



Regional Data Platform Scoping Study: Federal Data Task Report*

NOAA OCM

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**Modified version for posting online. Please contact David Stein (Dave.Stein@noaa.gov) for a copy of the full report.*

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EXECUTIVE SUMMARY

This report documents the results of Phase 1 of a Regional Data Platform Scoping Study being conducted by the National Oceanic and Atmospheric Administration (NOAA) and the Bureau of Ocean Energy Management (BOEM). The goal of the study is twofold: 1) to assess federally-sourced, geospatial data needs by region, and 2) to document and summarize the state of regional ocean data sharing to inform ocean management across the Nation, and provide recommendations for ways the federal government can support regional data sharing efforts going forward.

The goal of Phase 1 is to understand and document what federally-sourced geospatial data are needed to help states and regional organizations address pressing ocean and coastal management decisions. It focuses primarily on data that have already been collected, but are not easily accessible or provided in a way that meets the needs of the ocean and coastal management community.

Data collection for Phase 1 involved telephone interviews with the Marine Cadastre team as well as NOAA, BOEM and regional portal points of contact from each of the nine regions (Northeast, Mid-Atlantic, South Atlantic, Caribbean, Gulf of Mexico, West Coast, Pacific Islands, Alaska, and Great Lakes). The interviews focused on understanding the key ocean and coastal management issues facing each region and which federally-sourced geospatial data are needed to address those key issues are missing or have barriers that prevent access to the data in a readily usable format.

The Priority Issues section of this report details the key ocean and coastal management issues that were identified during the Phase 1 interviews. A ranked table of the priority issues showing which regions identified them is included in Appendix A.

The Data Priorities section of this report provides details of the top ten data needs that were identified during the Phase 1 interviews. A ranked table of the complete list of data priorities showing which regions identified them is included in Appendix B.

The data sets that were reported as a requirement by half or more of the regions are shown below in Table 1. Also included in this table is a summary of the issues or needed improvements for each of the top ten data sets. If addressed, these improvements would significantly reduce time and cost spent by the Marine Cadastre team and/or the regions on data processing and would improve stakeholders' ability to address pressing coastal and ocean management decisions. More detailed descriptions of the data sets and their needed improvements are provided in the Data Priorities section of this report. A list of actions to be considered for the future is also provided below.

Table 1 - Top Ten Required Data Sets with Issues or Needed Improvements

Rank	Data Requirements	Issues or Needed Improvements
1	Jurisdictions and regulated areas	<ul style="list-style-type: none">• Boundaries are currently being digitized from descriptions published in Acts, Code of Federal Regulations (CFR), treaties, and permit documents. Authoritative agencies should be publishing geospatial data in addition to the published documents.• Additional details about regulatory restrictions, when or why changed, duration of regulation or agreement, status of permit (e.g. proposed, planned, approved), etc. should be included as attributes in the geospatial data.• Thresholds for project size, update frequency, etc. should be agreed upon with the authoritative agency.• More detailed data are needed for military areas instead of broad areas of restriction (e.g. unexploded ordnance) if such information can be released.

Rank	Data Requirements	Issues or Needed Improvements
2	Abundance and distribution of marine species	<ul style="list-style-type: none"> • Synthesis of observation data is needed from the multiple entities that collect data. • Modeled data, derived products, and documentation of methodology are also needed (e.g. time series, heat or density maps, and trends over time, etc.). • Dependable and continuous updates to models and products are needed.
3	Synthesized oceanographic parameters	<ul style="list-style-type: none"> • Synthesis of monitoring and observation data is needed from the multiple regional entities that collect data. • Derived products from the raw data (e.g. forecasts, change over time, etc.) are needed. • In some regions, densification or winterizing of monitoring devices would greatly improve usability of the collected data. • Standardized, seasonal, annual or decadal products, as applicable, at an ocean-basin scale for temperature, salinity, oxygen, biomass, and productivity are needed.
4	Commercial fishing effort - Vessel Monitoring System (VMS)	<ul style="list-style-type: none"> • Processing and publication of data derived from VMS is conducted by regional partners at considerable cost and effort. Annual agency sponsored products are needed, and in more regions than are currently available. • Consultation with the FMC and regional experts by NOAA National Marine Fisheries Service (NMFS) is needed to define appropriate planning products compatible with existing efforts. • Improvements are needed to the consistency and completeness of declaration, gear type, and other codes. • Data on recreational fishing, including locations and type of fish caught, are needed. • Having access to economic data so the economic importance of fishing areas can be quantified would add considerable value to derived products.
5	Vessel traffic - Automatic Identification Systems (AIS)	<ul style="list-style-type: none"> • Publication of data derived from raw AIS data is currently performed by the Marine Cadastre. Stronger efforts by The U.S. Coast Guard (USCG), Maritime Administration (MARAD) and the U.S. Army Corps of Engineers (USACE) could stabilize, expand and improve this resource for the broader ocean community. • Improvements are needed to the identity and characteristics of vessels, higher frequency access, and ready-to-use products. • Better access to satellite AIS data is needed where land-based receivers are not available.
6	Human and cultural use areas	<ul style="list-style-type: none"> • Uniform and complete data are not readily available and data gathering is intensive. • Derived products (e.g. summary of use, hot spots, recreation patterns, etc.) are needed. • Data on Tribal Protected Areas need to be updated and made publicly available. • National Historic Preservation Act data need to be updated. • Improved documentation of provenance and procedures is also needed in the metadata.

Rank	Data Requirements	Issues or Needed Improvements
7	Commercial fishing effort - Vessel Trip Report (VTR)	<ul style="list-style-type: none"> • Processing and publication of data derived from VTR is conducted by regional partners at considerable cost and effort. Annual agency sponsored products are needed, and in more regions than are currently available. • Consultation with the FMC and regional experts by NMFS is needed to define appropriate planning products • Improvements are needed to the consistency and completeness of original codes, documentation, and products interpolated at a spatial resolution to support energy and aquaculture leasing (i.e. ~2.5 nm x ~2.5 nm or less). • Data on recreational fishing, including location, type of fish caught, and shore-based access location are needed.
8	Bathymetry	<ul style="list-style-type: none"> • Bathymetry data are collected and distributed in a patchwork form and are difficult to find and use at scales beyond individual surveys. Additional high resolution / full bottom surveys are needed for complete coverage in priority areas of interest, especially near shore. Seamless 'best available' products and more up to date bathymetry data products are needed. • Seafloor characterization by sediment texture and physiographic zones is also needed.
9	Sand and borrow sites	<ul style="list-style-type: none"> • Current information on sand and borrow sites is not complete, is not synthesized, and can be difficult to find. The forthcoming BOEM Marine Minerals Information System will address many issues when published. • Historic data may not be available in digital format.
10	Species and habitat locations, including benthic habitat	<ul style="list-style-type: none"> • Synthesis and normalization of data is needed from the multiple entities that collect data. • Modeled data, derived products, and documentation of methodology are also needed (e.g. seasonality of occurrence, gear types, high use areas, endangered species, etc.). • Interpretation of bathymetry into bottom habitat information.

The following actions that would improve the data currently being used in ocean and coastal management decision making should be considered. Data sets identified in this report as priority data (i.e. the top ten data sets identified as priorities by the regions) should be considered for near term implementation of some or all of these actions. However, all identified data sets would be enhanced by taking these actions into consideration for future data updates or releases.

- Identify the authoritative agency(s) or entity(s) responsible for the source data and determine the entity's capacity to enhance the currently available data.
- Determine the needed update frequency, resolution, accuracy, geospatial extent, data derivatives, file format, documentation, etc. for each data set.
- Identify data sets that are not yet available nationwide (e.g. data that may not yet be available for territories, Great Lakes, etc.), identify priority data sets, and pursue nationwide geospatial coverage of prioritized data sets to the extent possible.
- To the extent practical, pursue nationwide consistency in derived products, keeping in mind that regional differences may require different approaches, methodologies, and derived products. For example, data derived from commercial fishing data is being generated by some of the Atlantic coast regions but would be better performed by NOAA. However, different methodologies for

deriving these products may be needed for the Gulf and Pacific coasts than that which has been developed for the Atlantic coast.

- To the extent possible, pursue increased update frequency of published and synthesized data.
- Encourage the authoritative data source to maintain and publish their data as web services that can be consumed by stakeholders.
- Encourage publishers of data to improve data discovery and data delivery tools.
- Encourage publishers of data to improve data visualization, taking into account that the data may be used by various regional, state, and local users whose visualization needs are quite different than users with a national perspective.
- Work with authoritative agency(s) or entity(s) responsible for the source data to encourage more uniform coding of data at the point of origin via processes or tools. For example, data that are input by vessel operators could perhaps benefit from improvements to tools that automate or help enforce coding accuracy and consistency.
- Work with agencies charged with bi-national harmonization (e.g. International Joint Commission, International Boundary Waters Commission, and Great Lakes Commission) to further harmonize data standards and classification methods used in data sets that cross international boundaries.
- Require publishers of data to better document methodology, provenance, and full documentation of processing steps in the metadata that accompany geospatial data sets.
- Explore ways to increase access to data collected by industry.

BACKGROUND

This Regional Data Platform Scoping Study is being conducted by NOAA and BOEM. The goal of the study is twofold: 1) to assess federally-sourced, geospatial data needs by region, and 2) to document and summarize the state of regional ocean data sharing to inform ocean management across the Nation, and provide recommendations for ways the federal government can support each region's data sharing efforts going forward.

Phase 1 of this study is being conducted as an action item under Executive Order 13840, *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States*. The goal is to understand and document what federally-sourced geospatial data are needed to help states and regional organizations address pressing ocean and coastal management decisions. It focuses primarily on data that have already been collected, but are not easily accessible or provided in a way that meets the needs of the ocean and coastal management community.

This report documents the results of the Phase 1 data collection. Telephone interviews were conducted with the Marine Cadastre team as well as NOAA, BOEM and regional portal points of contact from each of the nine regional ocean partnerships (Northeast, Mid-Atlantic, South Atlantic, Caribbean, Gulf of Mexico, West Coast, Pacific Islands, Alaska, and Great Lakes). Interview notes from each of the regional discussions are included in Appendix C (please email Dave.Stein@noaa.gov for full report including Appendix C). Note that a telephone interview could not be scheduled with the Caribbean region due to schedule conflicts, but a written response was provided by the regional point of contact in lieu of the interview.

The Phase 1 interviews were focused on understanding what federally-sourced data could help states and regional organizations address pressing ocean and coastal management decisions. We were primarily interested in data that are already collected, but not easily accessible or provided in a way that meets the needs of the ocean and coastal management community. New data collection, real-time observations, and

research data were not the focus for this first phase of the study, but may be included in the second phase discussions.

General Questions Discussed at Interviews

1. What are the key ocean and coastal management issues facing your region?
2. When colleagues in your region are addressing those key issues, which federally-sourced geospatial data are they missing? What are the gaps or barriers to accessing these data?
3. How would having access to data or increasing usability enhance decision making?
4. Are there specific ways that data currently being used in decision making could be improved (e.g. resolution, accuracy, frequency, geospatial extent, data derivatives, file format, documentation, etc.)?
5. What other key regional stakeholders should we reach out to for more in-depth discussions in phase two?

PRIORITY ISSUES

This section documents the key ocean and coastal management issues that were identified during the Phase 1 interviews. The issues are presented in ranked order based on the number of regions that identified each as an issue. A ranked table of the priority issues showing which regions identified them is included in Appendix A.

For each issue, the geospatial data needed to address the issue is also listed in this section. The next section of this report, Data Priorities, provides additional details about the top ten data needs. A ranked table of the complete list of data priorities showing which regions identified them is included in Appendix B.

Table 2 - Priority Issues and Associated Data Requirements

Offshore aquaculture siting	
Issues	Data Requirements
<ul style="list-style-type: none"> • Identify areas suitable for aquaculture and mariculture • Identify species suitable for aquaculture • Understand and minimize impacts to aquaculture sites from proposed projects • Better understand ocean health and human impacts to water quality such as at sea fish processing 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Abundance and distribution of marine species • Synthesized oceanographic parameters • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Commercial fishing effort – Vessel Trip Report (VTR) • Bathymetry • Sand and borrow sites • Species and habitat locations, including benthic habitat • Water quality, including marine debris, ocean acidification, harmful algal blooms, and oil spills • Geophysical (i.e. bottom type and sediment type)

Fisheries management	
Issues	Data Requirements
<ul style="list-style-type: none"> • Understand fishing productivity • Understand active use areas, dense fishing areas, and type • Understand the economic importance of different fishing areas • Future cast commercial fishing trends • Develop fisheries management strategies • Manage protected species • Manage fishing quotas and allocation conflicts between commercial, recreational, and subsistence fisheries • Identify landing locations • Ensure proposed projects do not disturb fishing areas • Identify and engage fishing industry stakeholders 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Abundance and distribution of marine species • Synthesized oceanographic parameters • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Commercial fishing effort – Vessel Trip Report (VTR) • Bathymetry • Sand and borrow sites • Species and habitat locations, including benthic habitat • Water quality, including marine debris, ocean acidification, harmful algal blooms, and oil spills • Geophysical (i.e. bottom type and sediment type) Climate projections • Traditional Ecological Knowledge • Oil and gas seeps

Community resilience and climate adaptation	
Issues	Data Requirements
<ul style="list-style-type: none"> • Manage beach profile, shoreline change, and shoreline erosion • Manage beach and wetland nourishment • Manage coastal development, including permitting and siting for ports and other new development • Model sea level rise impacts • Model storm surge and coastal flooding • Model tsunami inundation • Develop climate projections and climate models • Better understand changes to species habitats, migration routes, and range extension • Understand the effects of ocean acidification, harmful algal blooms, and warming ocean temperatures on marine wildlife • Manage invasive species • Relocate properties and communities impacted by erosion • Better understand littoral drift 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Abundance and distribution of marine species • Synthesized oceanographic parameters • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Commercial fishing effort – Vessel Trip Report (VTR) • Bathymetry • Sand and borrow sites • Species and habitat locations, including benthic habitat • Oil and gas pipelines, cables, transmission lines, etc. • Water quality, including marine debris, ocean acidification, harmful algal blooms, and oil spills • Locations of onshore and offshore facilities • Geophysical (i.e. bottom type and sediment type) • Historic flood extents and high water marks • Littoral transport • Climate projections • Coastal erosion, storm surge, and shoreline change • Traditional Ecological Knowledge • Great lakes water levels • Wetlands delineation • Living shorelines

Offshore renewable energy siting and leasing	
Issues	Data Requirements
<ul style="list-style-type: none"> • Understand the impacts to active use fishing areas from proposed energy projects • Minimize impacts to fishing activities • Document areas that are important to vessel transit through areas under consideration • Identify locations of geological hazards • Evaluate the impacts on habitats of renewable energy projects, oil/gas, pipelines, cables, and other infrastructure • Identify offshore wind and hydrokinetic resources 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Abundance and distribution of marine species • Synthesized oceanographic parameters, including wind and wave resources • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Commercial fishing effort – Vessel Trip Report (VTR) • Bathymetry • Sand and borrow sites • Species and habitat locations, including benthic habitat • Oil and gas pipelines, cables, transmission lines, etc. • Seismic • Acoustic data • Geophysical (i.e. bottom type and sediment type) • Littoral transport
Issues	Data Requirements
<ul style="list-style-type: none"> • Identify sites suitable for sand extraction • Manage beach nourishment • Better understand sediment transport and erosion • Better understand littoral transport • Identify dredge holes, borrow pits, and spoil banks 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Synthesized oceanographic parameters, including wind, waves, and currents • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Bathymetry • Sand and borrow sites • Species and habitat locations, including benthic habitat and essential fish habitat • Water quality, including marine debris, ocean acidification, harmful algal blooms, and oil spills • Lidar • Geophysical (i.e. bottom type and sediment type) • Nearshore aquatic vegetation • Oil and gas pipelines, cables, transmission lines, etc. Including right-of-ways for cables and pipelines.

Species and habitat management	
Issues	Data Requirements
<ul style="list-style-type: none"> • Understand and minimize impacts to habitat from proposed projects • Protect and restore sensitive habitats and species • Identify change over time of distribution of species (e.g. kelp beds, corals, etc.) • Better understand changes in range due to climate change • Identify impacts of water quality and marine debris on species and habitat • Identify unique areas and areas of ecological importance • Identify habitat protected areas (Habitat Areas of Particular Concern [HAPCs] and Marine Protected Areas [MPAs]) • Better understand the migration of diseases • Monitor invasive and exotic species • Monitor loss of estuarine habitat • Minimize fisheries gear damage • Monitor hypoxia • Minimize habitat disturbance • Better understand impacts of sound (e.g. vessel traffic, seismic exploration, etc.) on species 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Abundance and distribution of marine species • Synthesized oceanographic parameters • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Commercial fishing effort – Vessel Trip Report (VTR) • Bathymetry • Sand and borrow sites • Species and habitat locations, including benthic habitat • Water quality, including marine debris, ocean acidification, harmful algal blooms, and oil spills • Geophysical (i.e. bottom type and sediment type) • Recent aerial imagery • Oil and gas seeps • Hypersaline discharges
Issues	Data Requirements
<ul style="list-style-type: none"> • Perform baseline assessments and trend analysis • Identify and mitigate areas subject to water quality impacts • Model flood and storm runoff • Estimate nutrient loading and discharge • Monitor hypoxia • Monitor beaches for marine debris and document results • Monitor and manage impacts of marine debris to marine habitats and species • Evaluate impacts to fisheries from ocean acidification • Mitigate for ocean acidification • Evaluate impacts to habitat and recreation from harmful algal blooms • Issue accurate beach advisories • Identify post-hurricane impacts on communities and resources from algal blooms • Predict future algal bloom outbreaks (aspirational) • Identify species and human communities at risk of ingesting toxins from harmful algal blooms • Manage oil spill cleanup and prevention 	<ul style="list-style-type: none"> • Abundance and distribution of marine species • Synthesized oceanographic parameters, including waves and currents and water chemistry • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Bathymetry • Species and habitat locations, including benthic habitat • Water quality, including marine debris, ocean acidification, harmful algal blooms, and oil spills • Environmental Sensitivity Indexes • Climate projections • Recent aerial imagery • Oil and gas seeps • Hypersaline discharges

Oil and gas exploration and extraction	
Issues	Data Requirements
<ul style="list-style-type: none"> • Manage oil and gas planning and site reviews • Facilitate oil and gas exploration • Identify sites suitable for oil and gas extraction • Manage oil spill cleanup and prevention • Assess the impacts of drilling on corals and other marine species • Understand noise impacts from exploration techniques (seismic surveys) • Mediate conflicts between industry and environmental uses of areas 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Bathymetry • Sand and borrow sites • Species and habitat locations, including benthic habitat • Oil and gas pipelines, cables, transmission lines, etc. • Locations of onshore and offshore facilities • Geophysical (i.e. bottom type and sediment type) • Seismic, including into Mexican waters • Coastal erosion, storm surge, and shoreline change • Traditional Ecological Knowledge • Locations of ice gouges and strudel scours • Oil and gas seeps
Issues	Data Requirements
<ul style="list-style-type: none"> • Identify sites suitable for dredge material disposal • Ensure dredge material disposal does not impact marine navigation routes • Maintain shipping and navigation channels, harbors, and ports 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Commercial fishing effort – Vessel Trip Report (VTR) • Human and cultural use areas • Bathymetry • Species and habitat locations, including benthic habitat
Issues	Data Requirements
<ul style="list-style-type: none"> • Maintain safety of shipping and other vessels • Increase global ocean trade • Manage port facilities • Maintain shipping and navigation channels, harbors, and ports • Manage conflicting uses by recreational fishing, tour boats, and charter fishing boats • Ensure proposed projects do not impact shipping channels 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Synthesized oceanographic parameters, including waves and currents • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Commercial fishing effort – Vessel Trip Report (VTR) • Bathymetry • Sand and borrow sites • Locations of onshore and offshore facilities • Recent aerial imagery

Flooding	
Issues	Data Requirements
<ul style="list-style-type: none"> • Improve evacuation planning • Improve infrastructure planning • Mitigate coastal inundation 	<ul style="list-style-type: none"> • Historic flood extents • High water marks
Military	
Issues	Data Requirements
<ul style="list-style-type: none"> • Identify restricted areas, active and proposed training grounds, WWII dump sites, and unexploded ordnances 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Sand and borrow sites
Vessel traffic	
Issues	Data Requirements
<ul style="list-style-type: none"> • Identify high traffic areas • Manage infrastructure needs of larger vessels • Manage increased vessel traffic in the Arctic due to changes in sea ice 	<ul style="list-style-type: none"> • Synthesized oceanographic parameters, including water temperature • Vessel Traffic – Automatic Identification Systems (AIS) • Commercial fishing effort – Vessel Trip Report (VTR) • Bathymetry • Locations of onshore and offshore facilities • Climate projections
Invasive species	
Issues	Data Requirements
<ul style="list-style-type: none"> • Monitor and manage invasive species, including mussels and Asian carp in the Great Lakes 	<ul style="list-style-type: none"> • Abundance and distribution of marine species • Synthesized oceanographic parameters, including water temperature • Bathymetry • Species and habitat locations, including benthic habitat • Geophysical (i.e. bottom type and sediment type)
Recreation	
Issues	Data Requirements
<ul style="list-style-type: none"> • Understand recreational patterns (e.g. fishing, swimming, diving, recreational boating, hunting, bird watching, whale watching, etc.) • Identify sites suitable for artificial reefs • Reduce conflicts between recreational fishing, tour boat, and charter fishing routes and areas • Reduce conflict between recreational and commercial activities 	<ul style="list-style-type: none"> • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Water quality, including marine debris, ocean acidification, harmful algal blooms, and oil spills • Locations of onshore and offshore facilities • Recreation patterns

Permitting and siting for other offshore infrastructure	
Issues	Data Requirements
<ul style="list-style-type: none"> • Manage siting and permitting of offshore energy transmission and telecommunications cables, pipelines, and platforms • Manage permitting of structures, permit reviews, Environmental Impact Statements (EISs) 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Abundance and distribution of marine species • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Commercial fishing effort – Vessel Trip Report (VTR) • Bathymetry • Sand and borrow sites • Species and habitat locations, including benthic habitat • Oil and gas pipelines, cables, transmission lines, etc. • Geophysical (i.e. bottom type and sediment type)
Soundscape	
Issues	Data Requirements
<ul style="list-style-type: none"> • Mitigate impacts of development on the soundscape • Monitor and mitigate impacts of increased sound on species and habitats 	<ul style="list-style-type: none"> • Synthesized oceanographic parameters, including waves and currents • Vessel Traffic – Automatic Identification Systems (AIS) • Commercial fishing effort – Vessel Trip Report (VTR) • Species and habitat locations, including benthic habitat • Seismic survey locations • Acoustic data
Public access	
Issues	Data Requirements
<ul style="list-style-type: none"> • Maintain public access for ocean and shore-based recreation • Preserve cultural use areas and traditional fishing areas 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • State public access areas
Harvesting other marine resources	
Issues	Data Requirements
<ul style="list-style-type: none"> • Identify areas suitable for harvesting seaweed, kelp, and invertebrates 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Abundance and distribution of marine species • Synthesized oceanographic parameters • Commercial fishing effort – Vessel Monitoring System (VMS) • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Bathymetry • Species and habitat locations, including benthic habitat

Subsistence use	
Issues	Data Requirements
<ul style="list-style-type: none"> • Monitor harvests • Minimize conflicts from vessel traffic and other uses 	<ul style="list-style-type: none"> • Jurisdictions and regulated areas • Abundance and distribution of marine species • Synthesized oceanographic parameters, including wind and wave resources • Vessel Traffic – Automatic Identification Systems (AIS) • Human and cultural use areas • Bathymetry • Species and habitat locations, including benthic habitat • Oil and gas pipelines, cables, transmission lines, etc. • Lidar • Locations of onshore and offshore facilities • Climate projections • Coastal erosion, storm surge, and shoreline change • Traditional Ecological Knowledge
Water safety	
Issues	Data Requirements
<ul style="list-style-type: none"> • Improve beach safety • Improve commercial and recreational boating safety 	<ul style="list-style-type: none"> • Bathymetry • Littoral drift • Great Lakes water levels
Bi-national partnerships	
Issues	Data Requirements
<ul style="list-style-type: none"> • Manage water quality • Manage water quantity • Develop common data standards 	<ul style="list-style-type: none"> • Bathymetry • Shoreline type and structure • Oil and gas pipelines, cables, transmission lines, etc. • Great Lakes water levels
State ocean planning efforts	
Issues	Data Requirements
<ul style="list-style-type: none"> • Determine the footprint and intensity of fishing vessel activity, including transit and fishing 	<ul style="list-style-type: none"> • Commercial fishing effort – Vessel Monitoring System (VMS)
Great Lakes water levels	
Issues	Data Requirements
<ul style="list-style-type: none"> • Improve beach safety • Improve commercial and recreational boating safety • Monitor adherence to bi-national agreements on water quantity 	<ul style="list-style-type: none"> • Synthesized oceanographic parameters • Bathymetry • Bi-national data • Locations of onshore and offshore facilities • Great Lakes water levels

DATA PRIORITIES

This section documents the top ten data needs that were identified during the Phase one interviews. The data needs are presented in ranked order based on the number of regions that identified each as a requirement. A ranked table of the complete list of data priorities showing which regions identified them is included in Appendix B.

For each data type, a data description, a list of the key issues that could be better addressed with data improvements, and a description of the needed improvements is provided.

1. Jurisdictions and Regulated Areas

Data Description:

The needed data include legal boundaries of areas defined by Acts, CFR, etc.; Tribal areas of interest, sovereignty, and treaty boundaries; USACE permit areas (planned, proposed, and approved); USACE permanent aquaculture sites; USACE and the Environmental Protection Agency (EPA) regulated ocean disposal sites; USCG designated anchorages and pilot boarding areas; and fishery management areas.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting
- Fisheries management
- Community resilience and climate adaptation
 - Coastal erosion
 - Manage coastal development
- Offshore renewable energy siting and leasing
- Sand and sediment management
- Species and habitat management
- Oil and gas exploration, permitting, and extraction
- Ocean disposal
- Maritime and navigation safety
 - Maintenance of shipping and navigation channels
- Military
- Permitting and siting for nearshore and offshore infrastructure
 - Siting of energy and telecommunications cables
 - Ports
 - Minerals extraction
- Public access
- Harvesting other marine resources
- Subsistence use

Data Issues or Needed Improvements:

Authoritative Areas: These are legal boundaries defined by Acts, CFR, etc. The legal descriptions were likely derived from spatial data but the spatial data are not published. Marine Cadastre is reconstructing and/or updating spatial data from the descriptions, which is not efficient. The spatial data should be published by the authoritative agency along with the legal descriptions.

Tribal Areas of Interest, Sovereignty, and Treaty Boundaries: Tribal areas of interest or sovereignty in ocean areas are needed. Additionally, certain water uses by the states are governed by treaties with Tribes. Better data on the geospatial areas covered, duration, and regulatory restrictions of the agreements is needed.

DoD Boundary Data: No-development areas are identified by the USCG and the Department of Defense (DoD) as areas where development is restricted. Currently data are only provided on an as-needed basis, which makes siting new facilities difficult. The military does not want to release data without clear need and the renewable energy sector does not want to spend time researching areas that are already off-limits. Data for other DoD restricted areas, active training grounds, proposed training grounds, WWII dump sites, and unexploded ordnance are also needed. DoD EISs may have some information on training grounds. The available data on unexploded ordnance areas show large polygons but no information on density; speculation is that DoD may have more detailed information but is not making it available and wants to provide broad area information only. The Marine Cadastre layer showing unexploded ordnance does not cover needed Pacific Island areas. The University of HI started some work on unused ordnance; typically these are small objects in deep water. Additionally, DoD data are also needed for coordination work regarding Great Lakes sanctuaries.

USACE Permits: The Rivers and Harbors Act requires USACE authorization of modification to a navigable water (e.g., dredging) or construction of any structure that affects a navigable water of the U.S. The USACE publishes information in documents, notices, and narratives, but not as geospatial data. Place names and/or coordinates have to be keyed in to create spatial data. Geospatial data, updated monthly if possible, are needed instead from USACE. Information about planned, proposed, and approved projects is needed.

USACE permitted shore based construction has the possibility of affecting the coastline from which the territorial sea and other boundaries are measured. NOAA and BOEM should be informed whenever a proposed construction project may affect the coastline (baseline). (Note: this is actually codified but not practiced)

In order to address this need, a threshold for project size and project type may need to be established. The USACE permits numerous projects, but some are quite minimal. Relevant project types may include cables, pipelines, aquaculture sites, DOE pilot projects with EISs, offshore wind lease or wind energy projects (BOEM), and ocean disposal sites.

USACE Permanent Aquaculture Sites: USACE maintains outlines for permanent aquaculture sites, but the data have to be pieced together by the regions or Marine Cadastre. Again, the responsible agency should publish the data in a geospatial format.

Ocean Disposal Sites: USACE and EPA regulate these areas. Data on designated sites and retired sites are needed. Data quality issues have been seen with the currently available data. The agencies appear to manage their data on a permit by permit basis, not in an enterprise system. The region(s) are forced to dig through the individual permit documents to piece together information. Marine Cadastre did the first nationwide product which is updated annually, but the regions need up to date data with additional details for individual sites. The managing agencies could do a better job of providing useful geospatial data. Any data updates done at the regions are provided back to Marine Cadastre for inclusion in the national data set.

Designated Anchorages and Pilot Boarding Areas: These data are managed by the USGC. Thousands of anchorages exist and the rate of change is low, but the data appear to be managed by district offices only, not agency-wide. Marine Cadastre updates the national data set annually but that is not sufficient for some uses. Updating the existing data set requires reading the CFR and digitizing the boundary from the description. The agency should send weekly or monthly updates in a geospatial format.

Fishery Management Areas: These areas are needed for permitting and fisheries management. Often the data are confusing as to where and/or why they are changing (i.e. is the change regulatory or due to an ecosystem concern).

2. Abundance and Distribution of Marine Species

Data Description:

Abundance and distribution of marine mammals, birds, fish, and deep sea corals. These data are typically derived from data collected by federal and state agencies using at-sea transect surveys for avian species, trawl data for fish species, and aerial and shipboard surveys for cetacean species. The raw data need significant modeling and other synthesis to derive density maps and other more usable products.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting
- Fisheries management
 - Species counts for commercial fishing
 - Future casting commercial fishing trends, particularly fin fish and shellfish
 - Productivity analysis
- Community resilience and climate adaptation
 - Species migration and range extension
 - Changes to migration routes
 - Effects of ocean acidification, harmful algal blooms, and warming ocean temperatures on marine wildlife
 - Increase in invasive species
- Offshore renewable energy siting and leasing
- Species and habitat management
 - Protection and restoration of sensitive habitats and species
 - Minimize impacts to sensitive species from new offshore activities
 - Species distribution
 - Effects of changes to water quality and marine debris
- Oil and gas exploration, permitting, and extraction
 - Assessing the impacts of drilling on corals and the risks to coral reefs from pipeline bursts
 - Oil spill clean-up and prevention
 - Understanding noise impacts from exploration techniques (seismic surveys)
- Permitting and siting for other offshore infrastructure
 - Siting of energy and telecommunications cables
- Subsistence use
 - Harvests and conflict avoidance

Data Issues or Needed Improvements:

Abundance and distribution of marine mammals, birds, and fish are needed, especially in areas beyond the Atlantic (i.e. Gulf of Mexico, Pacific, Alaska, and Hawaii). Additionally, data on deep sea corals are needed in all areas. Data on invasive species (e.g. mussels and Asian carp) are of particular interest in the Great Lakes. Trend data showing change over time are also needed.

Observation data are available but there is a need for updated modeled data and derived products. There are various ongoing modeling efforts that are funded by external entities and that depend on observation data sets. Trawl data sets are modeled to obtain three- to five-year averages for measuring abundance and change. Using AMAPS, Duke is modeling marine mammals, the National Center for Ocean Coastal Science (NCCOS) is modeling birds, and three geospatial products for fish species are being prepared by the Northeast Fisheries Science Center. The DoD and Navy fund the development of annual, seasonal, and monthly distribution maps. The Duke team is also analyzing species sensitivity to noise and wind turbines. The Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS) synthesizes available information to support management and control of aquatic nonindigenous species in the Great Lakes. Dependable and continuous funding streams are needed to ensure that models are maintained and refreshed.

Data on corals are just starting to come in from NOAA (via Okeanos Explorer) including video and other data, but a more useful format is needed. The Mid-Atlantic Regional Council on the Ocean (MARCO) is funding some analysis and synthesis for their portal. For sea turtles, data need to be more up to date, higher resolution, and include more species (only three are covered now).

Trawl survey data, among others, are needed as soon as possible after collection and in uploadable, GIS-ready formats.

Also, some of the data are not being served and there is no clear owner of the data. Some of the data may be held in studies performed at regional or local levels, and there is often a long lag time before publication. Varying levels of access to the modeled data are available. Access to the raw data should be provided as well as the modeled data and better documentation of the data processes and products is needed.

3. Synthesized Oceanographic Parameters

Data Description:

Needed synthesized oceanographic parameters include currents (speed and direction), sea surface height, wave and wind information, attenuation, water levels, tides, sea surface and ocean temperature, pH, salinity, chlorophyll A, zooplankton, and ocean color. The data may be collected via multiple types of sensors including tide gages, buoys that collect information on waves and ocean chemistry, high frequency radar systems, and satellites, among others. The Integrated Ocean Observing System (IOOS) regional associations collect and disseminate observational data.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting and impacts
 - Identify areas suitable for aquaculture
 - Species suitability
 - Better understand ocean health and human impacts to water quality such as at sea fish processing
- Fisheries management
 - Future commercial fishing trends
 - Hypersaline discharge locations
- Community resilience and climate adaptation
 - Coastal resiliency
 - Shoreline management and coastal erosion
 - Manage coastal development
 - Storm surge modeling and coastal flood modeling
 - Warming ocean temperatures
 - Input into climate projections and climate models
- Species and habitat management
 - Identify changes to dispersal of organisms on the Outer Continental Shelf (OCS)
 - Identify change over time of discreet resources (e.g. kelp beds)
 - Ecosystem health evaluations including invasive species and food security
 - Protection and restoration of sensitive habitats and species
- Water quality
 - Baseline assessments and trend analysis
 - Hind casts of ocean conditions
 - Identify and mitigate areas subject to water quality impacts including climate change, hypoxia, ocean acidification, flood and storm runoff, and hypersaline discharges
 - Forecast harmful algal bloom
 - Marine debris movement on waves and currents
 - Input into engineering studies for beach and port projects

- Offshore renewable energy siting
- Permitting and siting for nearshore and offshore infrastructure
- Sediment management and sediment transport
- Subsistence use
- Harvesting other ocean resources including seaweed, kelp, and invertebrates
- Great Lakes water levels
 - Commercial and recreational boating safety
 - Beach safety
 - Bi-national partnerships and agreements for water quantity in the Great Lakes

Data Issues or Needed Improvements:

The available observational data are very challenging to use. The data arrive in pieces, but would be more usable if they were better synthesized. Some of the synthesized data that are available in the Northeast and Mid-Atlantic are not available in the South Atlantic. Ultimately, the data need to be more accessible and usable without further processing.

Ocean acidification monitoring data are also needed. The Mid-Atlantic Ocean Acidification Network ([MACAN](#)) has two reports coming out soon that will highlight gaps in the monitoring data and additional research needs.

In the South Atlantic region, water level and wave height data are available, but observations are far apart and value needs to be added to them. More tide gages would be desirable, although it is recognized that it may be cost prohibitive to densify that network.

The Alaska Ocean Observing System (AOOS) coordinates two funded portals related to oceanographic data: the Alaska Ocean Acidification Network and the Alaska Harmful Algal Bloom Network. There is a need for forecast data in order to mitigate for ocean acidification. The greatest concerns regarding impacts of acidification on fisheries and other resources are local, yet the nearshore data are the hardest to tease out of the available data.

Data on harmful algal blooms may be collected on individual research cruises, but they are not always coordinated and getting agreement from researchers to make their data available to a larger community of users, and synthesizing the data, can be challenging.

Great Lakes buoy coverage is inadequate and not year round. Many buoys are pulled in the fall and replaced in the spring, but the timing is often such that there are gaps in data availability during times when shipping is still ongoing. Year-round all-weather buoys would address this concern. Additionally, local data needs are not adequately addressed by the resolution of the available monitoring data.

4. Commercial Fishing Effort - Vessel Monitoring System (VMS) Data

Data Description:

VMS data are collected aboard vessels (primarily commercial fishing vessels) equipped with systems that monitor the location of the vessel using Global Positioning Satellites (GPS). The systems can also monitor other vessel locations and help manage vessel traffic. Fisheries monitoring agencies can view specific locations of vessels at time intervals, compute vessel speed, and monitor catch and effort if the vessel operator enters this information into the system. Once aggregated from multiple vessels the VMS data provide a means to understand the extent and density of fishing activity, and in some cases, catch.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting
- Fisheries management
 - Understand active use areas, dense fishing areas, fishing type

- Manage impacts to the fishing industry
- The fishing community would like access to these data to demonstrate the importance of different offshore areas
- Identify and engage potentially affected fishing industry stakeholders
- Understand the economic importance of different fishing areas
- Conflict reduction between different uses
- Understand fishing productivity
- Community resilience and climate adaptation
 - Manage coastal development
- Offshore renewable energy siting and leasing
 - Understand the impacts to active use fishing areas and transit corridors from proposed energy projects
- Species and habitat management
 - Habitat conservation and restoration
- Water quality
 - Marine debris impacts to marine habitats and ingestion by marine species
- Maintenance of shipping and navigation channels
- Permitting and siting for other offshore infrastructure
 - Oil and gas planning and exploration
 - Energy, transmission, and telecommunications cable route planning
- Public access
- Harvesting other marine resources including seaweed, kelp, and invertebrates
- State ocean planning efforts
 - Determine the footprint and intensity of fishing vessel activity, including transit and fishing

Data Issues or Needed Improvements:

The Northeast region spends time to take the data provided by the NMFS and to further process it to derive products that characterize where fish are caught. To date, the focus has been on the North Atlantic, but the data are needed elsewhere as well. Elsewhere users report that the available data are not readily accessible and not easy to understand. VMS data for the Pacific Islands are not available at the same quantity or resolution as the data on the East Coast.

VMS data require significant additional regional processing time, engagement with fishery management professionals to understand the codes, and have important attributes removed due to privacy concerns. This requires the acquisition and use of significant regional grant funds to process the data, develop draft products characterizing each fishery, and to ground truth the data with managers and stakeholders. Significant modifications to the process can reduce costs and effort, improve the derived data products characterizing each fishery, and result in more timely and accurate products for use in decision making.

Recreational fishing data are needed in particular, including locations and type of fish.

Data are provided every two years but annual updates would be preferable. Significant spikes in usage of VMS products occur around the time of federal actions, such as offshore wind leasing milestones and fisheries management actions.

Having access to economic information so the economic importance of different fishing areas can be ranked is also needed.

5. Vessel Traffic - Automatic Identification Systems (AIS)

Data Description:

AIS data are transmitted from vessels to shore-based and/or satellite receivers and report information such as vessel name, location, speed, and direction of travel. The data can be used on board by vessel watchstanding officers for collision avoidance and by maritime authorities to track and monitor vessel movements. Global AIS data collected from both satellite and internet-connected shore-based stations are aggregated and made available on the internet through a number of service providers for a subscription fee. None of these service providers include AIS from the USCG's Nationwide Automatic Identification System (NAIS).

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting
- Fisheries management
 - Commercial fisheries management
 - Future commercial fishing trends
 - Manage allocation conflicts between commercial, recreational, and subsistence fisheries
- Community resilience and climate adaptation
- Offshore renewable energy siting and leasing
 - Document areas that are important to vessel transit through areas under consideration
- Species and habitat management
 - Impacts on sound from vessel traffic
- Oil and gas extraction
- Maritime and navigation safety
 - Vessel traffic
 - Manage conflicting uses by recreational fishing, tour boats, and charter fishing boats
- Permitting and siting for other offshore infrastructure
- Subsistence use
 - Minimizing conflicts from vessel traffic

Data Issues or Needed Improvements:

The USCG collects real-time data on vessel identify, characteristics, movement and other valuable security, economic, and environmental parameters using a network of land-based antennas. Through an informal collaborative with the Marine Cadastre, AIS has been re-packaged and released freely to the public for ocean planning purposes since 2009. The utility and popularity of these data have grown significantly as have the requests for enhancements to the data and the data sharing process. The Committee on Marine Transportation Safety is currently evaluating this ongoing effort to see if it can be stabilized and leveraged to serve a wider community of maritime stakeholders. The active participation of the USCG and other maritime agencies is essential to the success of any future expanded efforts.

Over the past few years, the Northeast portal has also taken a prominent role in working hands-on with stakeholders to improve AIS derived products, tools, and in the joint development of data and tools with the Marine Cadastre team. The Northeast and Mid-Atlantic regions develop derivative products from the Marine Cadastre data including heat maps and other derivatives indicating vessel traffic locations.

Stakeholders who use the AIS data frequently ask for improvements to the designation of vessel type and vessel characteristics which requires cross referencing to numerous other federal and commercial data sources. No single agency or office has an existing capacity or duty to take on this type of value-added AIS product support.

The AIS data published by the Marine Cadastre are generally 12 to 18 months old. Some projects need data for a specific time frame and/or nearer to real time data.

The USACE has advanced AIS analytical capacity in their AISAPI tool that is provided on request to other federal agencies. Currently there are no plans to make this publicly available.

Additionally, satellite AIS data are a need for some regions (i.e. Pacific Islands, Alaska) that do not have as many land antennae (or none at all such as American Samoa). The USCG has a license agreement in place for satellite AIS, but the Marine Cadastre and the regional portals cannot make these data publicly available. Alaska often gets the data from Norway. Funding for a license agreement for Alaska and the Pacific Islands would be one possible solution.

The Arctic Domain Awareness Center is working on integrating and visualizing vessel traffic data in and around Alaska. The land-based AIS data for Alaska come via the Marine Exchange, not the USCG. The real-time data are available by subscription (and to the USCG); historic data are free but require work to make them useful. Axiom has done some work on this but their work will end in late 2018.

6. Human and Cultural Use Areas

Data Description:

Human use areas would include those areas designed, constructed, designated, or used for recreational activities. They may be areas that are public (e.g. national, state, county, or city parks) or privately owned. Recreational uses may include fishing, swimming, diving, boating, hunting, bird watching, bike riding, hiking, or camping. Data may include areas used for recreational and commercial fishing; artificial reef locations used for diving; areas used for aquaculture; and cruise ship, tour boat, and charter fishing routes.

Tribal and cultural use areas are places and resources of past and present significance to tribal communities. These may include archaeological sites, burial grounds, and traditional use areas that are imbued with special meaning to past and present indigenous communities.

Specific examples of traditional use areas of interest to present indigenous communities include traditional Hawaiian paddle routes (e.g. the paddle race route from Molokai to Oahu) and wild rice locations in the Great Lakes area.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting
- Fisheries management
- Community resilience and climate adaptation
 - Manage coastal erosion, storm surge, shoreline change
 - Relocation of communities impacted by erosion
 - Manage coastal development, including ports
- Offshore renewable energy facility siting
- Sand and sediment management
 - Beach nourishment
 - Sediment management
- Species and habitat management
- Oil and gas exploration
- Maritime and navigation safety
 - Maintenance of shipping and navigation channels
- Public access
 - Manage conflicting uses of waters
- Recreation
 - Maintain public access for recreation, cultural use, and traditional fishing
- Harvesting other marine resources
- Permitting and siting for other offshore infrastructure

- Undersea cable route planning
- Permitting of structures, permit reviews, and EISs
- Subsistence use
 - Conflict avoidance

Data Issues or Needed Improvements:

Summary data of area uses, hot spots, and recreation patterns are needed. Areas used for recreational and commercial fishing and artificial reef locations used for fishing and diving are also of interest. Some human use data are available for Hawaii, the Pacific Coast, and New England. Western states may have data for their waters, but not beyond. However, there are big gaps in the data, and data gathering is intensive.

There may not be a federal data source for human use data.

Tribal areas, and in particular, paleo areas of importance along the coasts and under water are needed. Locations of submerged archaeological resources, including shipwrecks, are also needed. The Protected Areas Database (PAD-US) geodatabase provided by USGS currently includes Tribal protected areas, but they are not up to date and the next release of PAD-US will not include these areas until they can be resolved. The Bureau of Indian Affairs may need to provide guidance. Additionally, National Historic Preservation Act data managed by the National Park Service (NPS) are not up to date and NPS does not currently have the resources to address this need. The available data need better documentation in the metadata on the provenance of the process and entity that made the determination of significance, as well.

Work is ongoing in the Great Lakes region to identify locations of wild rice from hyperspectral data, develop methodologies, and identify ecosystem services and benefits of wild rice.

7. Commercial Fishing Effort - Vessel Trip Report (VTR) Data

Data Description:

VTRs are used to record and document catch landed by licensed fishermen. Data that are released are in a summary or aggregate form, so as to not reveal the identity of the fisherman. VTR data collected from fishermen include vessel name, date, trip type, number in party, gear used, area fished, average depth, species caught, amount kept, amount discarded, date sold, state and port landed, and date landed.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting
- Fisheries management
 - Manage fishing quotas
 - Assess fishery stock
 - Manage protected species
 - Economic analysis
 - Develop fisheries management strategies
 - Manage impacts to the fishing industry
 - Conflict reduction between different uses
 - Determine fishing activity and value
 - Identify landing locations
- Community resilience and climate adaptation
- Offshore renewable energy siting and leasing
 - Minimize impacts to fishing activities
- Species and habitat management
 - Protection and restoration of sensitive habitats and species
 - Impacts on sound from vessel traffic

- Maritime and navigation safety
- Permitting and siting for other offshore infrastructure
 - Siting of energy and telecommunications cables

Data Issues or Needed Improvements:

The Mid-Atlantic region contracted with Rutgers University to do an analysis of VTR data to show what ports fishermen came from, not just the locations of fishing areas. The analysis required considerable stakeholder vetting, but if NOAA could perform such an analysis it would be helpful for other states’ Federal Consistency Reviews. However, because of the differences in regions, the same methodology may not be applicable elsewhere without additional stakeholder engagement. The Mid-Atlantic methodology may be applicable in the Southeast, but not likely on the West Coast.

The currently available VTR data in the South Atlantic are out of date. Heat maps are available but newer data are needed. Alaska relies on fish surveys, which are costly and are not being done as frequently (every 2 – 3 years now), yet conditions are changing more rapidly.

VTR data only include commercial fishing in the Pacific Islands, fish types are not accurate for Hawaii, and the VTR data are spotty for American Samoa and Guam.

As with VMS data, recreational fishing data are needed in particular, including locations and type of fish, as well as shore based access locations for recreational fishing at a national scale.

8. Bathymetry

Data Description:

Bathymetry is essentially “submarine topography,” or the depths and shapes of underwater terrain. In the same way that topographic maps represent the three-dimensional features (or relief) of overland terrain, bathymetric maps illustrate the land that lies underwater. Bathymetry data are typically collected using acoustic (or sonar) technology; there are several types of sonar systems that may be used to capture the data. Often, additional sensors will be deployed at the same time to collect additional information that can be used to characterize the sediment type, bottom surface, plant cover, subfloor seabed type, and water column properties. In suitable nearshore areas, bathymetry may be collected using a lidar sensor that can capture topobathymetric data. Bathymetry data are typically delivered as a Digital Elevation Model.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture and mariculture siting
- Fisheries management
- Community resilience and climate adaptation
 - Manage beach profile, shoreline change, and shoreline erosion
 - Model sea level rise impacts
 - Manage coastal development
 - Model tsunami inundation
- Offshore renewable energy siting
 - Identify locations of geological hazards
- Sand and sediment management
 - Sediment transport and erosion
 - Manage beach nourishment
- Species and habitat management
 - Identifying benthic habitats and species distribution
 - Better understanding of habitats, unique areas, and areas of ecological importance
 - Habitat restoration
 - Manage invasive species

- Water quality
- Ocean disposal
 - Dredge material disposal siting
- Maritime and navigation safety
 - Harbor maintenance
 - Maintenance of shipping and navigation channels
- Oil and gas planning and exploration
- Harvesting other marine resources including seaweed, kelp, and invertebrates
- Great Lakes water levels
 - Commercial and recreational boating safety
 - Beach safety
 - Bi-national partnerships and agreements for water quantity in the Great Lakes

Data Issues or Needed Improvements:

Bathymetry is currently available in piecemeal in the data registry, but it is difficult to find what is needed, the data are not seamless, and not all areas of interest have high-resolution bathymetry. Better tools to find and download the data are needed. Ideally, an updated version of the Coastal Relief Model (CRM) should be published more frequently. The CRM, published by the NOAA National Centers for Environmental Information (NCEI) integrates offshore bathymetry and land topography into a seamless data model out to the continental slope as a Digital Elevation Model (DEM). Some areas of the CRM have not been updated since 1998, others are more up to date (2013).

High resolution bathymetry out to 60 meters depth is needed for the Great Lakes, all of the Gulf Coast states (even better would be out to the OCS), and out to the OCS on the West Coast. Nearshore bathymetry is also needed for the Pacific Islands.

The West Coast seabed data are quite old and only about a third of the shelf has been mapped with high resolution multi-beam bathymetry. Federal funding is often made available for data collection (e.g. by NOAA, BOEM, and others) but is often project based and outside the state waters. California is undertaking an effort to map the seafloor of its state waters; data collection is complete, but the data processing and analysis to derive bottom texture and habitat from the bathymetry are not complete.

Nearshore topobathymetric lidar data are needed for American Samoa.

Great Lakes bathymetry is also quite old. Some harbors are surveyed frequently, but other areas have not been surveyed recently. There is no high resolution bathymetry for Lake Superior, which has not been surveyed this century. In some areas, to address the lack of adequate bathymetry, local collections have taken place and these data may or may not be shared publicly.

Interpretation of the bathymetry into bottom habitat information is also desired.

9. Sand and Borrow Sites

Data Description:

Sand, gravel, and cobble borrow sites are designated areas where ocean bottom materials can be “borrowed” for use in beach nourishment or other uses. BOEM manages these areas in Federal waters.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting
 - Sand and borrow sites
- Fisheries management
 - Ensure sand removal does not disturb fishing areas

- Community resilience and climate adaptation
 - Beach and wetland nourishment
 - Sea level rise
 - Manage future coastal development
 - Manage shoreline erosion
 - Coastal restoration
 - Better understanding of littoral drift in the Great Lakes
- Sand and sediment management
 - Sediment transport and erosion
 - Manage beach nourishment
 - Identify dredge holes, borrow pits, and spoil banks
 - Identify sand resources for construction
- Species and habitat management
 - Ensure sand removal does not disturb habitat areas
- Oil and gas exploration and extraction
 - Site reviews
- Maritime and navigation safety
- Permitting and siting for other offshore infrastructure
 - Siting of energy and telecommunications cables, pipelines, and platforms
-

Data Issues or Needed Improvements:

The forthcoming BOEM Marine Minerals Information System will provide needed information on potential sand and borrow sites synthesized for both state and federal waters. Current data sets are not complete and are not synthesized, so users have had to acquire state data sets for nearshore areas, where available, and BOEM data for areas farther offshore. It was noted that the current BOEM site can be difficult to navigate, there are many portals, data are scattered, and the sand areas are not named with “sand.” Historic data are also not all in digital format.

Furthermore, locations of dredge holes, borrow pits, and spoil banks along the Gulf Coast are needed.

The Great Lakes experience bluff failures from erosion. Littoral drift needs to be better understood and nearshore monitoring is needed. A recent restoration project failed due to a lack of understanding of littoral drift. Decision making depends on good data.

10. Species and Habitat Locations, Including Benthic Habitat

Data Description:

Habitats provide the basic needs of living things including food, water, and shelter throughout an organism’s life cycle. Fish habitat includes any aquatic ecosystem where the organism can live either permanently or temporarily, including areas necessary for spawning, breeding, feeding, or growth to maturity.

Benthic habitat maps are typically derived using slope and rugosity from bathymetry or lidar, acoustic imagery or intensity imagery, underwater photos, and data gathered from sediment samples.

Key Issues that Could be Better Addressed with Data Improvements:

- Offshore aquaculture siting
 - Identify suitable habitats for siting aquaculture development

- Fisheries management
 - Identify future commercial fishing trends
 - Identify areas susceptible to damage from fishing gear
- Community resilience and climate adaptation
 - Understand habitat shifts due to climate change and warmer waters
 - Manage invasive species
 - Better understand littoral drift
- Sand and sediment management
 - Identify areas suitable for extraction
- Species and habitat management
 - Protection and restoration of habitat areas
 - Better understand coral migration
 - Better understand where resources are available
 - Better understand nearshore to offshore linkages
 - Identify habitat protected areas (HAPCs and MPAs)
 - Improve ecosystem health
 - Manage migration of diseases
 - Manage loss of estuarine habitats
- Water quality
 - Identify impacts on habitat from harmful algal blooms
- Offshore renewable energy siting and development
 - Evaluate the impacts on habitats of renewable energy projects, oil/gas, pipelines, cables, and other infrastructure
- Recreation
 - Siting for artificial reefs
- Harvesting other marine resources

Data Issues or Needed Improvements:

Marine mammal and fish habitat derivative products are needed. Derivatives similar to those available in the Northeast and Mid-Atlantic such as seasonality of occurrence and gear types are desired for the South Atlantic region. On the West Coast, habitat, conservation, and restoration data are needed. Data gaps include Endangered Species Act listed species and high use areas for marine mammals. Migration pathways are also needed.

Some states have collected data on species (e.g. turtles, other species of interest) but the data may not be normalized across states, may not all be publicly available, or may only be available by request. Best practices and processes for deriving regional data are needed.

Improved habitat maps would improve fisheries-independent surveys such as those conducted by the Southeast Area Monitoring and Assessment Program ([SEAMAP](#)), the State of Florida, and others.

Both Federal and state agencies manage species; there is some overlap. State species lists are of greatest concern at the regional level.

CONCLUSIONS AND RECOMMENDATIONS

This section provides a summary of the issues or improvements for each of the top ten data sets identified as priorities by the regions. If addressed, these improvements would significantly reduce time and cost spent by the Marine Cadastre team and/or the regions on data processing and would improve stakeholders' ability to address pressing coastal and ocean management decisions. A list of actions to be considered for the future is also provided in this section.

Summary of Issues or Needed Improvements

Table 3 - Top Ten Required Data Sets with Issues or Needed Improvements

Rank	Data Requirements	Issues or Needed Improvements	Responsible Agency(s)
1	Jurisdictions and regulated areas	<ul style="list-style-type: none"> Boundaries are currently being digitized from descriptions published in Acts, Code of Federal Regulations (CFR), treaties, and permit documents. Authoritative agencies should be publishing geospatial data in addition to the published documents. Additional details about regulatory restrictions, when or why changed, duration of regulation or agreement, status of permit (e.g. proposed, planned, approved), etc. should be included as attributes in the geospatial data. Thresholds for project size, update frequency, etc. should be agreed upon with the authoritative agency. More detailed data are needed for military areas instead of broad areas of restriction (e.g. unexploded ordnance) if such information can be released. 	USACE, EPA, USCG, DoD, Tribal
2	Abundance and distribution of marine species	<ul style="list-style-type: none"> Synthesis of observation data is needed from the multiple entities that collect data. Modeled data, derived products, and documentation of methodology are also needed (e.g. time series, heat or density maps, and trends over time, etc.). Dependable and continuous updates to models and products are needed. 	NOAA, DoD, Navy, states, others
3	Synthesized oceanographic parameters	<ul style="list-style-type: none"> Synthesis of monitoring and observation data is needed from the multiple regional entities that collect data. Derived products from the raw data (e.g. forecasts, change over time, etc.) are needed. In some regions, densification or winterizing of monitoring devices would greatly improve usability of the collected data. Standardized, seasonal, annual or decadal products, as applicable, at an ocean-basin scale for temperature, salinity, oxygen, biomass, and productivity are needed. 	IOOS, others

Rank	Data Requirements	Issues or Needed Improvements	Responsible Agency(s)
4	Commercial fishing effort - Vessel Monitoring System (VMS)	<ul style="list-style-type: none"> • Processing and publication of data derived from VMS is conducted by regional partners at considerable cost and effort. Annual agency sponsored products are needed, and in more regions than are currently available. • Consultation with the FMC and regional experts by NMFS is needed to define appropriate planning products compatible with existing efforts. • Improvements are needed to the consistency and completeness of declaration, gear type, and other codes. • Data on recreational fishing, including locations and type of fish caught, are needed. • Having access to economic data so the economic importance of fishing areas can be quantified would add considerable value to derived products. 	NOAA National Marine Fisheries Service (NMFS)
5	Vessel traffic - Automatic Identification Systems (AIS)	<ul style="list-style-type: none"> • Publication of data derived from raw AIS data is currently performed by the Marine Cadastre. Stronger efforts by The USCG, MARAD and the USACE could stabilize, expand and improve this resource for the broader ocean community. • Improvements are needed to the identity and characteristics of vessels, higher frequency access, and ready-to-use products. • Better access to satellite AIS data is needed where land-based receivers are not available. 	USCG or MARAD
6	Human and cultural use areas	<ul style="list-style-type: none"> • Uniform and complete data are not readily available and data gathering is intensive. • Derived products (e.g. summary of use, hot spots, recreation patterns, etc.) are needed. • Data on Tribal Protected Areas need to be updated and made publicly available. • National Historic Preservation Act data need to be updated. • Improved documentation of provenance and procedures is also needed in the metadata. 	NPS, state, local, Tribal

Rank	Data Requirements	Issues or Needed Improvements	Responsible Agency(s)
7	Commercial fishing effort - Vessel Trip Report (VTR)	<ul style="list-style-type: none"> • Processing and publication of data derived from VTR is conducted by regional partners at considerable cost and effort. Annual agency sponsored products are needed, and in more regions than are currently available. • Consultation with the FMC and regional experts by NMFS is needed to define appropriate planning products • Improvements are needed to the consistency and completeness of original codes, documentation, and products interpolated at a spatial resolution to support energy and aquaculture leasing (i.e. ~2.5 nm x ~2.5 nm or less). • Data on recreational fishing, including location, type of fish caught, and shore-based access location are needed. 	NOAA NMFS
8	Bathymetry	<ul style="list-style-type: none"> • Bathymetry data are collected and distributed in a patchwork form and are difficult to find and use at scales beyond individual surveys. Additional high resolution / full bottom surveys are needed for complete coverage in priority areas of interest, especially near shore. Seamless 'best available' products and more up to date bathymetry data products are needed. • Seafloor characterization by sediment texture and physiographic zones is also needed. 	NOAA, USGS, states, others
9	Sand and borrow sites	<ul style="list-style-type: none"> • Current information on sand and borrow sites is not complete, is not synthesized, and can be difficult to find. The forthcoming BOEM Marine Minerals Information System will address many issues when published. • Historic data may not be available in digital format. 	BOEM, USACE
10	Species and habitat locations, including benthic habitat	<ul style="list-style-type: none"> • Synthesis and normalization of data is needed from the multiple entities that collect data. • Modeled data, derived products, and documentation of methodology are also needed (e.g. seasonality of occurrence, gear types, high use areas, endangered species, etc.). • Interpretation of bathymetry into bottom habitat information. 	NOAA NMFS, Fish and Wildlife Service (FWS), states, others

Future Considerations

The following actions that would improve the data currently being used in ocean and coastal management decision making should be considered. Data sets identified in this report as priority data (i.e. the top ten data sets identified as priorities by the regions) should be considered for near term implementation of some or all of these actions. However, all identified data sets would be enhanced by taking these actions into consideration for future data updates or releases.

- Identify the authoritative agency(s) or entity(s) responsible for the source data and determine the entity's capacity to enhance the currently available data.
- Determine the needed update frequency, resolution, accuracy, geospatial extent, data derivatives, file format, documentation, etc. for each data set.
- Identify data sets that are not yet available nationwide (e.g. data that may not yet be available for territories, Great Lakes, etc.), identify priority data sets, and pursue nationwide geospatial coverage of prioritized data sets to the extent possible.
- To the extent practical, pursue nationwide consistency in derived products, keeping in mind that regional differences may require different approaches, methodologies, and derived products. For example, data derived from commercial fishing data is being generated by some of the Atlantic coast regions but would be better performed by NOAA. However, different methodologies for deriving these products may be needed for the Gulf and Pacific coasts than that which has been developed for the Atlantic coast.
- To the extent possible, pursue increased update frequency of published and synthesized data.
- Encourage the authoritative data source to maintain and publish their data as web services that can be consumed by stakeholders.
- Encourage publishers of data to improve data discovery and data delivery tools.
- Encourage publishers of data to improve data visualization, taking into account that the data may be used by various regional, state, and local users whose visualization needs are quite different than users with a national perspective.
- Work with authoritative agency(s) or entity(s) responsible for the source data to encourage more uniform coding of data at the point of origin via processes or tools. For example, data that are input by vessel operators could perhaps benefit from improvements to tools that automate or help enforce coding accuracy and consistency.
- Work with agencies charged with bi-national harmonization (e.g. International Joint Commission, International Boundary Waters Commission, and Great Lakes Commission) to further harmonize data standards and classification methods used in data sets that cross international boundaries.
- Require publishers of data to better document methodology, provenance, and full documentation of processing steps in the metadata that accompany geospatial data sets.
- Explore ways to increase access to data collected by industry

APPENDIX A: RANKED PRIORITY ISSUES

Rank												
1	Offshore aquaculture siting	X	X	X	X		X	X	X	X		8
2	Fisheries management		X	X	X	X	X	X	X	X		8
3	Community resiliency and climate adaptation		X	X	X	X	X		X	X	X	8
4	Offshore renewable energy siting and leasing	X	X	X	X	X		X	X			7
5	Sand and sediment management	X	X	X	X	X	X				X	7
6	Species and habitat management			X	X	X	X	X	X			6
7	Water quality, including marine debris, ocean acidification, and harmful algal blooms			X	X		X			X	X	5
8	Oil and gas exploration and extraction	X					X			X		3
9	Ocean disposal	X		X				X				3
10	Maritime and navigation safety			X				X				2
11	Flooding				X						X	2
12	Military							X	X			2
13	Vessel traffic, increased Arctic traffic				X					X		2
14	Invasive species				X						X	2
15	Recreation							X	X			2
16	Infrastructure management		X									1
17	Soundscape				X							1
18	Public access							X				1
19	Harvesting other marine resources							X				1
20	Subsistence use									X		1
21	Water safety										X	1
22	Bi-national partnerships										X	1
23	Great Lakes water levels										X	1

APPENDIX B: RANKED DATA ISSUES

Rank	Data Requirements	Marine Cadastre	Northeast	Mid-Atlantic	South Atlantic	Caribbean	Gulf of Mexico	West Coast	Pacific Islands	Alaska	Great Lakes	Count
1	Jurisdictions and regulated areas	X	X	X	X		X	X	X	X	X	9
2	Abundance and distribution of marine species	X	X	X			X	X	X	X	X	8
3	Synthesized oceanographic parameters	X		X	X		X	X	X	X	X	8
4	Commercial fishing effort - Vessel Monitoring System (VMS)	X	X	X	X	X	X	X	X			8
5	Vessel traffic - Automatic Identification Systems (AIS)	X	X	X	X				X	X	X	7
6	Human and cultural use areas	X	X	X				X	X	X	X	7
7	Commercial fishing effort - Vessel Trip Report (VTR)	X	X	X	X				X	X		6
8	Bathymetry	X				X	X	X	X		X	6
9	Sand and borrow sites		X	X	X	X	X	X				6
10	Species and habitat locations, including benthic habitat				X		X	X	X	X		5
11	Shoreline type and structures			X						X	X	3
12	Oil and gas pipelines, cables, transmission lines, etc.		X							X	X	3
13	Bi-national						X			X	X	3
14	Water quality, including marine debris, ocean acidification, harmful algal blooms, and oil spills			X	X		X					3
15	Lidar					X			X	X		3
16	Locations of onshore and offshore facilities	X		X						X		3
17	Geophysical (i.e. bottom type and sediment type)	X							X	X		3
18	Seismic				X		X					2
19	Economic data (from Bureau of Labor Statistics)	X										1
20	Historic flood extents				X							1
21	Acoustic data				X							1

Rank	Data Requirements	Marine Cadastre	Northeast	Mid-Atlantic	South Atlantic	Caribbean	Gulf of Mexico	West Coast	Pacific Islands	Alaska	Great Lakes	Count
22	Specific areas								X			1
23	Marine transportation routes								X			1
24	Disaster vulnerability								X			1
25	Socio-economic								X			1
26	Erosion and sediment transport, littoral transport										X	1
27	Land use										X	1
28	Recreation patterns		X									1
29	Environmental Sensitivity Indexes							X				1
30	Climate projections									X		1
31	Coastal erosion, storm surge									X		1
32	Traditional Ecological Knowledge (TEK)									X		1
33	Data captured by foreign vessels									X		1
34	Ice gouges and strudel scour									X		1
35	Recent aerial imagery							X				1
36	Great Lakes water levels										X	1
37	Oil and gas seeps						X					1
38	Wetlands								X			1
39	Nearshore aquatic vegetation										X	1
40	Living shorelines						X					1
41	Hypersaline discharges						X					1

