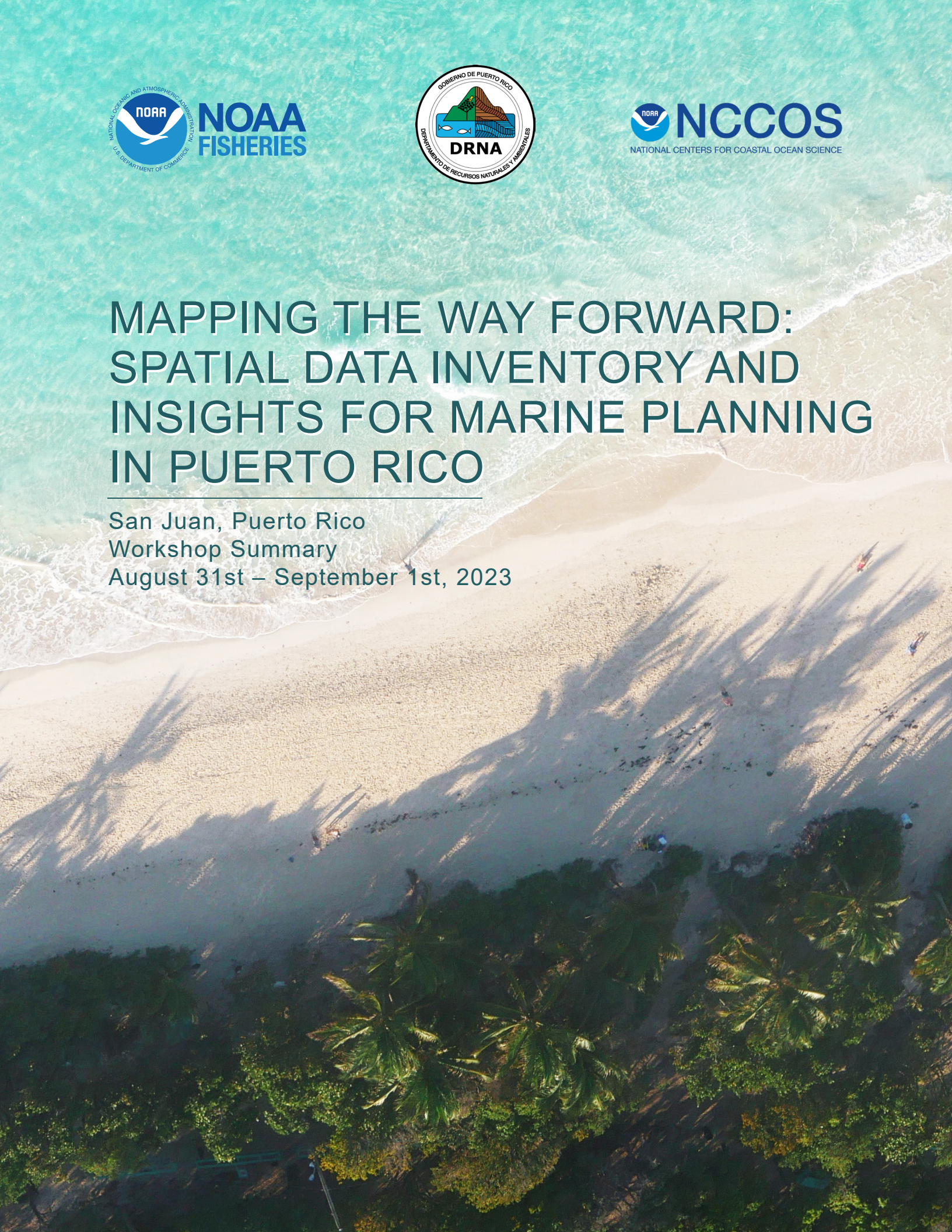

MAPPING THE WAY FORWARD: SPATIAL DATA INVENTORY AND INSIGHTS FOR MARINE PLANNING IN PUERTO RICO

San Juan, Puerto Rico
Workshop Summary
August 31st – September 1st, 2023

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NOAA Technical Memo NOS NCCOS 324, NMFS 773.

This workshop was co-led by the NOAA National Centers for Coastal Ocean Science, Marine Spatial Ecology Division and the NOAA NMFS Southeast Fisheries Science Center.

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EXECUTIVE SUMMARY

Workshop Overview

The National Oceanic and Atmospheric Administration (NOAA) National Centers for Coastal Ocean Science (NCCOS), in partnership with the NOAA National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC), convened multi-day marine spatial planning workshops in two US territories in late August 2023. Following the federal register notice for both events (88 FR 54302), the first workshop occurred in the United States Virgin Islands (USVI), followed by a second in Puerto Rico. This technical memorandum includes data development outcomes of the second workshop, held in San Juan, Puerto Rico from August 31st to September 1st.

NCCOS and NMFS SEFSC are working to build spatial planning capacity in the US Caribbean region. Marine spatial planning, especially for insular communities like the USVI and Puerto Rico, holds great promise to assist coastal managers, environmental organizations, and industry with planning for future development of the blue economy, including emerging opportunities like renewable energy and aquaculture. The following goals guided each event:

- Learn more about NOAA's marine spatial planning approaches and activities
- Inventory available spatial data for the USVI and Puerto Rico
- Document data shortcomings and gaps
- Increase local capacity and resources for regional ocean spatial planning
- Further develop a community of stakeholders to inform future marine planning

Workshop Organizers and Participants

NCCOS and NMFS SEFSC assembled and coordinated closely with a steering committee to develop each workshop agenda. Committee membership included territory-based planners and scientists, subject matter experts, agency leaders and representatives. A facilitation team lent planning support to the steering committee and fostered broad participation at the highly interactive events. The NCCOS Marine Planning Coordinator for the US Caribbean provided overall workshop coordination and will follow up on identified data leads from each workshop.

More than 50 individuals attended the Puerto Rico event. Participants included local agency leaders and planners, environmental organizations, scientists, subject matter experts, and members of the Caribbean Fishery Management Council (CFMC). Staff from NOAA—including NCCOS, NMFS SEFSC and the NMFS Southeast Regional Office (SERO)—as well as the Bureau of Ocean Energy Management (BOEM) and Department of Defense (DOD) represented the federal government. Participants acknowledged the lack of fisher attendance at the event, and highlighted the importance of engaging this stakeholder group anew as this marine spatial planning process evolves.

Workshop Outcomes

The workshop produced a wide range of data leads and gaps across each ocean sector explored. Many participants expressed a strong desire to address national security data gaps. Some suggested that tourism as a whole should be considered closely. Group discussion of fisheries and natural resources revealed that both fishery management and conservation face constraints due to a lack of data for commercial and recreational fishing, as well as the location of important spawning grounds for several fish species. Many emphasized the need to build trust with fishers in order to better understand where fishers fish, the level of effort, and species caught and sold.

Participants cited numerous data sets that could be important to marine planning, such as protected areas in the east, past mapping efforts, and various types of critical habitat. For example, important coral reef mapping has occurred in recent years and will extend into the future. Some also pointed out that certain maps are 15–20 years old and thus need to be updated. Suggestions were made to refine Essential Fish Habitat (EFH) and benthic data, improve understanding of the status of threatened and endangered species, and build greater capacity to track birds, marine mammals and sea turtles. A few participants expressed concern about the unknown impacts of sewage and other point source pollution on the coastal environment.

During discussion of cultural and social resources, group comments centered on the need to incorporate social vulnerability, coastal suitability data, and equity and environmental justice concerns into data development efforts. As alternative energy industries emerge, some emphasized the importance of securing community-based information as a critical step to support workforce development and build social and environmental resilience. Suggestions for the metocean sector focused primarily on improving understanding of ocean currents, Saharan dust, ocean acidification, underwater noise, and sediment movement among other topics.

This summary of workshop outcomes charts a path for increased coordination on marine spatial data between the federal government and its territorial partners and stakeholders in the months and years ahead. Detailed workshop outcomes are described below for each ocean sector, including data leads, gaps and additional questions, concerns and insights put forward by participants. The agenda and attendance list are included as appendices. Interested parties can access the NOAA workshop presentations here.

WELCOME AND OPENING REMARKS

Alberto Mercado, Deputy Secretary, Puerto Rico Department of Natural and Environmental Resources (DNER), welcomed the group and offered introductory remarks. He emphasized the many challenges facing Puerto Rico's government and island community when it comes to sustainable use, management and conservation of ocean resources. He encouraged active group engagement at the workshop, knowledge sharing and development of new tools to build marine spatial planning capacity in the region. He acknowledged and expressed appreciation for many familiar faces in the room and thanked NOAA for bringing this group together.

James Morris, marine ecologist, NCCOS, thanked all attendees and recognized the many different organizations and agencies present in the room. He emphasized that this workshop brings focus to information gathering, discussion of challenging topics in marine spatial data, and development of a digital infrastructure of ocean intelligence. The central goal of the event, James noted, is to mine and compile existing data across multiple ocean sectors. As data come together, NOAA and its partners are then well positioned to build site suitability models which can analyze any emerging projects like offshore aquaculture or wind energy development.

James introduced Jennifer Wright, the NCCOS Marine Planning Coordinator for the US Caribbean region. He explained how, during the course of the workshop, Jennifer will present data layers across six ocean sectors. Each presentation will set the stage for group identification of missing but available data, data leads, and key data gaps. After the workshop, Jennifer and the NCCOS team will follow up on identified leads. James stressed the importance of the multi-sector aspect of conversation. He acknowledged specific issues of interest that may arise but tasked the group to focus broadly on the range of current and prospective uses and functions of the marine environment in Puerto Rico, from nearshore waters out to the Exclusive Economic Zone (EEZ).

Karen Baker, Chief, BOEM Office of Renewable Energy Programs, thanked NOAA for hosting and expressed appreciation for everyone's attendance. The 2022 Inflation Reduction Act extends BOEM's jurisdiction to the US Caribbean, particularly as it relates to permitting facilities to help meet the Biden administration goal of securing 30 gigawatts of offshore wind energy by 2030 and deploying 15 gigawatts of floating wind technology by 2035. BOEM has recently begun to coordinate with the territorial governments in Puerto Rico and the USVI on this ambitious goal. More formal engagement processes will follow as project applications come forward. The ocean, Karen concluded, is a busy place, so it is good to see this kind of planning emerge.

APPROACH TO COLLABORATIVE ENGAGEMENT

Facilitators Rich Wilson and Meagan Wylie, Seatone Consulting, reviewed the workshop goals, agenda and proposed approach to maximize data brainstorming, idea generation and contributions among participants.

The six ocean sectors which served to focus group discussion included the following:

1. *National Security*: locations of various operation areas of the military or the National Aeronautics and Space Administration (NASA)
2. *Industries*: locations of vessel traffic, key industrial concerns (shipping lanes, pipelines, submarine cables, etc.), buoys and weather forecasting devices
3. *Fisheries*: areas where both commercial and recreational fisheries are active (revenue, landings)
4. *Natural Resources*: information about protected species and sensitive habitats
5. *Cultural and Social Resources*: cultural and recreational uses of the environment, social vulnerability, demographic data, and archaeological sites
6. *Metocean and Other*: meteorological and oceanographic conditions (temperature, wind, currents, etc.), shoreline, bathymetry, and boundaries

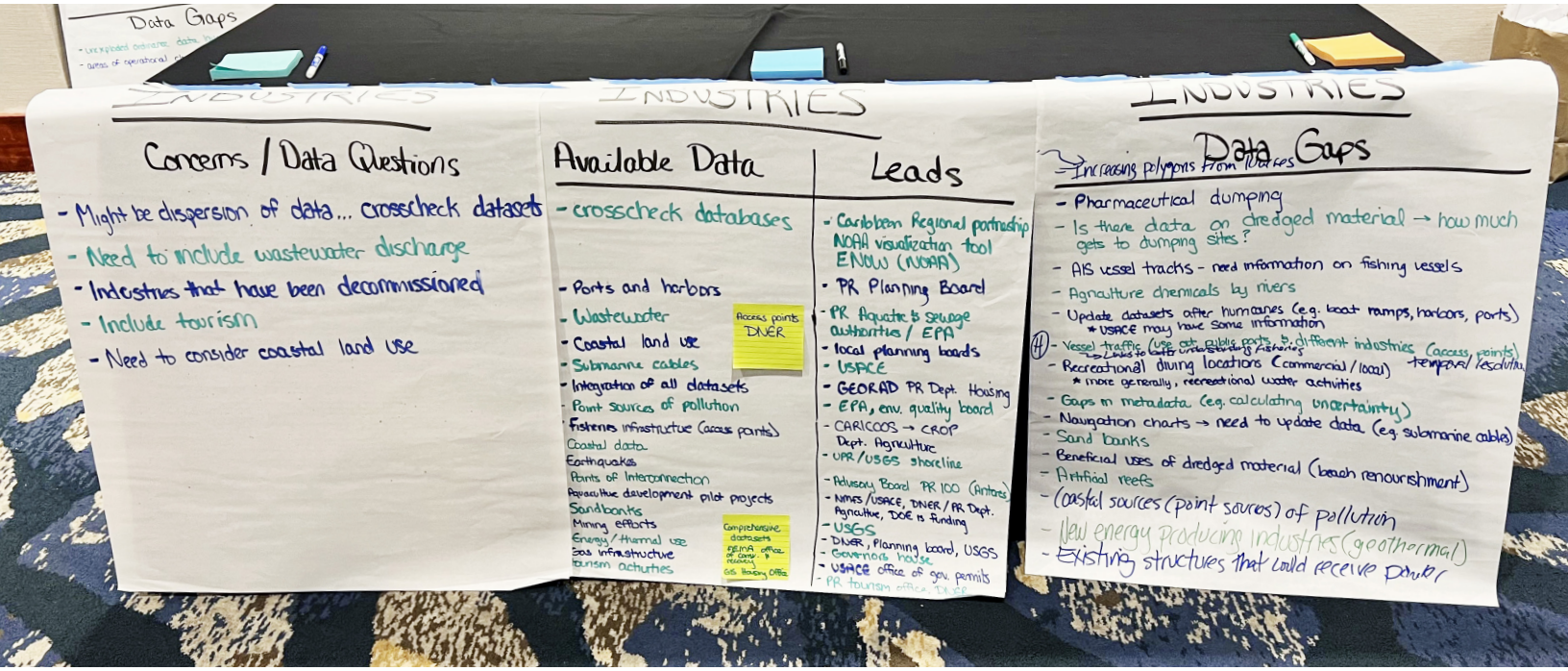
Following each NOAA presentation on baseline information that has been collected for the sector under consideration, three prompting questions, with related follow-ups, were utilized to stimulate group discussion.

1. What are your concerns or questions, if any, about the data layers just presented?
2. Are you aware of any data that are missing from the presented list, but are available? If so, can you provide a lead to acquire?
3. What data gaps exist? In considering the list of identified data gaps in group discussion, what stands out as a high priority?

At the conclusion of each presentation, individual participants used a simple worksheet to silently generate ideas prior to engaging with others in small and large group discussion. The facilitation team encouraged participants to introduce themselves when sharing comments with the full group, be concise and share the air, and stay focused on marine spatial data. The data development outputs described below represent an amalgamation of information collected on worksheets, via facilitated discussion and chart writing, and by extensive note taking.

As group engagement on each ocean sector concluded, any individual at the workshop could identify a data gap as a high priority. That said, no formal organization or ranking of data gaps by the group occurred. As the event concluded, the full group briefly revisited a comprehensive list of identified data gaps, then shared key takeaways and discussed next steps ahead.


US Caribbean Marine Spatial Planning Workshop
Puerto Rico
August 31, 2023 - September 1, 2023
The Courtyard Marriott Isla Verde, San Juan


Data Gaps
INDUSTRIES
Concerns / Data Questions
- Might be dispersion of data... crosscheck datasets
- Need to include wastewater discharge
- Industries that have been decommissioned
- Include tourism
- Need to consider coastal land use
INDUSTRIES
Available Data
- crosscheck databases
- Ports and harbors
- Wastewater
- Coastal land use
- Submarine cables
- Integration of all datasets
- Point sources of pollution
Fisheries infrastructure (access points)
Coastal data
Earthquakes
Points of interconnection
Aquaculture development pilot projects
Sandbanks
Mining efforts
Energy / thermal use
Seas infrastructure
tourism activities
Access points DNER
Comprehensive datasets
Leads
- Caribbean Regional partnership
NOAA visualization tool
ENOW (NOAA)
- PR Planning Board
- PR Aquatic & sewage authorities / EPA
- local planning boards
- USACE
- GEORAD PR Dept. Housing
- EPA, env. quality board
- CARICOOS → CROP
Dept. Agriculture
- UPR/USGS shoreline
- Advisory Board PR 100 (Artores)
- NMFS/USACE, DNER/PR Dept. Agriculture, DOE is funding
- USGS
- DNER, Planning board, USGS
- Governor's house
- USACE office of gov. permits
INDUSTRIES
Data Gaps
- Increasing polygons from Marxes
- Pharmaceutical dumping
- Is there data on dredged material → how much gets to dumping sites?
- AIS vessel tracks - need information on fishing vessels
- Agriculture chemicals by rivers
- Update datasets after hurricanes (e.g. boat ramps, harbors, ports)
* USACE may have some information
- Vessel traffic (use cat. public ports, b. different industries (access points)
- Recreational diving locations (commercial / local)
* more generally, recreational water activities
- Gaps in metadata (e.g. calculating uncertainty)
- Navigation charts → need to update data (e.g. submarine cables)
- Sand banks
- Beneficial uses of dredged material (beach renourishment)
- Artificial reefs
- (coastal sources (point sources) of pollution
- New energy producing industries (geothermal)
- Existing structures that could receive DMMP

NOAA'S MARINE SPATIAL PLANNING PROCESS

James Morris presented a brief overview of NOAA's marine spatial planning and modeling process in order to set the stage for data development across the six ocean sectors in Puerto Rico. Workshop participants and interested parties may view his presentation here.

Over the last decade, NCCOS has developed a robust marine spatial planning framework. To date, approximately 50 spatial analyses have been completed. These include two published atlases which compile the best available science to inform the identification of Aquaculture Opportunity Areas in the Gulf of Mexico and Southern California Bight. These established methods provide the foundation for interagency coordination now emerging between NOAA and BOEM as wind energy projects are increasingly proposed in federal waters across the United States.

NOAA and BOEM collaborate with local partners in all regions of the United States 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. Stakeholder engagement—building, for example, on the knowledge and data already possessed by many individuals, organizations and agencies in Puerto Rico—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 begin to enable local partners in Puerto Rico to move in this direction.

DATA DEVELOPMENT ACROSS SIX OCEAN SECTORS

Throughout the course of the workshop, participants engaged in rapid data brainstorming across each of the six ocean sectors. Following the opening NOAA presentation for each sector, participants initially asked questions, shared concerns or offered insights as conversation began. The group then pivoted to identify any missing but available data not included in the presentation, the leads to acquire said data, and key data gaps that need to be addressed.

Data development outcomes for each session are summarized below. NOAA's available database is initially presented for each ocean sector. Subsequent text and associated tables show the information collected from the group for the sector under consideration. Given the early stages of marine spatial planning in Puerto Rico, combined with the rapid pace of brainstorming and group discussion, some redundancy of text in this workshop summary is expected.

Workshop participants and interested parties may access the NOAA presentations here.

Session 1

NATIONAL SECURITY

The *National Security* sector includes information essential to safeguard the nation's interests, encompassing geographical data on infrastructure, military installations and critical sites. Data layers which NCCOS is aware of include danger zones and restricted areas, formerly used defense sites (FUDS), and unexploded ordnance (UXO) areas.

Nathan Owens, DOD, offered insights on national security data and described DOD's coordination process with NOAA and BOEM as more ocean-based activities like offshore aquaculture and wind energy come forward. Similar to his message at the USVI marine spatial planning workshop, he clarified certain military activities and terms, then described available data and data leads across a number of topics.

DOD works to identify conflict areas and devise mitigation strategies. Generally, data are available, Nathan noted, but they need to be acquired and organized. Nathan fielded questions and concerns regarding the restriction of military use from previously active sites, UXO areas and the location of submerged fiberoptic cables. Karen Baker, BOEM, agreed on the importance of data surrounding FUDS and suggested leads at the US Army Corps of Engineers (USACE) to acquire this information. The tone and substance of the national security dialogue among participants suggests all identified data gaps below are a high priority for those who raised them.

Participant worksheets collected at the conclusion of the workshop include additional questions, concerns and insights for the national security sector. With the exception of minor editing for readability, bullets in this and subsequent sessions reflect direct transcription from submitted participant worksheets.

- Questions persist about live fire near shipping routes. More information is needed.
- It is understood that some have access to classified data. What kind of data and information sharing conflicts should we anticipate during marine spatial planning efforts?
- Who will have access and the ability to work with classified data? What is the resolution of UXO areas and the ordnance contained within them? Can we work in these areas or are they entirely blocked off?

- More than one participant stressed the importance of knowing the cleanup status of formerly used military areas, especially live fire areas which created UXOs. Can Puerto Ricans be certain that these areas will be cleaned up and usable in five or 10 years?
- The presented maps and associated data are not at the appropriate resolution to represent local ocean complexities. Resolution is important, as is temporal resolution given that data can change over time.
- Only recently has data become available from areas previously used for military activity (e.g., Isla de Mona, Isla Desecheo).
- It is important to understand the different types of military activities in training and testing areas to the greatest extent possible.

Table 1. Available Data and Leads for the National Security Sector

Available Data	Leads to Acquire
Special use airspace polygons, low level airspace	• Nathan Owens, DOD
Military training routes (free form, linear)	• Nathan Owens, DOD
Relocatable over the horizon radar	• US Navy
Parachute jump areas/restricted areas	• Nathan Owens, DOD
Submarine testing grounds	• US Navy
FUDS	• USACE • René Esteves, Puerto Rico Sea Grant
UXO	• DOD • NMFS Enterprise Data Management Program
United States Coast Guard (USCG) operational/training areas	• Department of Homeland Security, regional USCG offices
NASA activities	• NASA
Ship traffic	• JP Freeman, USCG
Fiberoptic cables	• DOD • NOAA nautical charts

Table 2. Data Gaps for the National Security Sector

Data Gaps (including identified high priorities*)
UXO related risks near Culebra and Vieques*
FUDS (current and future status)*
Any intersection of live fire and shipping routes*
Vieques Channel*

Session 2

INDUSTRIES

The *Industries* sector includes a wide array of data pertinent to the operations of maritime and coastal sectors. Data layers which NCCOS is aware of include:

- Automatic Identification System (AIS) vessel tracks
- Aids to navigation
- Wrecks and obstructions
- Submarine cable and pipeline areas
- Ports and harbors, coastal channels and waterways
- Anchorage areas
- Buoy locations
- Ocean disposal sites
- Location of surface and submerged fish aggregating devices (FADs)
- Pilot boarding areas and stations
- High frequency radar stations
- Weather forecasting layers

At the outset of group discussion, some wondered how, especially for ports and harbors, to cross-check and reconcile federal data sets with data sets possessed by the Puerto Rico Planning Board. Additional comments covered a wide range of activities and associated impacts, from tourism to pollution to ocean-based development activities. Similar to the USVI, some suggested that the tourism sector as a whole needs to be considered closely. Many data leads and a lengthy data gaps list surfaced during the conversation. Participant worksheets showed additional questions, concerns and insights put forward for the industries sector:

- Has all of NOAA's digital coastal data been integrated in this effort? It is important to integrate information from the NOAA Office for Coastal Management (OCM) visualization tool: Economics: National Ocean Watch (ENOW) and National Centers for Environmental Information (NCEI).
- Why is a geospatial data inventory being created only after blue economy plans have been drawn up for Puerto Rico and the USVI? It seems to be the wrong order.
- It takes time to mobilize resources to remove wrecks from coastal areas. Do we have any updated information on this topic?
- A good number of cables and pipelines just end. Do they actually end or do we just not have data for the rest of the cable route? Is this possibly a data gap?
- Vessels at times turn off AIS and engage in illegal fishing. Is there a way to use satellite imagery to track illegal fishing?
- Do we have data on clearance around wrecks and other obstructions?

- How will vessel AIS not included in the presented data be captured? This is an important temporal element to these data.
- AIS does not include recreational or commercial fishing vessels in Puerto Rico. A possible exception is the use of this technology by pelagic longline vessels.
- We need data on specific components at ocean disposal sites as well as location and substance of discharge materials.
- We have a lack of information on waste water treatment pipelines.
- The tourism industry uses many anchorages, which are not usually mapped. Although it occurs mainly at a local scale, it is important to consider as tourism is increasing.
- Gas facilities in San Juan Bay pose a threat to local communities.
- USCG safety zones do not appear to be included. Perhaps AIS vessel transit data can be separated by category (e.g., cargo, fishing, transit).
- We need to frequently update certain data layers, such as aids to navigation, FADs and anchorage areas for recreational vessels, cruise ships and large shipping vessels.
- We should update information on the location and type of submarine cables. Many more exist than were shown in the presentation.
- We need to look at mining potential, including restrictions that may apply.

Table 3. Available Data and Leads for the Industries Sector

Available Data	Leads to Acquire
Need to cross check various databases	• Caribbean Regional Ocean Partnership (CROP), NCEI and ENOW
Ports and harbors, including areas for port deepening and channel widening	• Puerto Rico Ports Authority • USACE, other federal data sets
Puerto Rico Nuclear Center (existed from 1960s to 1980s)	• Jose Rivera, NMFS SERO Habitat Conservation Division (HCD)
Wastewater discharge	• Puerto Rico Aqueduct and Sewer Authority (PRASA) • Environmental Protection Agency (EPA)
Point source pollution	• EPA • Puerto Rico Environmental Quality Board
Coastal land use, shoreline data and working waterfronts	• Puerto Rico Planning Board • University of Puerto Rico (UPR) • United States Geological Survey (USGS)
Shoreside development areas, coastal zonation and economic opportunity zones	• Federal Emergency Management Authority • Andrew Richard, NOAA NMFS SERO

Table 3. *Continued*

Available Data	Leads to Acquire
Informal economic activity	• Jose Alameda, UPR
Location and type of abandoned coastal infrastructure	• Puerto Rico Industrial Development Company
Potential coastal areas for electricity substations (interconnection points), including decommissioned projects (e.g., Guayama Coal Fired Power Plant)	• Puerto Rico Grid Resilience and Transitions to 100% Renewable Energy Study (PR100) • Antares Ramos
Pilot projects and potential sites for aquaculture development	• NMFS, USACE, Department of Energy • Puerto Rico Department of Agriculture • PR DNER
Mining efforts	• Pedro Gelabert, formerly DNER Secretary • Puerto Rico Planning Board • USGS
Location of sandbanks	• USGS
Earthquakes	• USGS
Energy/thermal use	• Governor's House
Oil and gas facility near San Juan	• USACE
Fisheries infrastructure and coastal access points	• Caribbean Coastal Ocean Observing System (CARICOOS) / CROP • PR DNER • Puerto Rico Department of Agriculture
FAD updates	• Kelvin Serrano, PR DNER • Alfredo Torruella, UPR
Value of tourism activities	• Puerto Rico Tourism Company (PRTC) • PR DNER
Location of recreational water activities and anchorages (e.g., boating, SCUBA diving, kayaking, fishing and fishing tournaments, surfing)	• PRTC • PR DNER Recreational Fisheries Program • Juan Agar and Daniel Matos, Puerto Rico Department of Sports and Recreation • Javier Ramos and Alfredo Martinez, UPR
Cruise ship and air traffic routes	• Puerto Rico Planning Board • Federal Aviation Administration
AIS vessel speed – analyzed products	• Amilynn Adams, USCG

Table 3. *Continued*

Available Data	Leads to Acquire
Post-hurricane access points (e.g., boat ramps, harbors, ports) – LiDAR and other datasets	• Federal Emergency Management Authority • USACE • Environmental sensitivity index maps • National Geodetic Survey • Municipalities
Comprehensive geospatial datasets	• Federal Emergency Management Authority – Office of Response and Recovery
Submarine cables	• DOD • Tetra Tech • Vicente and Associates
Remote sensing/aerial imagery	• None provided

Table 4. Data Gaps for the Industries Sector

Data Gaps (including identified high priorities*)
Vessel traffic by different industries at public ports and coastal access points*
General blue economy data
Ocean dumping by the pharmaceutical industry
Data on dredged material – how much gets to actual dumping sites?
Beneficial uses of dredged material such as beach nourishment
Impacts associated with use and runoff of agricultural chemicals near rivers
Updated post-hurricane datasets (e.g., boat ramps, harbors, ports)
USCG safety zones
AIS vessel tracks for commercial and recreational fishing vessels
Anchorages used by cruise ships, industrial ships and other recreational vessels
Broad-based information on recreational water activities (e.g., snorkeling tour spatial data)
Recreational dive sites used by locals and/or for commercial tour operators
Sunken vessels (non-archaeological)
Location and status of artificial reefs
Gaps in metadata for calculating uncertainty
Updated navigation charts to include location of submarine cables
Location of sand banks
Deep sea mining data (e.g., polymetallic nodules, rare earth minerals)

Table 4. *Continued*

Data Gaps (including identified high priorities*)
Coastal point sources of pollution
Pilot projects and potential sites for aquaculture development
New energy producing industries (e.g., geothermal)
Existing infrastructure that could receive power from wind energy projects

Session 3

FISHERIES

The *Fisheries* sector is divided into three distinct categories: recreational fisheries data (including the charter sector), commercial fisheries data, and data collected through fishery independent surveys. Fisheries play a pivotal role in the socio-economic fabric of the US Caribbean, providing employment, sustenance and recreational opportunities. Accurate spatial data are essential for effective fisheries management, sustainable and productive harvest, and conservation of marine species and ecosystems. NOAA's data for this sector are not currently compiled in layer or map format. Key areas identified by NMFS for future data layer development include:

- *Recreational fisheries*: fishing tournaments (e.g., International Billfish Tournament), Dolphinfish Research Program, and FAD-associated activities
- *Commercial fisheries*: commercial landings reports, port sampling
- *Fishery independent surveys*: Southeast Area Monitoring and Assessment Program (SEAMAP), Coral Reef Conservation Program (CRCP), and National Coral Reef Monitoring Program (NCRMP)

During group discussion, participants cited a range of challenges for fishery managers given that data are limited for both commercial and recreational fisheries in Puerto Rico. Although required by law, there is no recreational fishing license in Puerto Rico, which leaves significant gaps in landings data and known economic value of the fishery. Moreover, conservation efforts are constrained by lack of information on spawning aggregation sites and species targeted by commercial and recreational fisheries. Several participants emphasized the need for trust building with fishers, followed by participatory mapping, in order to better understand where fishers fish, the level of effort, and species caught and sold.

Participant worksheets expanded on the many questions and insights put forward during discussion, and show a great deal of overlap and concern among individuals regarding data limited fisheries:

- The amount and quality of fisheries data is limited. Can we trust the quality of landings data reported by the commercial sector? How accurate are submitted logbooks? Fishery independent data has limitations.
- We need to capture spatially explicit fisheries data, by sector, and we need to better understand routes to fishing grounds.
- Is the existing data sufficient to responsibly assign annual catch limits to fisheries?
- What is the territorial nature of trap fishing?
- Do we have any data to show the strength of enforcement, or lack of, in protected areas?

- Do we have any data that helps identify illegal fishing?
- How do we reconcile mistrust and lack of high resolution information? What fisheries are represented in these discussions?
- Current datasets may miss artisanal/recreational fishing outside of sport or competitive fishing (e.g., local spear fishermen).
- Recreational fishers do not need a license and commercial fishers have no incentive to acquire one. This leaves data sets incomplete and not adequately quantified.
- It is difficult to get a permit for commercial fishing. This leaves us with many unregistered fishers and vessels.
- We have incomplete and incorrect fishery data, particularly in relation to spatial variables. Some resources are not registered at all (e.g., octopus, other invertebrates/ plants). Highly dynamic spatial information is difficult to record.
- In our experience, fishery-dependent statistics for commercial fisheries are not accurate and do not account for the full spatial coverage of fishery activities. We need an inclusive and just process to gather real fishing effort data through participatory mapping that builds trust and compensation for fisher knowledge. This will lead to more accurate fisheries value data than what is currently reported in catch statistics.
- We need a range of fisheries information. This could include site location use, seasonal fishing, recreational activities, and highly migratory species (HMS) targeted by fishers. Participatory mapping will help collect this information.
- We have very limited data and poor data quality for recreational fisheries. Tournaments and FADs alone may not provide a realistic view of recreational effort. Commercial data is also poor. Not all fishers report and the accuracy of what is reported is questionable. Moreover, resources for port sampling are severely limited.
- Critical habitat and EFH need to be protected from expansion of aquaculture and other marine resource industries.
- Historical catch data for Puerto Rico is reported at landing sites, not area fished.
- We need to integrate existing data and emerging data generation processes.
- We need higher resolution data than what was shared in the presentation. For example, electronic data reporting is more spatially explicit. Once integrated, this information can be utilized to produce heat maps of fishing effort.
- Temporal resolution of fishing data (yearly/seasonal) should be included in data layers. This information can be connected to the fishing industry to inform better analysis.
- Lack of spatial data, particularly no data since 2017, is a big concern.
- Commercial fishers do not want to give information on where they fish. A more personal approach with the fishers will be necessary to obtain this information. The CFMC can help with this effort.
- We have a universal lack of knowledge of recreational fisheries and its impact on natural resources in Puerto Rico.
- ABT Associates are integrating datasets and describing the marine environment.

Table 5. Available Data and Leads for the Fisheries Sector

Available Data	Leads to Acquire
Commercial and recreational data by gear and species caught	• Kevin McCarthy, NOAA NMFS SEFSC
Fisher ecological knowledge, participatory mapping, fishery management plans	• CFMC
Location of shore-based fishing and other areas where fishers fish	• Landings data • PR DNER San Juan Bay Estuary Program
Recreational fishing effort survey and/or catch from for-hire recreational charters	• Grisel Rodriguez, UPR • Jose Rivera, NMFS SERO HCD
Port intercept survey to adjust commercial statistics used for management	• Todd Gedamke, MER Consultants
Traditional/historical knowledge of state of resources and spatial fishery occupancy	• Valdes Pizzini, UPR • Carlos Garcia-Quijano, University of Rhode Island
Puerto Rico spatial fishing effort study and other spatial data on fisheries	• Roberto Koeneke and Manoj Shivlani, University of Miami • Martha Prada, CFMC
Fish trap distribution in Puerto Rico and the USVI (2004–2006)	• NMFS SEFSC
Information on designated coastal and marine protected areas (MPAs)	• Miguel Garcia, US Fish and Wildlife Service (USFWS)
Derelict fishing gear and discard containers	• NOAA Marine Debris Program
Critical spawning aggregation sites on target and non-target species	• NCCOS • Nautilus Foundation • Gray or published literature
Fish aggregation sites 2002–2003	• Jose Rivera, NMFS SERO HCD
Coral reef monitoring, including deep mesophotic reefs	• Maria Vega, PR DNER Coral Reef Program • NOAA NCRMP and Deeper Coral Reef Monitoring Program (DCRMP)
Spatial information on fishing areas, even if not fished	• SEAMAP
Socioeconomic data	• NOAA NCRMP survey

Table 5. *Continued*

Available Data	Leads to Acquire
Correlation between habitat change (natural and anthropogenic) and fisheries landings, including catch per unit effort analysis	• None provided
Lobster trap survey (fishery dependent and fishery independent data)	• Kevin McCarthy, NOAA NMFS SEFSC
Conch surveys	• Rich Appledoorn and Jennifer Doerr, SEAMAP
Diver led fishery independent surveys and information on mesophotic reefs	• Laura Jay W Grove, DCRMP
Deepwater snapper and hook and line video surveys	• Kate Overly, NMFS SEFSC
Commercial fishing vessel AIS data	• Raimundo Espinoza, Conservación ConCiencia
Information on seasonal closures	• CFMC
Integrated datasets which highlight different aspects of the blue economy, including fisheries	• Center for the Blue Economy • Ernesto Diaz, Puerto Rico Climate Change Council

Table 6. Data Gaps for the Fisheries Sector

Data Gaps (including identified high priorities*)
Critical spawning and nursery areas – gaps for some species*
Information on mesophotic/deeper marine areas*
Lack of information due to lack of fishing license, especially for the recreational sector (e.g., catch, revenue generated)*
The economic value of fisheries, including the recreational sector. Puerto Rico is distinct from the mainland United States
Spatial use of all nearshore/offshore fisheries (e.g., commercial, recreational, subsistence, HMS, seasonal, for-hire charters) including where they go, not just where they fish
Lack of information generally on subsistence fishing
Location of where fishers fish – need for trust building and participatory mapping
Fishing hot spots for the commercial and recreational sector
Documented conflicts where fishing occurs
Limited understanding of shore-based fishing (e.g., where it occurs, level of effort)
Inventory of ramps, marinas and other fishing infrastructure

Table 6. ***Continued***

Data Gaps (including identified high priorities*)
The kind of economic information which can be gained from recreational fishing licenses
Lack of operational longline fishing fleet information
Historical data inclusion and incorporation into recent landing statistics
Location and status of derelict fishing gear, whether removed or not
Potential impacts to fisheries from repurposing of decommissioned oil wells for other uses
Amount of bycatch
Oceanography and climatology
Repository for ecosystem-based fishery management (EBFM) data as part of the fishery ecosystem plan
How geographical prevalence/location of stocks will change due to climate change
Habitat management areas and important spawning areas
Habitat maps correlated to fishing grounds
EFH map of deepwater species such as queen snapper (*Etelis oculatus*)
EFH changes based on natural and anthropogenic impacts
Octopus and several different species of marine plants
Certain HMS data (e.g., billfish, swordfish)
Invasive species counts/tracking
Vessel monitoring systems and AIS tracking
Hydroacoustic survey routes and data
Information on algae cultivation

Session 4

NATURAL RESOURCES

The *Natural Resources* sector includes data layers of critical habitat, threatened and endangered species, essential fish habitat, and protected areas. Data layers which NCCOS is aware of include:

- Critical habitat designations for three sea turtle species
- Critical habitat designations for seven coral species
- Seven fishery management areas
- Essential Fish Habitat
- Atlantic Highly Migratory Species
- Habitat Areas of Particular Concern

Various federal agencies, as well as agencies and groups in Puerto Rico, possess data layers for:

- FADs
- Protected areas
- Coastal barrier resource areas
- Benthic habitat and coral habitat
- Shallow corals
- Deep sea corals and sponge observations
- *Acropora* presence/absence locations
- Seagrasses
- Bird observations
- Numerous data sources for sea turtle, marine mammal and other protected species distributions (e.g., Ocean Biodiversity Information System)

As discussion opened on natural resources, many cited different types of information potentially missing from the NOAA presentation, such as protected areas in the east, various types of critical habitat, and past mapping efforts. Certain maps, some noted, are 15–20 years old. Suggestions were made to refine EFH and benthic habitat, improve understanding of data needed from Endangered Species Act (ESA) listed species, and improve tracking of birds, marine mammals and sea turtles. Important coral reef mapping has taken place and will extend into the future. A few expressed concern about the unknown impacts of sewage and other point source pollution on the coastal environment.

Similar to the group's conversation, participant worksheets included a few questions and several suggestions for improving natural resources data:

- Are all MPAs and other protected areas included in the presented data layers? Some in the east may be missing.
- MPAs are not well enforced and not all prohibit fishing. Species move a lot throughout ontogenetic shifts. It is therefore difficult to identify important conservation areas.
- Are mangroves in the coastal zone considered? This is also critical habitat. Similarly, are coral reef restoration and recovery projects included and tracked?
- Does deepwater coral and sponge information also include algal plains for queen conch (*Aliger gigas*) habitat usage?
- Data from Puerto Rico and the USVI could be complementary and should, in some ways, be explored together.
- A range of technical data is needed, including bathymetry, critical coral habitat, sea surface temperature, salinity, and rain events and associated runoff.
- EFH habitat for reef fishes needs better detail. Additional EFH studies need to consider the entirety of Puerto Rico out to the EEZ.
- It will be helpful to bring together multiple maps (e.g., habitat, species) and tools which already exist.
- We need to improve understanding of sewage pollution and discharge impacts on coastal resources and public health.

Table 7. Available Data and Leads for the Natural Resources Sector

Available Data	Leads to Acquire
Significant range of data sets (e.g., social biological, water chemistry, benthic habitat)	• Puerto Rico CRCP • NCRMP
Location, type and conservation status of MPAs	• Ernesto Diaz, Puerto Rico Climate Change Council • Bill Gould, International Institute of Tropical Forestry (IITF)
Protected area data layers (coastal and marine)	• IITF
Location, type and conservation status of Desecheo National Wildlife Refuge	• USFWS
Location and status of coastal mangrove ecosystems	• Steve Canty, Smithsonian Institution
Value of mangroves	• The Nature Conservancy (TNC)
Critical spawning aggregation sites for target and non-target species	• NCCOS • Nautilus Foundation • Gray or published literature
Fish aggregation sites 2002–2003	• Jose Rivera, NMFS SERO HCD
Critical habitat for the Nassau grouper (*Epinephelus striatus*)	• NMFS SEFSC

Table 7. *Continued*

Available Data	Leads to Acquire
42 coral reef monitoring stations with data going back to 1999	• Puerto Rico CRCP
Shallow (0–40 meter) coral reef ecosystems	• NCRMP
Coral surveys (e.g., status, bleaching, disease)	• Atlantic Gulf Rapid Reef Assessment (AGRRA)
Mesophotic reef surveys	• Reni Garcia, UPR
Bioluminescent bays	• None provided
Online database of invasive species	• USGS
High resolution benthic data	• NCRMP
Benthic habitat maps, mangroves, coral refugia and larval connectivity – including coastal protection and tourism values	• TNC
Shallow coral reef mapping and prioritization	• Mark Monaco, NCCOS • Maria Lopez, NMFS
Deep sea corals, seamounts and general deep sea environment	• NOAA • Andrea Quattrini, Smithsonian Institution • Mike Rasser, BOEM
Bird flyways	• USFWS • Jorge Brenner, Puerto Rico Ornithological Society
Sea turtle nesting beaches, lighthouses and coastal pollution sources (e.g., light, other)	• PR DNER • Wider Caribbean Sea Turtle Conservation Network
Distinct population segments of green sea turtle (*Chelonia mydas*)	• NMFS SEFSC
Impacts of light and noise pollution on birds	• Jorge Brenner, Gulf of Mexico Coastal Ocean Observing System
Biodiversity hotspots	• Graciela García-Moliner, CFMC • Smithsonian Institution
ESA listed coral species on the north coast	• USFWS
Sargassum (*Sargassum natans* and *Sargassum fluitans*) watch/tracking	• CARICOOS • University of South Florida
Mining potential/products	• USGS
Assessment of places to be demolished (e.g., old piers)	• Local contractors conducting work

Table 8. Data Gaps for the Natural Resources Sector

Data Gaps (including identified high priorities*)
Marine mammals in the EEZ (e.g., presence/absence, species type, birthing areas and migratory routes)*
Location of bird hot spots, including nesting areas and migration patterns of seabirds and coastal dwelling species*
Benthic habitats – gaps to be filled as well as updating historical data*
Ecosystem services and tourism values
Comprehensive EBFM data
Sea turtle nesting beaches and dark areas
Coral reef distribution on the north coast, presence/absence of ESA listed corals, and fisheries presence/pressure
Deep sea coral data (e.g., species composition and distribution, biogeography)
Coral reef restoration and recovery projects
Spawning aggregation sites of conch and various fish species
Distribution of wetlands and mangroves
Invasive seagrass and other non-native species
HMS longline areas
Fishing near spawning aggregation sites
Sand areas east of Vieques
Migratory routes of pelagic and other fish species
Flow information and associated impacts from the Amazon River and Orinoco River
Questions and gaps in information regarding whether or not upwelling areas exist
Location of subterranean hydrologic flows from land to sea
Effects of subterranean hydrologic flows on the distribution of sessile species, manatees (*Trichechus manatus*) and corals
Cargo/vessel traffic
Sewage outflows and associated impacts – unclear how agencies share information

Session 5

CULTURAL AND SOCIAL RESOURCES

The *Cultural and Social Resources* sector includes data on the cultural uses of, and human interactions with, Puerto Rico's marine environment. This sector guides equitable and holistic decision-making, providing spatial insights that respect historical significance and empower communities. Data layers which NCCOS is aware of include historic lighthouses, wrecks and obstructions, protected areas, and the results of the NCRMP 2022 socioeconomic survey. Additional sources of data may be incorporated into this sector:

- Historical and archeological sites
- Traditional areas of cultural importance
- Traditional/ceremonial or important recreational uses of marine or coastal areas (e.g., dive sites, sandbars, transit routes)
- Coastal demographic data
- Social vulnerability data
- Traditional and current territory of tribes or native and traditional populations
- Coastal land tenure/land use
- Fishing territories at sea
- Coastal infrastructure/working waterfronts

Initial group comments stressed the need to incorporate social vulnerability, coastal suitability data, and equity and environmental justice concerns into data development efforts. As new alternative energy industries emerge, understanding community-based information will be key to workforce development as well as building social and environmental resilience. Some noted that scale is important when interpreting social science data, and that specific surveys are needed around human uses of the marine environment. A regional approach, building on the NOAA Fisheries Equity and Environmental Justice Strategy, is under development in Puerto Rico.

Comments from collected participant worksheets generally aligned with the questions, concerns and suggestions put forward during group discussion. Nearly all the data gaps described below were highlighted as a high priority by one or more individuals in the room.

- How are any new ocean development plans going to affect coastal resource use? Will new projects displace human communities? We must consider the potential cumulative impacts of development that may be coming.
- Spatial resolution of socioeconomic data is not representative down to the municipal level. It currently is only at a broad regional level. This data development exercise needs to include both marine spatial data and coastal suitability data.
- Consideration of cultural and social resources should be linked to nearby natural resources such as coral reef areas, EFH and critical habitat.

- Much of the socio-economic data presented lacks high spatial resolution or connection to explicit areas of Puerto Rico's nine nautical mile seaward boundary. We will need this information to analyze the impacts and benefits of offshore development.
- We need a fair process, centered on equity and designed to avoid new industries simply grabbing up ocean space. Development at sea needs to adopt this kind of approach in order to not repeat the displacement and marginalization issues experienced on land.
- NCRMP social science work has not yet included questions on the importance of viewsheds. This should be considered moving forward.
- Acquiring information in the deep ocean, and its links to cultural and social resources, could require special and expensive technology.

Table 9. Available Data and Leads for the Cultural and Social Resources Sector

Available Data	Leads to Acquire
Lighthouses (e.g., Cabezas de San Juan, Culebrita, Punta Yeguas)	• PR DNER • Puerto Rico Land Trust
Archaeological sites (e.g., Taino sites, Maroon communities, African traditions)	• Institute of Puerto Rican Culture • Puerto Rico Land Trust
Cabezas de San Juan Reserve (e.g., Hacienda Esperanza, native ecosystems)	• Institute of Puerto Rican Culture • State Historic Preservation Office
Historic coastal landmarks, tourism zones, beaches and other places with viewshed value	• Isabel Rivera-Collazo, UC San Diego • PR DNER Coastal Landmark Inventory • Robert Moyano, Estudios Técnicos, Inc. • Manuel Valdes Pizzini, UPR • Carlos Garcia-Quijano, University of Rhode Island
Areas designated for listing on the National Register of Historic Places	• National Register of Historic Places
Viewsheds and key observation points	• BOEM • University of Rhode Island • Argonne National Laboratory
Underwater trails and caves	• None provided
Location of recreational water activities and anchorages (e.g., boating, SCUBA diving, kayaking, fishing and fishing tournaments, surfing)	• PRTC • PR DNER Recreational Fisheries Program • Juan Agar and Daniel Matos, PR Department of Sports and Recreation • Javier Ramos and Alfredo Martinez, UPR

Table 9. *Continued*

Available Data	Leads to Acquire
Shipwrecks	• State Historic Preservation Office
Social vulnerability indicators in emerging Caribbean fishery ecosystem plans	• CFMC
Fisheries census, economic surveys and working waterfronts	• Matt McPherson, NMFS SEFSC Social Science Research Group
Commercial catch data and landings values	• NMFS SEFSC
Governance data for multiple coastal fishing centers	• Municipalities or fisher associations • PR DNER • USDA
Areas of vulnerability to hurricanes and storms, including areas of coastal erosion identified for protection	• Federal Emergency Management Authority • USACE
Waterparks	• USACE
Conceptual EBFM models	• NMFS SEFSC

Table 10. Data Gaps for the Cultural and Social Resources Sector

Data Gaps (including identified high priorities*)
Traditional fishing areas*
Traditional ceremonial areas*
Historic and changing uses of marine space*
Recent changes to fisheries (e.g., fisher demographics and associated gear changes)*
Local ecological knowledge to inform decision-making, especially fisheries management*
Land tenure in fishing villages*
Economic value of all fishing sectors (e.g., commercial, recreational, subsistence, seasonal, for-hire charters)*
Recreational areas at sea (cultural/social spaces)*
Surveys designed to assess socioeconomic impacts of hurricanes and similar disasters*
Surveys, especially with marginalized communities, that quantify and describe reliance on fisheries and related social vulnerability issues*
Human use mapping of coastal and marine areas*
Marine and coastal suitability indicators*

Table 10. ***Continued***

Data Gaps (including identified high priorities*)
Governance data that informs how fishing centers along the coast are managed*
Information on marinas, including type and use of vessels, number of captains/crew working on the water, and other economic activities which compliment fishing*
Map of municipalities with coastal resilience centers*
More fine grained census data for coastal municipalities*
Viewshed data and its importance to indigenous and other communities*
Conch habitat areas for cultural use
Time and location of fishing tournaments
Tourism use areas
Location and frequency of cruise ships
Coastal archaeological sites and submerged areas of prior human occupation or use
Resident and visitor perceptions of offshore wind energy development
Potential coastal connection sites for offshore wind energy
Maritime underwater noise
University research sites

Session 6

METOCEAN AND OTHER

The *Metocean and Other* sector includes a wide range of meteorological and oceanographic information needed to inform planning and decision-making. This includes:

- Bathymetry and prevailing currents
- Wave patterns
- Wind regimes
- Water temperatures
- Shoreline, ports and harbors, and boundary data

Data layers which NCCOS is aware of include:

- Federal and state water boundaries
- US maritime limits and boundaries
- USFWS management regions
- USACE regulatory boundaries
- County lines
- International Regulations for Preventing Collisions at Sea Demarcation Line
- Shoreline boundaries
- Locations of ports, harbors and high frequency radar stations
- Bathymetry data
- All available data collected by CARICOOS such as wind speed and direction, tidal information, and information on surface and subsurface currents

Suggestions during group discussion focused on the need to improve understanding of ocean currents (surface and at depth), Saharan dust, ocean acidification, underwater noise, and sediment movement, among other topics. One individual cited the need for better rain gauges in Culebra and other communities to assess precipitation, stormwater runoff and sedimentation. Another pointed to local professors collecting important data on a range of oceanographic topics.

Participant worksheets included just one question and a few additional comments:

- Is the resolution of the current data one kilometer in Puerto Rico waters and out to the EEZ?
- This sector should be subdivided further for more specific analysis.
- The resolution can be coarse on many topics for this sector.
- We need to capture changes over time due to increased risk of storms and hurricanes.
- Consider the impacts of earthquakes on habitat in places like the south coast.
- We need to look at international vessel traffic (e.g., navigation routes, emissions).

Table 11. Available Data and Leads for the Metocean and Other Sector

Available Data	Leads to Acquire
Saharan dust	• Jason Dunion, Atlantic, Oceanographic and Meteorological Laboratory (AOML) • Pablo Mendez, UPR
Sargassum mats	• CARICOOS and local modeling • AOML
Weather	• NOAA Terminal Doppler Weather Radar
Fault line and earthquake information	• USGS
Benthic, geologic and bathymetric maps	• USGS/Woods Hole Oceanographic Institution
Ocean level readings and seismic information (tsunami watch)	• Puerto Rico Seismic Network Tsunami Program
Modeling of surface and deepwater currents	• Roy Armstrong, UPR • Jorge Cabella Hernández, UPR
Post hurricane Maria shoreline data	• NOAA Digital Coast
Shoreline public land boundaries	• PR DNER
Special planning areas	• Puerto Rico Planning Board
Coastal oceanography and larval connectivity studies	• Ryan Smith, AOML • Miguel Canals Silander, UPR
Temperature, eddies, salinity, wave heights/period, currents, water masses	• CARICOOS

Table 11. *Continued*

Available Data	Leads to Acquire
Coastal data to 400 meters	• Department of Transportation
Seascape modeling	• CFMC
Wave Climate Atlas	• Miguel Canals Silander, UPR • CARICOOS
Geotechnical and geologic data	• USACE • USGS
Glauconite soils	• USGS
Sediment depth, type and uniformity	• Clark Alexander, Skidaway Institute of Oceanography • USGS
Ocean thermal energy conversion plants	• None provided
Disposal locations of radioactive material, explosives and other toxic waste	• DOD • US Navy
Prospective locations for offshore wind farms	• None provided
Municipal level information	• Puerto Rico Planning Board
Flight paths	• Federal Aviation Administration
Federal management area boundaries	• NMFS SERO

Table 12. Data Gaps for the Metocean and Other Sector

Data Gaps (including identified high priorities*)
Precipitation, stormwater runoff and sedimentation in Culebra and other communities*
Geologic submarine fault zones*
Vessel emission impacts on air quality
Underwater noise pre and post-development
Shoreline/coastal vulnerability projections
Physical oceanography generally
Surface and deepwater currents
Higher spatial resolution bathymetry
Ocean acidification
Larval transport and connectivity
Animal migrations
Mapping of priority coral reef areas
Sargassum transport
Effects of climate change on marine life

KEY TAKEAWAYS AND NEXT STEPS

As the workshop concluded, participants shared key takeaways and emerging insights to support marine spatial planning in Puerto Rico. Although some referenced "we" during closing remarks, each bullet below simply 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 particular comment.

- "Puerto Rico has come a long way with marine spatial planning. We have opened our eyes to new opportunities to gather important information. During this workshop we learned about a lot of new data sources, and where to get information that helps support fisheries management. CFMC is here to help, so please reach out to us. I'm grateful to see so many familiar friends and colleagues continuing to do this important work."
- "It is important for people working in Puerto Rico and the US Caribbean to know what is going on and how to share data. This was a lot of information to consider. The workshops showed we have some really good data. We need to make sure it gets to where it should be. This was a great effort to begin to do that and I plan to stay involved."
- "We still have gaps, but we have a lot of data here in Puerto Rico. It's a very positive development to work like this to collectively assess what data exists."
- "Data development is a complex task. We are dealing with huge amounts of data across several distinct but interconnected topics. This workshop is a good first step."
- "I appreciate the support and opportunity to participate in a very educational workshop. The range of information discussed is extremely helpful to the CFMC as it works on a fishery ecosystem plan for the region."
- "One important thing we did not discuss is how to compensate for the damage humans have caused to the ocean. Are we doing enough to mitigate our actions? As a next step we should consider how to use geospatial resources to answer this question."

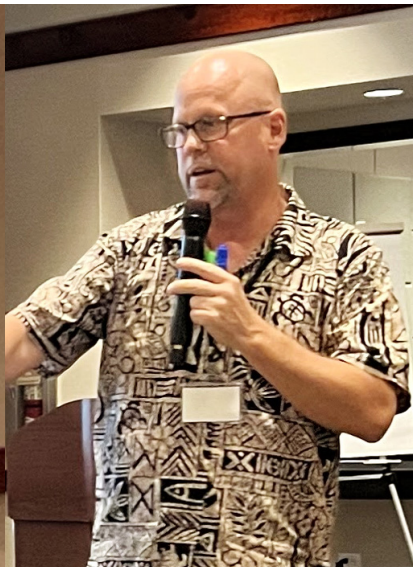
James Morris and Jennifer Wright thanked everyone for their hard work over two days, and committed to following up on all identified data leads. James mapped out next steps that will guide data development work in the US Caribbean in the months and years ahead:

1. Develop and distribute the NOAA presentation and workshop report on the NCCOS website
2. Distribute summary of data need priorities to funding sources (NOAA, BOEM, other)
3. Follow up on data leads – Jennifer/NCCOS team will be in touch
4. Develop marine spatial planning data inventory/geodatabase

5. Develop US Caribbean marine spatial toolbox including interactive map viewer
6. Begin working with territory and federal governments on planning priorities
7. Continue working with BOEM on offshore wind planning priorities
8. Continue working with NMFS and PR DNER on aquaculture planning priorities
9. Consider research on co-siting of offshore wind and aquaculture as a way to reduce impacts
10. Establish future meetings (virtual/in-person) targeted at specific data categories

As he brought the workshop to a close, James referenced comments made by Nicole Angeli, Director of the USVI Division of Fisheries and Wildlife, at the prior workshop, held just days before. Nicole expressed hope that the final products which emerge from marine spatial data collection will bring communities in the US Caribbean closer to respectful and sustainable use of the natural resources that elevate the quality of life of friends, families and neighbors.



APPENDIX 1: ACRONYMS AND ABBREVIATIONS

AIS	Automatic Identification System
AOML	Atlantic, Oceanographic and Meteorological Laboratory
BOEM	Bureau of Ocean Energy Management
CARICOOS	Caribbean Coastal Ocean Observing System
CFMC	Caribbean Fishery Management Council
CRCP	Coral Reef Conservation Program
CROP	Caribbean Regional Ocean Partnership
DCRMP	Deeper Coral Reef Monitoring Program
DOD	Department of Defense
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ENOW	Economics: National Ocean Watch
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAD	Fish Aggregating Device
FUDS	Formerly Used Defense Sites
HCD	Habitat Conservation Division
HMS	Highly Migratory Species
IITF	International Institute of Tropical Forestry
NASA	National Aeronautics and Space Administration
NCCOS	National Centers for Coastal Ocean Science
NCEI	National Centers for Environmental Information
NCRMP	National Coral Reef Monitoring Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCM	Office for Coastal Management
PRASA	Puerto Rico Aqueduct and Sewer Authority
PR DNER	Puerto Rico Department of National and Environmental Resources
PRTC	Puerto Rico Tourism Company
SEAMAP	Southeast Area Monitoring and Assessment Program
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
TNC	The Nature Conservancy
UPR	University of Puerto Rico
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USVI	United States Virgin Islands
UXO	Unexploded Ordnance

APPENDIX 2: WORKSHOP AGENDA

Day 1 (full day)

Time	Activity
8:30 – 9:00 am	Registration
9:00 – 9:15 am	Welcome and Introduction
9:15 – 10:00 am	Overview of NOAA's Marine Spatial Planning Process
10:00 – 10:45 am	Session 1: National Security
10:45 – 11:00 am	Break
11:00 – 12:00 pm	Session 2: Industries
12:00 – 1:00 pm	Lunch Break
1:00 – 2:45 pm	Session 3: Fisheries
2:45 – 3:00 pm	Break
3:00 – 4:45 pm	Session 4: Natural Resources
4:45 – 5:00 pm	Wrap Up Day 1 and Preview Day 2

Day 2 (half day)

Time	Activity
8:30 – 9:00 am	Registration
9:00 – 9:15 am	Recap of Day 1 and Introduction to Day 2
9:15 – 10:00 am	Session 5: Cultural and Social Resources
10:00 – 10:45 am	Session 6: Metocean and Other
10:45 – 11:00 am	Break
11:00 – 12:00 pm	Key Takeaways and Next Steps
12:00 – 1:00 pm	Closing Remarks

APPENDIX 3: WORKSHOP PARTICIPANTS

Name	Affiliation
Helena Antoun	NOAA NMFS
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Megan Considine	TNC
Ernesto L Diaz	Puerto Rico Climate Change Council
Raimundo Espinoza	Conservación ConCiencia
René Esteves	PR Sea Grant Program
Wright Frank	BOEM
Miguel Garcia-Bermudez	FWS
Connie Gillette	BOEM
Nicolás Gómez	Asociación Pesquera de Culebra
Graciela García-Moliner	CFMC
Lamar Hawkins Jr	NOAA NMFS SEFSC
Read Hendon	NOAA NMFS SEFSC
William J Hernandez	UPR Mayaguez
Arianna Honeycutt	BOEM
Brandon Jensen	BOEM
Maria Lopez	NOAA NMFS
Ricardo López	DNER
Vanessa Marrero	DNER
Kevin McCarthy	NOAA NMFS SEFSC
Matthew McPherson	NOAA NMFS SEFSC
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Tania Metz	TNC
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James Morris	NOAA NCCOS

APPENDIX 3: *CONTINUED*

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APPENDIX 4: PHOTO CREDITS

Puerto Rico Workshop Report Photos

Project staff and facilitators captured group photos during the course of the workshop. Other photos, acquired via Shutterstock, are credited to either the individual or account name listed.

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Rich Wilson	Page 5 (small group)
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Rich Wilson	Page 33 (presenters)
Rich Wilson	Page 33 (small groups)


NOAA
NCCOS
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