NCCOS
NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

MAPPING THE WAY FORWARD: SPATIAL DATA INVENTORY AND INSIGHTS FOR MARINE PLANNING IN VIRGINIA, NORTH CAROLINA, AND SOUTH CAROLINA

Beaufort, North Carolina
April 9th & 10th, 2024
WORKSHOP SUMMARY
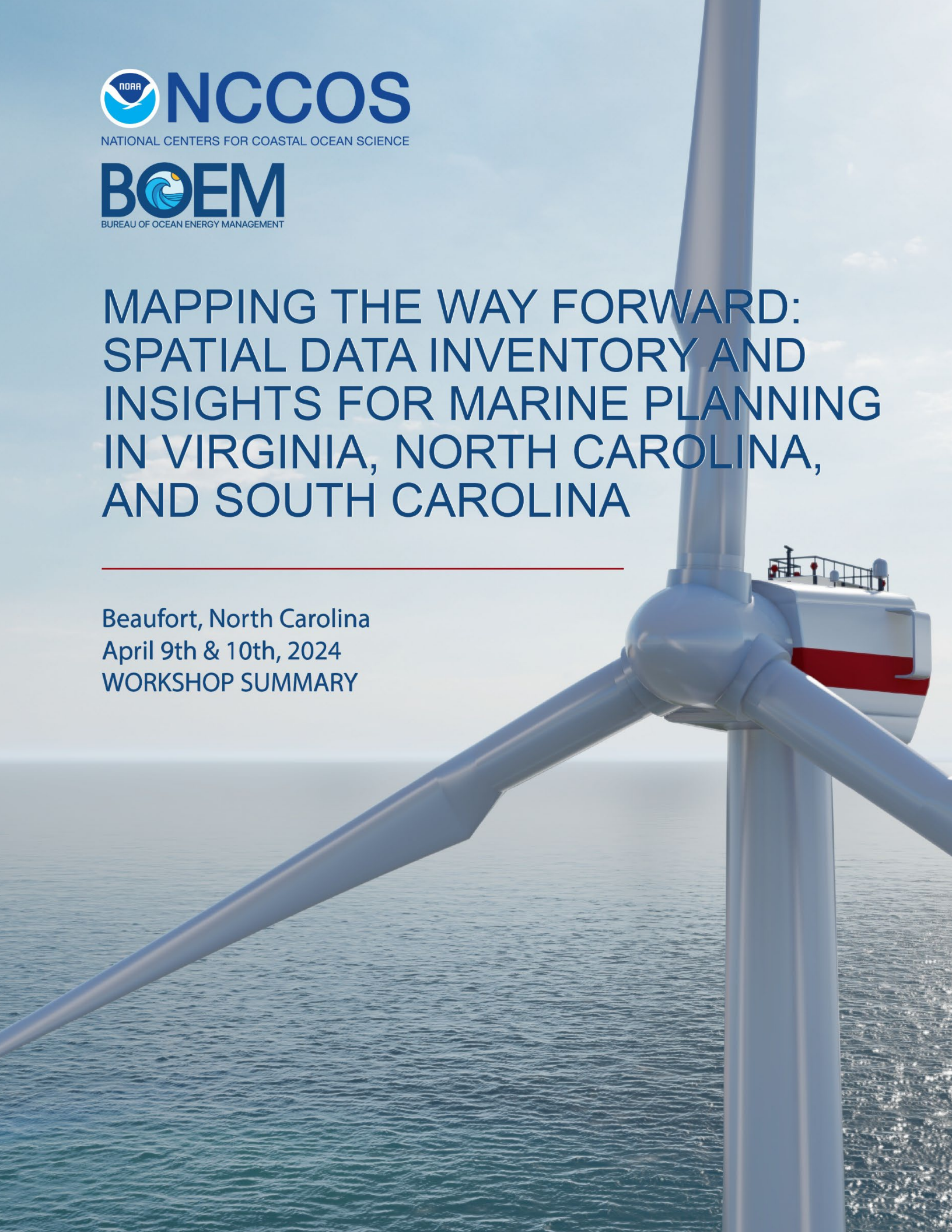
Mapping the Way Forward: Spatial Data Inventory and Insights for Marine Planning in Virginia, North Carolina, and South Carolina

Beaufort, North Carolina Workshop Summary
April 9th and 10th, 2024
NOAA Technical Memo 339

This workshop was co-led by the NOAA National Centers for Coastal Ocean Science, Marine Spatial Ecology Division and the Bureau of Ocean Energy Management.

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Workshop Overview

Offshore wind (OSW) energy planning efforts in the southeast region of the United States (US) catalyzed the need for data development to inform in-progress spatial analyses for OSW leases and transmission of energy to shore-based facilities. To address this need, the National Oceanic and Atmospheric Administration (NOAA) National Centers for Coastal Ocean Science (NCCOS), in partnership with the Bureau of Ocean Energy Management (BOEM), convened a marine spatial planning workshop in Beaufort, North Carolina on April 9th and 10th, 2024 [Federal Register Notice (89 FR 20638)]. This technical memorandum documents the outcomes of this two-day event.

NCCOS and BOEM are working around the nation to build spatial planning capacity, improve digital ocean intelligence and foster sustained community engagement as the New Blue Economy evolves. Marine spatial planning holds great promise to assist coastal managers, environmental organizations, academia, tribes, and industry with planning for future coastal and offshore development, including renewable energy. This workshop created a collaborative environment where participants could:

- Learn more about NOAA's marine spatial planning approaches and activities
- Inventory available spatial data for Virginia, North Carolina, and South Carolina
- Document the best available data and identify data gaps
- Increase local capacity and resources for regional ocean spatial planning
- Further develop an engaged community to inform future marine planning efforts

The workshop began with an overview of NOAA's marine spatial planning process and a description of how spatial suitability modeling informs BOEM's OSW lease planning process. Over the course of the two-day event, NOAA presented a summary of known available data for seven distinct ocean sectors. Participants discussed positive attributes and, conversely, any issues or challenges associated with the data layers for each sector, then helped identify additional data sets and leads to acquire this data. At the conclusion of the workshop, the group discussed key takeaways and next steps.

Workshop Organizers and Participants

NOAA and BOEM formed the core planning team, which developed the workshop agenda and approach to participant engagement. Supporting personnel included specialists in coastal planning, fisheries, and renewable energy, as well as NCCOS Marine Planning Coordinators from around the nation. A facilitation team lent additional planning support, fostered broad participation at the event, and helped document outcomes. Thirty-six individuals attended in person at the NOAA Beaufort Laboratory and 25 additional participants joined via an online format. Participants included state and federal agency personnel, scientists, renewable industry representatives, environmental organizations, and other subject matter experts.

Workshop Outcomes

The workshop produced a wide range of available data sets across each ocean sector and helped participants identify leads to acquire data and insights for pending spatial planning efforts. The *Natural Resources* sector stimulated the most discussion, in part due to the relative abundance of data layers available for this sector. Participants were generally pleased with the breadth of information collected, though several dozen additional data sources and leads were put forward for this sector. Participants also identified layers where more recent data are available and noted which layers did not cover state or federal waters for all three states.

The *Fisheries* sector also generated significant dialogue. Participants raised concerns about the usefulness and accuracy of using Vessel Monitoring System (VMS) data to adequately represent commercial and recreational fishing activity given its limited applicability throughout the region's fisheries. At times, concerns were shared about how future modeling will reconcile the use of different fishing gear types across the three states in this region. Some cited the need for updated and/or higher resolution data, particularly—though not exclusively—for the *Fisheries* and *Natural Resources* sectors.

Several participants emphasized the need to incorporate tribal and other local knowledge into this data gathering exercise. Throughout the workshop, a number of participants raised questions about how the data will be maintained after this initial effort is complete. Others discussed the importance of accounting for seasonality in select influential data sets, such as those for migratory species and seasonal fisheries.

This summary of workshop outcomes charts a path for increased engagement on marine spatial planning between the federal government and its partners in Virginia, North Carolina, and South Carolina. Detailed outcomes are described below, including data leads, any identified gaps, and additional questions, concerns and insights shared by participants. The agenda and attendance list are included as appendices. Interested parties can access the workshop presentation here.

James Morris, marine ecologist and lead for the coastal and marine spatial planning team at NCCOS, welcomed participants and reviewed the workshop goals listed above. The event, he noted, is the fourth marine spatial planning and data collection workshop convened by NOAA NCCOS in the last year. Similar workshops have been held in the US Virgin Islands, Puerto Rico, and Alaska. The impetus for data collection in the southeast region of the United States is to inform OSW development off the coasts of Virginia, North Carolina, and South Carolina. Data will also be used to inform many other types of future coastal development activities.

James explained that during the two-day workshop, participants will be asked to share data sources that are readily available, as well as historical knowledge, ideas, and information which may be available soon that could inform marine spatial planning efforts. He concluded his opening remarks by emphasizing the need to build a stronger marine spatial planning community in this region.

Facilitator Rich Wilson, Seatone Consulting, reviewed the workshop agenda and proposed an approach to maximize data brainstorming, idea generation and contributions among participants. The seven ocean sectors which served to focus the group discussions included:

1. *Natural Resources*: information about protected species and sensitive habitats
2. *Fisheries*: areas where both commercial and recreational fisheries are active, fishery management areas
3. *Cultural and Social Resources*: cultural uses of the environment, archaeological sites
4. *National Security*: locations of various military operation areas
5. *Metocean and Other*: meteorological and oceanographic data, geological features and seafloor substrate, water depth and slope (bathymetry), and boundaries
6. *Industries*: locations of oil and gas resources, key industrial concerns, shipping lanes, fishery independent surveys, weather forecasting, tourism
7. *Offshore Wind*: data relevant to siting offshore wind and associated transmission cables

NCCOS Marine Planning Coordinators Jennifer Wright, Alyssa Randall, and Bryce O'Brien set the stage for discussion of each ocean sector by presenting baseline information and data layers collected to date by NCCOS for the topic under consideration. Following each presentation, three prompting questions, with related follow-ups, were utilized to stimulate discussion among participants:

1. What are the positive attributes of the data just presented?
2. Conversely, what are the issues or challenges associated with these data?
3. Are you aware of any data that are missing from the list but available? If so, can you provide a lead to acquire these data?

At the conclusion of each presentation, individual participants used a simple worksheet to silently generate ideas prior to engaging with others, first in small groups and subsequently in a full group setting. The data development outputs described below represent an amalgamation of information collected on worksheets, via facilitated discussion and summarization of group comments on chart paper, and by extensive note taking.
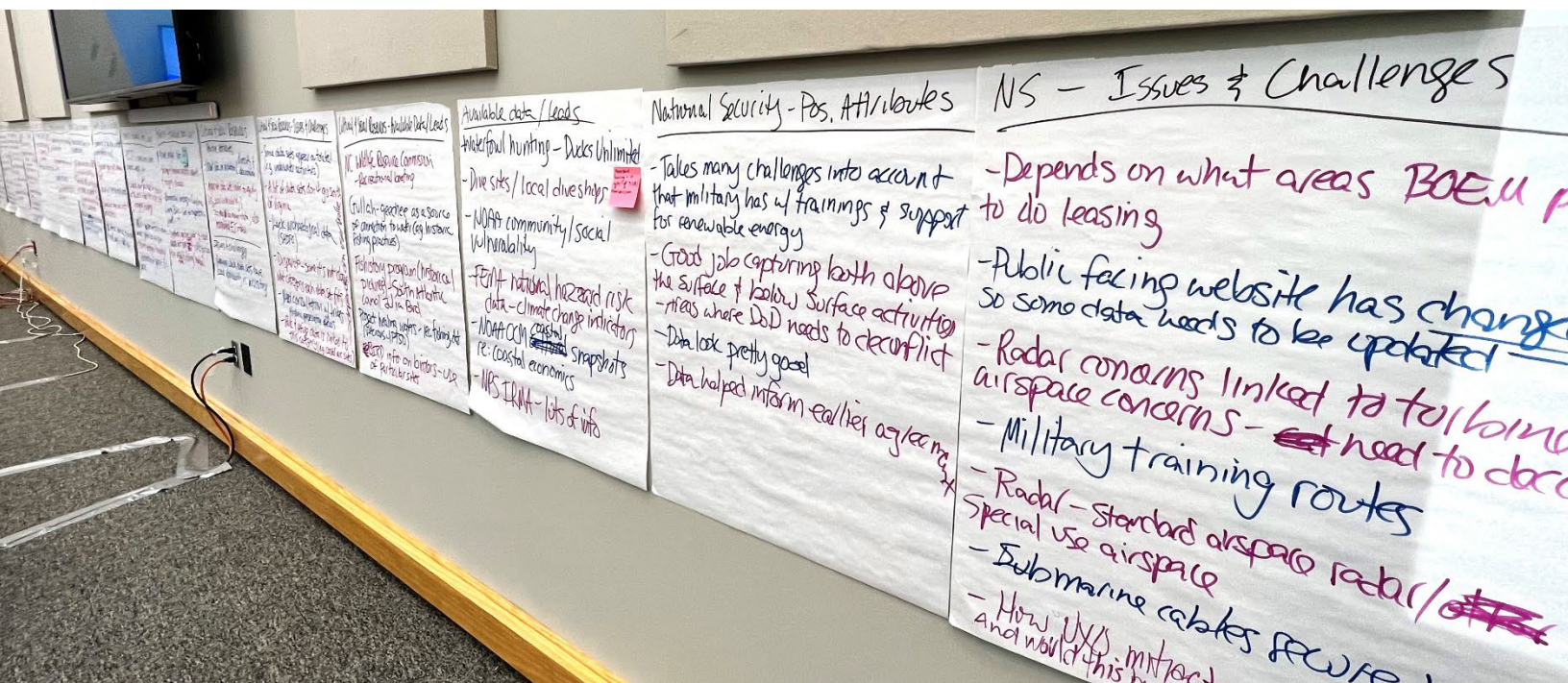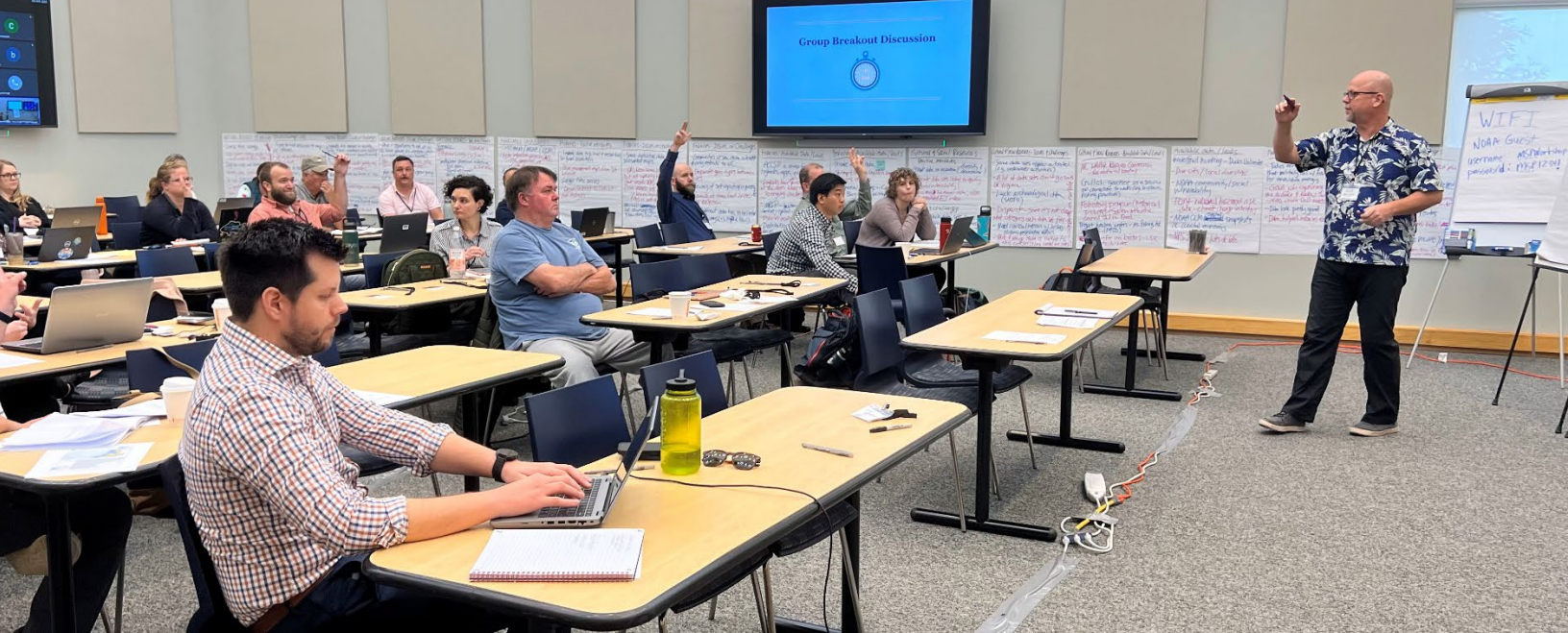
Mapping The Way Forward

James Morris presented a brief overview of NOAA's marine spatial planning and modeling process, and described how this work supports BOEM's efforts to facilitate the responsible development of renewable energy in the Outer Continental Shelf (OCS) of the US. NOAA provides data development and operational modeling to support BOEM's offshore wind lease planning efforts through a recently established interagency agreement. NOAA also consults on Endangered Species Act listings as needed for projects that fall under BOEM's permitting and siting work. All of this work between agencies, James noted, supports the current administration's goal of deploying 30 gigawatts of OSW energy by 2030.

Under BOEM's current regulatory framework (as of June 2024), there are approximately 50 leases/planning areas for OSW along US coastlines. The geographic scope under consideration at this workshop covers state and federal waters off the coasts of Virginia, North Carolina, and South Carolina. Data collection workshops for adjacent regions will be conducted in the months ahead. This marine spatial planning effort will aid decision-makers to identify existing ocean uses, potential areas of conflict, and areas with high opportunity for future siting of OSW.

NOAA's Marine Spatial Planning Process

James explained that marine spatial planning is a process which brings together multiple ocean users—including ocean industries, federal, state, and tribal government, conservation, and recreational sectors—to make informed and coordinated decisions about how to sustainably use natural resources. NCCOS uses marine planning science to support the needs of coastal communities to balance tradeoffs between sustainable use and conservation of marine resources.

NCCOS has developed a robust marine spatial planning framework over the last decade. Over 50 spatial analyses have been completed to date. These include two published atlases which compile best available science to inform the identification of Aquaculture Opportunity Areas (AOAs) in the Gulf of Mexico and Southern California Bight. In addition, an atlas to help identify AOAs in Alaska state waters is currently in progress. These established methods provide the foundation for interagency coordination between NOAA and BOEM as interest in offshore wind energy development in federal waters across the US has increased.

NOAA and BOEM collaborate with local partners in all regions of the US to advance marine spatial planning. As data come together, spatial suitability models can be developed which generate heat maps and allow planners and stakeholders to:

- Analyze the whole ecosystem through defensible and transparent methods
- Identify both hotspots of conflict as well as areas of opportunity
- Conduct scenario planning and support comprehensive environmental review

Spatial planning is about improving ocean intelligence and digital infrastructure. Community engagement—building, for example, on the knowledge and data already possessed by many individuals, organizations, and agencies in the southeast region—is a key element of the marine spatial planning process. In time, a spatial suitability analysis provides a holistic view across multiple ocean sectors. This workshop, James concluded, will enable local partners in Virginia, North Carolina, and South Carolina to move in this direction.

NOAA and BOEM co-produced a short video to further describe this collaboration and planning process.

BOEM's Siting Process

Seth Theuerkauf, Renewable Energy Program Specialist at BOEM, shared the Office of Renewable Energy Program's mission to facilitate responsible development of offshore renewable energy on the OCS through conscientious planning, stakeholder engagement, comprehensive environmental analysis, and sound technical review. He noted two specific places where the data collected during the course of this workshop will be put into practice to support this mission:

- BOEM's renewable energy planning process to identify new lease areas
- Spatial modeling to inform transmission cable corridor routing

BOEM's renewable energy planning process first considers a broad planning area within a region, then systematically narrows this area to smaller prospective lease areas that are ultimately offered through an open auction. Central to this winnowing process is the use of sound spatial data to represent potential areas of conflict with other ocean users and natural resources, as well as opportunities in terms of techno-economic feasibility for OSW project development.

Through its partnership with NCCOS, BOEM has expanded its planning efforts to include spatial modeling to inform transmission cable corridor routing. OSW projects require a transmission easement to connect generated power to an onshore electrical grid. Seth explained how BOEM's offshore wind leases guarantee the right to one or more project easements without further competition but require that the easements be in a location acceptable to BOEM. Again, Seth noted, sound spatial data is critical for informed decision making in this area. In the southeast, initial studies to support transmission planning and review will focus on the Kitty Hawk South and Carolina Long Bay lease areas.

Lastly, Seth described how data collected from this workshop will be used to inform a second round of OSW lease planning for the Central Atlantic region and BOEM's transmission modeling work.

Following their respective opening presentations, James and Seth each responded to a range of initial questions from the group. Participants expressed curiosity about, among other issues, the selection process by which data layers are incorporated into the final suitability model, how seasonality is considered, if modeling will be conducted for both state and federal waters, and if NOAA and BOEM are coordinating with other federal agencies such as the Department of Energy (DOE).

James clarified that NCCOS recommends to BOEM which data layers to include in the models, and BOEM makes the final determinations. The models do not currently account for seasonality, as many data sets use annual averages, though dynamic modeling is possible in the future. Models will be developed for both state and federal waters. Building on the anticipated outcomes of this multi-day event, NCCOS and BOEM will continue to work in close coordination with workshop participants—including other agencies—to gather appropriate data to inform the models.

Mapping The Way Forward

Throughout the course of the workshop, participants engaged in rapid brainstorming of data across seven ocean sectors. Following the opening NCCOS presentation for each sector, participants worked in small groups to identify any missing but available data not included in the presentation and the leads to acquire said data. Each small group also discussed positive attributes of the data, and, conversely, any issues or challenges with the data for each sector. At times, important gaps to address surfaced during full group discussion.

Data development outcomes for each session are summarized below. Only minor edits to improve readability and consistency of presentation have been made to ideas captured either on participant worksheets or in full group dialogue. Therefore, much of the text below remains conversational in tone and structure, with some redundancy expected. The tables and associated bullets reflect information collected in small groups for the sector under consideration. Follow-on discussion in a full group setting spurred additional information sharing and engagement around the initial ideas written down and discussed among small groups.

Workshop participants and interested parties may access the NCCOS presentation and study area maps here. NCCOS's available database initially presented for each ocean sector can be viewed here.

Separate from the data sessions below, participant worksheets captured questions, concerns, and insights related to the spatial suitability modeling process:

- How will maps be kept up to date? How frequently will they be updated?
- How is climate change prediction data incorporated into the model? Is it paired with hindcast modeling or habitat data?
- How will sea level rise be accounted for in the model?
- What kind of quality assurance/quality control is conducted on the data sets before they are incorporated into the model?
- How are data sources from different states compared?
- How are data standardized if they are available at different resolutions?
- How is "importance" defined for this exercise? Does importance vary for economic and intrinsic properties?
- How are metadata standardized? Is there standardization by collection season?
- Will models incorporate predictive modeling or future forecasting?
- Will models consider socio-economic impacts of building offshore wind turbines?
- It is important to ensure the most recent data sets are used for all data layers.
- Suitability analyses are limited in how they incorporate unknowns.
- The accuracy and resolution of data can be more clearly reported when Geographic Information System (GIS) data is derived from collating multiple data sets.

NATURAL RESOURCES

Jennifer Wright, Marine Planning Coordinator at NCCOS (Affiliate), provided the introduction to the *Natural Resources* sector. This sector includes data layers on critical habitat, threatened and endangered species, essential fish habitat, and protected areas. NCCOS presented 159 data layers for this sector, including data layers for:

- Protected species
  - Take reduction plans, critical habitat, protection areas, seasonal management areas, biologically important areas, and sightings
    - Marine mammals (e.g., bottlenose dolphin, North Atlantic right whale, Mid-Atlantic harbor porpoise)
    - Sea turtles
    - Atlantic sturgeon
- Fish and shellfish
  - Migratory and Atlantic estuarine fish habitat
  - Marine highly migratory fish
  - Essential Fish Habitat (EFH)
  - Highly Migratory Species (HMS)
  - Habitat Areas of Particular Concern (HAPC)
  - Fish nursery and spawning areas
- Birds
  - North American Wetlands Conservation Act bird priority areas
  - Southeast Conservation Blueprint
  - Important Bird Areas and critical habitat
  - Coastal Avian Protection Zones
- Habitat
  - Deep sea coral (richness, coral mounds, HAPC)
  - Habitat (seagrass, oyster reefs, wetlands, maritime forests, artificial reefs)
  - Protected areas, managed areas, and sanctuaries
  - Critical habitat and coastal barrier resources
- Fishery independent data
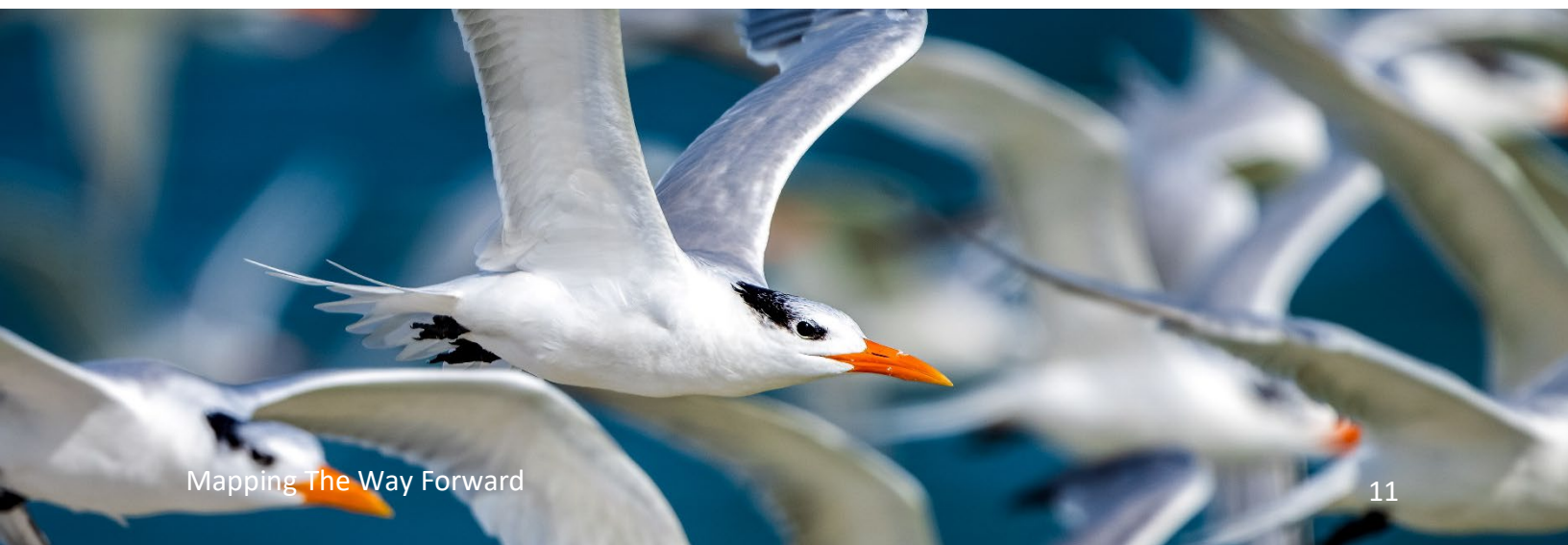
Following the NOAA presentation, participants moved into small breakout groups to first discuss positive attributes of the presented data, and any issues or challenges associated with these data. Groups next worked to identify missing data and leads to acquire this data. Each group utilized a simple worksheet to collect ideas. Feedback is compiled below.

Overall, participants indicated that data for this sector is robust, noting that this data set includes diverse species taxa coverage and excellent spatial and geographical representation. Furthermore, the data have undergone thorough review, vetting, and documentation. A few participants stressed that some data sets and synthesized data models need to be updated, such as those from the Southeast Conservation Blueprint.

Positive attributes of data presented for the *Natural Resources* sector:

- There is diverse species taxa coverage.
- There is good spatial and geographical coverage (shallow to deep, north to south, east to west) of the data.
- Data are well reviewed, vetted, and documented.
- Distribution models for cetaceans appear accurate and robust.
- Heat maps are useful visualization tools.
- There are extensive data sources available for this sector.
- There are a variety of data contributors.
- Much raster data is available.
- The data covers an appropriate spatial distribution from Florida to Virginia.
- Deep sea coral data is well represented.
- There is diverse taxa coverage, inshore data coverage, raster data, and HMS coverage.
- Many of the data layers can be reviewed at a higher resolution upon zooming in.
- There are many dedicated analysts working on this effort.
- Models have already done some work to combine data sets.

Issues or challenges with data presented for the *Natural Resources* sector:

Species and Habitat Data:

- Will the Chesapeake Bay distinct population segment of sturgeon be included in this region, or in the upcoming Mid-Atlantic workshop?
- The coastal bottlenose dolphin take reduction team polygons are not well informed. There is not yet a strong handle on where these populations are. However, there appears to be a northward shift in bottlenose dolphin distribution based on bycatch data.
- Coral richness data may be too broad or underrepresented here.
- The seal data appears questionable.
- Sea turtle data are too broad. Where are the likely sea turtle nesting sites?
- Species-specific information is needed for sea turtles.
- All migratory fish data should be closely examined for accuracy.

- It may be useful to include land and songbird abundance in coastal areas. Overnight migratory songbirds will come into these areas.
- NOAA should disentangle synthesized species data to analyze individual species data.
- More recent cetacean data needs to be included here. These data were updated six months ago.
- The presentation included no discussion on bats.
- Coastal geology is considered a natural resource by the National Park Service (NPS). For example, barrier islands may impact the location of transmission lines.

Data Sources and Quality:

- Is there an opportunity to include independent survey data for species distribution layers?
- It seems the Southeast Conservation Blueprint predictions may be using old (2014) hard-bottom predictions as inputs. These should be examined and updated.
- The Southeast Conservation Blueprint may not be the best data to use based on resolution and the combination of layers.
- It may be challenging to select which data sets to use in cases where multiple data sets exist for certain data.
- Electronically stored information is vast. Underlying metadata needs to be scrutinized.
- Biologically Important Areas (BIA) data layers are very broad.
- There is a projection discrepancy in the Audubon Important Bird Area maps for Virginia and the Carolinas.
- Seasonality is not well captured in the current data layers.
- Some of these data sets do not extend far enough up into estuaries.
- Data layers presented exclude shellfish mapping data in North Carolina estuaries.
- NOAA Protected Resources Division data combined layer is not high enough resolution for use with lease areas.
- Sources for some data layers are inaccurate or out of date.
- More resources are needed to map these natural resources.
- Most of these data products have associated uncertainties. This seems to be poorly represented or not represented at all here.

Mapping and Analysis Considerations:

- Mapping should consider subtidal and non-subtidal data layers.
- Data sets should be viewed from a habitat distribution lens, not only a species distribution lens.
- A lot of fisheries data are linked with habitat and not distribution.
- There appears to be an overlap between the HMS and EFH polygons.
- The South Atlantic and Mid-Atlantic regions have different considerations for EFH. This may make regional comparisons challenging.
- EFH maps are presence- and absence-based.
- Model assumptions may be either too broad or too conservative.
- Seasonality should be considered for things like seal haul out sites, marine mammal migratory patterns, and other migratory species.
- Accurately displaying the seasonality of data will be challenging, such as for migratory species and fisheries.
- Be careful to avoid duplicity or over-counting when utilizing multiple data sources. An example would be when conducting a species count based on habitat, and later counting the habitat layer.
- It is important to consider fisheries value and habitat value.

Mapping The Way Forward

Table 1. Available data and leads for the *Natural Resources* sector

Available Data	Lead(s) to Acquire
Protected Species	
Abundance and relative data	• NCCOS • Duke University
Soft bottom fish, sea turtles, sharks, coastal migrations, pelagics	• SEAMAP coastal trawl surveys • Tracey Smart, South Carolina Department of Natural Resources (SCDNR)
Federal/state listed species occurrences data	• North Carolina Natural Heritage Program • SCDNR
Species occurrence data	• National Heritage Partnership
Manatee data	• None provided
Individual whale species data	• Duke University Marine Geospatial Ecology Lab
Spatial density model for coastal bottlenose dolphins (Fall 2024)	• Matthew Bowers, NOAA Fisheries Southeast Fisheries Science Center (SEFSC)
BIA data will be updated in 2024	• Sarah DeLand, Duke University
Species density models should be updated by late 2024/early 2025	• Atlantic Marine Assessment Program for Protected Species
Updated (2023) cetacean species density models	• Duke University (link provided)
Marine mammal data	• North Carolina marine mammal observers
Range maps for threatened and endangered species	• US Fish and Wildlife Service (USFWS)
Leatherback turtle movements in the South and Mid-Atlantic Bights	• Rider et al., 2024. Where the leatherbacks roam: movement behavior analyses reveal novel foraging locations along the Northwest Atlantic shelf. https://doi.org/10.3389/fmars.2024.1325139
Turtle density layers from satellite-tagged animals	• Mid-Atlantic Ocean Data Portal (MARCO) • Winton et al., 2018. Estimating the distribution and relative density of satellite-tagged loggerhead sea turtles using geostatistical mixed effects models. https://doi.org/10.3354/meps12396

Table 1. *Continued*

Available Data	Lead(s) to Acquire
Protected Species *(Continued)*	
In-water turtle survey	• Tracey Smart, SCDNR • Mike Arendet, SCDNR
Sea turtle nesting sites	• A coalition of state agencies maintains this data • Michelle Pate SCDNR
Sea turtle models	• DiMatteo et al., 2023
Sea turtle habitat density	• US Navy data sets available at Ocean Biodiversity Information System • Spatial Ecological Analysis of Megavertebrate Population
Sea turtle models (four species), marine mammal models and summary products	• Sarah DeLand, Duke University
Sturgeon data	• BOEM-funded Coastal Virginia OSW study (Chris Hager et al.) • Matt Ogbrun, Smithsonian Environmental Research Center • Fred Scharf, University of North Carolina Wilmington • Matt Balazik Virginia Commonwealth University
Offshore Atlantic sturgeon data, specifically for 20-meter contour depth over-wintering areas off North Carolina	• None provided
Atlantic sturgeon telemetry data	• None provided
Variety of marine species/habitat data	• The Nature Conservancy (TNC) marine mapping tool
Fish and Shellfish	
Forage fish data layers in the estuarine, nearshore, inner, mid, and outer shelf zones	• None provided
Fisheries echosounder data (not species specific)	• Avery Paxton, NOAA NCCOS
Shellfish mapping data in North Carolina estuaries	• Charlie Denton, North Carolina Division of Marine Fisheries (NCDMF)
North Carolina crab sanctuary areas	• NCDMF

Table 1. *Continued*

Available Data	Lead(s) to Acquire
Fish and Shellfish *(Continued)*	
North Carolina blue crab spawning sanctuaries	• North Carolina Department of Natural Resources
Oyster sanctuary polygons	• NCDMF
Oyster restoration projects	• TNC • University of North Carolina (UNC) • South Carolina Office of Resilience
Oyster sanctuaries (natural and restored)	• UNC • North Carolina Coastal Federation
Birds and Bats	
New bird data that includes seasonality	• Southeast Coastal Ocean Observing Regional Association (SECOORA) • Arlis Winship, NOAA NCCOS
Altitude data for migratory shorebirds	• Motus Stations • Birds Canada • Rhunde and A Wilke, TNC
Shorebird data	• Smithsonian Shorebird Collective • Audubon North Carolina • North Carolina Bird Atlas • Cornell Lab of Ornithology • Motus Stations
Additional migratory bird data	• Lindsay Addison, Audubon North Carolina
Bird track data	• Movebank
Land-based songbird data	• Cornell University
Bird data	• Ducks Unlimited
Bird models and summary products (will be updated in April 2024)	• Sarah DeLand, Duke University
Flight height data for birds and bats	• Radar
Bat data	• Regional Wildlife Science Collaborative for Offshore Wind (RWSC) Science Plan • North American Bat Monitoring Program
Year-round bat ranges	• Melinda Turner and Jill Ultrap, USFWS
Habitat	
Updated seagrass data for Core Sound and Pamlico Sound	• Tim Ellis, Albemarle-Pamlico National Estuary Partnership
South Carolina seagrass layer	• Southeast Aquatic Connectivity Assessment Project
Virginia seagrass	• Roude and Bo Lusk, TNC
Submerged Aquatic Vegetation (SAV)/time series	• National Marine Fisheries Service (NMFS)

Table 1. *Continued*

Available Data	Lead(s) to Acquire
Habitat *(Continued)*	
North Carolina seagrass mapping data	• Charlie Denton, NCDMF
SAV data	• Rocky Mountain Cooperative Ecosystem Studies Unit – Southeast Coast Network Database Program (CAHA and CALO; Brian Gregory)
Harmful algal blooms (HABs)	• Margie Mulholland, Old Dominion University • Kim Reece and Marjorie Friedrichs, Virginia Institute for Marine Science (VIMS)
New wetlands data will be available by 2025	• NOAA Coastal Change Analysis Program
Estuarine surveys	• State of South Carolina
Deep sea coral maps	• Jeff Buckel, NC State University
Coral mound to the Blake Plateau	• Sowers, et al., Mapping and Geomorphic Characterization of the Vast Cold-Water Coral Mounds of the Blake Plateau. *Geomatics*. 2024; 4(1):17-47. https://doi.org/10.3390/geomatics4010002
Bottom type, such as soft coral sponge	• Southeast Reef Fish Survey • Marine Resources Monitoring, Assessment, and Prediction • Tracey Smart, Marine Resources Research Institute, SCDNR
Topographic breaks and canyons	• None provided
Environmental Protection Agency (EPA) Category 1 Airsheds	• Swansboro National Wildlife Refuge (NWR)
Coastal habitat change Lidar data	• Doug Newcomb, USFWS
North Carolina and Virginia offshore sand areas and dredge shore locations	• Jennifer Bucatari, BOEM Marine Minerals Division
Habitat data for Carolina Long Bay	• Chris Taylor, NCCOS
Coast Guard siting survey data in progress	• US Coast Guard (USCG)
Benthic surveys (lower impact/relief bottom) coming mid-June 2024	• TotalEnergies Carolina Long Bay, LLC
Horseshoe crab data	• Carl N. Shuster Jr. Horseshoe Crab Reserve

Table 1. *Continued*

Available Data	Lead(s) to Acquire
Habitat *(Continued)*	
Living shorelines	• NOAA Living Shoreline Map https://www.habitatblueprint.noaa.gov/living-shorelines/project-map/
More detailed shoreline alteration data available	• North Carolina Division of Coastal Management
Protected areas and marine sanctuaries	• None provided
Habitat/wetland transition data	• None provided
Habitat mapping/restoration efforts for salt marsh and oysters	• East Carolina University • University of North Carolina • Other universities • Rachel Gittmann, East Carolina University • TNC
Sand shoals	• Chris Taylor, NCCOS
Artificial reefs	• Virginia State Management Agency
Coastal geology	• NPS
Water quality data for Lower Cape Fear River	• Lower Cape Fear River Program
Fishery-Independent Data	
Fishery-independent surveys	• Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) • Northeast Area Monitoring and Assessment Program (NEAMAP)

Data gaps for the *Natural Resources* sector:

- Stock assessment for sea turtles
- Locations of sea turtle beaches and high tide nesting sites
- Seabird data layers
- Pathways for bird flight height and marine mammal depth
- Invasive species prevalence and distribution
- Data layers on food web dynamics and trophic hierarchy
- Animal movement and tracking data
- Marine mammal use of inshore estuarine areas
- Relative impact of OSW on wetlands via forecasting
- Inclusion of "fish hangs" as indicators of wrecks, artificial reefs, etc.
- Saltwater intrusion

FISHERIES

Alyssa Randall, Marine Planning Coordinator at NCCOS (Affiliate), provided the orientation to the *Fisheries* sector. This sector includes data layers for active commercial and recreational fisheries and fishery management areas. Alyssa commented that accurate spatial data are essential for effective fisheries management to ensure sustainable harvests, preserve marine ecosystems, and maintain the balance between economic growth and environmental conservation in this region. NCCOS presented 29 data layers for this sector, including data sets for:

- VMS
- Southeast Region Headboat Survey for 2014–2020
- Communities at Sea (CAS)
- Fishery dependent surveys
- Shellfish
- Marine fisheries prohibited areas
- Fishing gear and gear restriction areas
- Fish management areas
- Fishery closures and rotations
- Fishery restrictions
- Management units
- Public access
- Aquaculture

Early in the fisheries discussion, James Morris clarified for the group that the separation of the *Fisheries* and *Industries* sectors is intentional to give equal influence to both sectors in the spatial suitability models. Separation further helps retain the importance and high level of influence of the *Fisheries* sector, and ensures it is not diluted through inclusion in a broader category.

Following the NCCOS presentation, the group discussed challenges surrounding the accurate representation of recreational fishing. Currently, recreational fishing lacks close tracking and regulation, including the collection of information on revenue, landings, fishing effort, and locations fished. NCCOS seeks additional input in this area, recognizing the substantial value and importance of the industry in the region. One participant highlighted significant gaps in data concerning recreational fishing, pelagic long line closed areas, and seasonally closed areas. Moreover, participants discussed a discrepancy in vessel identification, noting that while vessels are identified via NOAA's Greater Atlantic Regional Fisheries Office (GARFO) permits, they often operate outside of VMS boundaries, and VMS is not required south of Hatteras Island, North Carolina. Consequently, some fishing effort remains unregistered on maps, leading to skewed data wherein fishing activities do occur in certain areas yet remain undocumented.

Positive attributes of data presented for the *Fisheries* sector:

- Aquaculture in North Carolina is primarily oysters and clams. The state has under 300 leases, but also different lease types.
- NCCOS acknowledged gaps in the annual Marine Recreational Information Program (MRIP) data sets.
- Comprehensive commercial data with good resolution (e.g., trip-level and vessel-level data) is available.
- Data include long time series.
- Management areas match SAFMC maps and website.
- Logbook data are at the trip and vessel level.
- It is clear NOAA and BOEM are attempting to account for all different components of the fishing industry.

Issues or challenges with data presented for the *Fisheries* sector:

Fisheries Data Collection and Standardization:

- States have disparate gear types for the same commercial fisheries. This impacts landings. How are these comparisons standardized?
- Gear types vary between states and will vary near wind farms.
- How do recent closures influence fisheries data?
- How can maps include non-regulated fisheries occurring in federal waters, such as the conch fishery in Virginia?
- Closures and restrictions are seasonal.
- Logbook details are self-reported and can be imprecise.
- Self-reported recreational fishing data may be grossly inaccurate.

- Recreational fisheries account for over half of the fisheries industry, where are the data for recreational fisheries? The South Atlantic does not have vessel trip reporting data.
- In regard to the CAS dataset, the total longline data don't come directly from the real logbook, it comes from offset or secondary sources.

Data Sources and Representation:

- Some are concerned about the potential overlap of wind farms with longtime NOAA fisheries dependent and fisheries independent surveys – suggest coordination with NOAA Fisheries to achieve deconfliction.
- VMS is not required south of Hatteras Island, North Carolina. Using only VMS data will underrepresent fishing in the entire South Atlantic region.
- It is difficult to determine if boats tracked via VMS are fishing in the area or just passing through.
- VMS is not required in the South Atlantic so it may incorrectly appear like no fishing exists on maps.
- VMS data only represent larger vessels and captures data that may not represent actual fishing locations.
- VMS data have been updated since 2019.
- Spatial resolution for some data layers may be a challenge.
- Some data presented in maps may be duplicative. For example, squid appears on two separate data layers.
- The data appears skewed towards GARFO.
- More closure data is needed.
- The CAS datasets from 2015 are likely outdated and only extend through North Carolina. Rutgers University and MARCO may be in discussions about updating this data set.
- CAS bottom trawl has no shrimp trawl data.

Modeling and Analysis:

- How do models account for temporal shifts of fisheries due to HABs, water quality, and climate change?
- Special Management Zones (SMZs) are hard to enforce.
- Shoreside routes may change if processing facilities close.
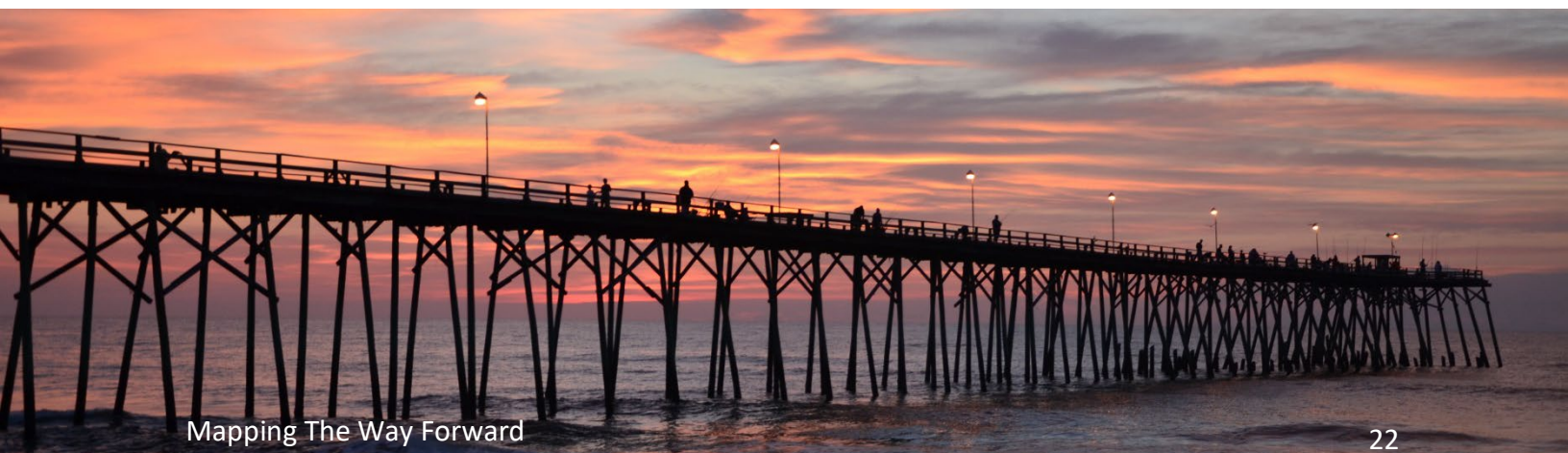- Closures in Wanchese will shift to Suffolk.

Table 2. Available data and leads for the *Fisheries* sector

Available Data	Lead(s) to Acquire
Longline vessel track data can be used instead of VMS	• None provided
Snapper and grouper fishing from May 1- January 1 commercial of recreational datasets (recreational grouper season starts June 1)	• None provided
Recreational angler data	• Fishery application reporting • Jen McCann, University of Rhode Island, workshop on Recreational Fishing and Offshore Wind
Various recreational data	• MRIP • Fishbrain • Myfishcount • NOAA Southeast Region For-Hire Integrated Electronic Reporting • Scifish • South Carolina charter logbooks • HMS in the South Atlantic
Various commercial fisheries data	• Atlantic Coastal Cooperative Statistics Program • Commercial logbooks • Fishery Management Councils
Vessel tracking for illegal vessels past the exclusive economic zone	• Satellite data • Synthetic aperture radar
Species of conservation concern	• Nate Bacheler, NOAA Fisheries SEFSC
Historical fisheries data	• OceanAdapt
Historical river herring and shark fishery data	• None provided
Shark longline data	• NEAMAP • J Garthland, VIMS
Sturgeon data	• None provided
Atlantic menhaden and other forage fisheries	• None provided
Growth of shrimp fishery in Virginia state waters	• Todd Janeski, Virginia Commonwealth University
Sargassum harvest areas	• None provided
Fisheries ecological knowledge and participatory mapping for the Gulf of Maine	• BOEM Notice of Funding Opportunity

Table 2. *(Continued)*

Available Data	Lead(s) to Acquire
Various maps (e.g., artificial reef locations, shellfish sanitation temporary closure, estuarine benthic maps, and more)	• North Carolina Department of Environmental Quality (Link)
South Carolina estuarine trawl surveys for crab and shrimp	• Peter Kinsley-Smith, SCDNR
South Carolina inshore trammel net survey	• Joseph Ballenger, SCDNR
South Atlantic deep water longline survey	• Kevin Craig, NOAA
South Carolina Coastal longline and Pamlico sound survey	• Dan Zafp, NCDMF • Tracey Smart, SCDNR
Shoreside impacts of wind on seafood processing in Virginia	• A. Michaelis and Andrew Scheld, VIMS
Timelines on closures or management changes by species	• Fish Rules app
HMS	• HMS compliance data
Shrimp and longline bycatch reports	• NOAA Fisheries SEFSC
Tagging studies	• None provided
Private angler and dealer reports	• None provided
Satellite data to track vessels	• None provided
Seafire charter boat data	• None provided
Fisheries data	• Michaelis, Scheld, and White, VIMS
Fisheries research projects database (link)	• Responsible Offshore Science Alliance
Marine and estuarine fishes	• Fred Scharf, UNC Wilmington
Fishery and fishery management data	• North Carolina Marine Fisheries Spatial Interface
Fisheries rules and proclamations, fishery management plans, enforcement, and habitat plans	• Common North Carolina Marine Fisheries Commission Rules interactive GIS maps

Data gaps for the *Fisheries* sector:

- Recreational fishing data for Carolina Long Bay
- Shrimp data layers
- Surf fishing locations
- Pier fishing locations
- Dark fishing locations
- Shoreside impacts of wind in Virginia

CULTURAL AND SOCIAL RESOURCES

Bryce O'Brien, Marine Planning Coordinator at NCCOS (Affiliate), provided an overview of the *Cultural and Social Resources* sector. This sector includes data layers related to cultural and social uses of the environment and archaeological sites. NCCOS is aware of 53 data layers for this sector, including for:

- Coastal recreation
    - Shore-based activities
    - Wildlife and sightseeing
    - Underwater activities
    - Surface water activities
- Recreational boating routes and whale watching areas
- Social vulnerability information
- Historical infrastructure

During report backs to the full group following small group discussion, participants highlighted the need to include tribal use data in this sector. Other commenters observed that many of the data layers end in Virginia and do not include information for North Carolina and/or South Carolina. More recent data may be available for a few of the presented layers.

Positive attributes of data presented for the *Cultural and Social Resources* sector:

- It is good to consider this sector in marine spatial planning efforts.
- Social vulnerability is included here (though data should be updated).
- Data on recreation is robust.

Issues or challenges with data presented for the *Cultural and Social Resources* sector:

Cultural and Social Considerations:

- Will NOAA conduct formal consultation with tribes about important cultural resources?
- The listed datasets do not take into consideration long-range municipal planning science. If a region is at capacity, can social infrastructure feasibly support additional growth from incoming workers and their families?
- All the datasets under culture and social are from a "positive" intrinsic values lens and leave out population and community planning factors, particularly onshore factors, that strongly influence intertidal and offshore outcomes.
- There is too much focus on positive intrinsic values, like recreation and parks, and not enough consideration of the basic foundational capacity of an area to sustainably support populations that are exposed to emergent risks. Intrinsic value factors are important to consider but the list so far ignores core population and development planning components.

Environmental Considerations:

- Are Brownfield sites, Superfund sites, and hazardous waste sites being taken into consideration? These are strong factors that influence society and culture and inform where future growth should and should not be excluded.
- How will loss of state marine reserve areas due to hurricane damage be represented here?

Data Sources and Coverage:

- Traditional territory and tribal use data are missing. In addition, the data needs to consider that not all tribes are federally recognized.
- Data layers here are provided at different scales.
- The social vulnerability options need to be looked at more closely.
- The social vulnerability poverty level does not seem accurate, especially around Albemarle Sound and Carteret County.
- Many data layers stop in Virginia and do not include information for North Carolina and/or South Carolina.
- The underwater activities dataset may date back to 2013.
- There is a lot of data for onshore activities but not much for offshore activities.
- More offshore cultural and social data is needed.
- Use surface water activities data layers with caution.
- No archaeological data is included here.
- Terrestrial archaeological sites are not included in North Carolina Historic Preservation Office data. This data cannot be shared publicly, and the North Carolina Office of State Archaeology must review it on a project-level basis.

Table 3. Available data and leads for the *Cultural and Social Resources* sector

| Available Data	Lead(s) to Acquire
Recreation	
Recreational scuba activities	• Local dive shops
Boating routes	• AIS data
Sailing routes to the Caribbean	• None provided
Recreational boating	• North Carolina Wildlife Resource Commission (WRC)
Boat and kayak rental locations	• None provided
Boat registrations	• North Carolina WRC boat registration data by county or year
Ecotourism data	• None provided
Dolphin feeding locations	• None provided
Birding locations	• E-bird
Hunting use areas	• None provided
Wild horse population data	• None provided
Tourism data	• None provided
Fishing Data	
Knowledge of historical fishing grounds	• Conversations with under-represented communities
FISHstory for historical fishing data	• Julia Byrd, SAFMC
Veteran fishing sites	• Project Healing Waters • Other charter fishing groups
Locations of the states' primary fishing tournament sailing lanes (e.g., Big Rock Tournament)	• None provided
Historical Data	
Archeological data	• State Historic Preservation Office
Submerged land with historical or cultural importance (offshore)	• None provided
Shipwreck locations	• NOAA Automated Wreck and Obstruction Information System • Monitor National Marine Sanctuary
Gullah-Geechee Cultural Heritage Corridor	• Amanda Jackson • Dionne Hoskins-Brown, NOAA, Savannah State University
Historic preservation sites	• South Carolina Department of Archives and History Perseveration Society

Table 3. *Continued*

Available Data	Lead(s) to Acquire
Infrastructure	
Working waterfront inventory	• None provided
Septic and municipal waste locations	• North Carolina Shellfish Sanitation data GIS team
Municipal infrastructure (roads, trash facilities, drinking water, electric, etc.)	• None provided
Location of emergency services for natural disasters, offshore/plant disasters, emergency response	• None provided
Infrastructure data	• North Carolina Building Footprint (2010)
Tribal and Traditional Cultural Resources	
Tribal use and value	• Kirk Havens, VIMS Center for Coastal Resources Management
Tribal traditional cultural resources	• Tribal Historic Preservation Officers
Environmental Protection Agency (EPA) Category 1 Airsheds	• EPA
Traditional ecological knowledge	• None provided
Social Vulnerability	
Climate change and social vulnerability	• Colburn et al., 2016. Indicators of climate change and social vulnerability in fishing dependent communities along the Eastern and Gulf Coasts of the United States. https://doi.org/10.1016/j.marpol.2016.04.030
New Environmental Justice Index and Social Vulnerability Index data for 2022	• Agency for Toxic Substances and Disease Registry, Centers for Disease Control and Prevention
Social science	• Christina Weigard, SAFMC
Regions Innovating for Strong Economies and Environment Communities	• Rebuild North Carolina
Justice40 Climate and Economic Justice Screening communities	• Climate and Economic Justice Screening Tool
Housing availability and affordable housing	• None provided

Table 3. *Continued*

Available Data	Lead(s) to Acquire
Social Vulnerability *(Continued)*	
Number of schools in ratio to number of students	• None provided
Social vulnerability	• NOAA Community Social Vulnerability Indicators data • NOAA Coastal County Snapshots
Natural Areas	
Natural areas and managed areas	• North Carolina Natural Heritage Program
Viewshed areas	• NPS sea shores • NWRs
Communities with watershed restoration plans	• North Carolina 205J funding data
NPS natural and cultural data	• NPS Integrated Resource Management Applications portal
Natural hazards	• Federal Emergency Management Agency (FEMA) natural hazard risk mapper
Local communities in reef conservation-focused activities	• Reef Environmental Education Foundation data portal
Natural and cultural resources data	• Surfrider Foundation

Data gaps for the *Cultural and Social Resources* sector:

- Petroglyphs
- Other forms of data that provide insight into social vulnerability
- Boat making locations
- Brownfields, Superfund sites, hazardous waste sites, and similar
- Public transportation versus non-public transportation ratios
- The Aids to Navigation (ATON) constellation includes historic ATON. Long range ATON towers could be considered historic.
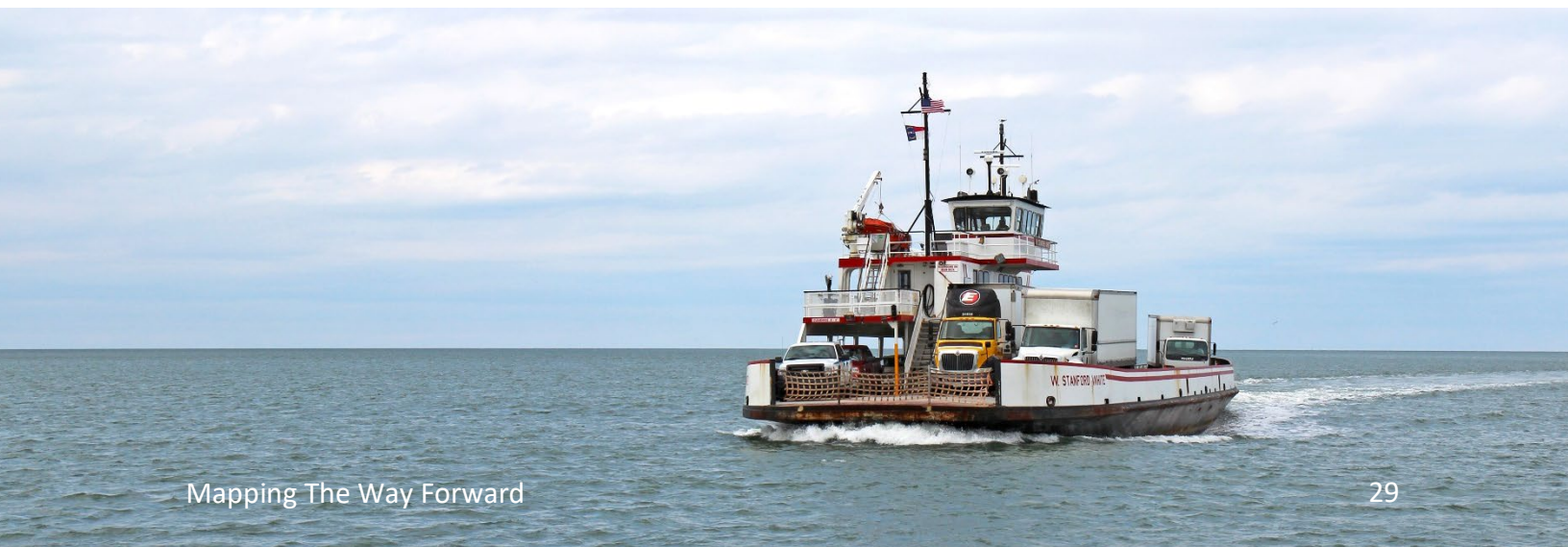
NATIONAL SECURITY

Alyssa Randall reviewed data layers for the *National Security* sector. This sector includes information essential to safeguard the nation's interests, encompassing geographical data on infrastructure, military installations, and critical sites. NCCOS presented 14 data layers for this sector related to:

- Military operating areas
- Military transit areas
- Danger zones and restricted areas
- Formerly used defense sites
- Unexploded ordnance areas
- BOEM Central Atlantic National Aeronautics and Space Administration (NASA) Mission Compatibility Assessment areas

Following the presentation, Robbin Beard, Department of Defense (DOD), expressed appreciation for how these data layers consider military needs for training areas. This makes it possible to support renewable energy development within a safe proximity. Robbin described how DOD's mission and activities are dynamic. Site suitability for wind energy or other offshore development is subject to change depending on how military activities evolve over time, thus regular consultation is important.

Nathan Owens, DOD, highlighted the importance of deconflicting activities both above and below the ocean surface as it relates to placement of wind turbines, with a focus on airspace concerns, military training routes, and radar issues. The size and motion of wind turbines can create Doppler signatures that need to be distinguished from standard and specialty radar signals. Furthermore, turbines can be mistaken for airplanes and pose hazardous obstructions. DOD will continue to contribute to marine spatial planning efforts and collaborate closely with NOAA and BOEM.

Carmen Lombardo, US Marine Corps, noted the importance of considering the nexus between offshore areas and onshore air routes from a long-term planning standpoint. He suggested that instrument routes and visual routes should be included as part of the military transit route data layers.

Positive attributes of data presented for the *National Security* sector:

- This data set seems comprehensive.

Issues or challenges with data presented for the *National Security* sector:

- How will disaster response planning for large facilities be conducted?
- The public facing DOD website is undergoing updates. NOAA will need to update data layers that can be obtained here.
- The US Navy may be able to provide updated information, though some information is classified.
- Layers of environmental contamination from military bases could influence how surrounding areas are used.
- Airspace areas are slowly changing to accommodate new aircraft requirements, so airspace for the DOD changes accordingly.
- Make sure that the military zone data includes blast radius. For example, Military Ocean Terminal Sunny Point has a 50-mile blast radius.

Table 4. Available data and leads for the *National Security* sector

Available Data	Lead(s) to Acquire
Navigation channels	• None provided
Active dredging sites	• US Army Corps of Engineers (USACE)
Unmanned aircraft system fly zones	• None provided
Updated links available on DOD website	• Robbin Beard, DOD • US Navy
Military transit routes, instrument routes, visual routes	• Carmen Lombardo, US Marine Corps
Defense Installations Spatial Data Infrastructure	• David Labranche, DOD • Provided link
Port security and disaster response	• USCG • FEMA
Atlantic Fleet Training and Testing 2025	• None provided
Marine mammal behavioral response training	• Duke University • DOD
SpaceX splash down and rocket recovery efforts	• NASA • USCG • DOD
Tagging studies and/or environmental permitting	• Naval Facilities Engineering Systems Command Atlantic
Navy training and testing activities	• Atlantic Fleet Training and Testing Environmental Impact Statement
Information about exploded ordinances that have been recovered in OSW leases and relocated to other bottom locations	• None provided
Coast guard search and rescue and safety zones	• USCG
Dark skies initiative areas	• None provided

METAOCEAN AND OTHER

Bryce O'Brien provided the orientation to the *Metocean and Other* sector. This sector includes data layers related to meteorology, oceanography, geology, and ocean boundaries. NCCOS presented 136 data layers for this sector, including data related to:

- Surficial sediment sample locations
- Benthic geology
- Coastal erosion
- Sea surface height and ocean waves
- Ocean winds
- Ocean currents
- Intrinsic seabed habitat vulnerability
- Seafloor shear stress
- Bathymetry
- Ocean boundaries
- Sea level rise projections

During report backs, participants suggested additional data to include in this sector that may influence future OSW siting locations, such as earthquake vulnerability, spatial data on lightning strikes, sea level rise (SLR) projections, flood and risk hazard zones, sand accretion areas, and shallow subsurface geology. Numerous other suggestions for additional data and data sources were captured in participant worksheets.

Positive attributes of data presented for the *Metocean and Other* sector:

- The data is comprehensive.
- Many good data layers were presented.
- Metocean data and modeling can be used to predict upwelling zones for seabird foraging and forage fish concentration.

Issues or challenges with data presented for the *Metocean and Other* sector:

- Live bottom habitat will get covered/uncovered by storm events. How do models account for these types of constant dynamic changes?
- Is sand sediment work incorporated into the model?
- Many layers do not extend to North Carolina or South Carolina (e.g., seabed vulnerability).
- Many data sets seem to end around Morehead City, North Carolina.
- Some data layers are outdated, such as seabed data and ocean winds.
- There are temporal constraints to these data. For example, sea surface heights and wind will increase seasonally.
- Erosion rates do not account for nourishment or accretion.
- Some data layers are missing for North Carolina and South Carolina.
- Governance challenges may emerge in areas where transmission lines cross.
- Deepwater Marine Protected Areas (MPAs) appear to be missing.
- The SLR legend is confusing. Inundation is shown at each location.
- SLR models do not consider accretion.
- With respect to bathymetry, some of the areas have much higher resolution bathymetry than what is reflected in the Global Multi-Resolution Topography. It might be worthwhile to use some additional higher resolution datasets.
- Ensure tribal data includes federally and non-federally recognized tribes.
- Land elevation should be considered. Onshore facilities and worker housing need to be located in places that can keep pace with sea level rise and/or be high enough above flood zones.

Table 5. Available data and leads for the *Metocean and Other* sector

Available Data	Lead(s) to Acquire
Beach nourishment and shoreline hardening	• USACE
Earthquake vulnerability	• None provided
Earthquake fault lines	• None provided
Tropical cyclone data	• None provided
Subsurface substrate and geology (sand, rocks, etc.)	• Reef fish surveys can serve as proxy • SEAMAP • USACE's Coastal Systems Portfolio Initiative • Nate Bacheler, NOAA
Seabed: updated data set available in 2025	• Mary Conley, TNC
Biological value of sand shoals	• NMFS Combined Habitat Model
EFH and offshore sand features	• Pickens and Taylor, 2020
Protected lands	• Mark Anderson, TNC
Landing zones	• DOE
Benthic geology	• TNC
2024 State of the Ecosystem: Mid-Atlantic	• Sarah Gaischas, NOAA Fisheries
2024 State of the Ecosystem: South-Atlantic	• Kevin Craig, NOAA Fisheries
Sea surface salinity, temperature	• Hycom • Navy Coupled Ocean Data Assimilation
Coastal habitat change Lidar data	• Doug Newcombs and Chris Sherwood, USFWS
Runoff/pH data sets	• None provided
South Atlantic Bight Marine Assessment data set - boundary issues with Northwest Atlantic Marine Ecoregional Assessment	• TNC
Higher resolution and more up to date physical oceanography data	• None provided
Regional direction models	• SECOORA • North Carolina State University (NCSU)
Chlorophyll a/productivity data or models	• None provided
Higher resolution ocean biogeography inclusive of offshore split	• Williamson et al., 2009
More detailed "sand resources" data layer is available	• Marine Minerals Information System (MMIS Application)
Modeled shoal data layer, often suggested for avoidance of offshore export cable corridors	• MMIS

Table 5. *Continued*

Available Data	Lead(s) to Acquire
North Carolina erosion and set back rates for beachfront	• Ken Richardson, North Carolina Division of Coastal Management • Provided Link #1
Land elevation	• None provided
Flood zones	• None provided
SLR projection data	• None provided
Deepwater MPAs	• Regional fisheries management councils
Living shorelines	• Carolyn Currin, NOAA • Provided Link #1
Pollution and debris mapping	• None provided
Climate change data (e.g., acidification, sea surface temperature, etc.)	• None provided
Ocean current fluxes in the Gulf Stream	• None provided
Atlantic multi-decadal oscillation	• None provided
Working waterfront inventory	• None provided
TNC coastal resilience and wetlands migration analysis: Resilient coastal sites	• Mark Anderson and Analie Barnett, TNC
NOAA Climate, Ecosystems, and Fisheries Initiative	• Grace Rosker, NOAA Fisheries
Insurance coverage data for wind, hail, and flooding	• Insurance companies
Transportation flood mapping	• North Carolina Flood Inundation Mapping and Alert Network
Relevant data (e.g., buoy data)	• Coastal Ocean Research and Monitoring Program
(VIMS mapping tool), includes: • Data given different scenarios • Data protection and restoration • Infrastructure • Shoreline management • Natural resources • Sea level rise/flooding/storm surge • Vulnerability and risk (e.g., marsh, social and physical)	• ADAPT VA
Data to be used in conjunction with coastal relief data	• Continuously Updated Digital Elevation Model
Marine ecoregions data	• TNC Marine Ecoregions of the World data sets

Table 5. *Continued*

Available Data	Lead(s) to Acquire
Coastal resilience data	• NCSU's Coastal Resilience and Sustainability Initiative • Coastal Resilience Evaluation and Siting Tool

Data gaps for the *Metocean and Other* sector:

- Earthquake vulnerability data
- Coastal erosion rates
- Beach nourishment activities
- Sand movement
- Sand accretion data
- Shallow subsurface geology
- Hurricane frequency
- Areas of subsidence, rebound, or uplift
- Areas of upwelling
- Areas of forage fish concentrations
- Spatial data on lightning strike sites
- Runoff
- pH
- Ecoregions
- Transmission to onshore facilities
- Chart plotter maps

INDUSTRIES

The *Industries* sector includes a wide array of data pertinent to the operations of maritime and coastal sectors. James, as noted above during the *Fisheries* discussion, reminded the group of NOAA's intention to give equal influence in the model to the *Fisheries* and *Industries* sectors. Jennifer Wright, NOAA, provided the overview.

NCCOS is aware of 55 data layers for this sector, including for:

- Shipping fairways
- Channels, ferry terminals, and ports
- Navigation
- Anchorage, pilot boarding, and disposal sites
- Pipelines and submarine cables
- Offshore wind and electricity
- Ocean lease areas
- Environmental sensors and buoys
- Beach nourishment and Virginia exclusion zones
- AIS vessel traffic
- Wrecks and obstructions
- Passive Acoustic Monitoring (PAM) device locations

Positive attributes of data presented for the *Industries* sector:

- This is a creative and comprehensive data set.

Issues or challenges with data presented for the *Industries* sector:

- The submerged pipeline data for Myrtle Beach may be outdated.
- The southern portion of the region appears to lack AIS data.
- PAM data are incomplete.
- South Carolina's AIS data is questionable, so should be considered with caution.
- The data set for proposed transmission lines to wind facilities may be incomplete.
- The Shipping Safety Fairways layer is likely mislabeled. While there are traffic separation schemes and precautionary areas, this file looks like North Atlantic right whale existing speed zones.
- This should also consider onshore power stations, electric plants, processing plants, and/or space to build plants and stations. OSW cannot be accomplished without onshore facilities.
- Acoustic monitoring arrays can drastically change over relatively short time periods.
- All the potential sand sources for nourishment activities have not yet been identified or mapped, particularly those in the southern Long Bay area.

Table 6. Available data and leads for the *Industries* sector

Available Data	Lead(s) to Acquire
Regular near shore trawl survey	• SEAMAP
State water surveys for transmission routing	• Department of Natural Resources • Division of Marine Fisheries
Sand borrow areas	• USACE
State-owned roads (potential right of way)	• Virginia Department of Transportation (DOT) • North Carolina DOT • South Carolina DOT • Federal Highway Administration
High kilovolt interconnection points and transmission lines offshore	• BOEM
Fishery independent surveys	• ChesMMAP • NEAMAP • State surveys
South Carolina coastal receiver array	• Mike Arendt, SCDNR
Anjana cable system installation near Myrtle Beach, South Carolina (April 2024)	• None provided
New cable landing station in Myrtle Beach	• DC Blox

Table 6. *Continued*

Available Data	Lead(s) to Acquire
Acoustic telemetry receiver locations	• Cooperative telemetry networks • Kim Richie, Matt Ogburn, Joy Young, FACT Network • Atlantic Cooperative Telemetry (ACT) Network • PAM data portal through RWSC project • MOTUS Network • Updated PAM data (Jesse Cleary, Duke University)
Port Access Route Studies	• David Mottel, USCG (shapefiles are available on the Federal Register)
Acoustic telemetry mapping efforts	• Christian Laspada, RWSC • ACT Network • FACT Network
Fiber Optics Network	• Contact individual states
Nuclear power plants located in the coastal zone	• None provided
Dredging schedules for channels and ports for burying transmission lines	• USACE
Onshore right of ways for routing to shore-based facilities	• DOT • South Atlantic Coastal Study
Atlantic seafloor mapping	• Christian Laspada, RWSC
USGS tracks, boating races – space operations information	• Publicly available on the navigation website

Data gaps for the *Industries* sector:

- Onshore transmission infrastructure data and potential interconnection points
- Onshore transportation data
- Some ferry routes
- Beacon locations for future ocean additions, such as monitoring devices

OFFSHORE WIND

Seth Theuerkauf (BOEM) discussed data layers and data considerations related to *Offshore Wind.* This session focused on data relevant to the siting of OSW lease areas and potential transmission cable corridors. Building on the opening framing of the workshop, Seth revisited BOEM's role to balance conflict and opportunity in the planning of new OSW lease areas. In this case, he stressed "opportunity" to mean consideration of factors that promote the technical and economic feasibility of offshore wind development. He shared a list of different data categories that are important for siting of OSW and transmission cables:

- Wind resource data
- Seabed geology and subsurface conditions
- Seabed bathymetry and topography
- Technical and engineering considerations
- Subsurface infrastructure and hazards
- Navigation and shipping routes
- Fishing activity, grounds, and management areas
- Marine wildlife and habitat data

Seth and the workshop facilitator invited Jen Banks, TotalEnergies Carolina Long Bay, LLC (hereafter, TotalEnergies), to join the discussion via a virtual connection with the full group in the room. Jen thanked BOEM and NOAA for their work. She noted that some data sets which inform decision-making related to transmission cable corridor locations are straightforward. Others are more dynamic and will be influenced by grid interconnections. Currently, there is uncertainty about interconnection locations for the Carolina Long Bay leases. Land-based grids will need to be updated to incorporate energy produced by offshore wind farms. If TotalEnergies receives strong commitments from coastal states in this region to move forward with offshore wind development, swift progress can be made. Otherwise, development activities might be delayed.

Albie Solana, a participant in the room also employed by TotalEnergies as its Fisheries Liaison, acknowledged the volume of missing fishing activity data in the southeast due to lack of requirements for use of VMS systems within regional fisheries. Other methods will be needed to incorporate this data due to its importance for decision making. In addition, Albie spoke to the need for more subsurface data to support developers in considering best placement for offshore wind.

A few participants commented that historically, recreational fishers have been reluctant to share their locations and data for fear of losing their fishing grounds. However, OSW may pose a threat to this industry if these areas go unidentified. This data development effort provides an important opportunity for agencies to increase outreach to the fisheries sector, improve communications, and conduct trust-building such that commercial and recreational fishers may participate in the planning process and help protect fishing grounds.

Participant worksheets collected at the conclusion of this session showed additional concerns for the *Offshore Wind* sector:

- Potential increases in shoreside property values and the impact of transmission lines on properties are concerns for the environmental justice community.
- Most subsurface data within wind planning lease areas is collected after these areas are selected. Data are considered proprietary if collected by the lessee.
- There is a lack of subsurface geology information for OSW lease areas.
- This data development exercise does not account for social license.
- Can outreach efforts be increased to encourage fishers to report locations to help agencies avoid fishing hot spots?
- It is essential to communicate the importance of spatial data to commercial and recreational fishers as a step to ensure buy-in to the spatial planning process. This could influence regional fishery management councils to change rules to collect better data.

As the workshop concluded, participants shared key takeaways and emerging insights to support marine spatial planning in Virginia, North Carolina, and South Carolina. Each bullet below reflects a comment made by a single individual. Given the focus of the workshop—initial brainstorming of data development ideas, leads and gaps—no effort was made to either assess or build consensus on any comment.

- "Establishment of regional data coordination partnerships for this spatial planning effort could be beneficial, like what has been done across the Atlantic region. Partners could include NOAA, MARCO, the Regional Wildlife Science Collaborative, and others."
- "It is important to sustain these collaborative conversations over the long-term, and to establish a mechanism to keep data layers up to date."
- "Numerous different types of species, gear and surveys are used for data collection in North Carolina and South Carolina. Bridging gaps to harmonize data will be a challenge."
- "This spatial planning effort should be considered from a regional perspective, which includes tracking the cumulative impacts of activities and actions across the region."
- "This is a dynamic process wherein models will use best available data, and best available data are changing all the time."
- "This marine spatial planning effort holds great value beyond its use for siting OSW projects. This exercise will be useful for many initiatives going forward."
- "This workshop, and the range of participants brought together by NOAA and BOEM, is evidence that multiple agencies and organizations can work together in a productive and collaborative manner."
- "This workshop and the subsequent spatial planning processes offer an approach that is easy to understand and a consistent methodology that can be/is applied across disparate regions, thus improving external participation and transparency."
- "This group's work over two days has helped demonstrate where and how data collection can be improved so that future projects will be easier to implement."
- "The community engaged in this work needs to evolve further to include state-based data sets in these mapping efforts, especially for the purpose of informing transmission line locations."
- "Hundreds of data layers will be used in the spatial suitability model. It is critical to carefully assign weights to each layer. This community needs to work together, discuss the relative importance of each layer, and thereby inform decisions on each layer's level of influence."
- "Questions remain on how to address the temporal dynamics of the data."
- "NOAA and BOEM should keep direct communications open with people involved in the data collection."
- "Please ensure the data included in the model is useful and be willing to eliminate data layers that are not appropriate or superfluous."

- "Included data sets all have different update cycles. A mechanism is needed to capture the periodicity of data sets."

James and Seth thanked both workshop participants and NOAA and BOEM staff for supporting the collective data development effort. James reviewed next steps that will guide work in the coming months:

1. Develop and distribute the workshop report on the NCCOS website
2. Follow up on identified data leads – the NCCOS team will be in touch
3. Continue to develop the NCCOS marine spatial planning data inventory/ geodatabase
4. Work with state and federal governments on planning priorities
5. Incorporate identified best-available data for BOEM's offshore wind planning priorities:
    a. Spatial modeling to inform transmission cable corridors for the Carolinas
    b. Central Atlantic Round 2 Wind Energy Area development

James concluded by acknowledging the rapid pace at which this planning effort is unfolding, particularly the urgency and associated timelines put forward by the current administration. He shared the commonly known quote that "all models are wrong, some are useful." While the data for this spatial suitability model is imperfect, he noted, it will reflect the best available science produced to date in this region. How data layers are used to inform marine spatial planning and development efforts is of paramount importance. He again thanked the group for its commitment to collaboration as the workshop adjourned.

ACT	Atlantic Cooperative Telemetry
AIS	Automatic Identification System
AOA	Aquaculture Opportunity Area
ATON	Aids to Navigation
BIA	Biologically Important Area
BOEM	Bureau of Ocean Energy Management
CAS	Communities At Sea
ChesMMAP	Chesapeake Bay Multispecies Monitoring and Assessment Program
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GARFO	Greater Atlantic Regional Fisheries Office
GIS	Geographic Information Systems
HAB	Harmful Algal Blooms
HMS	Highly Migratory Species
MARCO	Mid-Atlantic Ocean Data Portal
MMIS	Marine Minerals Information System
MPA	Marine Protected Area
MRIP	Marine Recreational Information Program
NASA	National Aeronautics and Space Administration
NCCOS	National Centers for Coastal Ocean Science
NCDMF	North Carolina Division of Marine Fisheries
NCSU	North Carolina State University
NEAMAP	Northeast Area Monitoring and Assessment Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OSW	Offshore Wind
PAM	Passive Acoustic Monitoring
RWSC	Regional Wildlife Science Collaborative for Offshore Wind
SAFMC	South Atlantic Fishery Management Council

SAV	Submerged Aquatic Vegetation
SCDNR	South Carolina Department of Natural Resources
SEAMAP	Southeast Area Monitoring and Assessment Program
SECOORA	Southeast Coastal Ocean Observing Regional Association
SEFSC	Southeast Fisheries Science Center
SLR	Sea Level Rise
SMZ	Special Management Zone
TNC	The Nature Conservancy
UNC	University of North Carolina
US	United States
USACE	US Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VIMS	Virginia Institute for Marine Science
VMS	Vessel Monitoring System
WRC	Wildlife Resource Commission

Day 1
NOAA Beaufort Laboratory: Tuesday, April 9, 2024

Time	Activity
8:30 am - 9:00 am	Registration
9:00am - 9:15 am	Welcome and Agenda Review
9:15am - 10:00 am	Overview of NOAA's Marine Spatial Planning Process and How It Informs BOEM's Siting Process
10:00 am - 11:00 am	Session 1: Natural Resources
11:00 am - 11:15 pm	Break
11:15 am - 12:30 pm	Session 1: Natural Resources (*continued*)
12:30 pm - 1:30 pm	Lunch Break
1:30 pm - 3:00 pm	Session 2: Fisheries
3:00 pm - 3:15 pm	Break
3:15 pm - 4:45 pm	Session 3: Cultural and Social Resources
4:45 pm - 5:00 pm	Wrap Up Day 1 and Prepare for Day 2

Day 2
NOAA Beaufort Laboratory: Wednesday, April 10, 2024

Time	Activity
8:30 am - 9:00 am	Registration
9:00 am - 9:15 am	Recap of Day 1 and Preview of Day 2
9:15 am - 10:00 am	Session 4: National Security
10:00 am - 11:00 am	Session 5: Metocean and Other
11:00 am - 11:15 am	Break
11:15 am - 12:30 pm	Session 6: Industries
12:30 pm - 1:30 pm	Lunch Break
1:30 pm - 2:15 pm	Session 7: Offshore Wind
2:15 pm - 2:45 pm	Open Discussion and Next Steps
2:45 pm - 3:00 pm	Closing Remarks

In-Person Participants

Name	Affiliation
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Jessica Carlton	NOAA NCCOS/Consolidated Safety Services
Jonathan Choi	Duke University
Jesse Cleary	Duke University
Mary Conley	VIMS
Anne Deaton	NOAA Fisheries
Sarah DeLand	Duke University
Kerby Dobbs	BOEM
Jillian Eller	East Carolina University
Betsy Evans	USFWS
Joshua Gange	BOEM
Dewey Hemilright	Commercial Fisherman
Michelle Hobgood	NOAA NCCOS/Consolidated Safety Services
Kathleen Howington	SAFMC
Brandon Jensen	BOEM
Kathy Matthews	USFWS
Adriane Michaelis	VIMS
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Thea Petzling	USCG
Alyssa Randall	NOAA NCCOS/Consolidated Safety Services
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