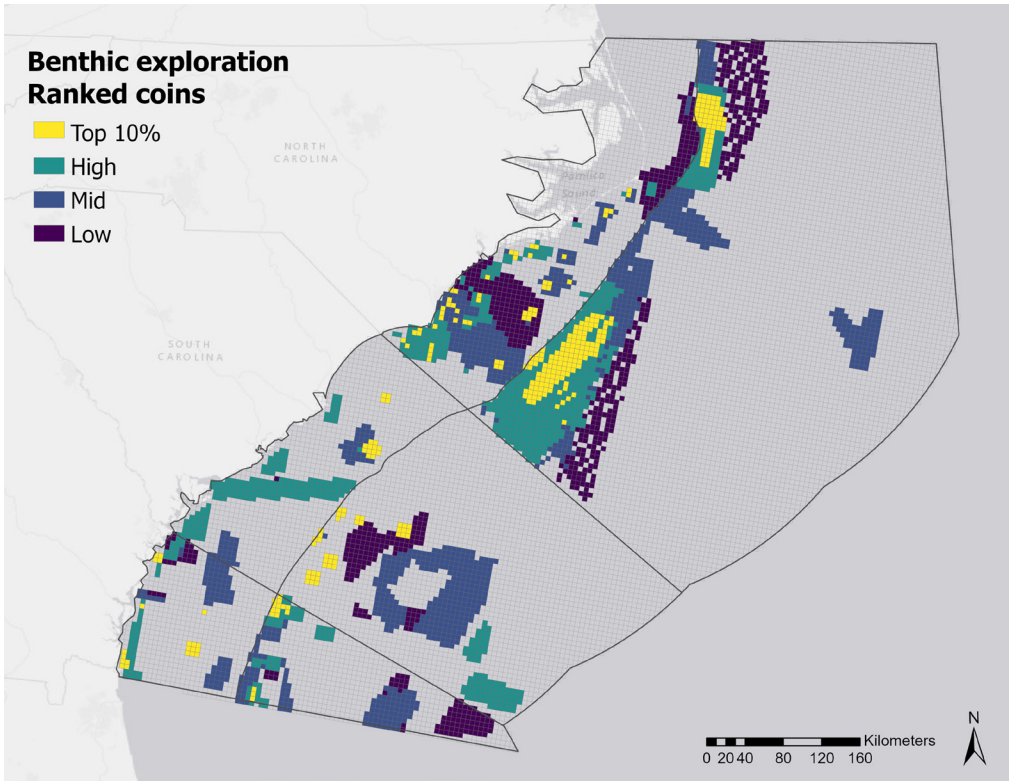


Figure C.1. *Benthic Exploration* standardized and ranked coins across the study region, where targeted benthic exploration is for seafloor characterization. Grey boundaries identify study subregions.

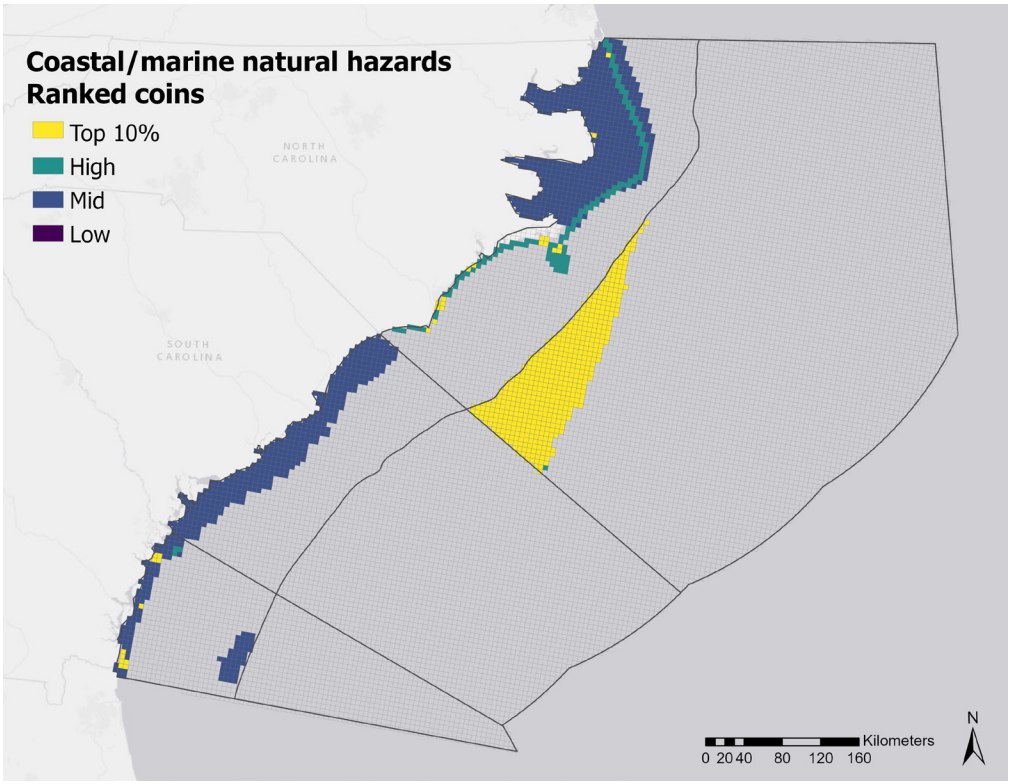


Figure C.2. *Coastal/Marine Natural Hazards* standardized and ranked coins across the study region, where coastal/marine natural hazards refers to the detection, forecast and management of coastal and marine hazards, including weather/storm surge, flooding, tsunamis, earthquakes, geologic faults. Grey boundaries identify study subregions.

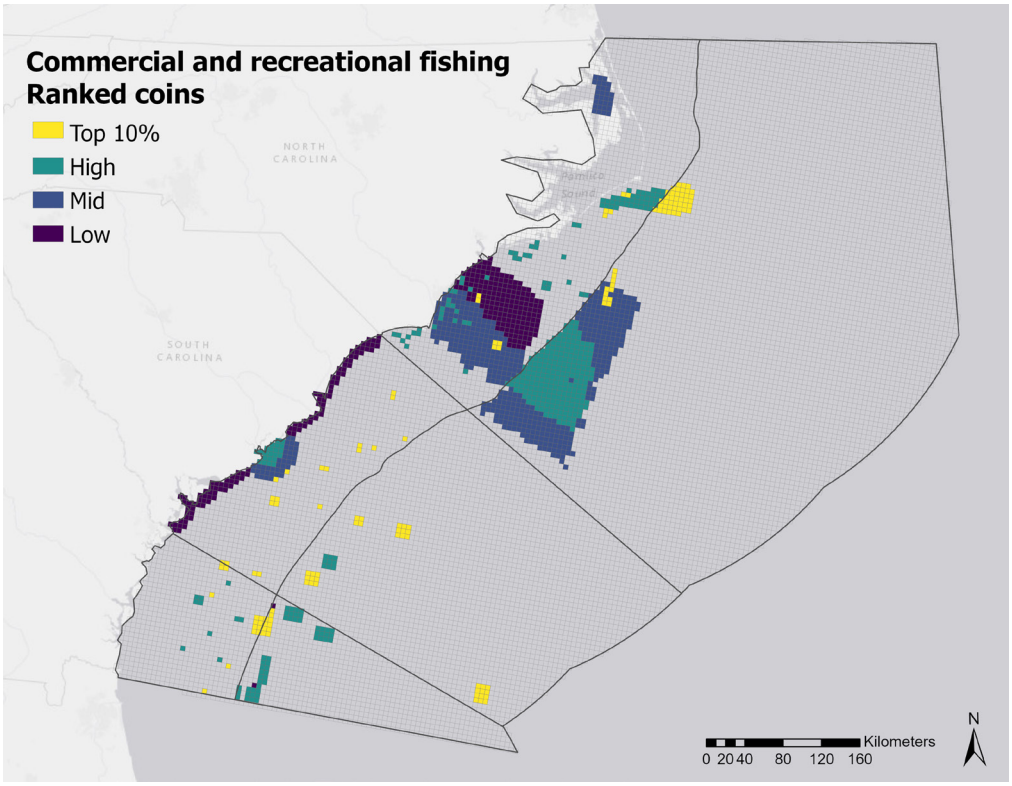


Figure C.3. *Commercial and Recreational Fishing* standardized and ranked coins across the study region, which includes fisheries management and regulation (e.g., commercial/recreational fishing locations, aquaculture siting, fisheries sampling stations, high bycatch areas, sport/charter fishing). Grey boundaries identify study subregions.

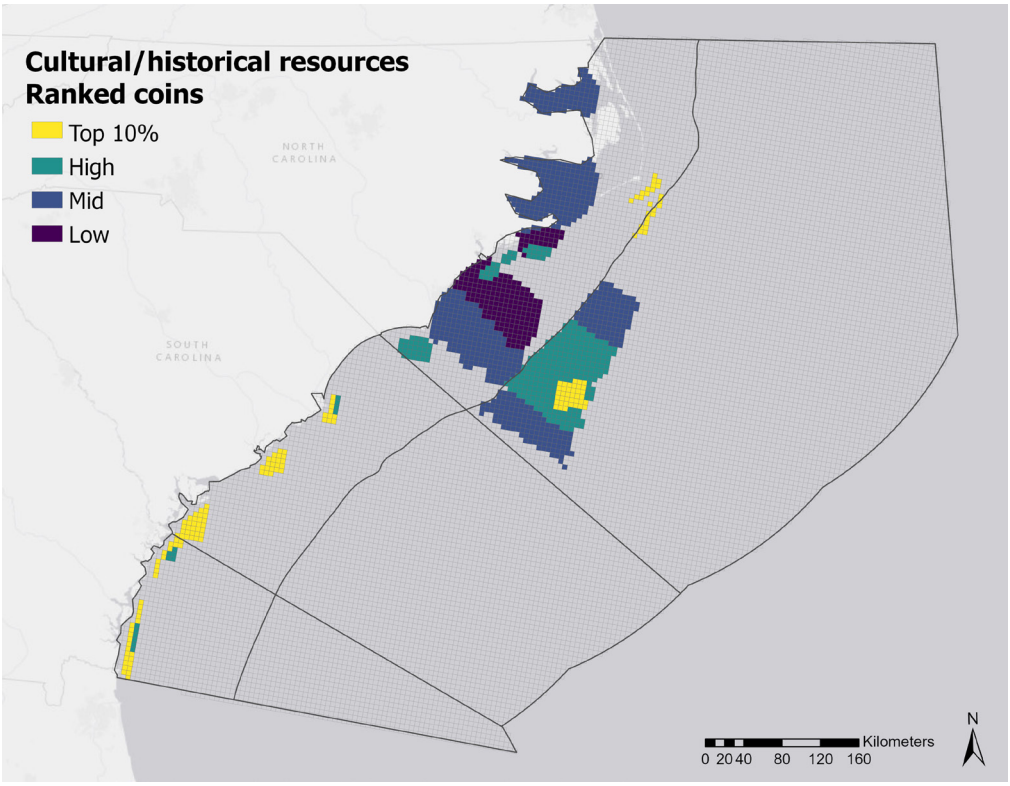


Figure C.4. *Cultural/Historical Resources* standardized and ranked coins across the study region, where cultural/historical resources include shipwrecks, tribal use areas and other archaeological/cultural/historic resources. Grey boundaries identify study subregions.

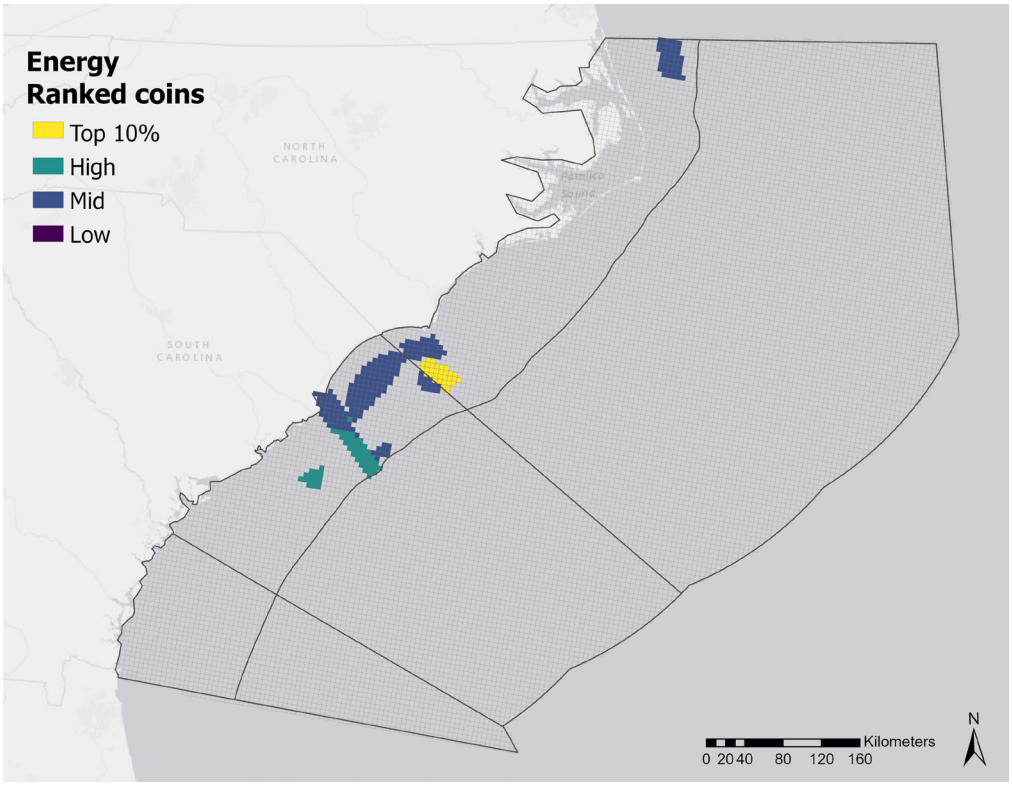


Figure C.5. *Energy* standardized and ranked coins across the study region, where energy interests includes energy permitting, siting, management, transmission (e.g. oil/natural gas platforms, wind turbine, tidal/hydropower, cables, pipelines, etc.). Grey boundaries identify study subregions.

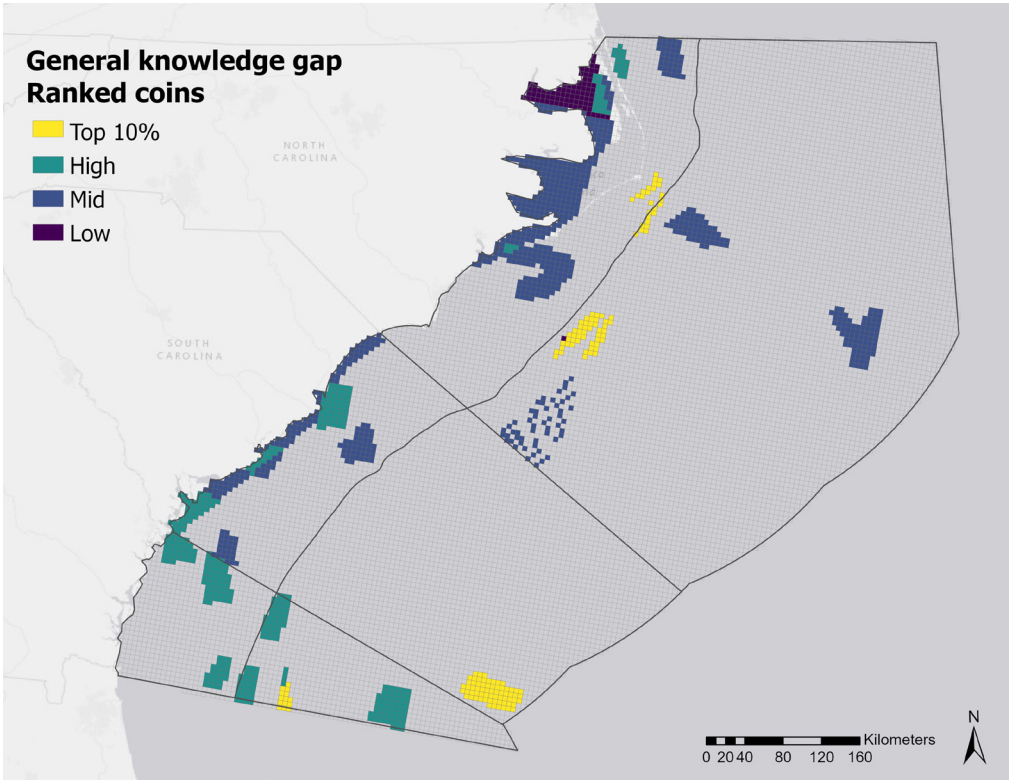


Figure C.6. *General Knowledge Gap* standardized and ranked coins across the study region. Grey boundaries identify study subregions.

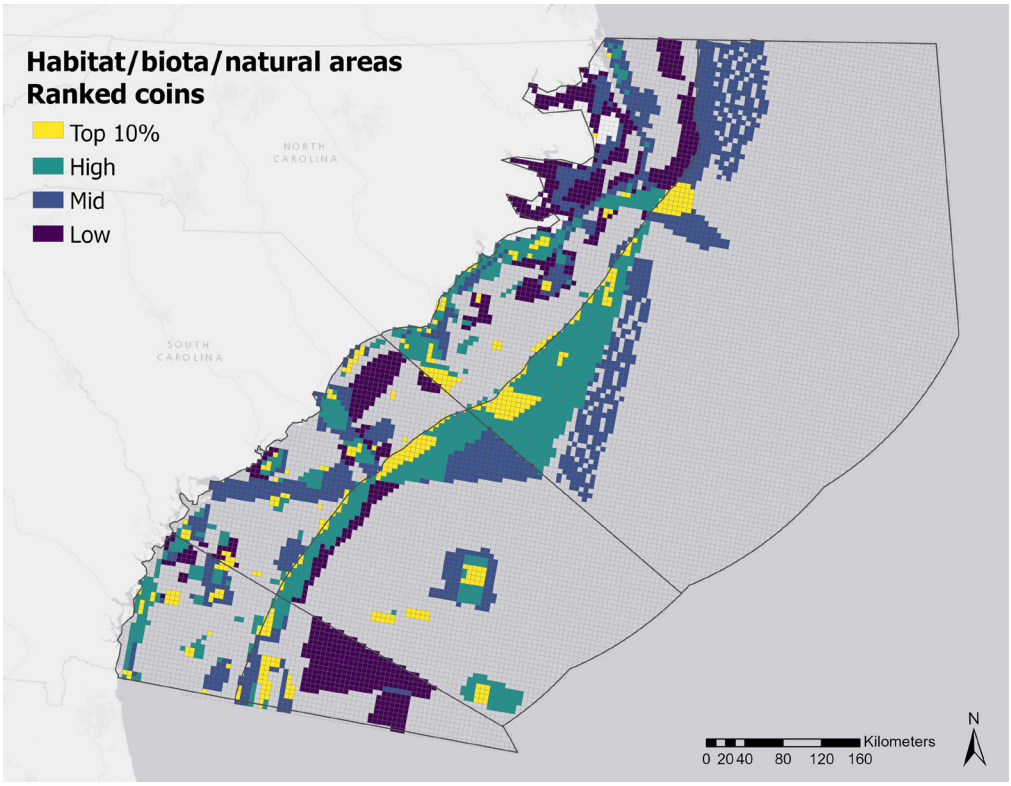


Figure C.7. *Habitat/Biota/Natural Area* standardized and ranked coins across the study region, where habitat includes Essential Fish Habitat, Critical Habitat (for marine mammals and other protected species), spawning/nursery areas, feeding grounds, key benthic habitats, habitat mapping, coastal geomorphology and other ecologically significant areas. Grey boundaries identify study subregions.

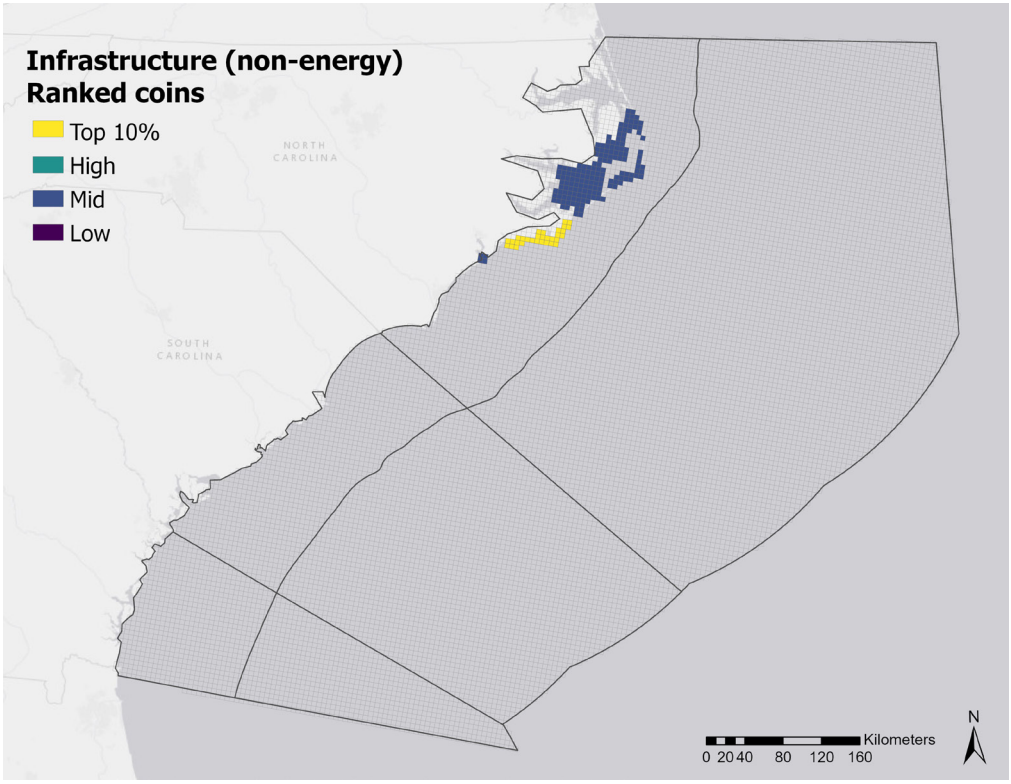


Figure C.8. *Infrastructure* (non-energy) standardized and ranked coins across the study region, which includes existing or potential infrastructure development, referring to port facilities, bridges, telecommunication cables, roads, etc. Grey boundaries identify study subregions.

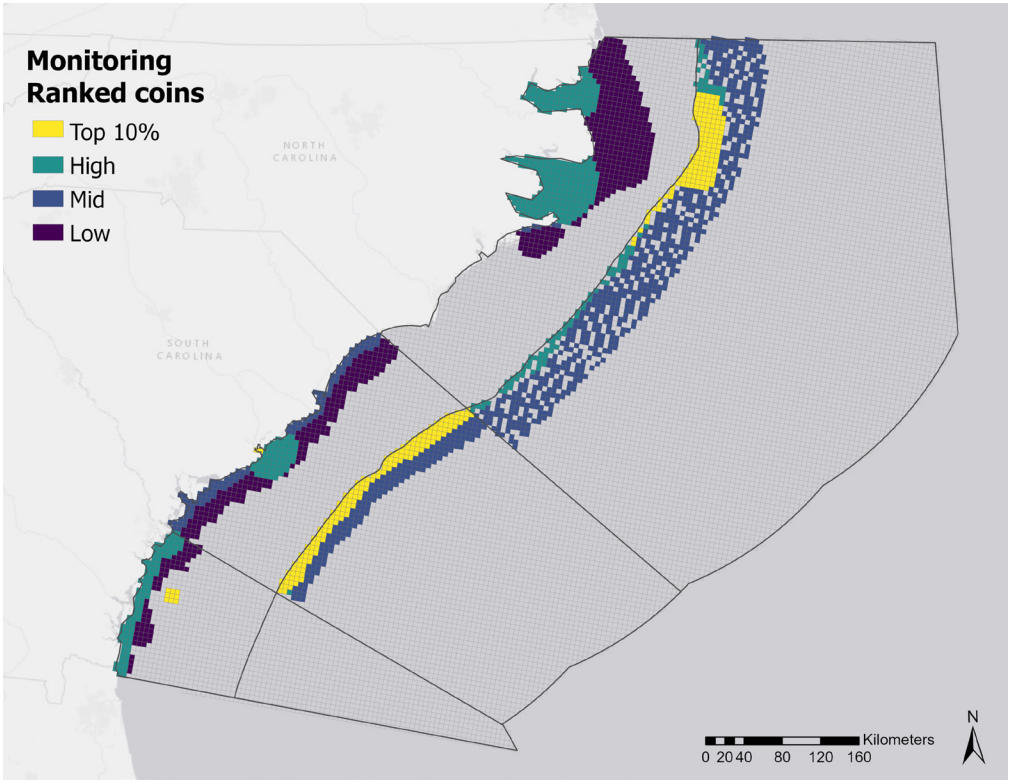


Figure C.9. *Monitoring* standardized and ranked coins across the study region, including monitoring of a specific study area for scientific or other purposes (e.g., coral health monitoring). Grey boundaries identify study subregions.

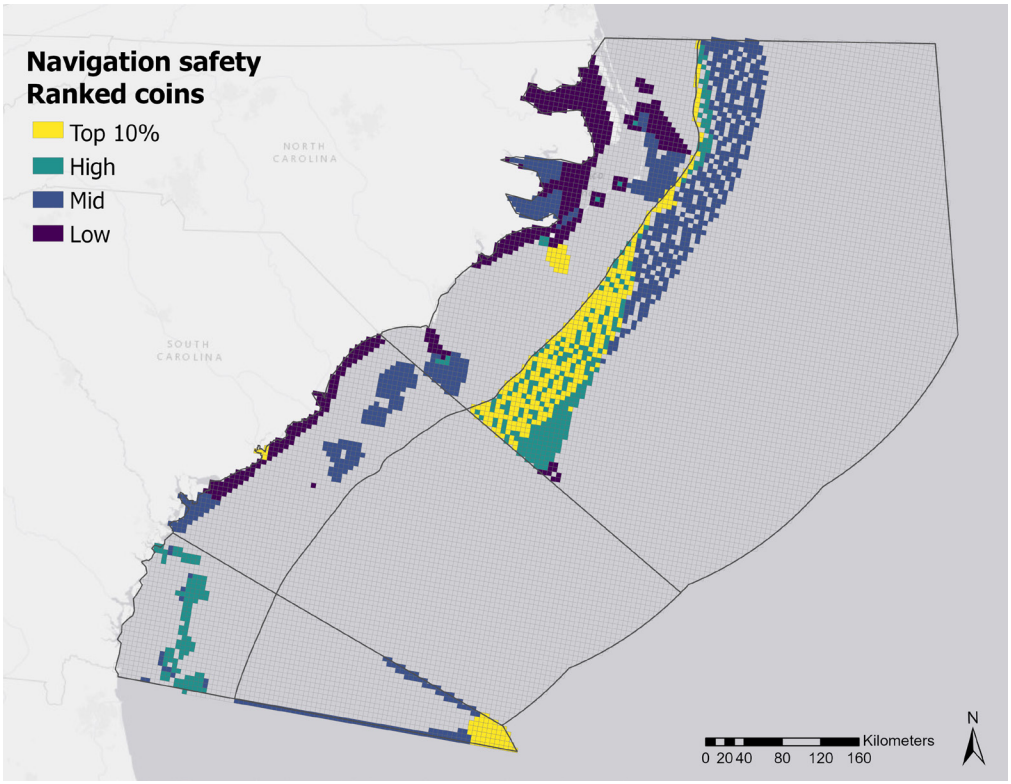


Figure C.10. *Navigation Safety* standardized and ranked coins across the study region. Navigation safety includes shipping lanes, ferry routes, harbors/approaches, port facilities and marinas; includes detection of hazards to navigation (rocks, wrecks, other obstructions). Grey boundaries identify study subregions.

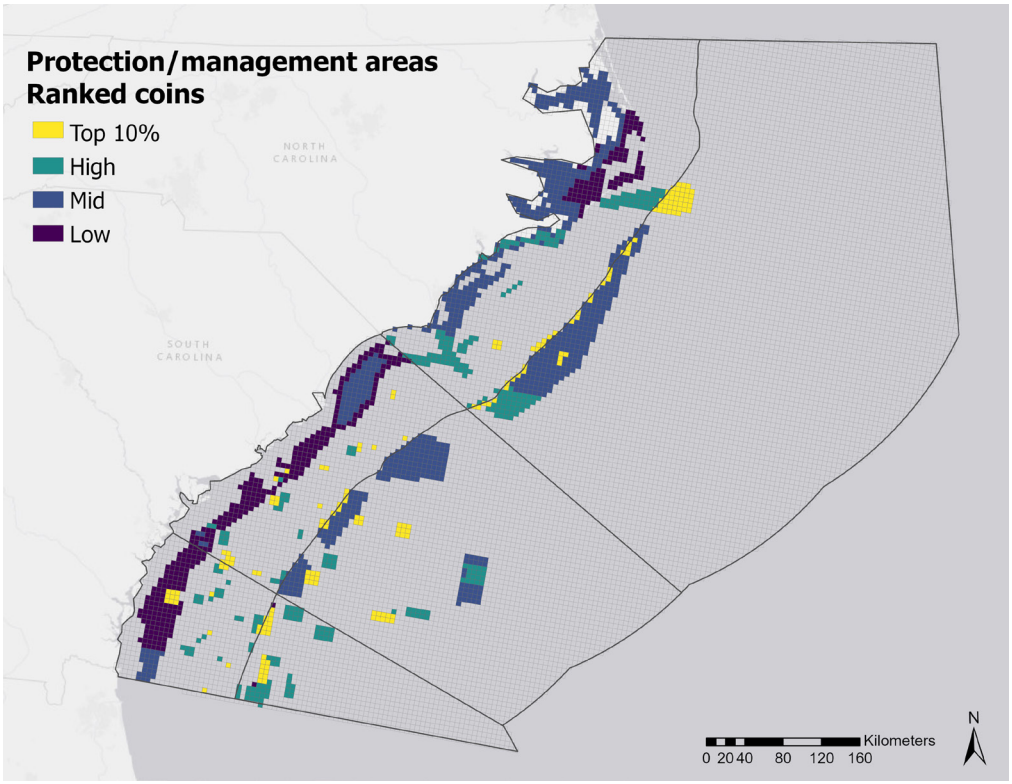


Figure C.11. *Protection/Management Areas* standardized and ranked coins across the study region, where protection/management areas include marine protected areas, sanctuaries, conservation areas, restoration sites, and dynamic management areas for marine mammals and other protected species. Grey boundaries identify study subregions.

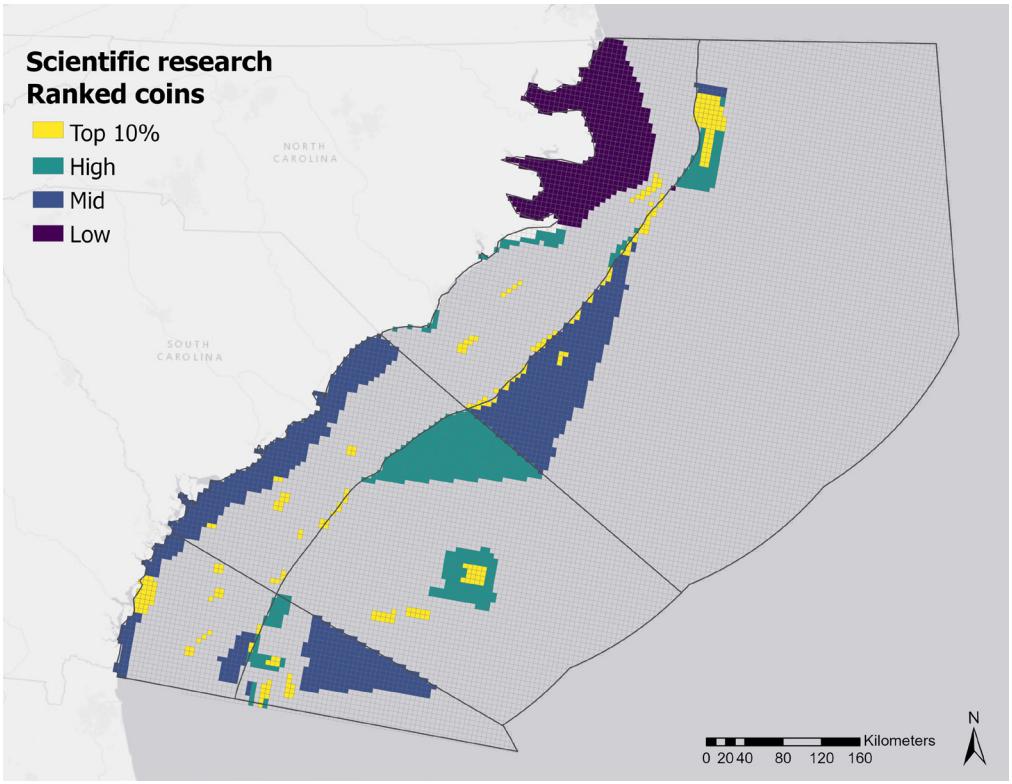


Figure C.12. Scientific research standardized and ranked coins across the study region, referring to general scientific research, not including monitoring of a specific area. Grey boundaries identify study subregions.

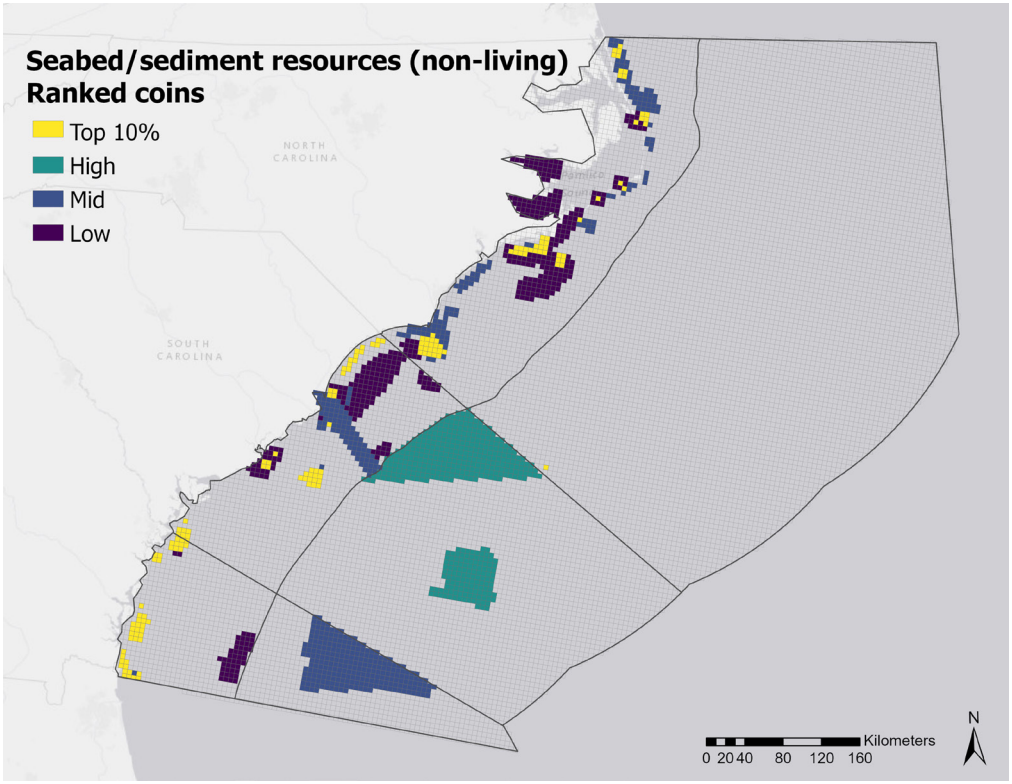


Figure C.13. *Seabed/Sediment Resources* (non-living) standardized and ranked coins across the study region, where seabed/sediment resources includes critical minerals and other geologic resources; sediment movement and management needs, such as sand/gravel assessments, managing beach erosion/renourishment or sediment buildups in channels and ports. Grey boundaries identify study subregions.

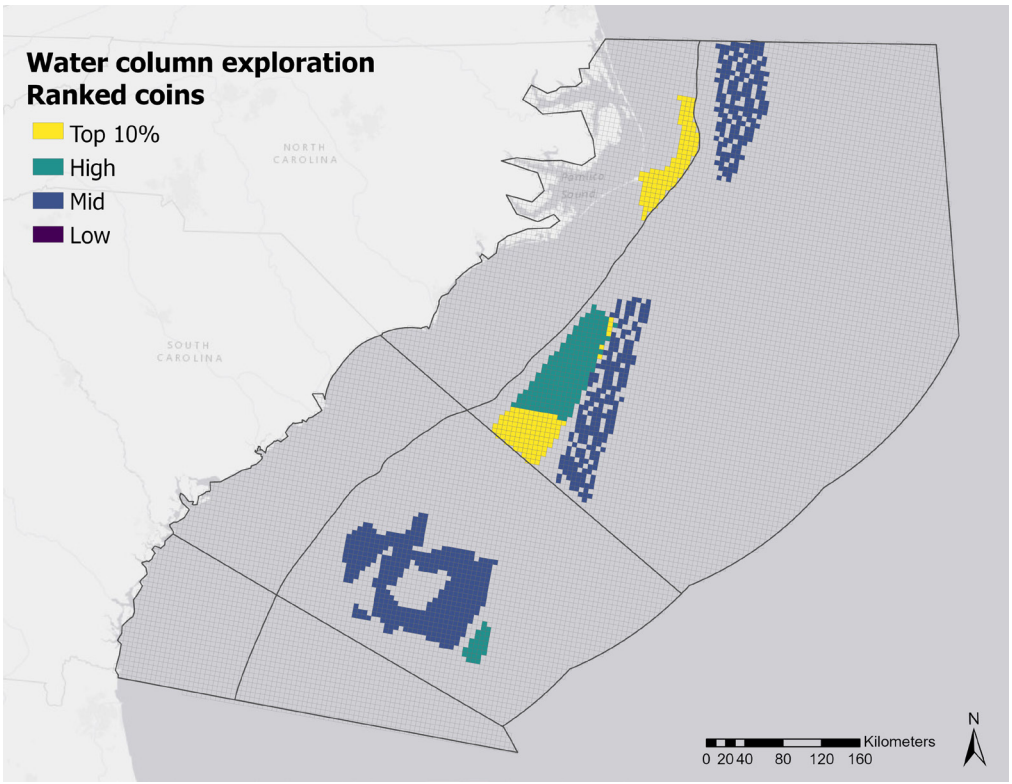


Figure C.14. *Water Column Exploration* standardized and ranked coins across the study region, including targeted *Water Column Exploration* for water column characterization (e.g., upwelling, seeps). Grey boundaries identify study subregions.

Appendix D. Maps for each data product

These maps identify normalized and ranked coins for each data product used within this study. A complete list of products and definitions is within Table 3

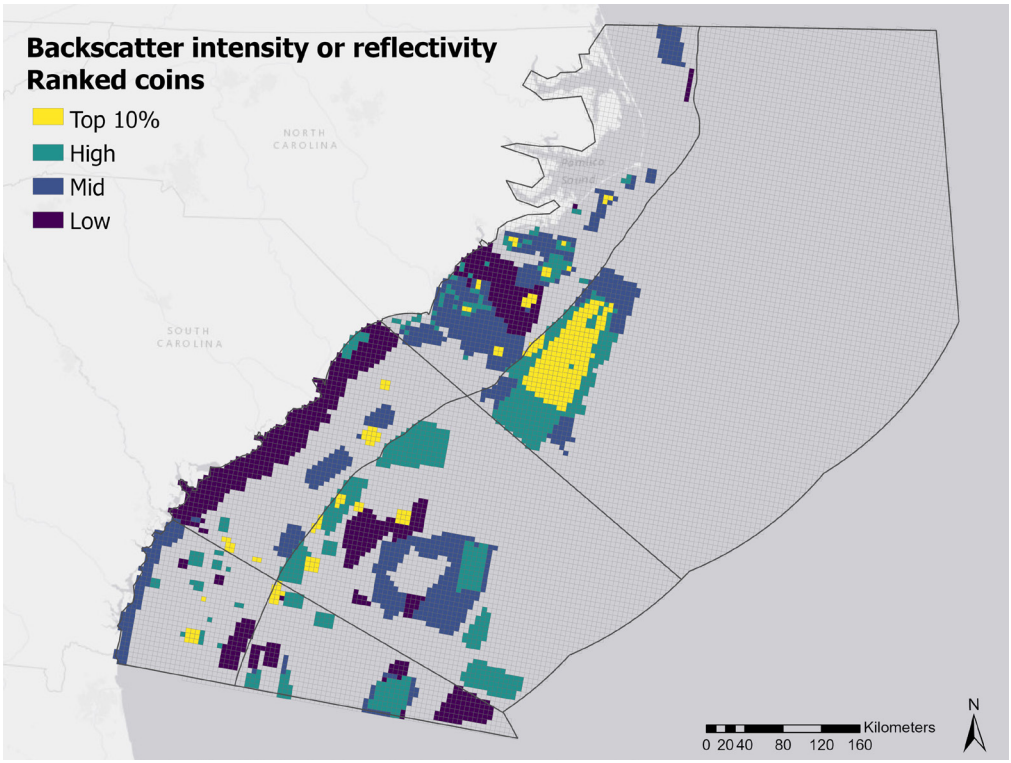


Figure D.1. *Backscatter Intensity or Reflectivity* standardized and ranked coins across the study region, where backscatter products are defined as a gray-scale raster of the strength of the acoustic echo returned or light reflectance from the seabed for location and distribution of different substrate types and habitat that is collected simultaneously with acoustic bathymetry. Grey boundaries identify study subregions.

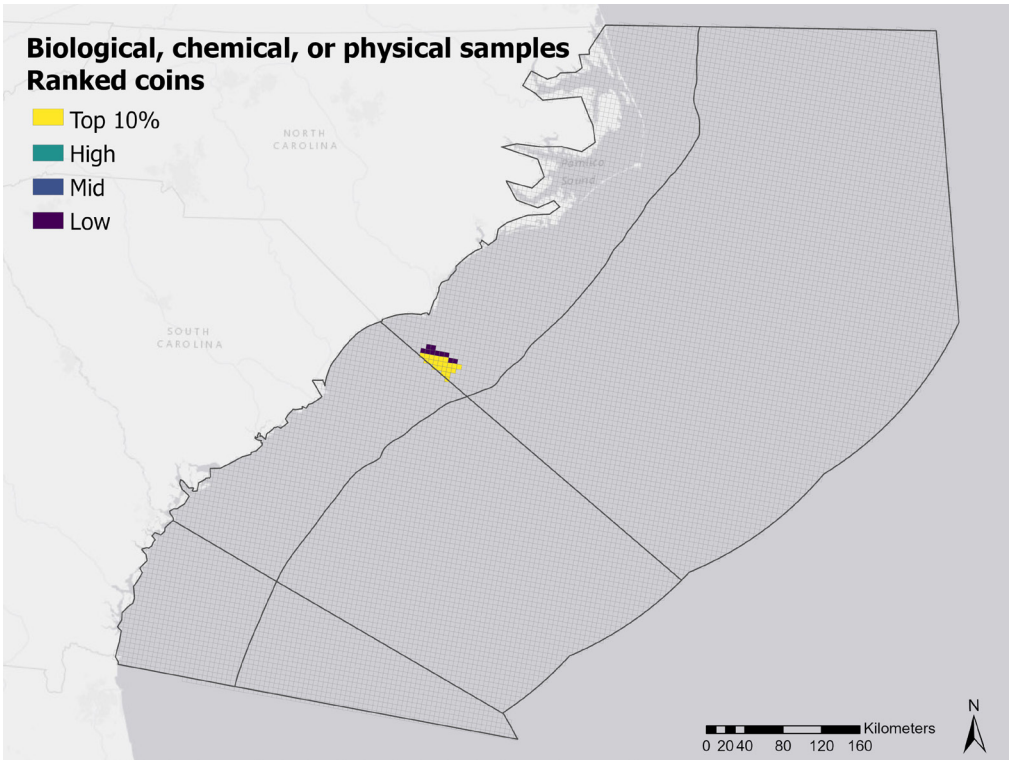


Figure D.2. *Biological, Chemical, or Physical Samples* standardized and ranked coins across the study region, where samples are collected using divers, AUVs, ROVs, cores, grabs, CTDs, rosettes, etc. Grey boundaries identify study subregions.

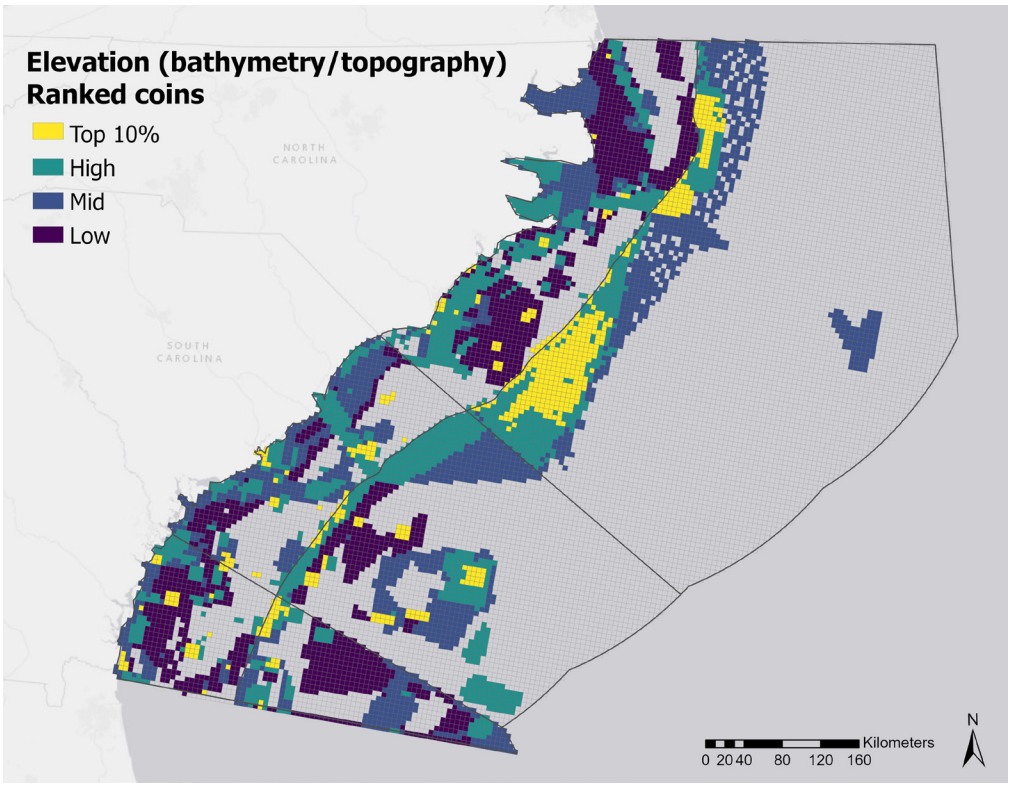


Figure D.3. *Elevation* standardized and ranked coins across the study region, where elevation products are collected using multibeam echosounder (MBES) sonar, airborne lidar or other methods and processed into bathymetric grids or Digital Elevation Models for a wide variety of downstream products, including modeling (e.g., marine/coastal/ecological/numerical modeling). Grey boundaries identify study subregions.

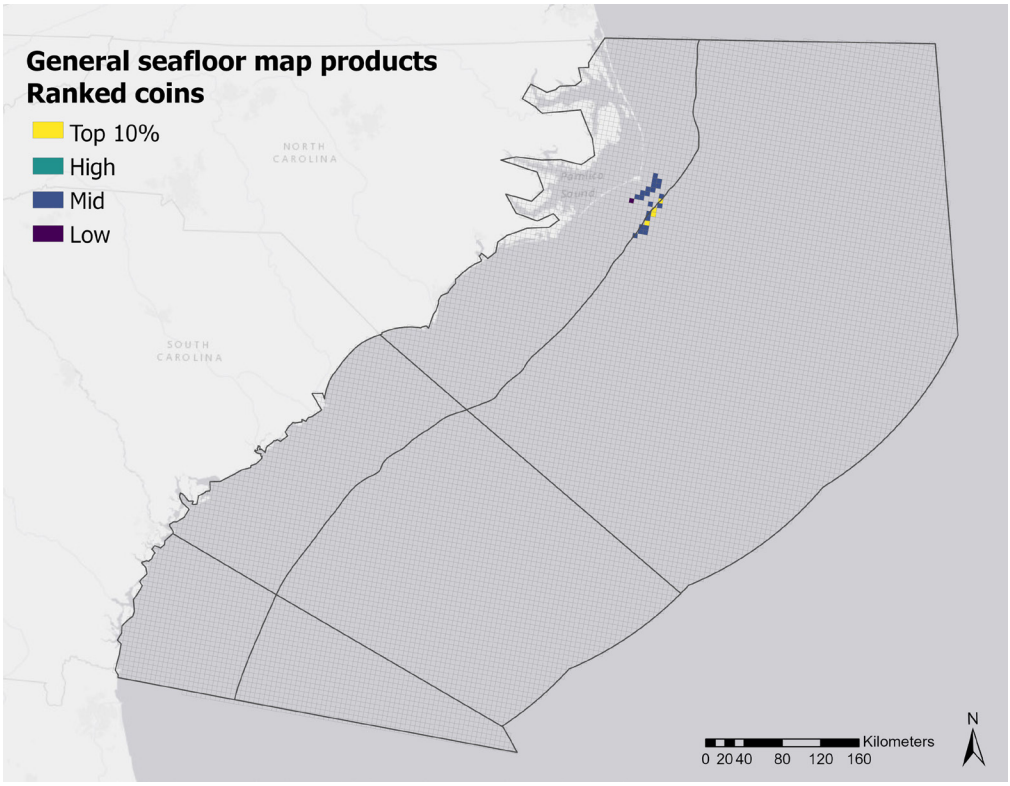


Figure D.4. *General Seafloor Products* standardized and ranked coins across the study region. Grey boundaries identify study subregions.

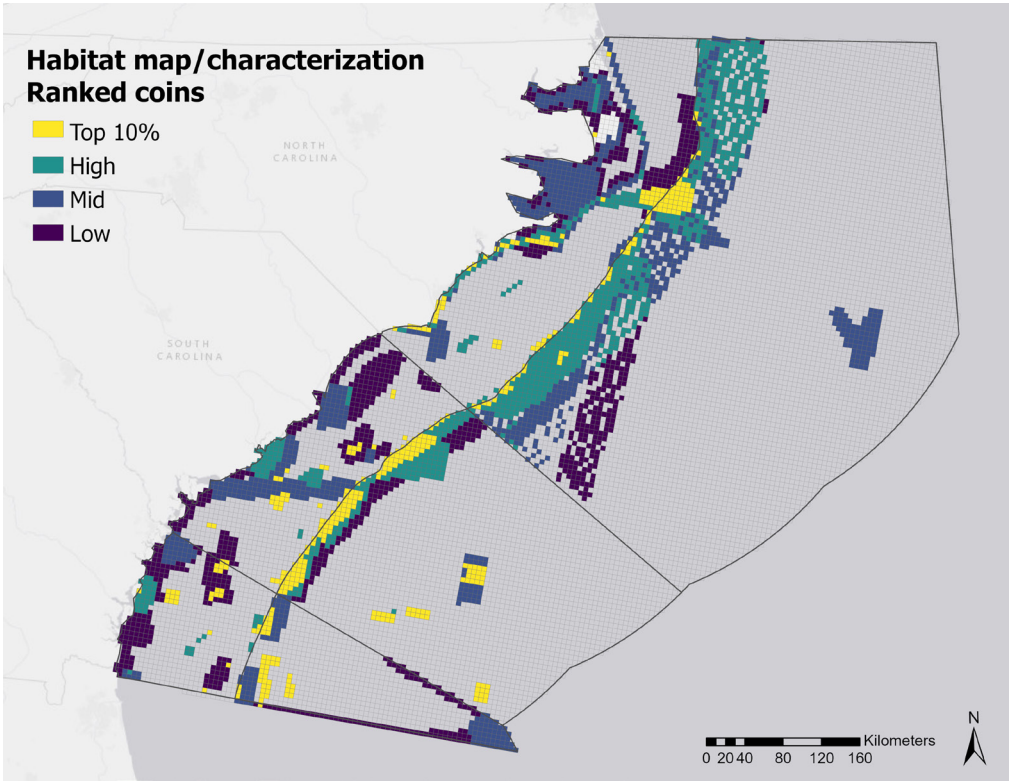


Figure D.5. *Habitat Map/Characterization* standardized and ranked coins across the study region, where habitat map and characterization products are synthesized using MBES sonar, underwater photographs/video, ground truthing and other methods. Grey boundaries identify study subregions.

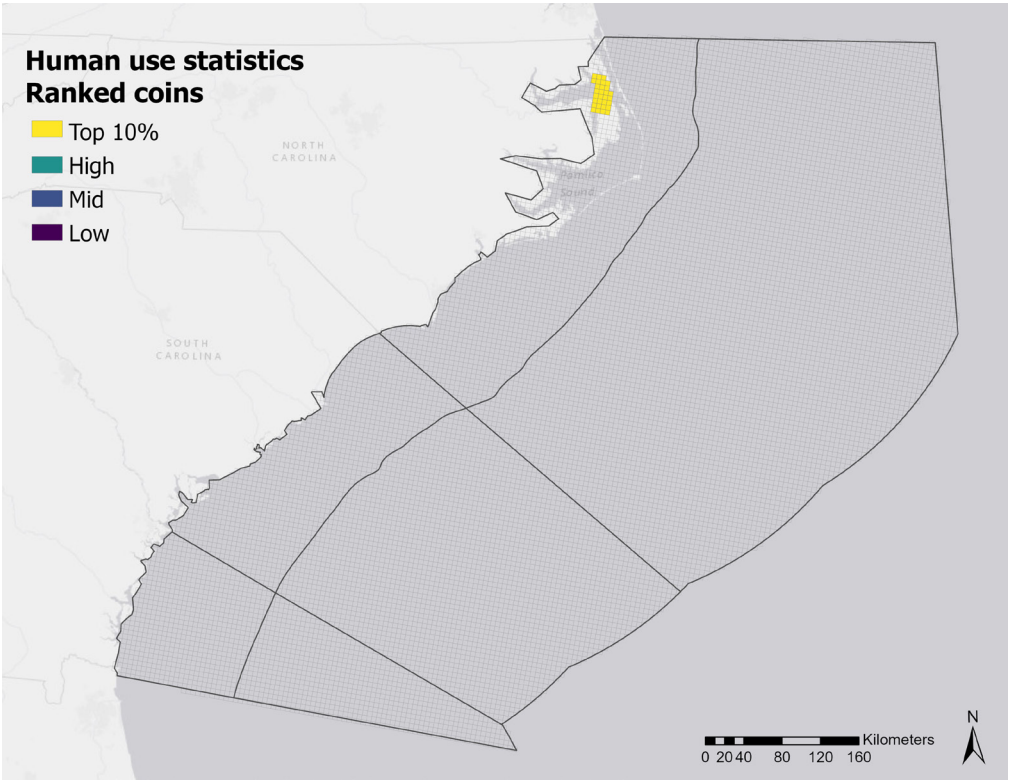


Figure D.6. *Human Use Statistics* standardized and ranked coins across the study region, including socioeconomic, demographic, and other statistics regarding human use of ocean areas. Grey boundaries identify study subregions.

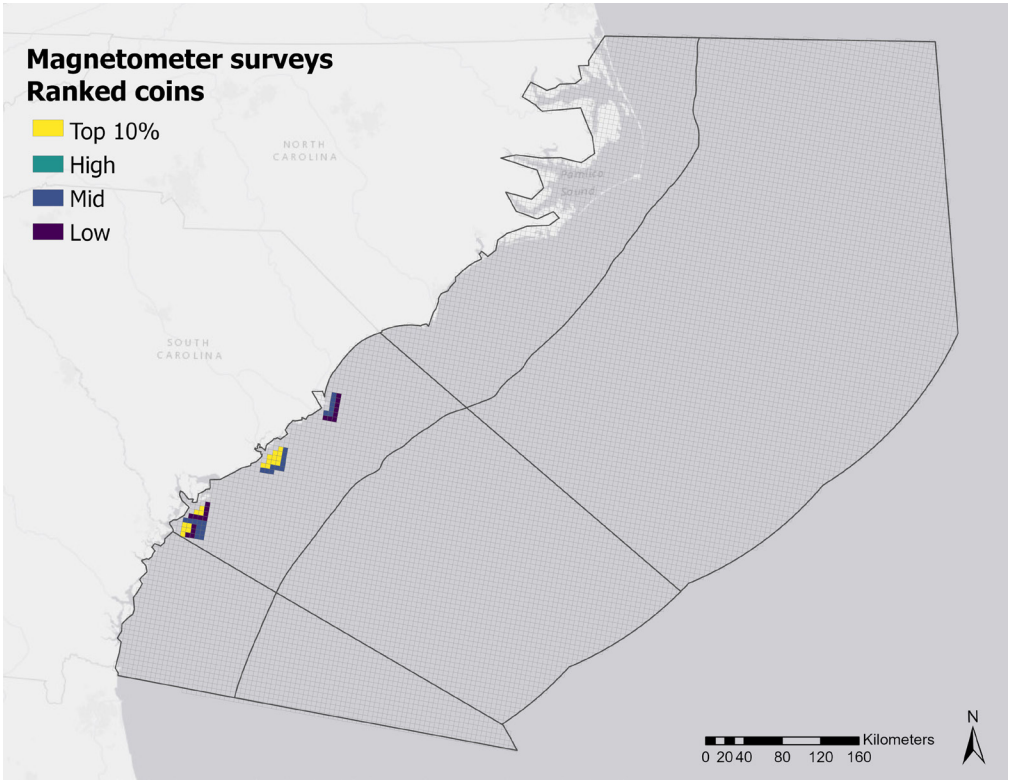


Figure D.7. *Magnetometer Surveys* products standardized and ranked coins across the study region, including Ferrous object detections/magnetic anomalies. Grey boundaries identify study subregions.

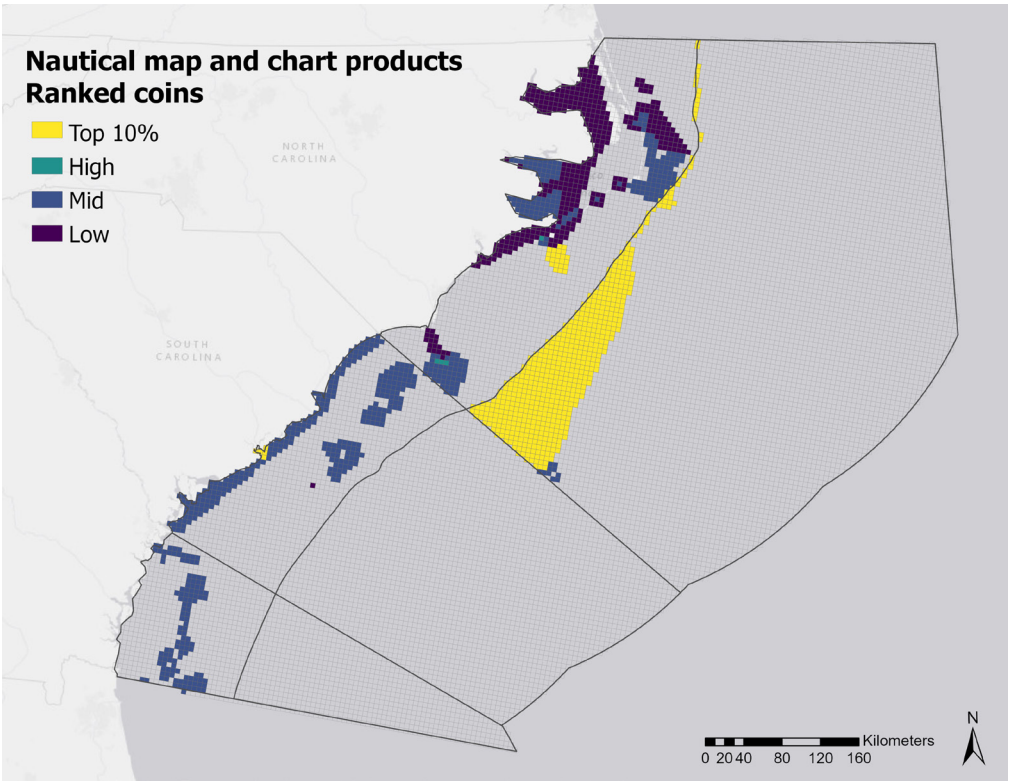


Figure D.8. *Nautical Map and Chart* products standardized and ranked coins across the study region, which includes NOAA Electronic Navigational Charts (ENC), other products for navigation. Grey boundaries identify study subregions.

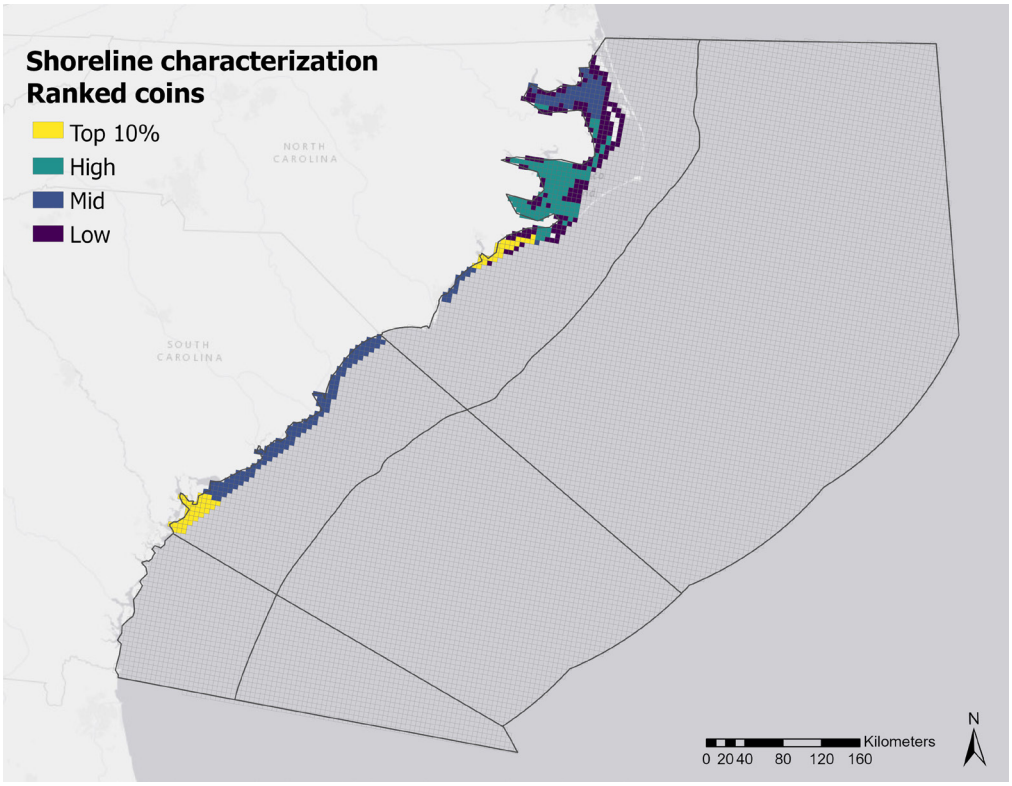


Figure D.9. *Shoreline Characterizations* products standardized and ranked coins across the study region, including delineation and characterization of shoreline/coastal infrastructure and features (port facilities, boat ramps, docks, etc.). Grey boundaries identify study subregions.

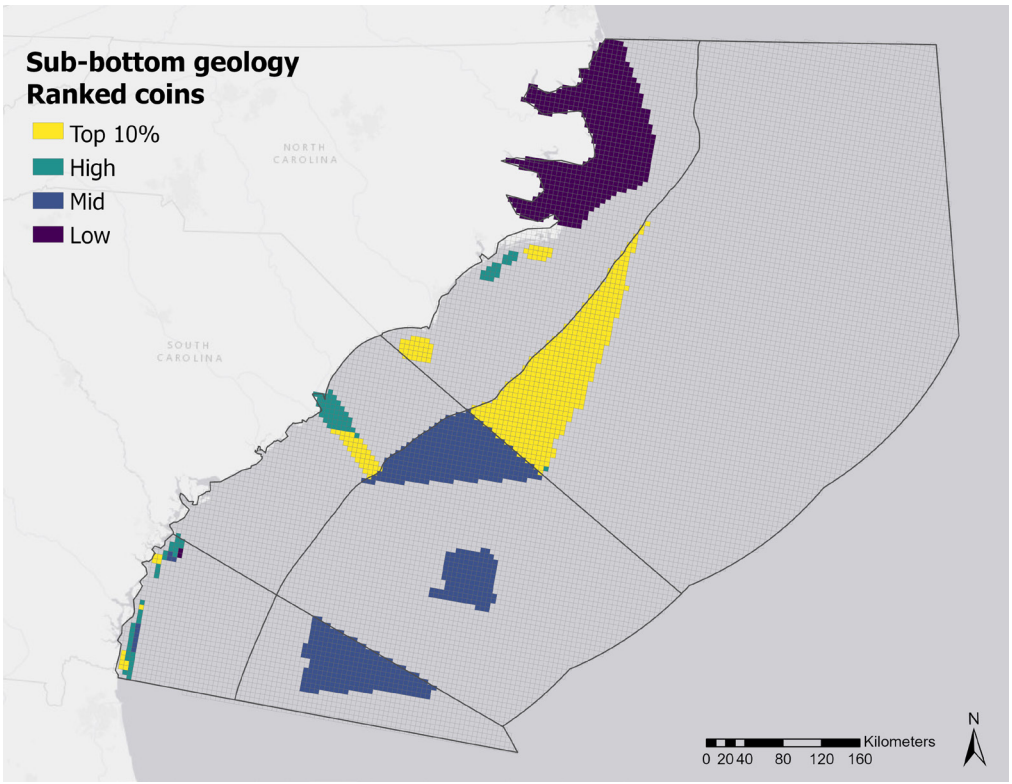


Figure D.10. S*ub-bottom Geology* products standardized and ranked coins across the study region, which are collected using sub-bottom profiling sonar. Grey boundaries identify study subregions.

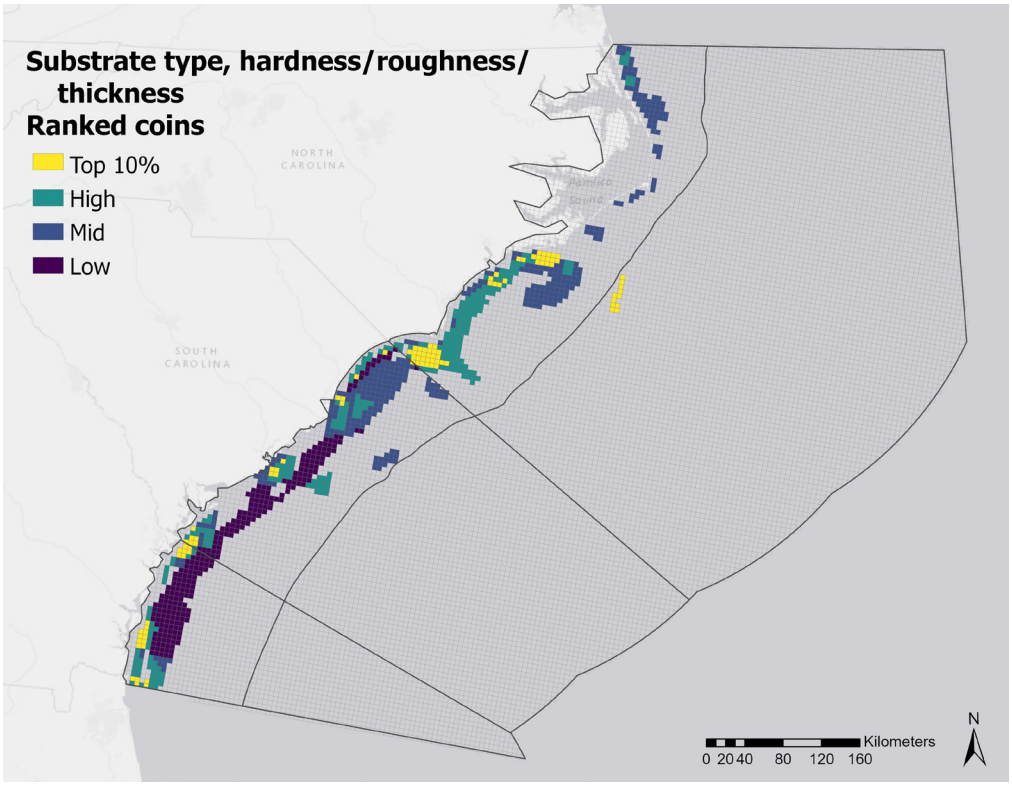


Figure D.11. Products describing *Substrate Type, Hardness/Roughness/Thickness* standardized and ranked coins across the study region, which are collected using high resolution sidescan sonar and sub-bottom profiling techniques. Grey boundaries identify study subregions.

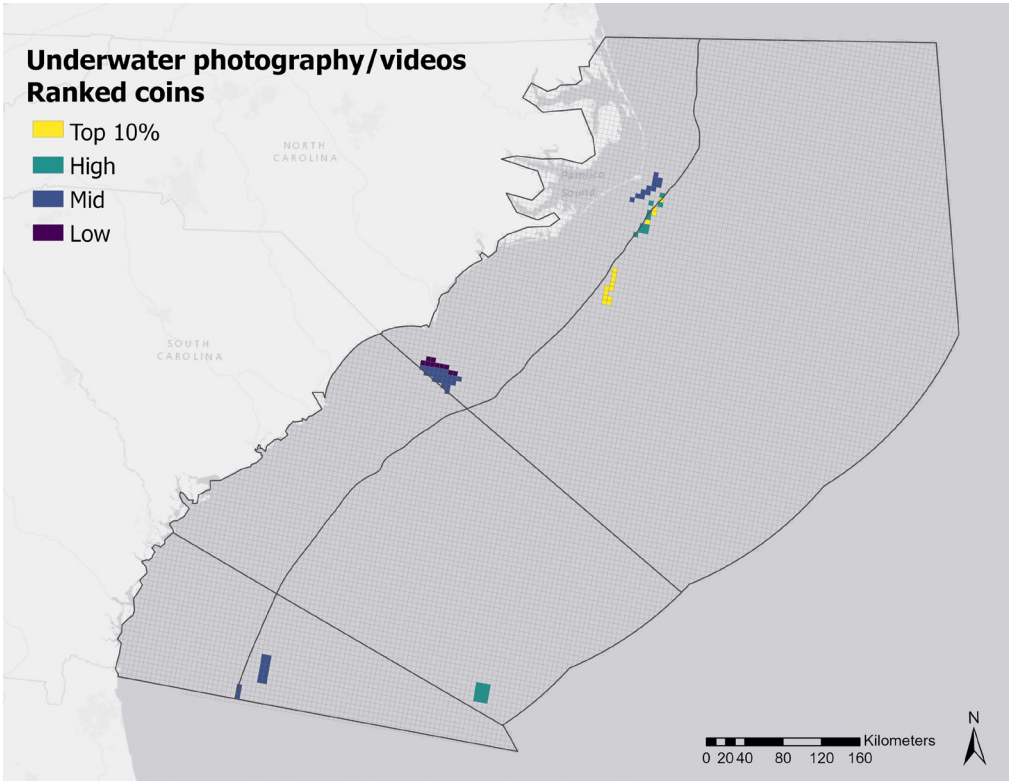


Figure D.12. *Underwater Photographs/Videos* products standardized and ranked coins across the study region, where imagery is collected using ROVs, AUVs, or other camera platforms. Grey boundaries identify study subregions.

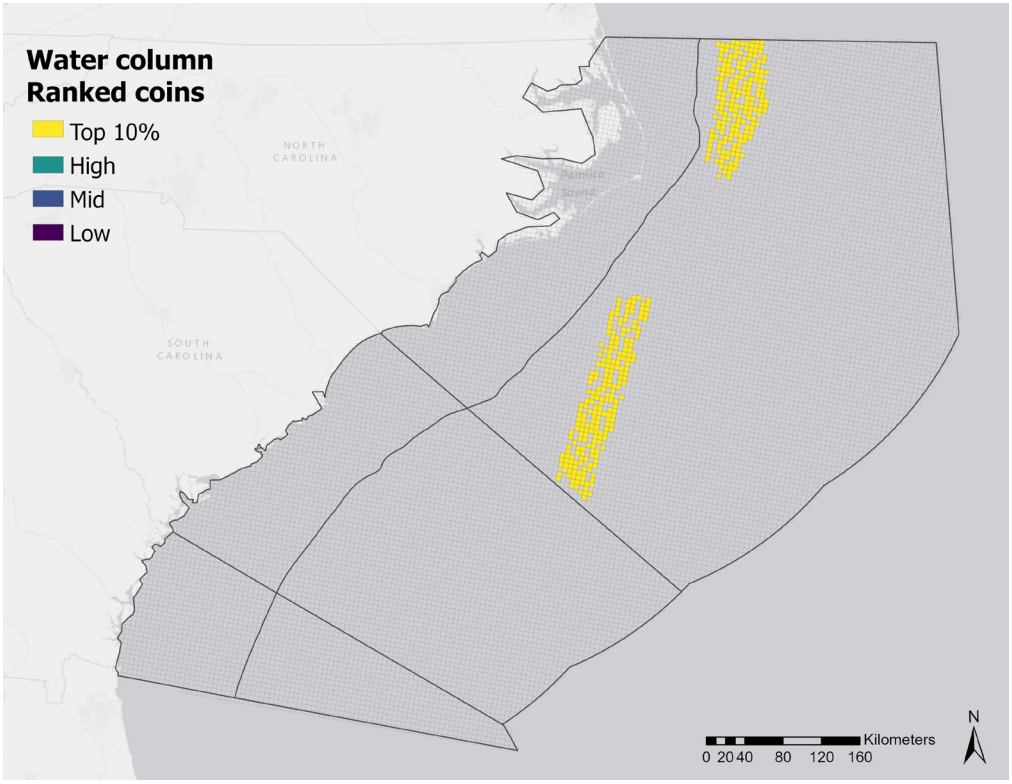


Figure D.13. *Water Column* products standardized and ranked coins across the study region, where water column products are collected with multibeam or single beam sonar systems. Grey boundaries identify study subregions.

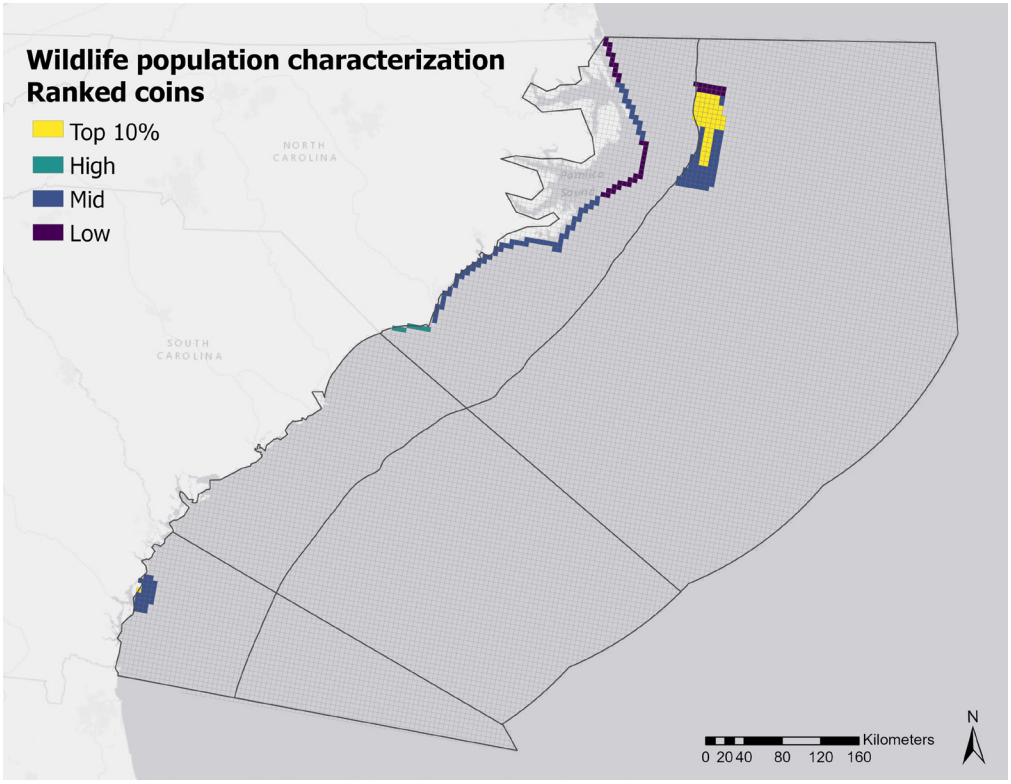


Figure D.14. *Wildlife Population* products characterization standardized and ranked coins across the study region, where wildlife population characterization includes marine mammal and sea turtle surveys, and stock assessments. Grey boundaries identify study subregions.

Appendix E. Project informational materials

The items below, project one page overview, slides from the inital demonstration webinar, and user guide, were provided to all invited participants. These documents help cover the project goals, and instructions on submitting seafloor mapping priorities.

Project overview

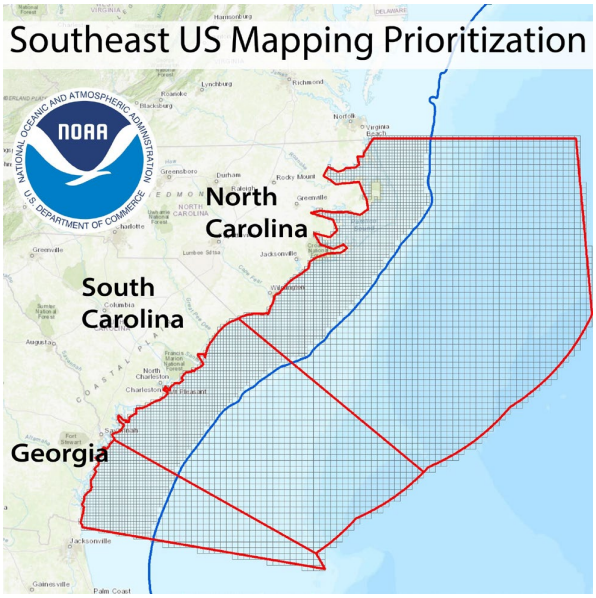
Prioritizing Areas for Future Seafloor Mapping, Research, and Exploration in the Southeast U.S. Atlantic

Why We Care

Spatial information about the geomorphology, surficial habitats, and underlying geology of the seafloor is critical for decision-making by marine research and management organizations tasked with ensuring safe navigation, sustainable fisheries, smart energy extraction, and sound ecological stewardship and conservation in U.S. coastal and ocean waters. Improving coordination of seafloor mapping goals among research and management organizations will result in better resource leveraging to survey seafloor areas while achieving each agency's mandates and missions faster and more economically. Mapping the full extent of the U.S. Exclusive Economic Zone is a top national priority and NOAA is working to achieve this goal.

To help promote regional coordination, NOAA's Southeast and Caribbean Regional Collaboration Team and National Centers for Coastal Ocean Science developed a participatory mapping and web-based tool to identify common spatial management priorities across partner organizations in the Southeast Region. This framework spatially captures and summarizes:

- What locations are important?
- Why are they important?
- How quickly is data collection needed?
- What data products are needed most?



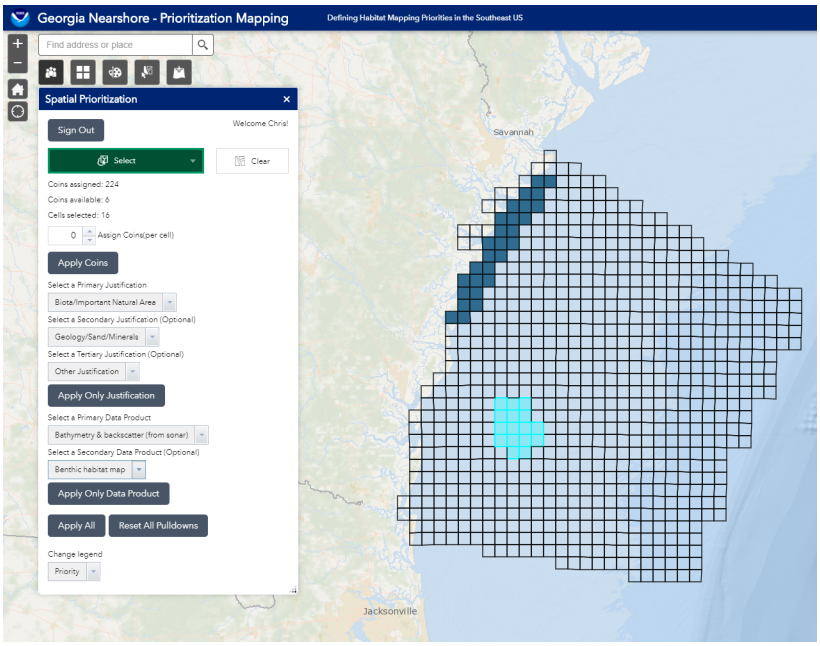
Our approach has been successfully applied in the state of Washington, Florida, New York and Alaska, as well as regions of the Great Lakes, U.S. Caribbean and West Coast. For example, actionable intelligence from these prioritizations resulted in actions taken to fill gaps by NOAA and partner state agencies in Florida.

What We Propose to Do

The online prioritization application will contain existing geospatial data readily available through GIS portals (e.g., essential fish habitats, habitat areas of particular concern, energy lease areas, navigation, etc.) or data provided by partners in GIS-friendly formats. The inventory of spatially relevant datasets will provide the spatial reference and context for participants to select their own high priority areas.

Participant priorities will be entered into an online portal using a process and widget developed by NCCOS. Results will be analyzed using clustering and other spatial statistical techniques to identify

significant relationships between priorities, issues, and ranking criteria. Our analytical approach is similar to the one used recently in Washington State prioritization effort. Preliminary results from the prioritization process will be reviewed and finalized by partners online using “dashboard viewers”. Final results will be publicly available on an interactive map and integrated into other relevant products, including: justification for NOAA fleet allocation, ocean exploration mission planning, Integrated Ocean and Coastal Mapping and Inter-agency Working Groups and toward SEABED 2030. They will also be compiled into a technical report and shared with operating and funding agencies to assist with aligning programmatic goals and resource allocation.



Spatial priorities for seafloor mapping and visual surveys will be entered on the grid (right) using the spatial prioritization tool (left). Information about where, when, why and what information is needed will be saved to the grid and analyzed to find key patterns and overlap among participant needs.

Benefits of Our Work

The compiled seafloor mapping priorities will (1) help organizations better understand how their priorities align with other southeast U.S. partner needs, (2) better position participating organizations to more efficiently coordinate projects, and (3) better enabling partners to leverage assets and resources to fill their most pressing data and information gaps in the southeast U.S. coastal and outer continental shelf.

Contact: Chris.Taylor@noaa.gov, Christine.Addison@noaa.gov, John.McCombs@noaa.gov

NCCOS | NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

NOAA Southeast and Caribbean

Improving NOAA's service to the Nation through collaboration

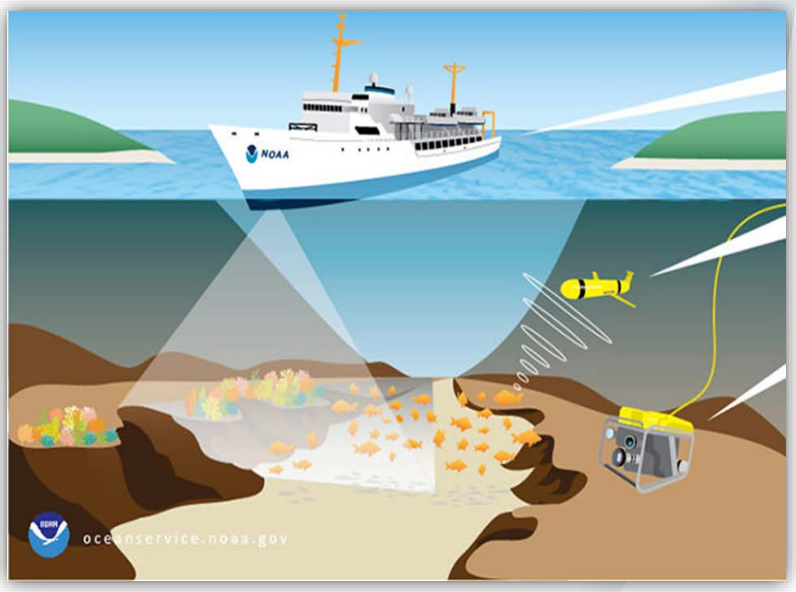
Prioritizing Seafloor Mapping Needs

Southeast Atlantic Coast

Chris Taylor – Chris.Taylor@noaa.gov - National Centers for Coastal Ocean Science
Christine Buckel – Christine.Addison@noaa.gov - National Centers for Coastal Ocean Science
John McCombs – John.McCombs@noaa.gov – Office for Coastal Management

Agenda

1. Project overview
2. Prioritization tool demonstration
3. Timeline



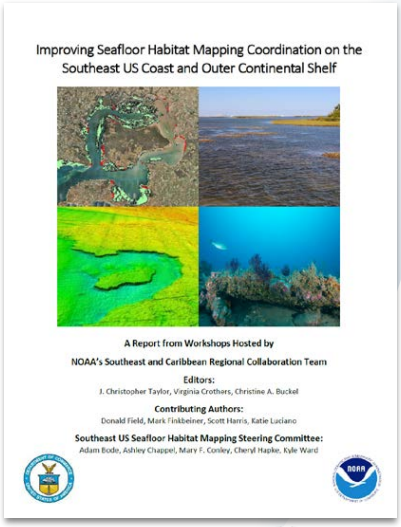
Background and project overview

Funding: Southeast and Caribbean Regional Collaboration Team (SECART) and NCCOS

- SECART identified seafloor (habitat) mapping as high priority in SE in 2014
- Seafloor mapping coordination workshops held 2016 & 2018
- Interagency mapping prioritization identified as next step

Primary Objective: Identify and summarize spatial priorities for seafloor mapping in the SE US coast and outer continental shelf

****MAP ONCE, USE MANY TIMES****



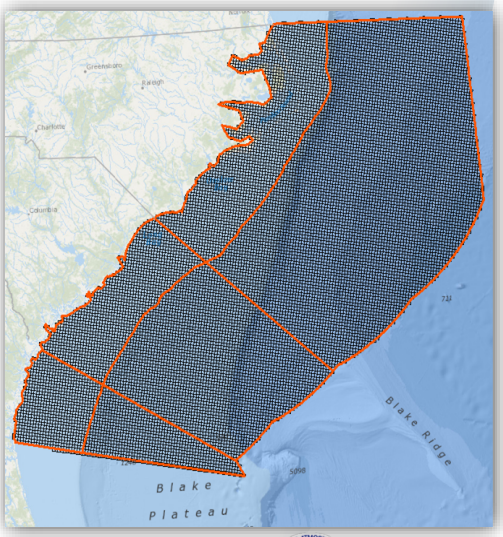
Background and project overview

Target Audience: Agencies charged with ocean planning, seafloor mapping practitioners, research and conservation organizations

Scope*: Estuaries to outer slope or EEZ; NC, SC, GA (Florida has already conducted their own prioritization.)

Products: Digital atlas and inventory of existing mapping data, reports, ranked priorities and decision support for future mapping

*** Southeast Prioritization will contribute to National Prioritization efforts led by the Interagency Working Group on Ocean and Coastal Mapping**



National Mapping Prioritization

Presidential Memorandum on Ocean Mapping
November 19, 2019

. . . in coordination with the Administrator of the National Oceanic and Atmospheric Administration, shall develop a proposed strategy to map the U.S. EEZ, to identify priority areas within the U.S. EEZ, and to explore and characterize the priority areas, and shall submit it to the Director and the Chairman."

NOAA Southeast and Caribbean

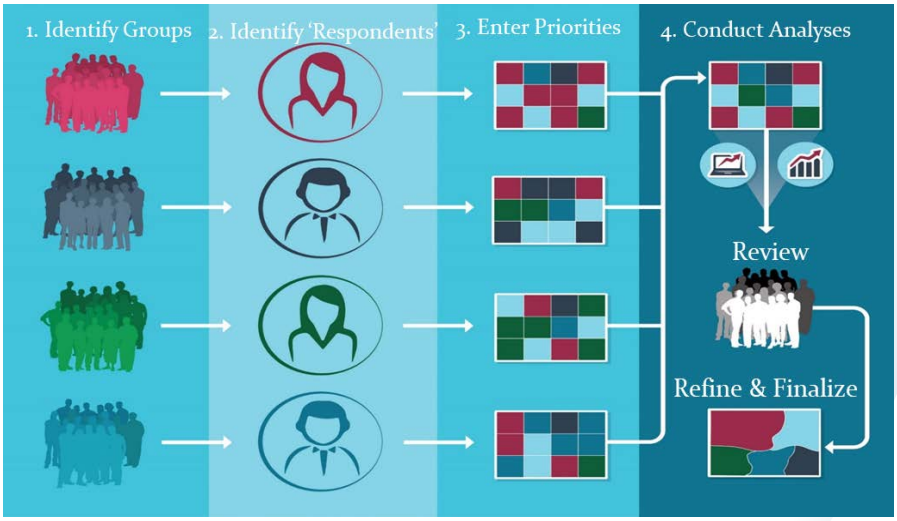
Prioritization Approach

4 basic steps

Vetted and applied in multiple U.S. locations

Web-based, interactive

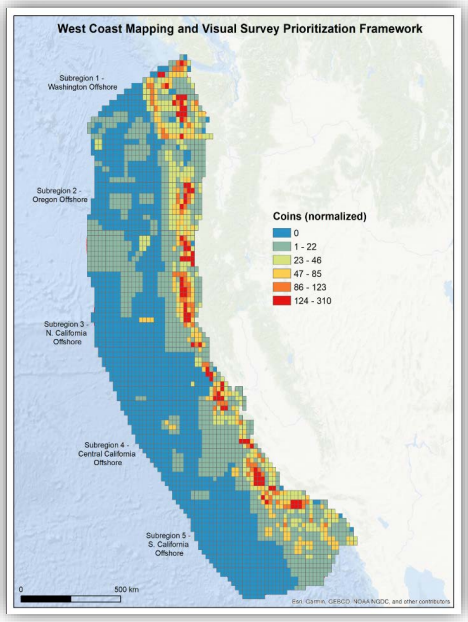
Standardized to allow post-hoc analysis

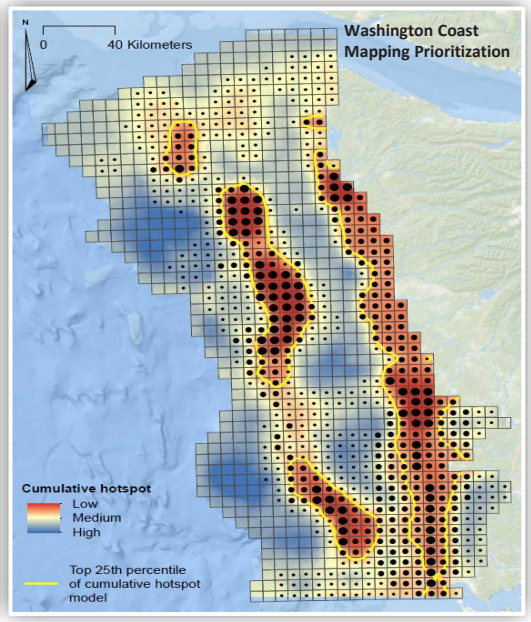


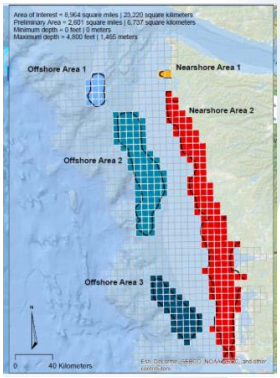
Battista et al. 2017. Sensors. 17,701

NOAA Southeast and Caribbean

Results from the West Coast







Clustered cells based on common justifications or products

NOAA Southeast and Caribbean

Outcomes from the Past Prioritizations

- Actionable intelligence for allocating assets and resources to achieve multiple organizational missions
- **Washington**: Mapping priorities in 2015 led to large new project by NOAA ships 2016-2017
- **Florida**: Panhandle identified as mutual data gap for fisheries and navigation, NOAA and state projects implemented

NOAA Southeast and Caribbean

Prioritization Approach

Prioritization answers 4 questions important for planning:

1. (**Where**) What locations are important?
2. (**Why**) Why are they important?
3. (**When**) How quickly is data needed?
4. (**What**) What data products are needed most?

NOAA Southeast and Caribbean

WHERE you will identify priorities is a customized interface producing a

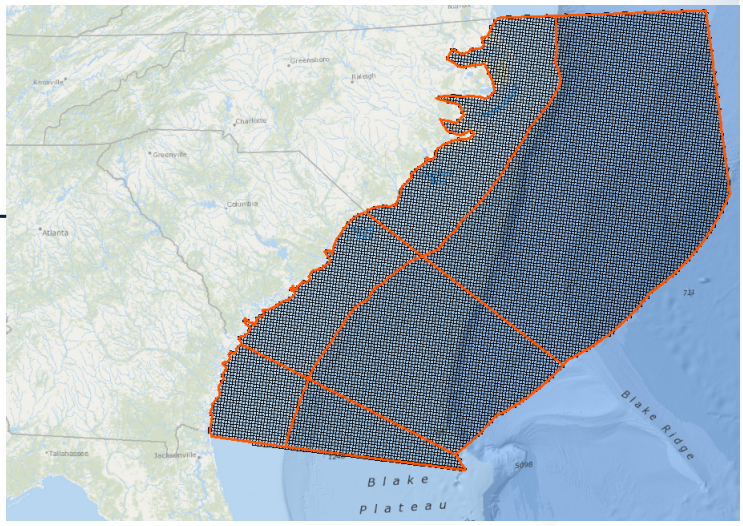
Targeted Area of Responses

3 States

2 Depth Zones (split at 100m)

6 Subregions

Unified grid of 5km x 5km

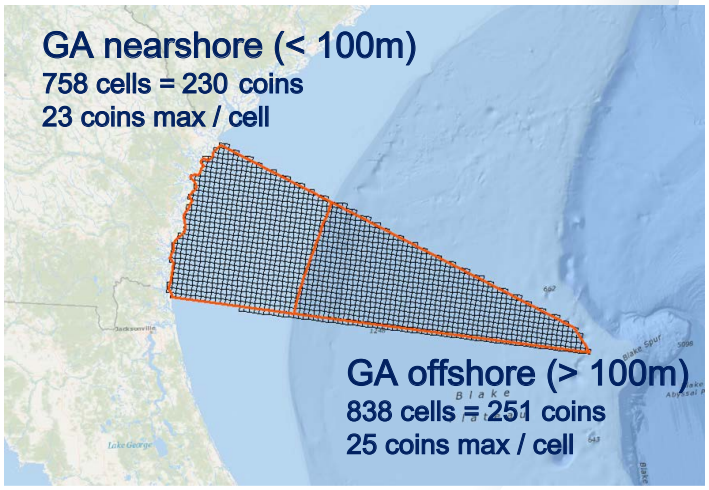


NOAA Southeast and Caribbean

Prioritizing **WHEN** & **WHERE** is based on coin placement

More coins = More important or urgent need

- Predefined number of coins
- Coin number is based on 30% of grid cells
- Maximum of 10% coins per cell
- Allocate all coins



Prioritizing **WHEN** & **WHERE** is based on coin placement

More coins = More important or urgent need

Assign coins based on urgency of need:

8-10% coins = needed this year

4- 7% coins = needed in 2-4 years

1- 3% coins = needed in 5-10 years

5			10
			17
20	23		
		3	

WHY you need data in this location is defined with

Justifications (Primary - Secondary - Tertiary)

- Important biota/natural area
- Coastal/marine hazards
- Commercial Fishing
- Cultural/historical resources
- Infrastructure
- Benthic Exploration
- Sediment movement and management
- Safety and navigation
- Managed Area
- Scientific Research
- Recreational Activities
- Water column exploration
- Monitoring
- DoD/DHS security operations

NOAA Southeast and Caribbean

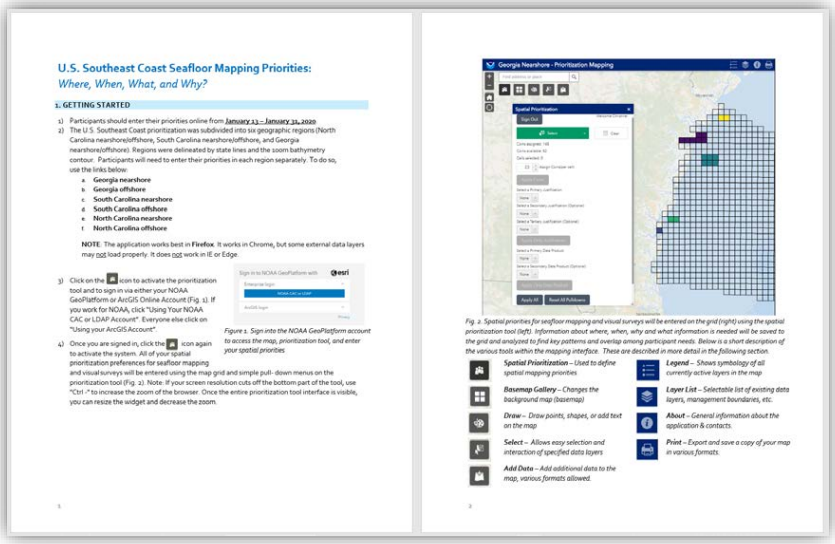
WHAT information is needed is defined by

Data Products (Primary - Secondary)

- Bathymetry & backscatter (DEM)
- General lakebed or seafloor mapping
- Ferrous object detections/magnetic anomalies
- Biological or physical samples
- Shoreline characterization
- Substrate type, hardness/roughness/thickness
- Sub-bottom geology
- Water column
- Habitat map
- Nautical chart
- Underwater photographs/videos
- Other product

NOAA Southeast and Caribbean

Instruction and Reference Manual



U.S. Southeast Coast Seafloor Mapping Priorities:
Where, When, What, and Why?

1. GETTING STARTED

1) Participants should enter their priorities online from January 13 – January 31, 2020.
2) The U.S. Southeast Coast prioritization was subdivided into six geographic regions (North Carolina nearshore/offshore, South Carolina nearshore/offshore, and Georgia nearshore/offshore). Regions were delineated by state lines and the 100m bathymetry contour. Participants will need to enter their priorities in each region separately. To do so, use the links below:
   a. Georgia nearshore
   b. Georgia offshore
   c. South Carolina nearshore
   d. South Carolina offshore
   e. North Carolina nearshore
   f. North Carolina offshore

NOTE: The application works best in Firefox. It works in Chrome, but some external data layers may not load properly. It does not work in IE or Edge.

3) Click on the icon to activate the prioritization tool and to sign in via either your NOAA GeoPlatform or ArcGIS Online Account (Fig. 1). If you work for NOAA, click "Using Your NOAA CAC or LDAP Account". Everyone else click on "Using your ArcGIS Account".

Figure 1. Sign into the NOAA GeoPlatform account to access the map, prioritization tool, and enter your spatial priorities.

4) Once you are signed in, click the icon again to activate the system. All of your spatial prioritization preferences for seafloor mapping and visual surveys will be entered using the map grid and simple pull- down menus on the prioritization tool (Fig. 2). Note: If your screen resolution cuts off the bottom part of the tool, use "Ctrl -" to increase the zoom of the browser. Once the entire prioritization tool interface is visible, you can resize the widget and decrease the zoom.

Georgia Nearshore - Prioritization Mapping

Fig. 2. Spatial priorities for seafloor mapping and visual surveys will be entered on the grid (right) using the spatial prioritization tool (left). Information about where, when, why and what information is needed will be saved to the grid and analyzed to find key patterns and overlap among participant needs. Below is a short description of the various tools within the mapping interface. These are described in more detail in the following section.

- ***Spatial Prioritization*** *– Used to define spatial mapping priorities*
- ***Basemap Gallery*** *– Changes the background map (basemap)*
- ***Draw*** *– Draw points, shapes, or add text on the map*
- ***Select*** *– Allows easy selection and interaction of specified data layers*
- ***Add Data*** *– Add additional data to the map, various formats allowed.*
- ***Legend*** *– Shows symbology of all currently active layers in the map*
- ***Layer List*** *– Selectable list of existing data layers, management boundaries, etc.*
- ***About*** *– General information about the application & contacts.*
- ***Print*** *– Export and save a copy of your map in various formats.*

NOAA Southeast and Caribbean

Prioritizing Seafloor Mapping Needs

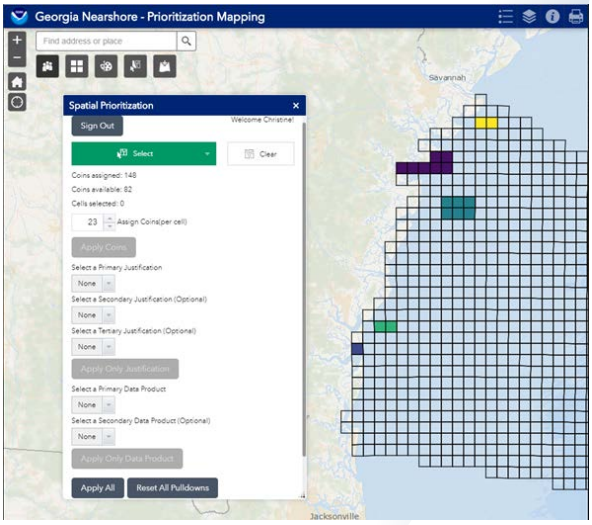
WHERE
- Custom interface for each sub-region
- Areas of need defined by you

WHY
- Justification (1st, 2nd, 3rd)

WHEN
- How quickly do you need the data (Coins)?

WHAT
- Data products needed most

Demonstration



NOAA Southeast and Caribbean

Next Steps & Timelines

Dec 11 Overview meeting

Dec 20 Confirm Org. Representative & Regions to christine.addison@noaa.gov

Jan Online tool available - Response Period

Mar Summary & Priorities Analysis

Apr Preliminary Results by Webinar

Questions? Email: chris.taylor@noaa.gov or christine.addison@noaa.gov

Check out the widget - https://coastalscience.noaa.gov/project/spatial-prioritization-widget/

U.S. Southeast Coast Seafloor Mapping Priorities:
Where, When, What, and Why?

These instructions are intended to provide guidance on the use of the spatial prioritization applications for the Southeast U.S. Please keep in mind the following points as you designate priorities for your organization:

- You must assign all your coins, however the lack of coins placed in a cell does not mean that area holds no interest, it just means it's not a priority at this time.
- This prioritization is a starting point, we recognize priority areas can change given changing conditions. When mapping efforts coalesce, we plan to reach out to stakeholders who placed coins in a corresponding region to see if their needs have changed and adjust mapping project areas as appropriate.
- Funding for this project is provided by NOAA's Southeast Caribbean Regional Team (SECART). Results will contribute to NOAA's National Mapping Prioritization effort led by the Interagency Working Group on Ocean and Coastal Mapping
- Questions? Email: christine.addison@noaa.gov or chris.taylor@noaa.gov

1. GETTING STARTED

1) Participants should enter their priorities online from **January 21 – February 7, 2020**.
2) The U.S. Southeast Coast prioritization is subdivided into six geographic regions (North Carolina nearshore/offshore, South Carolina nearshore/offshore, and Georgia nearshore/offshore). Regions were delineated by state lines and the 100m bathymetry contour. Participants will need to enter their priorities in each region separately. To do so, use the links below:
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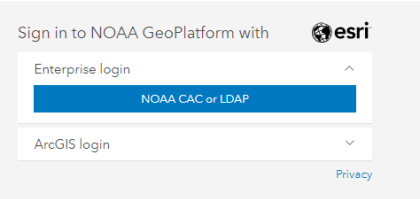

Figure 1. Sign into the NOAA GeoPlatform account to access the map, prioritization tool, and enter your spatial priorities

2) Once you are signed in, click the icon again to activate the system. All of your spatial prioritization preferences for seafloor mapping and visual surveys will be entered using the map grid and simple pull- down menus on the prioritization tool (Fig. 2). Note: If your screen resolution cuts off the bottom part of the tool, use "Ctrl -" to increase the zoom of the browser. Once the entire prioritization tool interface is visible, you can resize the widget and decrease the zoom.

1

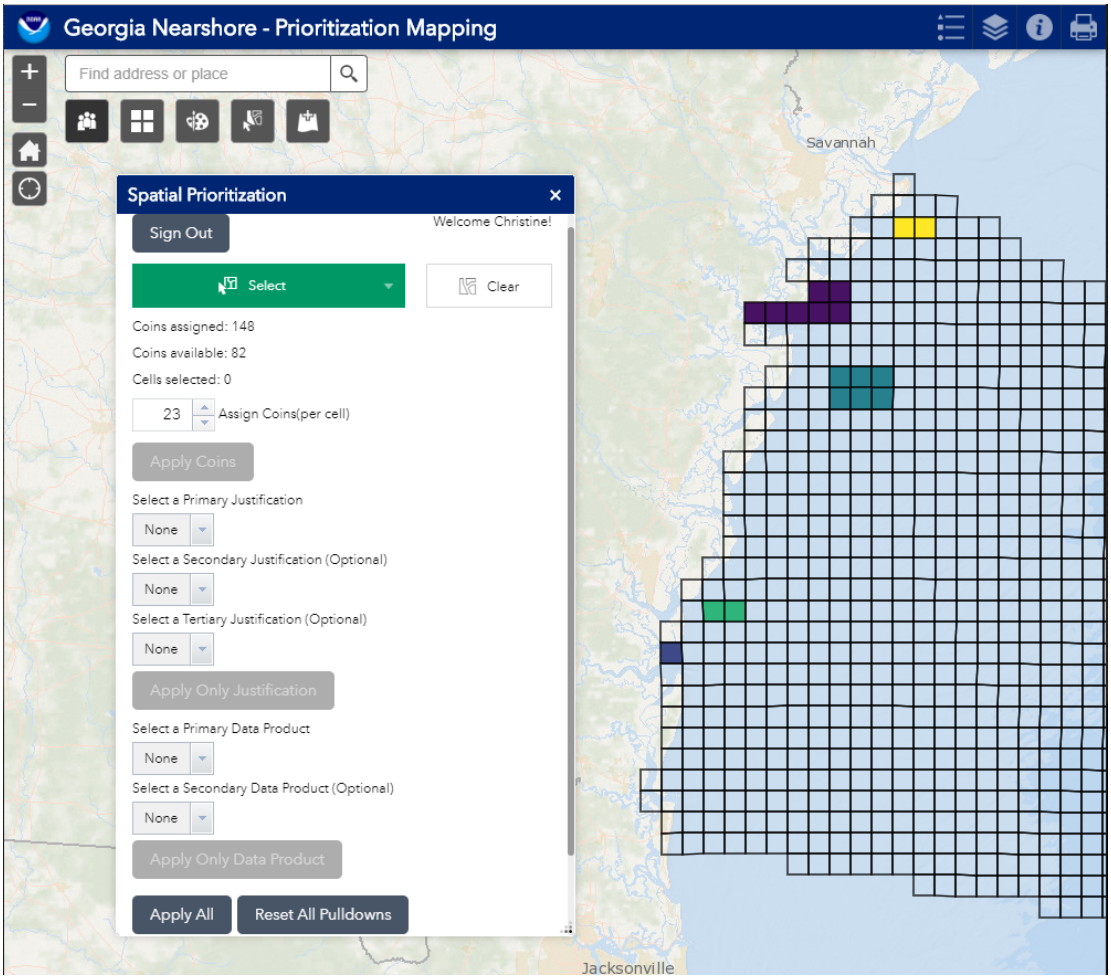

Fig. 2. Spatial priorities for seafloor mapping and visual surveys will be entered on the grid (right) using the spatial prioritization tool (left). Information about where, when, why and what information is needed will be saved to the grid and analyzed to find key patterns and overlap among participant needs. Below is a short description of the various tools within the mapping interface. These are described in more detail in the following section.

Spatial Prioritization *– Used to define spatial mapping priorities*

Basemap Gallery *– Changes the background map (basemap)*

Draw *– Draw points, shapes, or add text on the map*

Select *– Allows easy selection and interaction of specified data layers*

Add Data *– Add additional data to the map, various formats allowed.*

Legend *– Shows symbology of all currently active layers in the map*

Layer List – *Selectable list of existing data layers, management boundaries, etc.*

About *– General information about the application & contacts.*

Print *– Export and save a copy of your map in various formats.*

2

2. WHERE ARE YOUR PRIORITY AREAS FOR SEAFLOOR MAPPING AND VISUAL SURVEYS?

Use map tools to find out what we already know in the subregion:

Many ecological, administrative, cultural, and existing mapping data layers are viewable in the map to help you identify important places and orient yourself in space. Use the Data Layers tool (top right) to display and explore different datasets. Some data layers can be slow to display. We are ingesting data services provided by partners. While this keeps our map current with the most up to date information there may be an occasional broken link or data beyond our immediate area of interest.

You can add your own map services or ArcGIS-compatible spatial data files, such as zipped shapefiles, CSV, KML, GPX, or GeoJSON, using the Add Data tool . You can change the basemap using the Basemap Gallery tool. See the complete list of map tools in Figure 2.

Use the Spatial Prioritization tool to identify what you need to know:

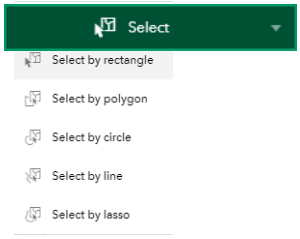

Fig. 3 Selection options with the spatial prioritization tool

Once you've identified grid cells where data are needed, you need to select the cells and distribute your coins. First, use the selection tool (Fig. 3) at the upper left of the prioritization menu to select cells you want to prioritize. This tool has multiple ways of selecting cells, such as with a single click (Select by point), along a line (Select by line), in a freehand polygon (Select by lasso), or several other defined shapes (rectangle, polygon, or circle). Click the arrow within the select button to choose your preferred selection method. The select option is activated when it turns dark green and your mouse has a text box that says 'press down to start and release to finish'.

Not the cells you meant to highlight?...or you want to pick some new cells?

Use the clear selection tool Clear to clear the cells you have selected and then make a new selection.

Apply coins to your selection:

Enter the number of coins you wish to place into the selected cells. Use the 10 Assign Coins (per cell) up or down arrows to choose the number of coins you want to place in each selected cell. Once you have made your selections, click Apply Coins. Each respondent can allocate their coins as they would like in the prioritization area. However, a maximum of 10% coins can be placed into a single grid cell. These numbers will differ based on the prioritization area (Table 1).

Table 1. Number of cells, coins, and max coins allocated for each geographic region in the SECART prioritization effort. Nearshore and offshore were delineated by the 100-m depth contour. Also included are the 3% and 7% coin values to aid in identifying 'When' products are needed, see Section #3.

Prioritization Region	Total # Cells	Total # of Coins	Max # coins per cell (10%)	3% of Coins	7% of coins
North Carolina Nearshore	1,994	598	60	18	42
North Carolina Offshore	6,971	2,091	209	63	146
South Carolina Nearshore	1,222	366	37	11	26
South Carolina Offshore	2,941	882	88	26	62
Georgia Nearshore	758	227	23	7	16
Georgia Offshore	838	251	25	8	18

Note that the system automatically keeps track of how many coins you have assigned, how many you still have available, and prevents more than 10% from going into any particular cell.

OOPS! You want to change the allocation of coins?

Select the cells already containing coins that you want to change. This activates the Return Coins button. Clicking this removes the coins in these cells and makes them available for redistribution. This is useful if you've made a mistake or if you want to move a few coins to another priority location.

3. WHEN DO YOU NEED MAP PRODUCTS?

When distributing coins among grid cells, use these general guidelines to indicate the relative urgency of the priority:

- 8 – 10% coins = map products needed this year
- 4 – 7% coins = needed in 2-4 years
- 1 – 3% coins = needed in 5-10 years
- ZERO coins = needed in >10 years

At this point, you may wish to continue attributing answers to the 'why' and 'what' for these cells while you have them selected. If so, continue down the prioritization menu and click Apply All when you are done.

Please note: the "Apply All" button will not work if the "Return Coins" button is active (i.e., you have selected cells with coins allocated). In this case, you will need to use the Apply Only Justification and Apply Only Data Product buttons (see sections 4 and 5).

4. WHY DO YOU NEED THIS AREA MAPPED?

In this section, you can identify a primary, secondary and tertiary "Justification" for mapping the selected grid cells to convey your rationale for making this choice. The default is "Exploration" if you do not want to specify particular products. Use the pull-down menus to make your selections from this list:

Justification Label	Justification Description
None	None
Benthic exploration	Targeted benthic exploration for seafloor characterization
Water column exploration	Targeted water column exploration for water column characterization (e.g. upwelling, seeps)
Commercial & Recreational fishing	Fisheries management and regulation (e.g., commercial/recreational fishing locations, aquaculture siting, fisheries sampling stations, high bycatch areas, sport/charter fishing)
Cultural/historical resources	Shipwrecks, tribal use areas and other archaeological/cultural/historic resources
Energy	Energy permitting, siting, management, transmission (e.g., oil/natural gas platforms, wind turbine, tidal/hydropower, cables, pipelines, etc.)
Habitat/biota/natural area	Includes Essential Fish Habitat, Critical Habitat (for marine mammals and other protected species), spawning/nursery areas, feeding grounds, key benthic habitats, habitat mapping, coastal geomorphology and other ecologically significant areas.
Coastal/marine natural hazards	Detection, forecast and management of coastal and marine hazards, including weather/storm surge, flooding, tsunamis, earthquakes, geologic faults
Infrastructure (non-energy)	Existing or potential infrastructure development, includes port facilities, bridges, telecommunication cables, roads, etc.
Protection/Management Areas	Marine protected area, sanctuaries, conservation areas, restoration sites, dynamic management areas for marine mammals and other protected species
Monitoring	Monitoring of a specific study area for scientific or other purposes (e.g., coral health monitoring)
Navigation safety	Safe navigation in U.S. waters, e.g., shipping lanes, ferry routes, harbors/approaches, port facilities and marinas; includes detection of hazards to navigation (rocks, wrecks, other obstructions)
Scientific research	General scientific research, not including monitoring of a specific area
Seabed/sediment resources (non-living)	Critical minerals and other geologic resources; sediment movement and management needs, such as sand/gravel assessments, managing beach erosion/renourishment or sediment buildups in channels and ports
Maritime Domain Awareness & Enforcement	DoD/DHS security operations, countermine measures, border patrols, law enforcement
Recreational activities (other than fishing)	Recreational activities (e.g., boating, ecotourism, swimming and diving)

Justification Label	Justification Description
General knowledge gap	Default/general option; select if none of the other criteria meet your needs
Other Justification	Contact chris.taylor@noaa.gov if you have a Justification not listed

Once you have made your selections, click Apply Only Justification in the "Justification" section.

Now that you have entered a couple of attributes to cells, note that you can change your coin allocation, desired map products, and justification independently of editing the other sections. This is useful when you want to adjust only some of the attributes of a cell or two without re-entering all of your preferences.

If you want to reset all the pull-down menu selections for Justification and Map Products, click Reset All Pulldowns.

5. WHAT TYPES OF MAP PRODUCTS DO YOU NEED?

In this section, you can identify a primary and secondary "Map Product" for each selected grid cell to convey the types of seafloor data that you need. The default is None if you do not want to specify particular products. Select cells (if none are selected) and then use the pull-down menus in this section to make your choices from this list:

Product Title	Product Description
None	None
Elevation (bathymetry/topography)	Collected using Multibeam Echosounder (MBES) Sonar, airborne LiDAR or other methods. Processed into bathymetric grids or Digital Elevation Models for a wide variety of downstream products, including modeling (e.g., marine/coastal/ecological/numerical modeling and
Backscatter intensity or reflectivity	Collected simultaneously with acoustic bathymetry, a gray-scale raster of the strength of the acoustic echo returned or light reflectance from the seabed for location and distribution of different substrate types and habitat.
Magnetometer surveys	Ferrous object detections/magnetic anomalies
Underwater photographs/videos	Collected using ROVs, AUVs or other camera platforms
Substrate type, hardness/roughness/thickness	Collected using high resolution sidescan sonar and subbottom profiling techniques
Biological, chemical or physical samples	Collected using divers, AUVs, ROVs, cores, grabs, CTDs, rosettes, etc.
Sub-bottom geology	Collected using sub-bottom profiling sonar
Water column	Collected with multibeam or single-beam sonar systems
Shoreline characterization	Delineation and characterization of shoreline/coastal infrastructure and features (port facilities, boat ramps, docks, etc.)

Product Title	Product Description
Habitat map/characterization	Synthesized using MBES, underwater photographs/video, ground truthing and other methods
Nautical map and chart products	Electronic navigational charts (ENCs), other products for navigation
Human use statistics	Socioeconomic, demographic, and other statistics regarding human use of ocean areas
Wildlife population characterization	Includes marine mammal, bird, sea turtle surveys; stock assessments
General lakebed or seafloor map products	Default/general option; select if none of the other products meet your needs
Other mapping product	Contact chris.taylor@noaa.gov if you have a product not listed

Once you have made your selections, click Apply Only Data Product in the "Map Products" section or click Apply All to assign coins, justifications, and products.

6. WHAT DO MY PRIORITY ENTRIES LOOK LIKE?

At any point in the prioritization process, you can examine your entries by clicking the icon at the upper right of your screen to activate the legend.

You can toggle the attributes displayed in the map using the pull down menu at the bottom of the prioritization tool (Fig. 4, top left). You can also click on an individual cell and get its attributes in a pop-up table.

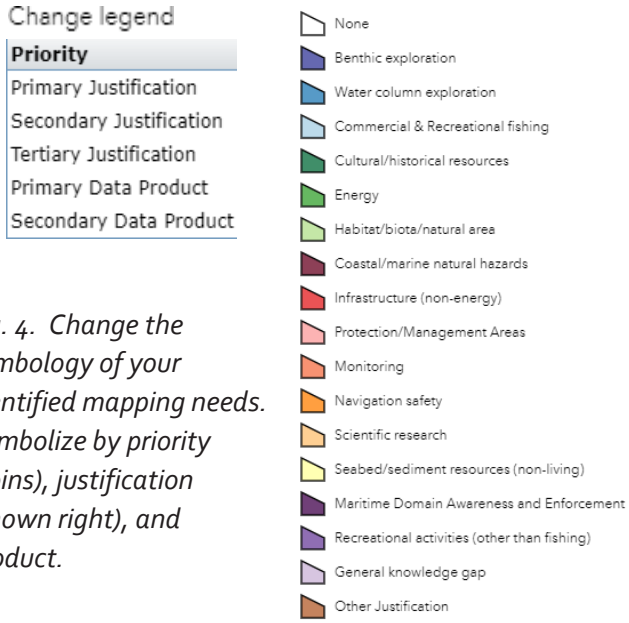

Fig. 4. Change the symbology of your identified mapping needs. Symbolize by priority (coins), justification (shown right), and product.

7. ALL DONE?

Please feel free to contact Christine.Addison@noaa.gove or Chris.Taylor@noaa.gov you have questions or problems. Once you have made your final selections, please email us so we can begin analyzing your suggestions. We kindly request that all entries be completed no later than **COB February 7, 2020**.

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