

# COUNCIL MONITORING AND ASSESSMENT PROGRAM (CMAP)

Compilation of Existing Habitat and Water Quality Monitoring, and Mapping Assessments for the Gulf of Mexico Region

A joint collaboration between  
National Oceanic and Atmospheric Administration and the U.S. Geological Survey

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# Council Monitoring and Assessment Program (CMAP)

## Compilation of Existing Habitat and Water Quality Monitoring, and Mapping Assessments for the Gulf of Mexico Region

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National Oceanic and Atmospheric Administration and the U.S. Geological Survey

RESTORE CMAP Report Series: Task 7

December 2019

NOAA National Ocean Service, National Centers for Coastal Ocean Science, Marine Spatial Ecology Division  
NOAA National Marine Fisheries Service, Southeast Regional Office

and

USGS Southeast Region  
USGS Wetland and Aquatic Research Center  
USGS Texas Water Science Center  
USGS Lower Mississippi-Gulf Water Science Center



## RESTORE Council Background

The Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) was signed into law on July 6, 2012. The RESTORE Act calls for a regional approach to restoring the long-term health of the valuable natural ecosystem and economy of the Gulf Coast region. The RESTORE Act dedicates 80 percent of civil and administrative penalties paid under the Clean Water Act, after the date of enactment, by the responsible parties in connection with the Deepwater Horizon oil spill to the Gulf Coast Restoration Trust Fund (Trust Fund) for ecosystem restoration, economic recovery, and tourism promotion in the Gulf Coast region.

In addition to creating the Trust Fund, the RESTORE Act established the Gulf Coast Ecosystem Restoration Council (Council). The Council includes the Governors of the States of Alabama, Florida, Louisiana, Mississippi and Texas, the Secretaries of the U.S. Departments of Agriculture, the Army, Commerce, Homeland Security, and the Interior, and the Administrator of the U.S. Environmental Protection Agency.

The Council plays a key role in developing strategies and implementing projects that help ensure the Gulf's natural resources are sustainable and available for future generations. This has included the development of a Comprehensive Plan to restore the ecosystem and the economy of the Gulf Coast region. Approved in 2013 and updated in 2016, the Comprehensive Plan provides a framework to implement a coordinated, Gulf Coast region-wide restoration effort in a way that restores, protects and revitalizes the Gulf Coast (Gulf Coast Ecosystem Restoration Council, 2016). The Comprehensive Plan identifies five goals for Gulf Coast restoration: (1) Restore and Conserve Habitat, (2) Restore Water Quality, (3) Replenish and Protect Living Coastal and Marine Resources, (4) Enhance Community Resilience, and (5) Restore and Revitalize the Gulf Economy.

Under the Council-Selected Restoration Component of the RESTORE Act, the Council develops Funded Priority Lists (FPLs) that describe the projects and programs it will fund. Projects and programs funded through this component must further the goals and objectives of the Council's Comprehensive Plan and address at least one of the restoration criteria identified in the RESTORE Act. The Initial FPL, finalized in December of 2015, selected projects and programs that focused on the first two goals above, with a strong emphasis on watershed and estuary restoration and foundational cross-Gulf projects.

Approved as a Gulf-wide investment in the 2015 Initial FPL, the Council Monitoring and Assessment Program (CMAP) is administered jointly by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS). Funded activities include the development of basic, foundational components for Gulf-wide monitoring that can be used by the Council to measure the effectiveness of investments in Gulf restoration. The program, in coordination with the Gulf of Mexico Alliance (GOMA) and through collaboration with the Gulf States, Federal and local partners, academia, non-governmental organizations, and business and industry, has leveraged existing resources, capacities, and expertise to build on existing monitoring data and programs.



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We would like to thank the project team for their participation and expertise.

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# 1 Program Overview

Mangrove shoreline in Florida Bay, Everglades National Park, Florida.  
Credit: National Park Service

Under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act), the Gulf Coast Ecosystem Restoration Council (RESTORE Council or Council) is required to report on the progress of funded projects and programs. Systematic monitoring of restoration at the project-specific and programmatic levels (watershed and Gulf of Mexico [GoM]) enables consistent reporting and gives the public confidence that the restoration investments selected by the RESTORE Council are evaluated and adaptively managed. Monitoring information that has been collected at different spatial and temporal scales can be used as the foundation to illustrate progress toward comprehensive ecosystem restoration goals and objectives that promote holistic GoM recovery (see ‘RESTORE Council Background’ at the beginning of this report for additional Council information).

The best available science is required to make informed decisions to effectively manage ecosystem resources at multiple geographic scales across the GoM. However, knowing what data are being collected and where is a daunting challenge. Thus, a spatially and temporally comprehensive environmental monitoring network for habitat monitoring, water quality monitoring, and habitat mapping is a foundational element that can support scientifically sound decisions regarding the health and viability of the GoM

ecosystem. In the context of Gulf protection and restoration, a coordinated compilation of existing environmental monitoring programs and assessments can provide essential information to support the development, selection, and application of effective management and restoration alternatives, and inform adaptive management decisions at the local, State, and regional levels.

## **RESTORE Council Monitoring and Assessment Program (CMAP)**

Currently, Federal, State and local agencies, universities, private industry, and non-governmental organizations (NGOs) are conducting multi-scale monitoring activities around the Gulf. In addition, each RESTORE Council-funded project will, at a minimum, perform project-specific monitoring. This collection of monitoring activities is being inventoried and coordinated into a network of existing programs by the Council-funded RESTORE Council Monitoring and Assessment Program (CMAP), which will suggest opportunities for efficiencies and collaborative cross-program review of performance with other Gulf ecosystem recovery efforts. CMAP is designed and funded to inventory existing monitoring and assessments, improve discovery and accessibility of existing monitoring data, and ensure collected information supports management decision making.



The fundamental approach to integrating existing monitoring program information is to:

1. Adopt, or construct as needed, a comprehensive inventory of existing habitat and water quality observation, monitoring, and mapping programs in the Gulf;
2. Evaluate the suitability/applicability of each program and its existing and prospective data for use in restoration activities;
3. Develop a catalog of existing habitat, water quality and mapping assessments;
4. Coordinate and integrate appropriate existing assessments, observations and monitoring systems to form a regional monitoring network with an integrated data management structure;
5. Identify information gaps;
6. Provide recommendations to strategically supplement and refine observations and monitoring systems to fill the acknowledged gaps with available capabilities and capacities of all the regional partners; and
7. Develop a searchable information portal/database to enable access to information and products.

This report is a deliverable to the RESTORE Council for *Task 7: Document the existing baseline habitat and water quality conditions prior to implementation of the restoration projects*; these baseline conditions will serve as a basis for measuring change/progress after restoration.

It is the second in a series of CMAP reports. The first report describes the process and development of the CMAP monitoring program inventory, herein the Inventory (NOAA and USGS, 2019). The goals and objectives for the Inventory were to identify and document existing habitat and water quality monitoring, and mapping programs, data, and protocols in the GoM. The Inventory built upon existing databases, such as the Ocean Conservancy (Love, 2015), Global Change Monitoring Portal (GCMP; GCMP, 2017), and Gulf of Mexico Alliance (GOMA) databases (GOMA, 2013), including habitat and water quality monitoring programs at national, regional, State and local scales. This second report identifies and catalogs existing water quality, habitat and mapping assessments within the Gulf of Mexico. This assessment catalog, herein the Catalog, was intended to supplement the Inventory to identify the best

available science necessary for restoration, conservation or management activities. Both the Inventory and the Catalog databases will be accessible to the Council and the greater GoM restoration, monitoring, management, and academic communities through a searchable web-based tool.

### Report Overview

The protocols and database framework established for the Inventory were adopted, where applicable, for the Catalog. Consistency and integration with the Inventory will allow the two databases to be queried independently in the web-based tool, currently in development. This report provides technical details on the development of the report and how this information will be accessed and used.

Chapter 1 provides background information about CMAP and products of this project to date. Chapter 2 describes the Catalog in detail and the organizational structure of the report as well as the goals and objectives. Chapter 3 examines the variety of sources that were mined for assessments and community engagement. Chapter 4 describes the process for assessment inclusion into the Catalog, and outlines other information gathering activities. Chapter 5 provides a detailed description of the development and final version of the Catalog framework and website development. Chapter 6 describes the protocols and data entry process for the Catalog and the review process for maintaining information accuracy of the database. Chapter 7 provides summary information about the monitoring assessments included in the Catalog. Lastly, Chapter 8 discusses the immediate and long-term future of the Catalog including how it will be used for the remaining elements/tasks of the CMAP project, the benefits and uses beyond RESTORE Council projects, and lessons learned.



# 2 Monitoring Assessment Catalog



Orange basket star on a 450 m deep Lophelia reef at Viosca Knoll, Gulf of Mexico. Credit: NOAA OER/BOEM, Lophelia II: Reefs, Rigs, and Wrecks 2009 Expedition

## Goals and Objectives

**GOAL** To create a catalog of descriptive summaries for existing assessments of habitat, water quality, and mapping products in the GoM region.

**OBJECTIVE** Compile existing assessments of habitat, water quality, and mapping products into a comprehensive searchable web-based catalog to assist with restoration planning, development, and performance monitoring.

The Catalog includes assessments that gauge the condition of a particular habitat, water quality, or mapping parameter and meet the criteria listed herein. We have included value-added summary text, tables, and figures that describe what the baseline reports provided, such as general spatial domain, time period, and parameters analyzed in the assessment. This information supports the Council by identifying potential reference points for evaluating restoration projects. For example, does Gulf-wide information exist depicting submerged aquatic vegetation (SAV) spatial extent circa 2018?

We included assessments that evaluate conditions or allow comparisons of groups or individual parameters listed for water quality, habitat and mapping programs identified in the CMAP Inventory (NOAA and USGS, 2019). Assessments to be included needed to meet spatial criteria ranging from Gulf-wide to individual watersheds/estuaries. Temporal

criteria were generally from 1980 to 2018. We used best judgment on a case-by-case basis to determine whether to include assessments conducted earlier or at smaller scales.

Assessments conducted by Federal, State and local agencies, and programs conducted by large NGOs were the focus for the Catalog. CMAP did not analyze data contained within the assessments, but instead compiled, cataloged, and summarized existing habitat, water quality, and mapping assessments that met the criteria listed above. The CMAP Inventory was used as the initial resource for assessment discovery. In addition to the Inventory, publication databases or websites from monitoring program agencies were explored for assessments that met the prescribed criteria (Table 1).

The information that was collected and summarized included bibliographic information, such as authors, agency affiliations, publication website, duration of assessment, a brief summary or abstract and general region of the assessment. More detailed information was also collected following the framework developed for the Inventory (NOAA and USGS, 2019). However, parameters documented from the assessments were limited to general parameters for water quality and habitat monitoring and to technology and activity type for mapping assessments. More information on the assessment framework is discussed in Chapter 4.

Synthesized information was reviewed internally. Once all information was reviewed for accuracy, the entry was considered final and was integrated with the CMAP assessment database, which will be made web-accessible via a geo-referenced webtool. This framework web directory design will accommodate multiple search features across numerous database attributes and is planned for completion in 2020.

**Table 1** Assessment source categories identified for the Catalog.

<b>Assessment Type</b>	<b>Examples</b>
Status and/or Trends Report	Seagrass Status and Trends in the Northern Gulf of Mexico: 1940–2002 (Handley et al., 2007) <a href="https://pubs.usgs.gov/sir/2006/5287/pdf/CoverandContents.pdf">https://pubs.usgs.gov/sir/2006/5287/pdf/CoverandContents.pdf</a>
Condition Reports	National Coastal Condition Report 2010 (USEPA, 2015) <a href="https://www.epa.gov/sites/production/files/2016-01/documents/ncca_2010_report.pdf">https://www.epa.gov/sites/production/files/2016-01/documents/ncca_2010_report.pdf</a>
Assessments/ Baseline Assessments	Palm Beach County Natural Areas Water Quality Baseline Assessment (PBC ERM, 2015). <a href="http://discover.pbcgov.org/erm/Publications/naturalareaswaterquality.pdf">http://discover.pbcgov.org/erm/Publications/naturalareaswaterquality.pdf</a>
Summary Reports (Single or Series)	Louisiana Barrier Island Comprehensive Monitoring (BICM) Program Summary Report: Data and Analyses 2006 through 2010 (Kindinger et al., 2013) <a href="https://pubs.usgs.gov/of/2013/1083/pdf/ofr2013-1083.pdf">https://pubs.usgs.gov/of/2013/1083/pdf/ofr2013-1083.pdf</a>
Inventory/Index	Okefenokee National Wildlife Refuge Water Resource Inventory and Assessment (Thom et al., 2015) <a href="https://ecos.fws.gov/ServCat/DownloadFile/52787">https://ecos.fws.gov/ServCat/DownloadFile/52787</a>
Stock Assessments (summarized)	Oyster Stock Assessment of the Public Oyster Areas of Louisiana (LDWF, 2016) <a href="http://www.wlf.louisiana.gov/sites/default/files/pdf/page/37756-stock-assessments/2016oysterstockassessment.pdf">http://www.wlf.louisiana.gov/sites/default/files/pdf/page/37756-stock-assessments/2016oysterstockassessment.pdf</a>
Report Card/Guides	2002-03 Sanctuary Science Report: An Ecosystem Report Card After Five Years of Marine Zoning (Keller and Donahue, 2006) <a href="https://nmsfloridakeys.blob.core.windows.net/floridakeys-prod/media/archive/research_monitoring/final_draft.pdf">https://nmsfloridakeys.blob.core.windows.net/floridakeys-prod/media/archive/research_monitoring/final_draft.pdf</a>
State of the [Blank]	State of the Bay - Galveston Bay (Lester and Gonzales, 2011) <a href="https://galvbaydata.org/www.galvbaydata.org/StateoftheBay/tabid/1846/Default.html">https://galvbaydata.org/www.galvbaydata.org/StateoftheBay/tabid/1846/Default.html</a>





# 3 Information Synthesis and Framework

Gulf State Park, Gulf Shores, Alabama. Credit: NOAA NCCOS

The purpose of the Catalog was to provide bibliographic information for various types of assessment publications (Table 1) that could be used to provide baseline information for habitat and water quality conditions. This effort used the framework developed for the Inventory (NOAA and USGS, 2019) and modified it where applicable so that consistency in language, keywords, and interface was maintained. Several components of the Inventory, such as the organizational framework, were used in the development of the Catalog (Chapter 4).

Existing publication databases, a few of which are described in more detail below, were often composed of a wide variety of publication types that covered a broad range of subject matters. In order to develop a more streamlined catalog (see Chapter 4), we set finite criteria to focus on the assessments that met CMAP objectives. Those assessments outside the CMAP objectives were compiled and maintained in a list of “deferred assessments”.

## Assessment Databases

### CMAP Monitoring Inventory

CMAP’s Inventory was developed and built to house programmatic metadata on existing habitat and water quality monitoring and mapping programs (NOAA and USGS, 2019). This inventory provides standardized summaries of program attributes of national, regional, and local monitoring programs in the GoM. A list of parameters for habitat and

water quality monitoring programs, and technology/tool types and parameters for mapping programs were prepared for the Inventory with input from regional experts and practitioners (see next section).

Metadata-level information on programs within the Inventory aided in identifying agencies with projects or programs that met the inclusion criteria for monitoring and mapping programs. CMAP investigated the websites of the agencies and organizations listed in the Inventory to discover resources such as publication databases or links to assessments that could be included in the Catalog.

### Publication Databases

Agencies (Federal, State, local) and large NGOs often have searchable publication databases. Many of these publication databases searched by CMAP were identified through building the Inventory using the criteria set by the documented assumptions (Chapter 4; Appendix 1). Table 2 provides a selection of databases investigated for the Catalog. The table is not inclusive, but contains representative databases discovered through developing the Inventory and is limited further by priority objectives for this task.

### Gulf of Mexico Alliance

The Gulf of Mexico Alliance (GOMA) is a Regional Ocean Partnership led by the five Gulf States. GOMA collaborates

**Table 2** Select list of agencies/organization publication databases investigated for the Catalog. The full list can be found in Appendix 1. NGO = identified as a non-governmental organization or a non-profit organization.

State/ Coverage	Agency/Organization	Agency/Entity Type			
		Federal	State	Local	NGO
Alabama	Mobile Bay National Estuary Program	X	X		
	Dauphin Island Sea Lab		X		
	Geological Survey of Alabama		X		
Florida	Choctawhatchee Basin Alliance				X
	Florida Fish and Wildlife Conservation Commission		X		
	Tampa Bay Estuary Program	X	X		
Georgia	Georgia Department of Natural Resources		X		
Louisiana	Coastal Protection and Restoration Authority		X		
	Coastwide Reference Monitoring System	X	X		
	Lake Pontchartrain Basin Foundation				X
Mississippi	Grand Bay National Estuarine Research Reserve	X	X		
	Mississippi Department of Environmental Quality		X		
	Mississippi Department of Marine Resources		X		
Texas	Coastal Bend Bays and Estuaries Program				X
	Flower Garden Banks National Marine Sanctuary	X			
	Texas Parks and Wildlife Department		X		
Gulf-wide	National Park Service	X			
	The Nature Conservancy				X
	Ocean Conservancy				X

regionally with Federal and State agencies, academics, businesses, and NGOs to enhance the environmental and economic health of the GoM. In 2013, GOMA released a white paper that recommended the implementation and funding of an integrated Gulf-wide water quality monitoring network to address issues that could not be answered by monitoring programs existing at that time (GOMA, 2013). The white paper described monitoring goals and objectives similar to those identified by CMAP. Goals included:

1. Integrate monitoring and related research and technology development efforts to aid in answering local, regional, and Gulf-wide questions;

2. Promote inter-agency data sharing and the expansion of international partnerships;
3. Provide real-time or near real-time observations; and
4. Provide synthesized information and products.

Additionally, the white paper report included a list of key water quality monitoring programs in the Gulf and online monitoring catalogs and data portals, which were useful for discovery for the Inventory and the Catalog, covered in this report.



### Engagement with Existing Gulf of Mexico Monitoring Experts and Practitioners

CMAP obtained additional water quality, habitat monitoring and mapping assessments by communicating directly with various monitoring practitioners and workgroups.

### Monitoring Community of Practice

The Gulf of Mexico Monitoring Community of Practice (GoM MCoP) provides a forum for sharing and coordinating monitoring knowledge with the larger monitoring and restoration community. The GoM MCoP provides a broad network of monitoring experts across the GoM, specifically through collaboration with GOMA's Priority Issue Teams (PITs). The primary goals associated with the development of the GoM MCoP were to promote regional collaboration, to improve coordination, accessibility, and comparability of monitoring information and to develop and share tools and practices aimed to support GoM ecosystem health. This coordination and information exchange was designed to occur during five workshops and periodic webinars during the three-year CMAP project.

The GoM MCoP was first introduced to the CMAP project and objectives through an informational webinar held on February 23, 2018. Approximately 70 individuals

participated in the webinar. The first in-person workshop was held on June 11, 2018 and approximately 90 individuals representing Federal, State, and local governments, as well as NGOs, academic, and industry sectors were in attendance. The framework for the assessment Catalog was presented, and attendees were told how the Catalog was intentionally designed to incorporate as many elements of the Inventory as possible so that they could be seamlessly integrated into the assessment web-based tool.

### Council Monitoring and Assessment Work Group

The overarching purpose of the Council Monitoring and Assessment Work Group (CMAWG) is to serve as the leadership body responsible for coordinating Council monitoring and assessment activities, including the recommendation of monitoring and assessment standards that may be used on Council projects and programs. The CMAWG consists of the primary and secondary representatives from the 11 RESTORE Council members (States of Florida, Alabama, Mississippi, Louisiana, and Texas; U.S. Departments of Agriculture, Interior, Commerce and Homeland Security; U.S. Army Corps of Engineers; and the U.S. Environmental Protection Agency [U.S. EPA]). The CMAWG was engaged and provided feedback throughout the development of the Catalog and this report.



USGS CRMS vegetative monitoring station, an impounded forested wetland (Cypress Swamp) located south of Lake Maurepas in Ponchartrain Basin. Credit: Brett Patton (USGS)





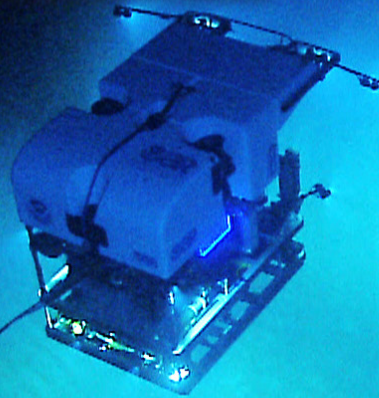
Horn Island, Gulf Islands National Seashore, Mississippi (September 2016). Credit: Amy Hartsfield



Coral reef and fish community at Bright Bank, Gulf of Mexico. Credit: NOAA FGBNMS and UNC-Wilmington



# 4 Inclusion Criteria and Framework



Remotely operated vehicle (ROV) Deep Discoverer in Bryant Canyon. Credit: NOAA Office of Ocean Exploration and Research, Exploration of the Gulf of Mexico 2014

## Assessment Inclusion Criteria

The documented assumptions developed for the Inventory, (NOAA and USGS, 2019) were adapted and modified, as necessary, for the Catalog framework. In addition to similar language, key terms, and spatial and temporal criteria used for the Inventory, web accessibility was added as a requirement for Catalog inclusion. These terms and criteria for inclusion into the Catalog database are outlined in Appendix 2 and Appendix 3, respectively.

To ensure that important assessments were not excluded, exceptions were considered on a case-by-case basis. Specifically, assessments that provide a principal source of information or data for a certain geography, are related to a NRDA resource category, or provide a principal cited report for baseline condition were included in the Catalog.

## Temporal Criteria

The temporal criteria used for the assessment task were similar to those used for the Inventory. Unlike the duration requirements for the Inventory, there was no minimum duration required for an assessment to be included in the Catalog; this is due to the infrequent repetition of a baseline assessment or condition report. In addition, mapping assessments are commonly one-time cruises or other non-recurring expedition efforts. It is generally preferred, but not critical, that both monitoring programs and assessments were active between 1980 and 2018. Some assessments outside this timeframe were included, especially if they were the only source of information for a region.

## Spatial Criteria

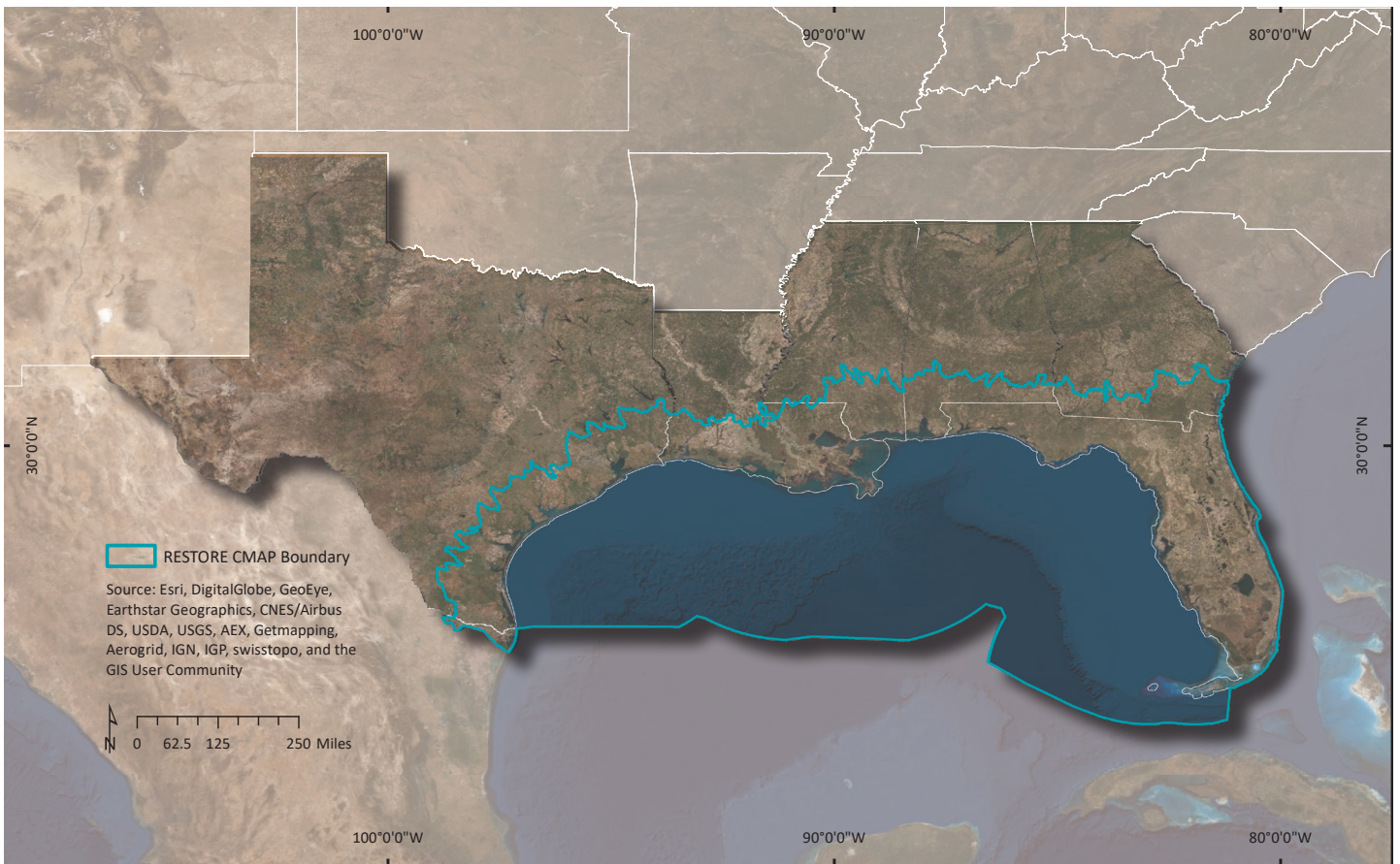
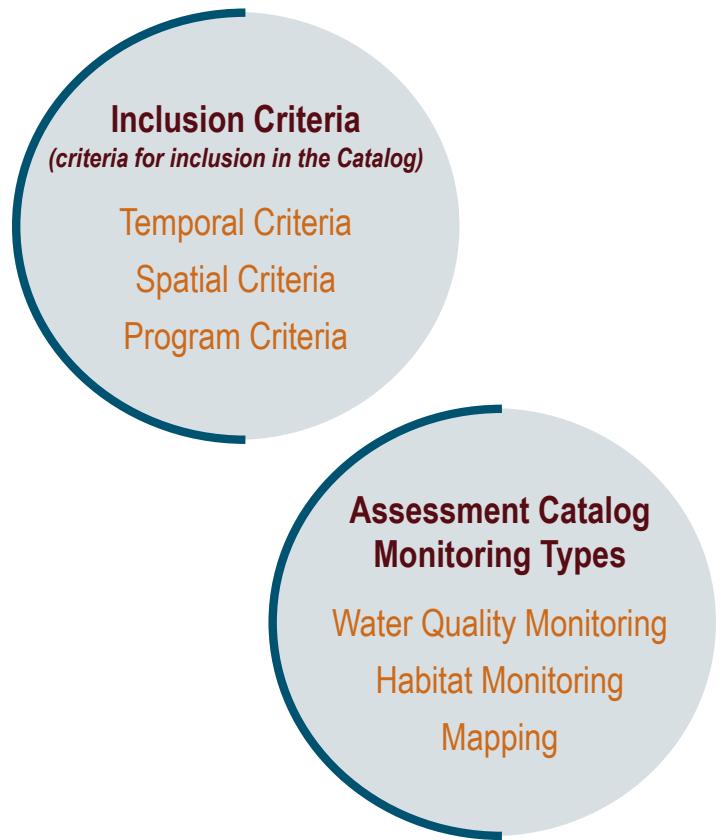
CMAP's spatial criteria for the Catalog were set at a larger scale than that of the Inventory. The spatial scale for the assessment inclusion criteria was set to a minimum of a watershed or estuary level. Similar to the Inventory, the assessment's spatial extent had to fall within or intersect the CMAP project boundary (Figure 1). This boundary is a spatial domain that includes the coastal zone of the Gulf States, including Federal lands, the adjacent land, water/watersheds within 25 miles of the coastal zone, and all Federal waters within the U.S. Exclusive Economic Zone (EEZ; Figure 1). Assessments must have footprints within this spatial domain; however, the assessment does not have to be completely contained within this domain. Assessments that were conducted at a finer scale than estuary level, intersect with the U.S.–Mexico border, or intersect the boundary between the Gulf and Atlantic, were evaluated on a case-by-case basis. Examples of assessments that may be included from fine-scale spatial domains include protected areas, Federally-managed lands and protected areas, and/or restoration areas. For example, assessments for marine protected areas (i.e., Flower Garden Banks National Marine Sanctuary) and other managed lands (i.e., Gulf Islands National Seashore), and restoration areas (i.e., Nueces Bay Marsh Restoration, coral reef restoration in the Florida Keys) typically encompassed areas smaller than the specified spatial criteria, but were included due to their applicability to the goals and objectives of this effort.



**Assessment Type Criteria**

Water quality, habitat, and mapping assessments were required to contain information for at least one of the parameter subgroups and meet the spatial and temporal criteria described earlier in this chapter. It is possible that an assessment included parameters outside the scope of CMAP. However, only CMAP parameters were included in the database.

To maintain a streamlined process and more efficient data entry process, assessments were categorized using the more generalized parameters for all components instead of the detailed level used for the Inventory. During data entry, the detailed parameters, while not listed on the webform, were used to identify which general parameters would need to be included for a particular record. Additionally, assessments combining two or more detailed parameters to form an index or indicator were noted in the Catalog. More information about the parameters, both general and detailed, can be found in the following sections and the Glossary (Appendix 2).



**Figure 1** CMAP spatial domain. Blue-green line indicates the integration of the RESTORE Council boundary extent of the coastal zone plus 25 miles, and the underlying hydrologic unit code 10 (HUC10) boundaries.

## Inclusion Criteria and Framework

### Water Quality Assessments

Water quality assessments are those that provide an interpreted or synthesized assessment of data that report at least one of the nine general parameters from the CMAP Inventory (Table 3). For the Catalog, water quality parameters were not identified beyond the general parameter level. Where possible, water quality summaries associated with natural resources monitoring (e.g., birds, marine mammals, fish, sea turtles) were included. In addition, assessments that reported water quality data summaries, but were not primarily water quality assessments, were included in the Catalog.

### Habitat Assessments

Habitat assessments are those that gauge the occurrence, distribution, condition, or state of habitat through *in situ* measurements. Habitat summaries and syntheses associated with natural resource monitoring (e.g., birds, marine mammals, fish, sea turtles) were included where appropriate. Faunal species assessments were only included for benthic habitat-forming groups (i.e., bivalves, shallow corals, deep sea benthic communities, etc.). Assessments that provided habitat data syntheses and summaries but were not primarily habitat assessments were also included.

Habitat assessments were documented using a modified framework developed for the Inventory (three general parameters and eight parameter groups; Table 4). The group/subgroup organization allowed CMAP staff to distinguish between parameter subgroups that are shared between the general parameters (e.g., density of corals versus density of macroalgae).

### Mapping Assessments

The development of criteria for mapping assessments was based on mapping activities that gauge the condition of water quality or habitat over time via syntheses of remotely sensed data (i.e., lidar [light detection and ranging], sonar, satellite, aerial imagery, etc.) and derived products needed to develop recurrent map products for one or a variety of targeted habitat types. For the mapping component of the Catalog, the same general parameters from the Inventory were used (Table 5).

**Table 3** CMAP water quality parameters. The Catalog identified assessments to general parameter level.

<b>General Parameters</b>	<b>Includes</b>
Nutrients	Total nitrogen, nitrite, nitrate, nitrite + nitrate, ammonia, ammonia + organic nitrogen, total phosphorus, soluble phosphorus, phosphate, orthophosphate, silicate
Pathogens	<i>Escherichia coli</i> , <i>Enterococcus</i> , fecal coliforms, total coliforms, <i>Giardia</i> , <i>Cryptosporidium</i> , <i>Vibrio</i>
Aquatic Primary Producers	Phytoplankton, chlorophyll
Harmful Algal Bloom Indicators	Cyanobacteria, algal toxins
Sediment	Suspended sediment concentration, total suspended solids
Mercury	Total mercury, methylmercury
Freshwater Inflow	Discharge, stage
Field Parameters	Water temperature, conductance, dissolved oxygen, turbidity, pH, light attenuation, currents, water level
Carbon	Organic carbon, polycyclic aromatic hydrocarbons (PAHs)



**Table 4** CMAP habitat assessment parameters. The Catalog identified assessments to detailed group parameter level.

<b>General Parameters</b>	<b>Parameter Groups</b>	<b>Includes</b>
Submerged habitat building animals	Ecological metrics	Composition, abundance, cover, density, distribution, biomass
	Physiology/Health	Disease, size, bleaching, growth
	Population dynamics	Settlement/Recruitment, survivorship, larval transport, spawning, mortality
Plant/Macroalgae	Ecological metrics	Composition, abundance, cover, density, distribution, biomass
	Physiology	Canopy extent/Structure, size, growth, litterfall
	Population dynamics	Recruitment, survivorship, mortality, reproductive effort, primary production
Abiotic	Substrate metrics	Substrate geochemistry, substrate composition, topographic complexity, sediment classification, substrate depth
	Coastal processes	Vertical accretion, subsidence

**Table 5** CMAP mapping general parameters. The Catalog identified assessments to the general parameter level.

<b>Mapping Parameters</b>		
Area of habitat types	Land use/land cover	Soil type
Backscatter intensity	Multispectral imagery	Subsidence
Chlorophyll	Reflectivity	Surficial elevation
Conductance/Salinity	Sea surface height	Turbidity
Currents	Sea surface temperature	Vertical accretion
Digital photography	Sediment depth	Water column profiling
Hyperspectral imagery	Sediment grain size	Water temperature





# 5 Database Framework



San Bernard National Wildlife Refuge, Texas Coast.  
Credit: USFWS

The Catalog database is organized into two sections: General Assessment Framework and Assessment Component Information. Each section and subsection contain information fields specific to that section. Table 6 displays the General Assessment Information section, field names, field definitions, and data type, which are common to all assessments in the database. Parameters have controlled vocabularies that are listed in the Glossary (Appendix 2) and more specific information may also be found in the CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review (Appendix 3).

## General Assessment Framework

### Assessment Bibliography

This subsection (Table 6) contains 16 fields and provides general bibliographic information on the assessment, such as the assessment title, authorship and publication information, and website access links for the report. For more detailed information, refer to the Glossary in Appendix 2.

### Assessment Setting

**Assessment setting** provides six fields that have descriptive terminology, such as assessment category and habitat information (Table 7).

**Assessment Type** refers to the type of monitoring being conducted. It could be water quality, habitat, mapping, or any combination of the three.

**Coverage** is a general geographic descriptor of the assessment. Choices included International, Nationwide, Atlantic, Gulf-wide, Multi-state, Statewide, or Local. Local refers to an assessment that reports at a scale smaller than Statewide and no smaller than estuary or watershed.

**Waterbody Keywords** is a waterbody organizational unit where the assessment was conducted. Keywords are kept to general surface-water areas at the scale set for inclusion in the Catalog.

**Aquatic Setting** is a hydrologic setting or stratum that is observed within the assessment's domain. The aquatic setting may be one or a combination of nine possible settings.

**Habitat Type** refers to specific habitat types where monitoring/reporting occurs within an assessment's domain. An assessment may have one or a combination of 18 possible habitat types. When combined (Table 8), **Aquatic Setting** and **Habitat Type** provide a general description of location or where an assessment activity took place.

**Table 6** General assessment information subsections, field names, definition and data type.

	<b>Field Name</b>	<b>Definition</b>	<b>Data Type</b>
<b>Assessment information</b>	Assessment Title	Title of the assessment	Text
	Assessment Description	Abstract or brief description of the assessment	Text
	Assessment Source Category	Type of source the assessment originates from (Status and Trends, Condition Report, Baseline Assessment, etc.)	Text (Dropdown)
	Authors	List of lead authors or cited agency	Text
	Agency	Agency or organization leading the program	Text (Dropdown)
	Agency Type	Type of agency leading the assessment (i.e., Federal, State, Academic, etc.)	Text (Dropdown)
	Report Date	Date of publication	Date (YYYY)
	Earliest Date	Earliest date of data summarized/reported for assessment	Date (YYYY)
	Recent Date	Most recent date of data summarized/reported for assessment	Date (YYYY)
	DOI	Digital object identifier	Text
	ISBN or ISSN	International Standard Book Number or International Standard Serial Number	Text
	Record Citation	Recommended citation obtained from source	Text
	Recurring?	Is this source a part of a recurring series or published at various intervals?	Yes/No
	Associated Monitoring Program	Monitoring/assessment program associated with the assessment	Text
	Publication Website	Hyperlink of publication	Text
Associated Website	Hyperlink for associated websites (description or landing page)	Text	

**Table 7** Assessment setting subsections, field names, definition and data type.

	<b>Field Name</b>	<b>Definition</b>	<b>Data Type</b>
<b>Assessment Setting</b>	Assessment Type	Water Quality; Habitat Monitoring; Habitat Mapping	Text (Dropdown)
	Coverage	Gulf-wide; Nationwide; International; etc.	Text (Dropdown)
	States	State(s) where project occurs	Text (Dropdown)
	Waterbody Keywords	Surface waterbody(s) associated with assessment	Text
	Aquatic Setting	Hydrologic setting/stratum of assessment	Matrix
	Habitat Type	Habitat types monitored/mapped (linked to specific aquatic settings)	Matrix

## Database Framework

**Table 8** CMAP Program Aquatic Settings (columns) and Habitat Types (rows). An assessment may have multiple selections within this matrix. Below is an example from *An Ecological Characterization of the Florida Panhandle* (Wolfe et al. 1988). Refer to Appendix 2 for Aquatic Setting and Habitat Type definitions.

<i>Habitat Type</i>	<i>Aquatic Settings</i>								
	<i>Upland</i>	<i>Riverine</i>	<i>Palustrine</i>	<i>Lacustrine</i>	<i>Estuarine</i>	<i>Marine Nearshore</i>	<i>Marine Offshore</i>	<i>Marine Oceanic</i>	
Agriculture	X								
Artificial reef									
Barrier island									
Beach/dune	X					X			
Coral reef						X			
Deep sea benthic communities									
Emergent marsh		X	X		X				
Forest	X	X	X						
Hard bottom						X			
Karst/Barren	X								
Mangrove									
Oyster/Bivalve bed					X				
Sargassum/Floating macroalgae									
Submerged aquatic vegetation (SAV)					X	X			
Shrub/Grassland			X						
Soft bottom						X			
Tidal flat					X				
Urban	X								
Water column		X		X	X	X			

Marine Nearshore: 0–30 m depth; Marine Offshore: 30 m to approximately 100/200 m; Marine Oceanic: 100/200–11000 m



## Assessment Specific Parameters

This section includes fields (Table 9) that identify all the general monitoring parameters summarized in the assessment and if the assessment is based on the combination of one or more monitoring parameters (Tables 3-5). Assessment parameters were assigned to general parameters for water quality and group parameters for habitat using the Inventory classification scheme. Appendix 2 provides definitions for general and subgroup parameters that pertain only to those used for the Catalog.

The database sections below describe the specific parameters within water quality, habitat, or mapping assessment categories. Some assessments report on one monitoring type, such as water quality, while some may contain multiple. An additional metric field was incorporated into the Catalog because some assessments (e.g., The National Coastal Condition Assessment) group several water quality parameters into metrics or indices including some that are not captured in the CMAP water quality, habitat, or mapping parameter lists. These were captured as **WQMetricIndex**, **HabMetricIndex**, and **MapMetricIndex** (Table 9).

### Water Quality

**WQMetricIndex** notes the integration of multiple detailed parameters into a single metric or index to describe the condition or state of a waterbody (Table 9). The metric can be tracked across spatial and temporal domains but can also indicate a single event.



A fresh *Sagittaria lancifolia* marsh located in Terrebonne Basin.  
Credit: Brett Patton (USGS)

**WQParameterGen** is a field of identified general parameters summarized in the assessment (Table 3). Parameters in this list include nutrients, pathogens, harmful algal bloom indicators, mercury, etc. Refer to NOAA and USGS (2019) for a list of parameters and the process for inclusion into the CMAP project.

**Table 9** Assessment type parameter field names, definition and data type.

<b>Field</b>	<b>Field Description</b>	<b>Data Type</b>
WQMetricIndex	Does the assessment report on metric(s) combining one or more water quality parameter?	Yes/No
WQParameterGen	List of general and detailed water quality parameters	Text (Dropdown)
HabMetricIndex	Does the assessment report on metric(s) combining one or more habitat parameter?	Yes/No
HabParametersGrp	List of general habitat monitoring parameters. Combines the group and parameters together in one metric	Text (Dropdown)
MapMetricIndex	Does the assessment report on metric(s) combining one or more mapping parameter?	Yes/No
MapParameter	List of mapping parameters	Text (Dropdown)

## Database Framework

### Habitat

**HabMetricIndex** notes the integration of multiple detailed parameters into a single metric or index to describe the condition or state of a habitat (Table 9). The metric can be tracked across spatial and temporal domains but can also indicate a single event.

**HabParametersGrp** is a field used to provide functional organization and combines 'General Parameters' and 'Parameter Group' (Table 4). These General categories refer to living and/or abiotic habitats. These levels include:

1. *Submerged habitat-building animals*: oysters and corals but also includes sponges, tube worms and bivalves;
2. *Plants and Macroalgae*: terrestrial plants, seagrasses, and floating and/or benthic algal communities; and
3. *Abiotic*: non-living chemical and physical aspect of a habitat.

The next tier of habitat monitoring information, Groups, are similar groupings for plants and animals. *Physiology/Health* refers to parameters that portray growth, size, or any effects from disease. *Population dynamics* refers to parameters that depict reproductive or spawning capacity, mortality, survivorship, etc. *Ecological metrics* are community parameters including percent cover, abundance, and species composition. The parameter groups included under *Abiotic* include substrate metrics (substrate descriptors or classifiers) and coastal processes, which are influencing factors in coastal zone habitats. Refer to NOAA and USGS (2019) for a list of parameters and the process for inclusion into the CMAP project.

### Mapping

**MapMetricIndex** notes the integration of multiple detailed parameters into a single metric or index to describe the condition or state of a habitat map. The metric can be tracked across spatial and temporal domains but can also indicate a single event.

**MapParameter** is a field of general mapping parameters (Table 5) that were drafted and compiled through a collaborative process among CMAP staff and in consultation with habitat and seafloor mapping experts. Refer to NOAA and USGS (2019) for a list of detailed parameters and the process for inclusion into the CMAP project.

Appendix 4 provides an example of a full assessment entry in the Catalog.



Divers deploying water quality monitoring instrumentation at Flower Garden Banks National Marine Sanctuary. Credit: NOAA Office of National Marine Sanctuaries



### Website Development

The Catalog framework used the Inventory database framework as a template to ensure consistency in terminology and structure where applicable. The Inventory and Catalog have different objectives and purposes; fields unique to assessments were added and fields not applicable were removed. The following section describes the process of developing the website for the Inventory and Catalog.

### Building the Inventory Database

A PostgreSQL relational database was created to store program information for the CMAP Inventory. A website was developed for CMAP staff to manage the contents of the database; this website was internal only for development of the Inventory. The site included a series of webforms that

allowed staff to enter new program/project records; search, view, and amend existing records; and usher a record through the review process. The webforms covered all information collected about a program in the Inventory. For more information refer to NOAA and USGS (2019).

### Assessment Catalog Development

A webform was developed for the Catalog using the Inventory webform as a template. The same format and restrictions developed for the Inventory were incorporated into the Catalog. Since CMAP staff were already familiar with the Inventory's webform and review process, they were able to populate the Catalog and review the information more easily and efficiently due to the Catalog's similar structures, rules, and internal workflows.



Sea turtle in seagrass beds. Credit: Jamie Letendre (St. Martins Marsh Aquatic Preserve DEP)

# 6 Protocols for Data Entry and Review



Rock and oyster shell barrier along marsh shoreline, Alabama. Credit: NOAA NMFS

The evaluation of assessments for inclusion into the Catalog was based on the criteria outlined in the Assessment Inclusion Criteria document (Appendix 3). However, each of the criteria contained areas requiring interpretation and decision-making due to the subjective nature of how one defines an ‘assessment’ or a ‘synthesis’. This potential for variation in assessment evaluation, combined with the high participation effort expended by both NOAA and USGS staff, many which are located across the GoM, a protocol and standard operating procedure (SOP) document was developed to help standardize record entry and evaluation (Appendix 3).

The SOP document in Appendix 3 outlines the inclusion criteria and the process of entering and reviewing assessment publication for the Catalog. All staff conducting discovery, evaluation, and information capture used the manual throughout the process.

Database access was limited to CMAP staff and incorporated specific restrictive functions that ensured the entry and review process was conducted within the bounds set forth by the protocols (Appendix 3). A record could not be edited during review except by the reviewer and a user was prevented from acting as both data entrant and reviewer on the same record.

The criteria and SOP document are structured similarly to the Inventory SOP, with each section detailing a specific

component of the cataloging process. Each section contains links to external reference documents that were used as resources for the evaluation, entry and review process.

The following section provides a brief summary of the Assessment Inclusion Criteria and Protocols document. For more details, refer to Appendix 3.

## Assessment Inclusion Protocol Summary

Each of the five sections in Appendix 3 details a specific component of the assessment development. Section 1 contains the criteria for assessment inclusion, which was previously discussed in Chapter 3. This section provides staff steps for the inclusion of potential assessments into the database. The first step was an internal check to see if the assessment had already been entered into the database. If not, the assessment was checked against the Assessment Inclusion Criteria and its requirements (Appendix 3). If the assessment satisfied the requirements, then data entry to populate assessment information into the Catalog would proceed to Section 2— assessment criteria and specifications required for entry into the Catalog. Section 3 within Appendix 3 is a detailed guide that references how to enter information for each field, identifies potential obstacles, and offers potential remedies. Section 4 focuses on processing assessments that do not meet the requirements of Assessment Inclusion Criteria.



Similar criteria for exclusion were applied to the Catalog as developed for the Inventory database (See 1–4, first box to the right). Three additional exclusion factors were applied specifically for the Catalog that may have resulted in an assessment being deferred from entry into the Catalog (see 5–7, second box to the right). Assessments that were not included based on spatial requirements were cross-checked to determine if they merited inclusion based on the exceptions for inclusion outlined in Chapter 4. If no criteria were met, the assessment was added to a list of questionable/deferred assessments.

### Review Process

The Catalog review process consisted of two steps: record review and record completion. All assessments that were entered into the database or listed as questionable were reviewed internally. Each record was reviewed by a staff member other than the person who entered the assessment. This review process included verifying that the Assessment Inclusion Criteria or exceptions criteria were met and validating each field of the record. Field validation involved searching for information to populate fields that were not originally completed. In cases where the reviewer identified potential errors or recommended information removal, the reviewer coordinated with the person who entered the data before making the appropriate changes in the database.

The review process included quality assurance checks both during the record review process (Phase I), and during the record completion process (Phase II; Appendix 3). During Phase I, accuracy and formatting of the review was conducted (i.e., acronym consistency, spacing, capitalization, etc.). Phase II consisted of analytical quality checks and formatting consistencies and marked the conclusion of the assessment review process.

### Monitoring Inventory exclusion factors used for Assessment Catalog:

1. **Faunal species monitoring**  
An assessment that only monitors faunal species (no habitat or water quality data collection)
2. **Atmospheric monitoring**  
An assessment that collects atmospheric data (i.e., precipitation, winds, air temperature, etc.)
3. **Other monitoring targets**  
An assessment that does not monitor habitat or water quality condition
4. **Geographic coverage**  
A potential assessment in which the collection area does not overlap with the CMAP spatial extent

### Assessment Catalog-specific exclusion factors:

5. **Spatial scale**  
An assessment that reports on spatial scales smaller than the watershed/estuary level
6. **Lack of data synthesis or interpretive summaries**  
A report that does not include synthesized data or provides data without providing summaries or conclusions (tabular data outputs, manuals, planning reports, etc.)
7. **Peer-reviewed publications**  
Assessments published in peer-reviewed publications were not considered as a source type for this catalog. Exceptions occurred if the assessment met the criteria and provided an important reference point for a particular parameter or habitat type



Water sampling during 2015 hypoxia cruise in the Gulf of Mexico.  
Credit: The Louisiana Universities Marine Consortium (LUMCON)



# 7 Catalog Summary Results

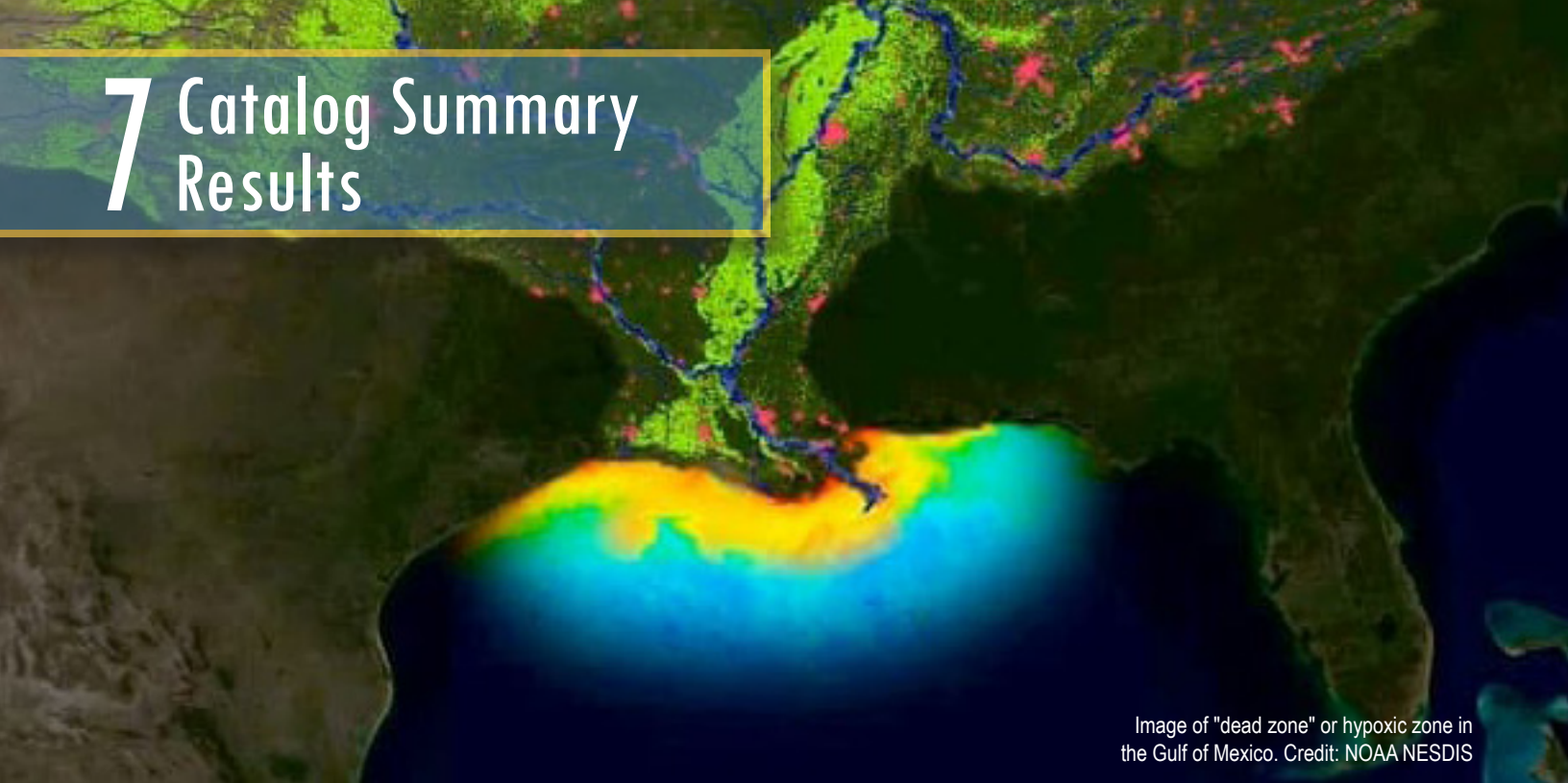


Image of "dead zone" or hypoxic zone in the Gulf of Mexico. Credit: NOAA NESDIS

## General Results

Using the Inventory as a blueprint for the Catalog, a comprehensive directory of water quality, habitat, and mapping assessments was developed. Initially, potential assessments were identified during the development and review of the Inventory. Next, monitoring agency websites identified in the Inventory were explored for online publication databases or bibliographies. The CMAP team identified and explored 63 online publication databases for potential entries. After all the databases were reviewed, the list of potential assessments was evaluated against the requirements for inclusion. Additionally, assessments or publication databases were provided by MCoP participants during the June 2018 meeting.

Overall, the CMAP team evaluated 300 assessments for potential inclusion in the Catalog with 274 meeting the criteria for inclusion. The 26 records that were excluded from the Catalog included duplicates and reports that did not include data summaries or synthesized data, such as tabular data reports, protocols, and high-level management reports. All of the assessments fell into one or more of the assessment category types (condition report, status and/or trends, baseline assessment, etc.).

## Summary of General Assessment Information

Assessments that met the inclusion criteria were categorized as either water quality, habitat, mapping, or some

combination of the three. In general, most assessments combined at least two types (Figure 2). The majority of records in the Catalog contained water quality (213) and/or habitat (177) components (either solely or in combination with the other monitoring types) compared to mapping which was included as a component in just under half of the assessments (133).

The majority of assessments occurred at the local level within a watershed/estuary (Figure 3). Statewide assessments were the second most frequent type and comprised primarily of water quality assessments. Thirty-two assessments were conducted at the Gulf-wide (Florida through Texas) scale and focused mostly on habitat, and 15 assessment types were noted at the multi-state scale (Figure 3).

The number of assessments conducted in Florida surpassed all other states. Texas ranked second followed by Alabama, Louisiana, Mississippi, and Georgia (Figure 4). Thirty-five assessments were conducted in Federal waters. Water quality assessments were the most abundant assessment type within all states (Figure 5). Habitat and mapping assessments were mostly equivalent within each state. Florida was an exception, where habitat assessments were almost as frequent as water quality while mapping assessments were considerably fewer.

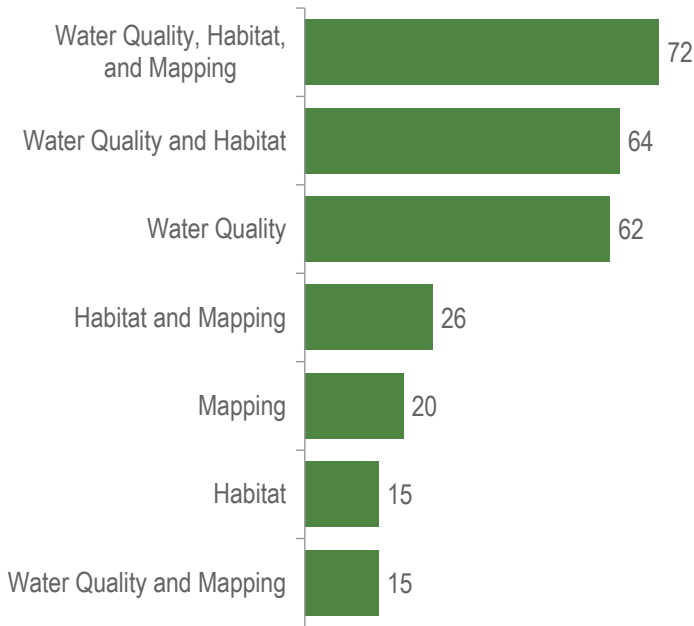


Figure 2 Total records by assessment type.

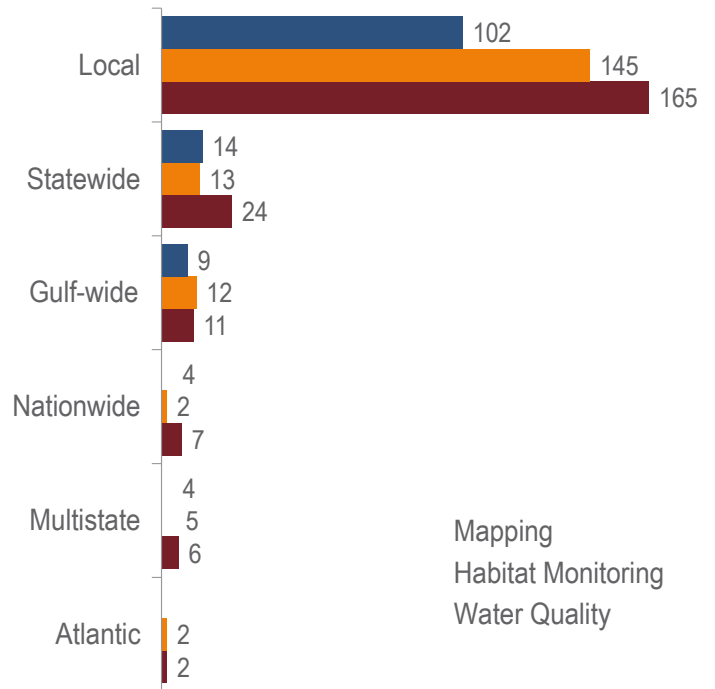


Figure 3 Number of assessments by coverage level.

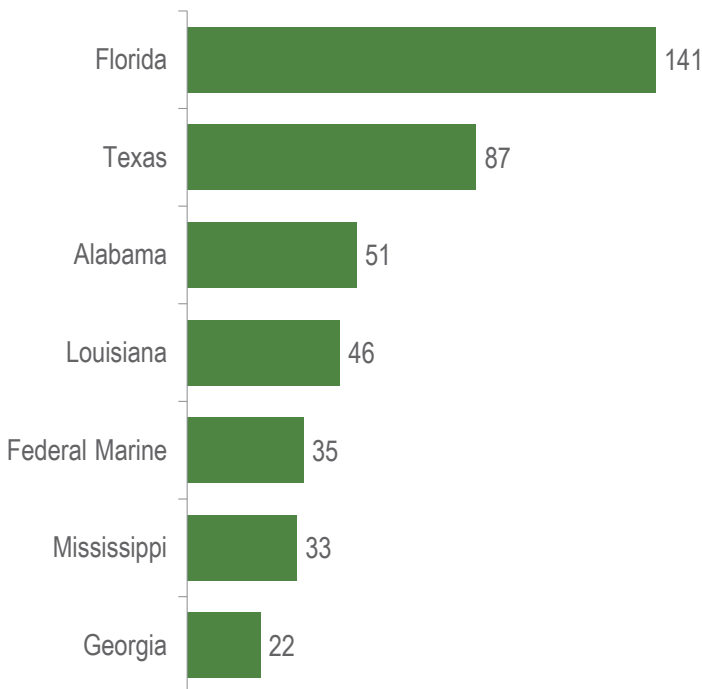


Figure 4 Number of assessments by jurisdiction.

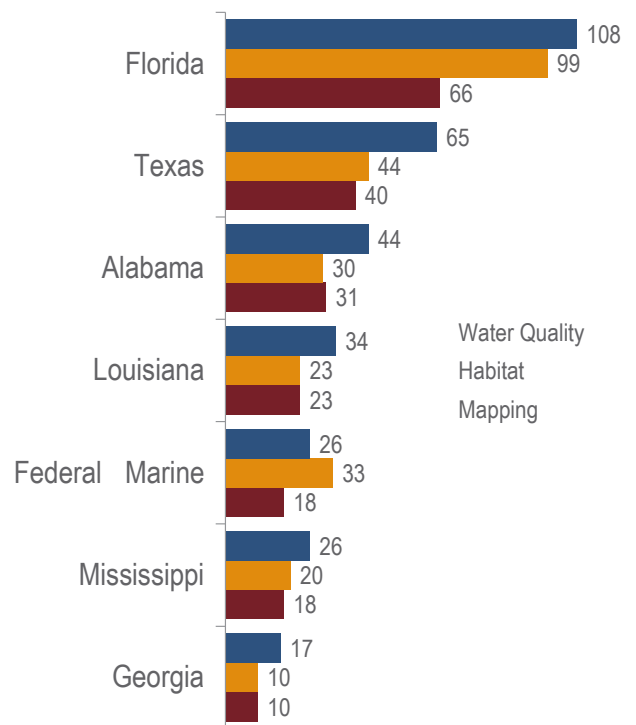


Figure 5 Number of water quality, habitat monitoring, and mapping assessment types by jurisdiction.



## Catalog Summary Results

Nearly 40% of assessments were led by Federal agencies, although many included state and local partners (Table 10). Assessments conducted by state and local entities were almost equivalent, 70 and 66 respectively. Combined, NGOs, private entities, consortia, and regional groups accounted for 35 (10%) assessments. A small proportion (24%) of assessments are recurrent at a variety of temporal scales (Figure 6). The majority of recurring assessments are water quality and habitat at the local scale.

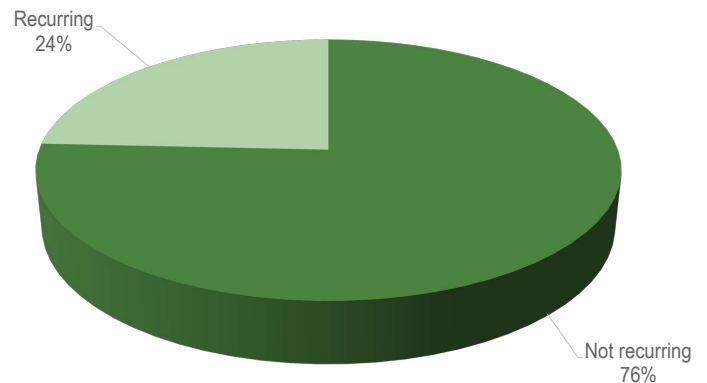
While the GoM region has a variety of habitats from wetlands to deep sea communities, the nearshore habitats associated with the majority of assessments were wetlands, marshes, oyster reefs, seagrasses, and barrier islands (Figure 7). Coral reefs are frequent throughout the Gulf, and assessments correspond with those at Flower Garden Banks National Marine Sanctuary or the Florida Keys. Along those lines, marine assessments are less frequent due to the amount of resources and weather requirements needed to conduct monitoring for assessments offshore.

### Summary of Parameter Information

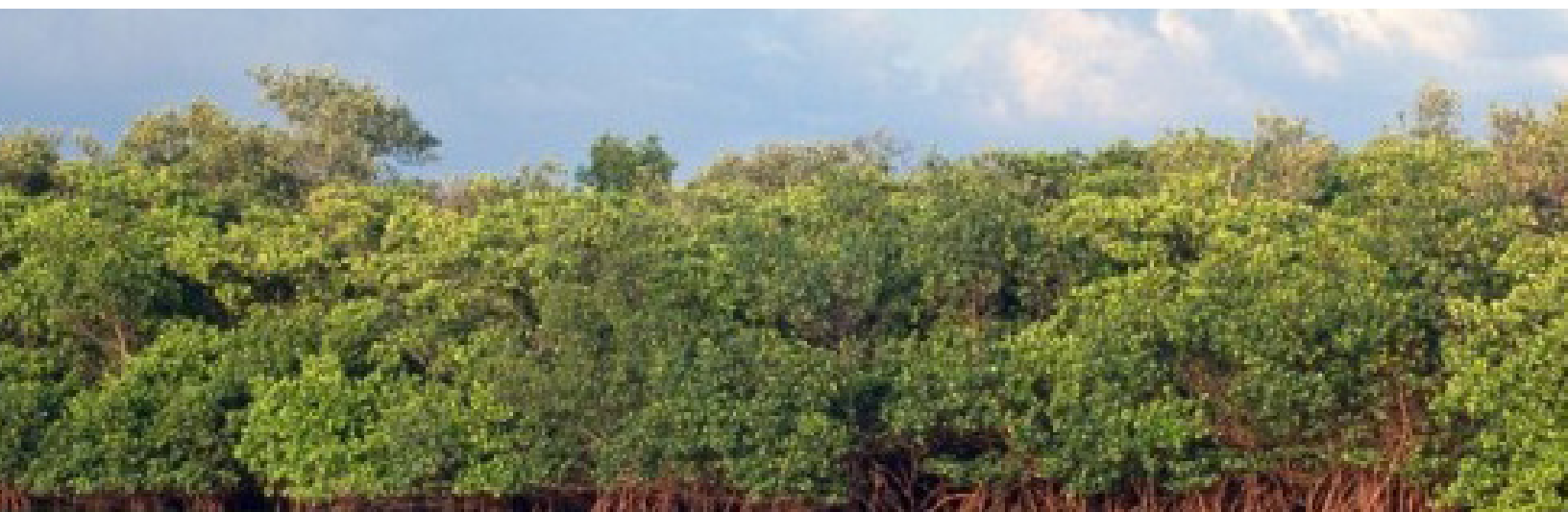
Most water quality assessments included field parameters and nutrients (Figure 8). A similar number of assessments examined primary producers, water inflow and sediment, perhaps indicative of eutrophication studies. Pathogens, carbon, mercury and harmful algal bloom indicators were less frequently found in water quality assessments.

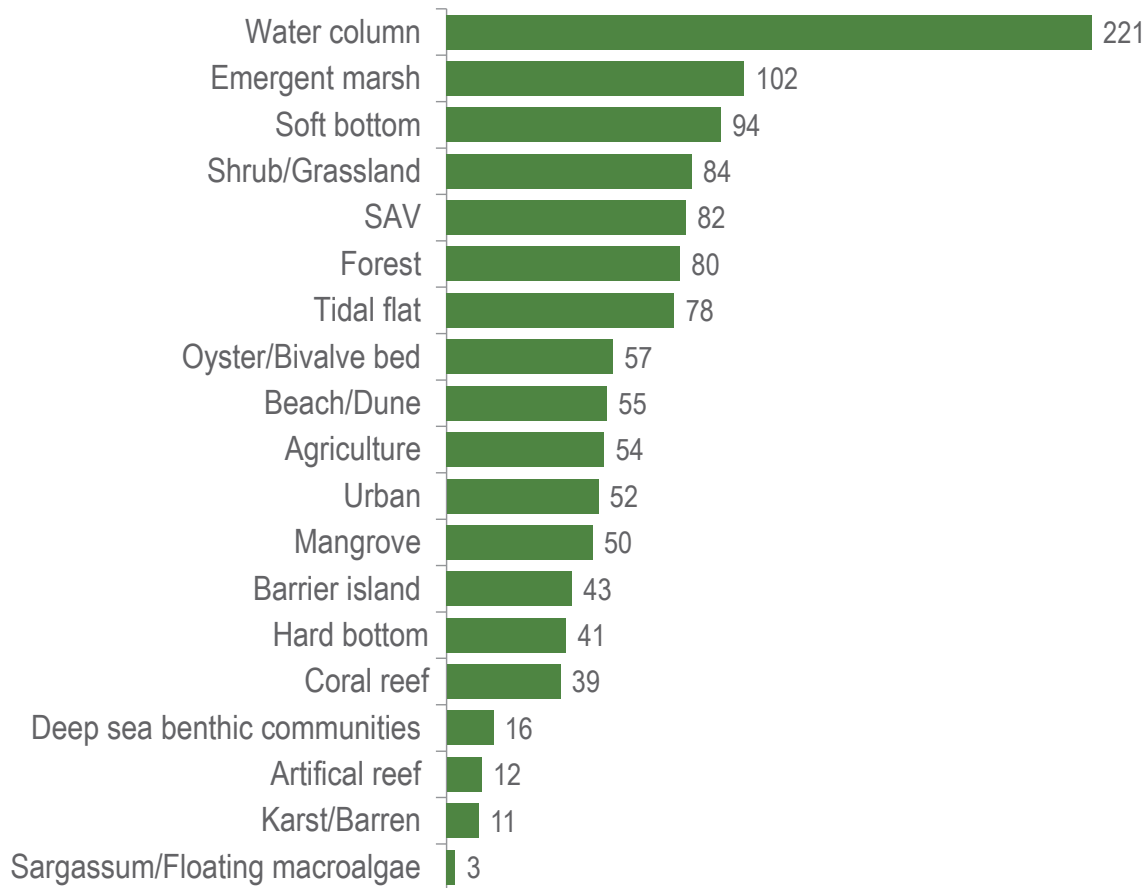
**Table 10** Number of assessments by entity.  
*Note: some assessments have more than one lead entity resulting in a total greater than 274.*

<b>Entity</b>	<b>Count</b>
Federal	142
State	70
Local	66
Academic	27
Non-Governmental Organization (NGO)	13
Private	9
Consortium	8
Regional	5

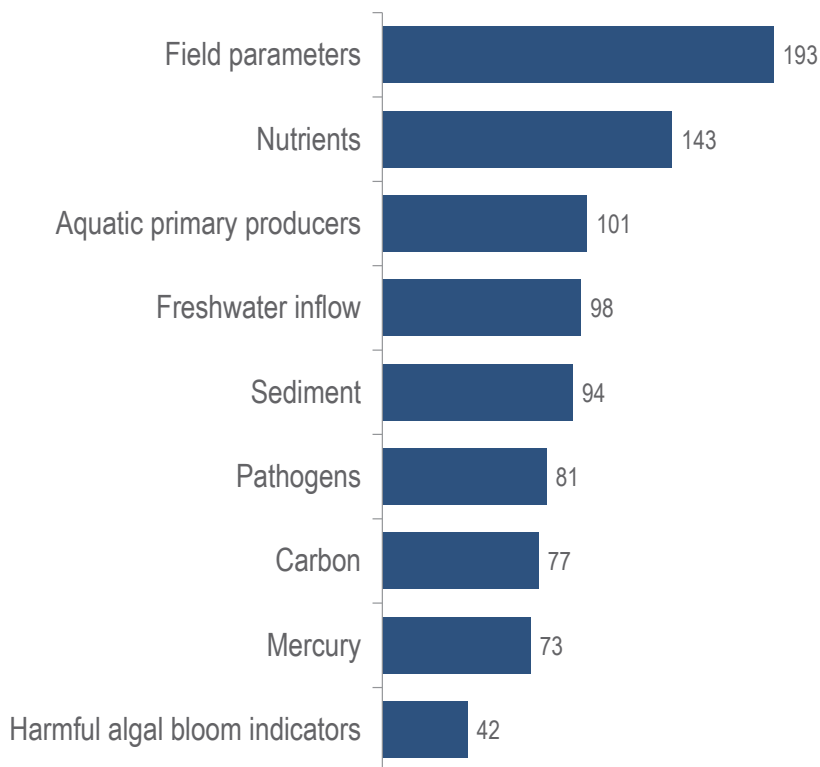


**Figure 6** Percentage of assessments that were not recurring versus recurring.





**Figure 7** Number of assessments by habitat type.



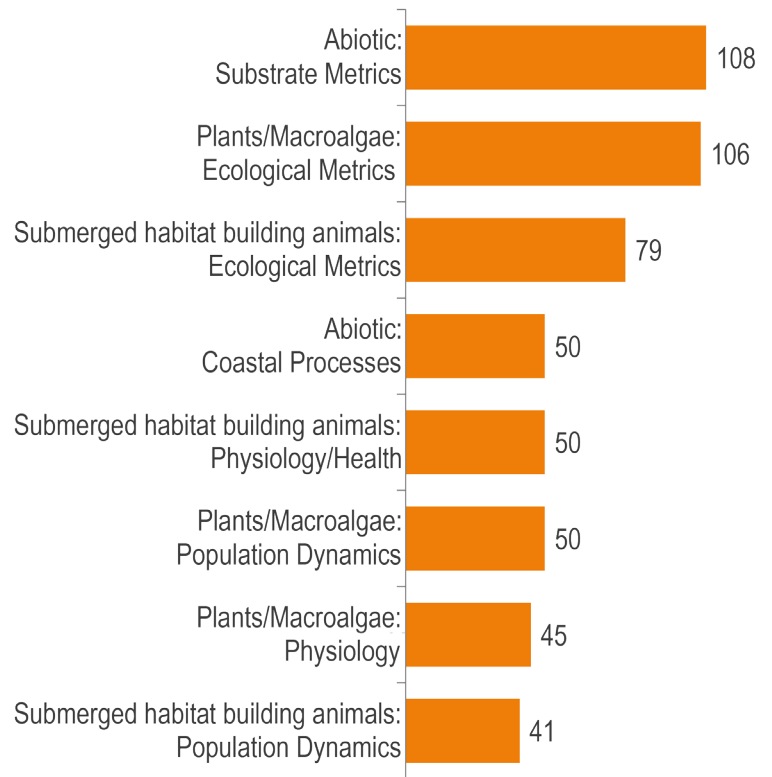
**Figure 8** Occurrence of parameters (general) in assessments with a water quality component (N=213).



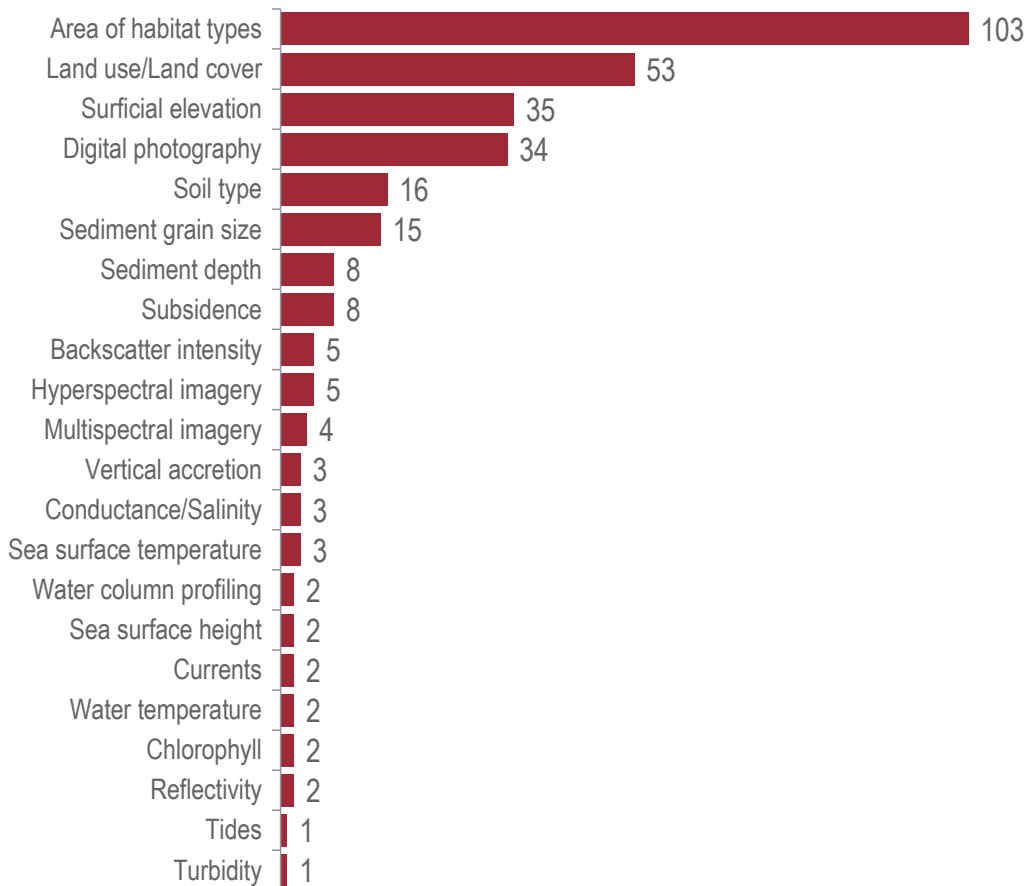
## Catalog Summary Results

Field parameters, such as conductance/salinity, water temperature, and chlorophyll were not commonly observed. Habitat subgroups that were most frequently assessed were abiotic substrate metrics and ecological metrics for plants/macroalgae and submerged habitat building animals (Figure 9). Population dynamics, physiology and coastal processes parameter groups occurred nearly half as often as ecological metrics and substrate metrics group parameters.

Area of habitat types was the most frequent mapping parameter observed in mapping assessments (Figure 10). This objective is a primary focal point for many resource agencies across the GoM. Parameters pertaining to land use or land loss and elevation were commonly found in assessments.



**Figure 9** Occurrence for parameters (group level) in assessments with a habitat component (N=177).



**Figure 10** Occurrence of parameters in assessments with a mapping component (N=133).





Sunrise in the Gulf of Mexico.  
Credit: NOAA Office of Ocean  
Exploration and Research, Gulf  
of Mexico 2018.



# 8 Uses, Lessons Learned and Future Considerations



Living shoreline breakwaters of a Mississippi marsh. Credit: NOAA NMFS

## Uses and Benefits

### Supporting other CMAP Tasks

The Catalog was developed to supplement the Inventory by providing spatial and temporal reference point information related to water quality and habitat conditions. Combined, the two databases provide the current knowledge of where habitat, water quality monitoring and mapping programs occur and where to find synthesized information on the status or condition of waterbodies or habitats with respect to the select CMAP monitoring parameters. Ultimately, the Inventory and the Catalog will be discoverable through an online webtool that is currently under development. The tool will allow users, such as the RESTORE Council, to query the attributes of each database. Each assessment will be represented spatially in a geodatabase with a generalized footprint. Assessments will be spatially articulated with level-10 hydrologic unit code (HUC) boundaries (watersheds) from the USGS National Hydrography Dataset HUC10 boundaries, and broader State, regional or Gulf-wide footprints. The tool will also include polygon footprints, and in some cases, more detailed information like station and transect locations, representing where all participating programs conduct monitoring activities. For more information on the Inventory of spatial data see NOAA and USGS (2019).

### How Assessments Can Be Used to Support RESTORE Council Activities

Assessments may identify the condition/status and/or trend for specific parameters or suites of parameters in a

given area and for a specific time. This information may be useful to understand pre-restoration conditions at a variety of scales. Understanding what assessments have been conducted where over time also may help identify relevant gaps of condition/status and/or trend in support of restoration needs and priorities in a given area or habitat type. The Catalog provides a tool for the Council members to query available monitoring assessments in their geographic area of interest to inform restoration actions.

Often, assessments identified in the Inventory are co-located in areas with long-term monitoring programs. Knowing this information, resource managers could establish a sound scientific foundation for restoration planning, performance evaluation, and adaptive management. For example, the RESTORE Council may want to see how a geographically targeted restoration effort (e.g., emphasis on a particular watershed) can impact water quality. In this case, water quality assessments from the targeted watershed could potentially be used to establish reference conditions.

Multiple assessments using comparable methods and techniques may be combined to provide a broader assessment. This concept is beyond the scope of the current CMAP project but may be a consideration for future efforts. Restoration evaluation at scales greater than the project-scale may benefit from the combination of assessments at state-, regional- or nationwide-scales, if applicable.



### Uses and Benefits Beyond the Council

In general, the Catalog will be easily discoverable and accessed through the CMAP webtool that is being developed. Resource managers, scientists, researchers and others working in the Gulf can use the tool to easily discover and access both monitoring programs and assessments. When all programs/projects working within a given geography, or on a particular resource(s) have access to the same reliable information, environmental conditions can be described more accurately and the needs in a given area can be consistently articulated. Programs can then better coordinate and allocate scarce resources (funding, capabilities, and capacity) to match the identified restoration needs and approaches.

As previously mentioned, the monitoring and restoration community working in the GoM provided valuable input through several workshops. The most common suggestion was the need for more baseline information for management decisions and for restoration. Additionally, concerns were raised about inconsistent monitoring protocols, which could confound broader baseline evaluations. Thus, having scalable reference points was suggested as valuable to respond to future anthropogenic and natural disasters.

### Lessons Learned

Preliminary exploration of potential assessments yielded a wide array of publication types across many spatial scales. If CMAP wanted to include all publications that

met the programmatic and parameter requirements, the Catalog would have become unwieldy with several thousand programs included and perhaps not useful as a more targeted stand-alone database or spatial webtool. Spatial domain, publication type, and web accessibility (see Appendix 3) were used as filters to pare down the list of assessments that had relevance to Council projects and goals. With additional time and resources, a more comprehensive catalog could be developed. Additionally, future efforts could target multi-assessment integration with the scope of creating Gulf-wide baselines for the library of CMAP parameters. The CMAP team is currently working on the evaluation of specific program protocols, which addresses protocol and data comparability and may help inform future efforts related to multi-assessment integration.

### Next Steps

Future tasks focusing on assessments will need to be identified and developed by the CMAWG. At a minimum, the current database should include periodic maintenance and project/program metadata updates to ensure information accuracy and current content.



A saline *Spartina alterniflora* marsh located in Terrebonne Basin just south of the town of Isle De Jean Charles, LA.  
Credit: Brett Patton (USGS)



# References



ROV Deep Discoverer. Credit: NOAA Office of Ocean Exploration and Research, Exploration of the Gulf of Mexico, 2014

Carlson, P., and L. Yarbro. 2006. Benthic Oxygen and Nutrient Fluxes in Tampa Bay: A Final Report to the Tampa Bay Estuary Program, Florida Department of Environmental Protection, and U.S. Environmental Protection Agency, Gulf of Mexico Program. Tampa Bay Estuary Program Technical Publication #04-06. 20 pp.

GCMP. 2017. Southeast Global Change Monitoring Portal. Global Change Monitoring Portal website. Department of the Interior Southeast Climate Science Center, North Carolina State University, and U.S. Geological Survey. Online: <https://my.usgs.gov/gcmp/> (Accessed 17 December 2019)

Gulf Coast Ecosystem Restoration Council. 2016. Comprehensive Plan Update 2016: Restoring the Gulf Coast's Ecosystem and Economy. Gulf Coast Ecosystem Restoration Council. 31 pp. Online: [https://www.restorethegulf.gov/sites/default/files/CO-PL\\_20161208\\_CompPlanUpdate\\_English.pdf](https://www.restorethegulf.gov/sites/default/files/CO-PL_20161208_CompPlanUpdate_English.pdf) (Accessed 17 December 2019)

GOMA. 2013. White paper on Gulf of Mexico Water Quality Monitoring: Providing water quality information to support informed resource management and public knowledge. Gulf of Mexico Alliance, Water Quality Team—Monitoring Workgroup. 124 pp. Online: [https://gulfofmexicoalliance.org/files/projects/files/goma\\_gulf\\_monitoring\\_white\\_paper.pdf](https://gulfofmexicoalliance.org/files/projects/files/goma_gulf_monitoring_white_paper.pdf) (Accessed 17 December 2019)

Handley, L., D. Altsman, and R. DeMay (eds.). 2007. Seagrass Status and Trends in the Northern Gulf of Mexico: 1940-2002: U.S. Geological Survey Scientific Investigations Report 2006-5287 and U.S. Environmental Protection Agency 855-R-04-003. 267 pp.

Keller, B.D., and S. Donahue (ed.). 2006. 2002-03 Florida Keys National Marine Sanctuary science report: an ecosystem report card after five years of marine zoning. Marine Sanctuaries Conservation Series NMSP-06-12. NOAA National Marine Sanctuary Program, Silver Spring, MD. 358 pp.

Kindinger, J.L., N.A. Buster, J.G. Flocks, J.C. Bernier, and M.A. Kulp. 2013. Louisiana Barrier Island Comprehensive Monitoring (BICM) Program Summary Report: Data and Analyses 2006 through 2010. U.S. Geological Survey Open-File Report 2013-1083. 86 pp. doi: 10.3133/ofr20131083

Lester, L.J., and L.A. Gonzalez (eds.). 2011. The State of the Bay: A Characterization of the Galveston Bay Ecosystem, Third Edition. Texas Commission on Environmental Quality, Galveston Bay Estuary Program. Houston, TX. 356 pp.

LDWF. 2016. 2016 Oyster Stock Assessment of the Public Oyster Areas of Louisiana. Oyster Data Report Series No. 22. Louisiana Department of Wildlife and Fisheries. 127 pp.

Love, M., A. Baldera, C. Robbins, R.B Spies, and J.R. Allen. 2015. Charting the Gulf: Analyzing the gaps in long-term monitoring of the Gulf of Mexico. Ocean Conservancy. New Orleans, LA. 95 pp.

NOAA and USGS. 2019. Council Monitoring and Assessment Program (CMAP): Inventory of Existing Habitat and Water Quality Monitoring, and Mapping Metadata for Gulf of Mexico Programs. National Oceanic and Atmospheric Administration and U.S. Geological Survey. NOAA NOS NCCOS Technical Memorandum 262. Silver Spring, MD. 155 pp. doi: 10.25923/gwpx-ff30

PBC ERM. 2015. Palm Beach County Natural Areas Water Quality Baseline Assessment. Palm Beach County Department of Environmental Resources Management. West Palm Beach, FL. 36 pp.

Thom, T.A., K.J. Hunt, and J. Faustini. 2015. Water Resource Inventory and Assessment (WRIA): Okefenokee National Wildlife Refuge, Ware, Charlton, and Clinch Counties, Georgia and Baker County, Florida. U.S. Fish and Wildlife Service, Southeast Region. Atlanta, GA. 113 pp.

USEPA. 2015. National Coastal Condition Assessment 2010. U.S. Environmental Protection Agency, Office of Water and Office of Research and Development. Washington, DC. EPA 841-R-15-006. 113 pp.

Wolfe, S.H., J.A. Reidenauer, and D.B. Means. 1988. An ecological characterization of the Florida Panhandle. U.S. Fish and Wildlife Service Biological Report 88(12) and Minerals Management Service. OCS Study\MMS 88-0063. 277 pp.

# Appendices

## Appendix 1: Publication Databases

Various publication databases were queried for assessments. It is important to note that many organizations listed in the table below had more than one publication database investigated by CMAP. Some organizations within this list may have more than one website publication that was queried by the CMAP team, but only one representative source is listed in this table (e.g., National Park Service's Gulf Coast and Southeast Networks). This list is not exhaustive, as the CMAP team investigated a variety of sources that may not be captured in this table.

Coverage	Organization	Federal	State	Local	NGO
<b>Alabama</b>	Mobile Bay National Estuary Program	X	X		
	Alabama Department of Environmental Management		X		
	Alabama Department of Public Health		X		
	Dauphin Island Sea Lab		X		
	Geological Survey of Alabama		X		
<b>Florida</b>	Brevard County, Florida			X	
	Broward County, Florida			X	
	Choctawhatchee Basin Alliance				X
	Coastal and Heartland National Estuary Partnership	X	X		
	Conservancy of Southwest Florida				X
	Environmental Protection Commission of Hillsborough County			X	
	Florida Department of Environmental Protection		X		
	Florida Fish and Wildlife Conservation Commission		X		
	Florida Keys National Marine Sanctuary	X			
	Guana Tolomato Matanzas National Estuarine Research Reserve	X			
	Northwest Florida Water Management District		X		
	Orange County, Florida			X	
	Palm Beach County, Florida			X	
	Pinellas County, Florida			X	
	Sanibel-Captiva Conservation Foundation				X
	Sarasota Bay Estuary Program	X	X		
	South Florida Water Management District		X		
	Southwest Florida Water Management District		X		
	St. Johns River Water Management District		X		
	Suwannee River Water Management District		X		
Tampa Bay Estuary Program	X	X			
<b>Georgia</b>	Georgia Department of Natural Resources		X		
<b>Louisiana</b>	Barataria-Terrebonne National Estuary Program	X	X		
	Coastal Protection and Restoration Authority		X		
	Coastal Wetlands Planning, Protection and Restoration Act	X	X		
	Coastwide Reference Monitoring System	X	X		
	Lake Pontchartrain Basin Foundation				X
	Louisiana Department of Environmental Quality		X		
Louisiana Department of Wildlife and Fisheries		X			



**Appendix 1: Publication Databases**

Coverage	Organization	Federal	State	Local	NGO
<b>Mississippi</b>	Grand Bay National Estuarine Research Reserve	X	X		
	Mississippi Department of Environmental Quality		X		
	Mississippi Department of Marine Resources		X		
<b>Texas</b>	Texas Commission on Environmental Quality		X		
	Coastal Bend Bays and Estuaries Program				X
	Flower Garden Banks National Marine Sanctuary	X			
	Galveston Bay Estuary Program	X	X		
	Guadalupe-Blanco River Authority		X		
	Lower Colorado River Authority		X		
	Mission-Aransas National Estuarine Research Reserve	X	X		
	Nueces River Authority		X		
	Texas Parks and Wildlife Department		X		
	The Texas General Land Office		X		
<b>Gulf-wide</b>	Bureau of Ocean Energy Management	X			
	National Oceanic and Atmospheric Administration	X			
	National Park Service	X			
	U.S. Environmental Protection Agency	X			
	U.S. Fish and Wildlife Service	X			
	U.S. Geological Survey	X			
	The Nature Conservancy				X
	Ocean Conservancy				X

### Appendix 2: Council Monitoring and Assessment Program Glossary of Terms

**Agency Type:** The type of agency leading the program

**Academic:** An institution dedicated to education and research that grants academic degrees.

**Consortium:** An association of several businesses or agencies.

**Federal:** An administrative unit of the United States Federal Government established for a specific purpose.

**International:** An organization that works in more than one country, generally funded by contributions from national governments.

**Local:** An administrative unit of a county or city government established for a specific purpose.

**Non-governmental organization (NGO):** A non-profit, voluntary citizens' group organized on a local, national, or international level.

**Private:** A company owned either by non-governmental organizations or by a relatively small number of shareholders or company members that does not trade its company stock to the general public on the stock market exchanges.

**Regional:** An organization or agency that operates at a regional level (e.g., Migratory Bird Joint Ventures).

**State:** An administrative unit of a State government established for a specific purpose.

**Tribal:** A governing body of a tribe, band, pueblo, community, village, or group of Native American Indians.

#### Program Type

**Aquatic setting:** Hydrologic setting/stratum falling within a program extent.

**Estuarine:** Defined by salinity and geomorphology. This setting includes tidally influenced waters that (1) have an open-surface connection to the sea; (2) are regularly diluted by freshwater runoff from land; and (3) exhibit some degree of land enclosure (FGDC, 2012). For more information, see <https://www.cmeccatalog.org/cmecc/classification/aquaticSetting/2.html>.

**Lacustrine:** Environment associated with lakes; shoreline areas of lakes with less than 30 percent areal coverage by trees, shrubs, and persistent emergents. In areas with a greater than 30 percent vegetative cover, the Palustrine classification should be used (FGDC, 2012). For more information, see <https://www.cmeccatalog.org/cmecc/classification/aquaticSetting/3.html>.

**Marine:** Defined by salinity, which is typically about 35 ppt (parts per thousand), although salinity can measure as low as 0.5 ppt during the period of average annual low flow near fresh outflows. This setting has little or no significant dilution from fresh water except near the mouths of estuaries and rivers. Includes all non-estuarine waters from the coastline to

the central oceans. The landward boundary of this setting is either the linear boundary across the mouth of an estuary or the limit of the supratidal splash zone affected by breaking waves. Seaward, the setting includes all ocean waters. The marine zone includes three subzones based on depth range (i.e., Marine, nearshore; Marine, offshore; and Marine, oceanic). For more information, see <https://www.cmeccatalog.org/cmecc/classification/aquaticSetting/1.html>.

**Marine nearshore (0–30 m depths):** Marine area extending seaward from the landward limit to a depth of 30 meters (m).

**Marine oceanic (100/200–11000 m depths; deep ocean):** Marine area of the open ocean extending seaward of the continental shelf break to the deep ocean. Salinity levels are typically 36 ppt.

**Marine offshore (30–100/200 depths; continental shelf break):** Marine area extending from a depth of 30 m to transition between the continental shelf and the continental slope, generally about 100/200 m.

**Palustrine:** Includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 hectares (ha; 20 acres); (2) lacking an active-wave formed or bedrock shoreline; (3) water depth in the deepest part of basin less than 2.5 m (8.2 feet) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt. (Cowardin et al., 1979). For more information see, <https://www.fgdc.gov/standards/projects/wetlands/nwcs-2013>.

**Riverine:** Includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts of 0.5 ppt or greater (Cowardin et al., 1979). For more information, see <https://www.fgdc.gov/standards/projects/wetlands/nwcs-2013>.

**Upland:** Environment above the extreme high water spring (EHWS) level (Cowardin et al., 1979).

**Habitat:** Abiotic (e.g., rocky shorelines or mud flats) or biotic (e.g., coral reefs or seagrass beds) environments or structures where organisms live, are most likely to be found, or where key life cycle phases must be completed.

**Habitat Type:** Detailed habitat types monitored/mapped/observed within the program extent.

**Agriculture:** Land areas used for the cultivation or breeding of animals and plants to provide food, fiber, medicinal plants and other products to sustain and enhance life.

## Appendix 2: CMAP Glossary

**Artificial reef:** An underwater structure built by humans to promote marine life.

**Barrier island:** A long broad sandy island lying parallel to a shore that is built up by the action of waves, currents, and winds and that protects the shore from the effects of the ocean.

**Beach/dune:** The area above the low-water mark extending across the backside of the associated sand ridges, which may, or may not be vegetated.

**Coral reef:** Ecosystems held together by structures formed by the growth and deposition of calcium carbonate by coral.

**Deep sea benthic communities:** The assemblage of organisms that live in and above the sediments forming the deep ocean floor, including corals, worms, clams, crabs, lobsters, sponges, and microorganisms.

**Emergent marsh:** An area of low-lying land dominated by erect, rooted, herbaceous plant species rather than woody plant species that is flooded in wet seasons or at high tide, and typically remains waterlogged at all times.

**Forest:** A large area dominated by trees and can include upland (dry) and riverine forests and swamps. The aquatic zone selected will be indicative of the type of forest. For example, palustrine forest would indicate swamp habitat.

**Hard bottom:** Nearshore/offshore areas dominated by a hard substrate.

**Karst/Barren:** Includes barren rock outcrops (exposures of rock, either natural or due to mining or construction), and karst formations (caves and sinkholes). Sinkholes may be barren, grass- or water-filled, or forested.

**Mangrove:** Coastal wetlands dominated by mangrove species.

**Oyster/Bivalve bed:** Large aggregations of aquatic mollusks that have a compressed body enclosed within a hinged shell; can occur in either fresh or marine environments.

**Sargassum/floating macroalgae:** Genera of large brown algae that float in island-like masses.

**Shrub/Grassland:** Non-saline, grass-dominated sections of the coastal plain, generally associated with the occurrence of heavy clay soils.

**Submerged aquatic vegetation (SAV):** Benthic macroalgae and aquatic plants that grow to the surface of the water but do not emerge from it. Seagrasses are submerged monocotyledonous plants with narrow grass-like leaves often occurring in dense underwater meadows. Benthic macroalgae are large aquatic photosynthetic organisms attached to the benthos and often occurring in dense beds. Can occur in both freshwater and saltwater.

**Soft bottom:** Nearshore/offshore areas dominated by a soft substrate.

**Tidal flat:** Unvegetated coastal wetlands within/slightly above the intertidal zone, usually characterized by mud deposited by tides.

**Urban:** Land areas used primarily for human settlement, often with large population sizes and infrastructure built on the environment.

**Water column:** Conceptual column of water that extends from the water's surface to porewater amongst sediment grains and groundwater.

### **Water Quality Monitoring**

*The repeated observation of one or more suites of parameters within a particular body of water to describe the condition of that waterbody. For definitions of detailed parameters included within the general parameter groups, refer to NOAA and USGS (2019).*

**Aquatic primary producers:** The organisms responsible for primary production of organic matter. These form the basis of the food chain. Within the CMAP application, aquatic primary producers is a general parameter group that consists of the detail parameters chlorophyll and phytoplankton.

**Carbon:** Within the CMAP application, the carbon general parameter group consists of organic carbon (total and dissolved organic carbon) and polycyclic aromatic hydrocarbons (PAHs)

**Field parameters:** Parameters that are typically collected through observation or instrumentation at a sampling site. Within the CMAP application, this general parameter group consists of the detail parameters: water temperature, conductance, dissolved oxygen, pH, turbidity, light attenuation, currents and water level.

**Freshwater Inflow:** Freshwater inflow is the freshwater that flows into an estuary. Within the CMAP application, the freshwater inflow parameter group consists of discharge and stage

**Harmful algal bloom (HAB) indicators:** An algal bloom is a rapid increase or accumulation in the population of algae in freshwater or marine water systems, and is recognized by the discoloration in the water from their pigments. Cyanobacteria were mistaken for algae in the past, so cyanobacterial blooms are sometimes also called algal blooms. Blooms that can injure animals or the ecology are called harmful algal blooms (HAB) and can lead to fish die-offs, cities cutting off water to residents, or States having to close fisheries. Within the CMAP application, HAB indicators is a general parameter group that consists of the detail parameters, cyanobacteria and algal toxins.

**Mercury:** A bioaccumulative environmental toxicant that negatively affects humans and wildlife even at low concentrations. Within the CMAP application, mercury is a general parameter that includes the detail parameters, methylmercury and total mercury.

**Nutrients:** Molecules that are essential for the growth and nourishment of organisms within the environment. Within the CMAP application, nutrients are a general parameter group that



### Appendix 2: CMAP Glossary

consists of the detail parameters: total nitrogen, nitrite, nitrate, nitrite + nitrate, ammonia, ammonia + organic nitrogen, total phosphorus, soluble phosphorus, phosphate, orthophosphate, and silicate.

**Pathogen:** Disease causing bacteria, virus, or protozoan that can contaminate water resources making it unsafe for humans. Within the CMAP application, the general parameter pathogen consists of the detail parameters: *Escherichia coli*, *Enterococcus*, fecal coliforms, total coliforms, *Giardia*, *Cryptosporidium* and *Vibrio*.

**Sediment:** Solid particulate material suspended, transported and deposited by wind or water. In aquatic environments evaluation of sediment quantity, size distribution, suspension, transport and deposition is an important component of both the hydrology and ecology of the environment. Within the CMAP application, the general parameter sediment consists of the detail parameters, suspended sediment concentration and total suspended solids..

#### **Habitat Monitoring**

*Habitat monitoring refers to the collection of in situ measurements of various parameters with regards to the condition and/or state of habitats for broad categories such as corals, oysters, plants, sediment, and other physical characteristics of the environment. For definitions of detailed parameters included within the general parameter subgroups, refer to NOAA and USGS (2019).*

**Abiotic:** The non-living chemical and physical aspects of the environment that affect living organisms and the functioning of ecosystems. Within the CMAP application, abiotic is a general habitat monitoring parameter that includes substrate metrics and coastal processes parameter groups.

**Coastal processes:** Physical processes influencing the coastal zone. Within the CMAP application, coastal processes is a parameter group within the abiotic general parameter and includes vertical accretion and subsidence subgroups.

**Ecological metrics:** Parameters or measures of how biological communities are structured or composed in a particular area (both animal and plant communities). Within the CMAP application, ecological metrics is a parameter group contained under the submerged habitat building animals and plants/macroalgae general parameters. Ecological metrics includes composition, species abundance, percent cover, density, biomass parameter subgroups.

**Physiology/Health:** Parameters or measures detailing animal physiology or health information (i.e., presence of coral disease or bleaching). Within the CMAP application, physiology/health is a parameter group within the submerged habitat building animals general parameter. Physiology/health includes disease, size, bleaching, and growth parameter subgroups.

**Plants/Macroalgae:** Terrestrial or submerged plants and macroalgal species within the environment that act as biological habitat and/or food sources for animal and other plant species. Within the CMAP application, plants/macroalgae is a general parameter and includes ecological metrics, physiology, and population dynamics parameter groups.

**Population dynamics:** Study of how and why populations change in size and structure over time (for animal and plant populations). Within the CMAP application, population dynamics is a parameter group contained under the submerged habitat building animals and plants/macroalgae general parameters. Population dynamics groups includes settlement/recruitment, survivorship, larval transport, spawning, mortality, reproductive effort, and primary production.

**Submerged habitat building animals:** Animals such as corals, bivalves, sponges, or tube worms that create structures on the benthos. Within the CMAP application, submerged habitat building animals is a general parameter. Submerged habitat building animals includes the physiology/health, population dynamics, and ecological metrics parameter groups.

**Substrate metrics:** Parameters used to describe or classify the substrate in a given area. Within CMAP application, substrate metrics is a parameter group contained under the abiotic general parameter. Substrate metrics include substrate geochemistry, substrate composition, topographic complexity, sediment classification, and substrate depth.

#### **Mapping**

*Assessments that summarize or assess the condition or state of water quality or habitat through remotely sensed measurements.*

**Area of habitat types:** The areal coverage of particular habitat types.

**Backscatter intensity:** Backscatter intensity is a data type often collected alongside multibeam sonar (MBES) that provides insight into the texture, roughness, or complexity of the seafloor. Generally, a higher intensity of the returning signal can be associated with a hard, coarse-grained sediment or surface. However, a more complex surface (i.e., high rugosity, shipwrecks, etc.) often causes more interference with the signal and hence is associated with a low-intensity return.

**Chlorophyll:** A green pigment that allows plants and algae to photosynthesize. Chlorophyll is often used as an indicator of the amount of algae or phytoplankton growing in or the trophic condition of a waterbody. Within the CMAP application, the chlorophyll parameter includes all types of chlorophyll, collectively (e.g., a, b, c, etc.).

**Conductance/Salinity:** A measure of the amount of salts dissolved in a body of water. Within the CMAP application, conductance/salinity for mapping programs refers to estimates of salinity delineated from remotely sensed data.

## Appendix 2: CMAP Glossary

**Currents:** In reference to the Mapping “Parameters” field; Ocean currents; directed movement of ocean water.

**Digital photography:** A form of photography that uses a camera with electronic image sensors rather than film; includes photographic images of the Earth’s surface captured by aircraft, drones, satellites, remotely operated vehicles/underwater, etc.

**Hyperspectral imagery:** A type of imagery that captures information from across the electromagnetic spectrum; employed since the early 1980s in remote sensing technology; often captured remotely by sensors on satellites.

**Land cover:** The physical material at the surface of the Earth; documentation of how much a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types; can be determined by analyzing satellite and aerial imagery. For more information, see <https://oceanservice.noaa.gov/facts/lclu.html>.

**Land use:** Broad categories often combined with land cover (i.e., habitats) classes to convey how people use the landscape (e.g., development, conservation, mixed use, agriculture).

**Multispectral imagery:** A type of imagery that captures information from across the electromagnetic spectrum; produced by sensors that measure reflected energy within several specific sections (also called bands) of the electromagnetic spectrum.

**Reflectivity:** A function of the wavelength used, which is most commonly in the near infrared wavelength range. The strength of the returns varies with the composition of the surface object reflecting the return. For more information, see <http://desktop.arcgis.com/en/arcmap/10.3/manage-data/las-dataset/what-is-intensity-data-.htm>.

**Sea surface height:** Sea surface height refers to the height of the ocean’s surface above the center of the Earth. In reference to the mapping “Parameters” field, sea surface height is an estimate based on satellite imagery. For example, see <https://www.ospo.noaa.gov/Products/ocean/ssheight.html>

**Sea surface temperature:** A measure of water temperature at the surface or the upper portion of the water column (i.e., upper few meters).

**Sediment depth:** In reference to the Mapping “Parameters” field, a measurement of the depth of the sediment often collected using seismic or subbottom technology.

**Sediment grain size:** The size of loose, uncemented pieces of rocks or minerals (e.g., mixture of sand-, silt-, clay-sized particles). For more information, see <https://geomaps.wr.usgs.gov/parks/misc/glossarys.html>.

**Soil type:** A classification or taxonomy of soils determined according to soil texture, color, organic content, and chemical composition. For more information, see <https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/class/taxonomy/>.

**Subsidence:** Land subsidence is a gradual settling or sudden sinking of the Earth’s surface in response to subsurface movement of earth materials including aquifer-system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost. For more information, see <https://water.usgs.gov/ogw/subsidence.html>.

**Turbidity:** The measure of the relative clarity of water. It is the amount of light that is scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity. Material that causes water to be turbid includes clay, silt, finely divided inorganic and organic matter, algae, soluble colored organic compounds, and plankton and other microscopic organisms. Within the CMAP application, turbidity for mapping programs includes estimates of turbidity produced by remotely sensed data. For more information, see <https://water.usgs.gov/edu/turbidity.html>.

**Vertical accretion:** The process of growth or increase, typically by the gradual accumulation of additional layers of matter.

**Water column profiling:** In reference to the Mapping “Parameters” field, collection of oceanographic data throughout the water column.

**Water temperature:** Water temperature can include temperature measured at the surface and throughout the water column. These measurements may also be collected using remote sensing technologies.

### References

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS-79/31. Washington, DC. 131 pp.

FGDC (Federal Geographic Data Committee). 2012. Coastal and Marine Ecological Classification Standard, Marine and Coastal Spatial Data Subcommittee, Federal Geographic Data Committee. FGDC-STD-018-2012. Online: [https://www.fgdc.gov/standards/projects/cmecs-folder/CMECS\\_Version\\_06-2012\\_FINAL.pdf](https://www.fgdc.gov/standards/projects/cmecs-folder/CMECS_Version_06-2012_FINAL.pdf) (Accessed 20 June 2019)

NOAA and USGS. 2019. Council Monitoring and Assessment Program (CMAP): Inventory of Existing Habitat and Water Quality Monitoring, and Mapping Metadata for Gulf of Mexico Programs. National Oceanic and Atmospheric Administration and U.S. Geological Survey. NOAA NOS NCCOS Technical Memorandum 262. Silver Spring, MD. 155 pp. doi: 10.25923/gwp-x-ff30

### Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

#### *CMAP Baseline Assessment Catalog:* Assessment Inclusion Criteria Manual and Protocols for Data Entry and Review

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##### Introduction

This document outlines the process of assessing, entering, and reviewing assessment reports for the CMAP Assessment Catalog (the Catalog). It is presented in five sections (and a Glossary), each presenting a specific component of the cataloging process.

##### Description of Task

The purpose is to compile existing assessments of habitat, water quality and mapping into a comprehensive searchable web-based directory to be used as an informational resource by the RESTORE Council for restoration planning, development, and performance monitoring. Programs and reports that assess the condition of a particular habitat, water quality or mapping parameter and meet the criteria listed herein will be cataloged at a descriptive metadata level. We will provide value-added text, tables, and figures that summarizes report information, such as spatial domain, time period, and objectives for the assessment. This information supports the Council by identifying potential monitoring reference points for evaluating restoration projects. For example, if submerged aquatic vegetation (SAV) restoration was proposed in a particular watershed, the Catalog could be searched to see if an SAV assessment was available. The assessment might provide a spatial and temporal reference point for the proposed restoration.

We will include all assessments that evaluate conditions or allow comparisons of groups or individual parameters listed within the CMAP water quality, habitat and mapping (Task 2) Inventory. Assessments will include those in estuarine and marine waters and habitats on spatial scales ranging from Gulf-wide to within individual watersheds/estuaries, and at temporal scales generally starting in 1980. We will use best judgement on a case-by-case basis to determine whether to include assessments done earlier or at smaller scales. Assessments conducted by Federal, State and local agencies, and programs conducted by large organizations are prioritized. Examples of these sources are listed in the General Assessment Source Category of this document.

This task will compile, catalogue and summarize existing habitat, water quality and mapping assessments and will not provide in-depth analysis of the datasets used for assessment. Furthermore, synthesis and assessments of data from programs or data portals resulting in peer-reviewed journal publications, or similar, will not be included in this phase of the project. In the event this type of publication is a primary source of information for resource assessment, it will be investigated for inclusion on a case-by-case basis.

##### **Section 1 - Initial Assessment for Catalog Inclusion Procedure**

This section provides step-by-step guidance for how to determine the suitability of an assessment and its inclusion in the Catalog.

##### **Section 2 - Assessment Inclusion Criteria**

This section provides descriptions and interpretations of the criteria (Assessment Inclusion Criteria) used to determine if an assessment should be included in the Catalog.

##### **Section 3 - Initial Data Entry Procedure**

This section provides a description of the process for entering an assessment into the Catalog. Links, notes, definitions, and tips are provided with regards to the overall process and each attribute field.

##### **Section 4 - Questionable/Deferred Assessments**

This section provides a description of how to process assessments that do not meet the initial assessment for inclusion in the Catalog.

##### **Section 5 - Catalog Record Review Process**

This section outlines the process for reviewing the information for each cataloged assessment.



## Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

### Section 1 - Initial Assessment for Catalog Inclusion Procedure

Prior to entering a new assessment into the Catalog, three initial checks were made: 1) is the assessment identified as a prioritized Source Type; 2) has the assessment already been entered; and 3) does it meet the Assessment Inclusion Criteria. These checks were made for every potential assessment by sequentially working through these three questions. Assessing the four categories of Assessment Inclusion Criteria does not need to be done in any specific sequential order.

#### 1. Is this assessment identified as a prioritized Assessment Source Category?

- Assessments conducted by Federal, State and local agencies, and programs conducted by large organizations are prioritized. These publications include:

Assessment Type	Examples
Status and/or Trends Report	<i>Seagrass Status and Trends in the Northern Gulf of Mexico: 1940-2002</i>
Condition Reports	<i>National Coastal Condition Report 2010</i>
Assessments/ Baseline Assessments	<i>Palm Beach County Natural Areas Water Quality Baseline Assessment</i>
Summary Reports	<i>Louisiana Barrier Island Comprehensive Monitoring (BICM) Program Summary Report: Data and Analyses 2006 through 2010</i>
Inventory/Index	<i>Okefenokee National Wildlife Refuge Water Resource Inventory and Assessment</i>
Stock Assessments (summarized)	<i>Oyster Stock Assessment of the Public Oyster Areas of Louisiana</i>
Report Card/Guides	<i>2002-03 Sanctuary Science Report: An Ecosystem Report Card After Five Years of Marine Zoning</i>
State of the [Blank]	<i>State of the Bay - Galveston Bay</i>

#### 2. Has this assessment already been entered into the Inventory?

- If yes, access the Catalog record in the database and search for the assessment of interest, click edit, and check to see if any blank fields can be completed from the source you are reviewing.
- If no, move on to question 3.

#### 3. Does this assessment meet the Assessment Inclusion Criteria? (must meet ALL criteria for inclusion.)

- Does this assessment meet the Assessment Type documented assumption?
  - Does this assessment meet the Spatial documented assumption?
  - Does this assessment meet the Temporal documented assumption?
- If yes to ALL of the above, proceed to Section 3 - Initial Data Entry Procedure.
  - If no or you are uncertain of the answer to any of these questions, add this assessment to the Questionable/Deferred list. See Section 4 - Questionable/Deferred Assessments for the procedure for this process.

**If an assessment is not already in the Catalog and meets ALL of the Assessment Inclusion Criteria, open a new webform and begin the Initial Data Entry Procedure.**

Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

**Section 2 - Assessment Inclusion Criteria**

Listed in this section are criteria and specifications each assessment needs to meet for entry into this Catalog.

**2.1 Habitat Type and Aquatic Settings**

Assessments will be documented as falling within one or more habitat type(s) and associated aquatic setting(s).

Habitat Types

<i>Agriculture</i>	<i>Deep sea benthic communities</i>	<i>Oyster/Bivalve bed</i>	<i>Tidal flat</i>
<i>Artificial reef</i>	<i>Forest</i>	<i>Sargassum/Floating macroalgae</i>	<i>Urban</i>
<i>Barrier island</i>	<i>Hard bottom</i>	<i>Submerged aquatic vegetation (SAV)</i>	<i>Water column</i>
<i>Beach/dune</i>	<i>Karst/Barren</i>	<i>Shrub/Grassland</i>	
<i>Coral reef</i>	<i>Mangrove</i>	<i>Soft bottom</i>	

Aquatic Settings

<i>Upland</i>	<i>Lacustrine</i>	<i>Marine Offshore (30 - 100/200m depths - cont. shelf break)</i>
<i>Riverine</i>	<i>Estuarine</i>	<i>Marine Oceanic (100/200 - 11000 m depths - deep ocean)</i>
<i>Palustrine</i>	<i>Marine Nearshore (0-30 m depths)</i>	

**2.2 Assessment Type**

An assessment must meet the following requirements for water quality, habitat and/or habitat mapping to be included into the Catalog.

Water Quality Assessments

*Documented Assumption*

- Assessment provides an interpreted or synthesized assessment of water quality data that reports on at least one of the parameters listed in Table A3.1.
  - Water quality parameters will be recorded to the General Parameter level.

*Interpretation/Tips*

- Assessments with a water quality component should report within one or more of the habitat types listed in the Habitat Type and Aquatic Settings section above.
- Assessments that report water quality information but are not primarily water quality assessments will be included.
  - Example: An assessment that focuses on faunal species monitoring but also collects water quality parameters.
- Include assessments that measure water quality parameters via animal tissue samples.

**Table A3.1. Water quality parameters.**

General Parameters	Includes
Nutrients	Total nitrogen, nitrite, nitrate, nitrite + nitrate, ammonia, ammonia + organic nitrogen, total phosphorus, soluble phosphorus, phosphate, orthophosphate, silicate
Pathogens	<i>Escherichia coli</i> , <i>Enterococcus</i> , fecal coliforms, total coliforms, <i>Giardia</i> , <i>Cryptosporidium</i> , <i>Vibrio</i>
Aquatic Primary Producers	Phytoplankton, chlorophyll
Harmful Algal Bloom Indicators	Cyanobacteria, algal toxins
Sediment	Suspended sediment concentration, total suspended solids
Mercury	Total mercury, methylmercury
Freshwater Inflow	Discharge, stage
Field Parameters	Water temperature, conductance, dissolved oxygen, turbidity, pH, light attenuation, currents, water level
Carbon	Organic carbon, polycyclic aromatic hydrocarbons (PAHs)

**Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review**

Habitat Assessments

*Documented Assumption*

- Assessments that gauge the condition or state of habitat through in situ measurements and include at least one of the parameters listed in Table A3.2.
  - Habitat parameters will be recorded to the ‘Parameter Group’ level.

*Interpretation/Tips*

- Assessments with a habitat component should include one or more of the habitat types listed in the Habitat Type and Aquatic Setting section above
- Faunal species assessments are only included for benthic, habitat forming groups (i.e. bivalves, corals, deep sea benthic communities, etc.)

**Table A3.2. Habitat assessment parameters**

General Parameters	Parameter Groups	Includes
Submerged habitat building animals	Ecological metrics	Composition, abundance, cover, density, distribution, biomass
	Physiology/Health	Disease, size, bleaching, growth
	Population dynamics	Settlement/Recruitment, survivorship, larval transport, spawning, mortality
Plant/Macroalgae	Ecological metrics	Composition, abundance, cover, density, distribution, biomass
	Physiology	Canopy extent/Structure, size, growth, litterfall
	Population dynamics	Recruitment, survivorship, mortality, reproductive effort, primary production
Abiotic	Substrate metrics	Substrate geochemistry, substrate composition, topographic complexity, sediment classification, substrate depth
	Coastal processes	Vertical accretion, subsidence

Mapping Assessments

*Documented Assumption*

- Assessments with a mapping component should include one or more of the parameters listed in Table A3.3 below
- Assessments that gauge the condition or state of water quality or habitat over time via the syntheses of remotely sensed data (i.e., lidar, sonar satellite, aerial imagery, etc.).
  - Mapping parameters will be recorded to the ‘General Parameter’ level.

*Interpretation/Tips*

- Mapping assessments should include at least one of the General Parameters listed in Table A3.3.
- These parameters provide information collected from a variety of satellite, video, radio, or sonar instruments.

**Table A3.3. Mapping assessment parameters.**

General Parameters		
Area of habitat types	Land use/Land cover	Soil type
Backscatter intensity	Multispectral imagery	Subsidence
Chlorophyll	Reflectivity	Surficial elevation
Conductance/Salinity	Sea surface height	Turbidity
Currents	Sea surface temperature	Vertical accretion
Digital photography	Sediment depth	Water column profiling
Hyperspectral imagery	Sediment grain size	Water temperature



## Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

### 2.3 Spatial

#### Documented Assumptions

- Assessment spatial extent must fall within or intersect the CMAP project boundary (Figure A3.1).
  - Will use boundary that includes HUC10 boundaries.
- The spatial domain for this task will be limited to Gulf-wide, State, regional, or basin/watershed level.
- Assessments can be regional across the Gulf of Mexico, nearshore waters in the entire CMAP domain (for example, the National Coastal Condition Assessment), or at the level of an individual estuary (for example Barataria-Terrebonne Estuary or other National Estuary Programs) or habitat (beach monitoring in Mississippi).

#### Interpretation/Tips

- If the coverage of an assessment falls or includes:
  - Within and outside of the boundary, we will investigate on a case-by-case basis based on area of assessment on either side of the boundary.
  - At a finer-scale than estuary, we will investigate on a case-by-case basis.
  - Along the United States /Mexico border or the GoM/Atlantic Ocean boundary, we will investigate on a case-by-case basis.



basis.

**Figure A3.1. Map of the CMAP Project boundary**

## Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

### 2.4 Temporal

#### *Documented Assumptions*

- The temporal domain will focus on more recent assessments, 1980–present, but will not automatically exclude other time periods.

#### *Interpretation/Tips*

- Best judgement will be used, and if in doubt, the assessment will be included as a bibliographic reference.
- Assessments that are conducted with some level of recurrence will be noted.

### Section 3 - Initial Data Entry Procedure

This section serves as a guide to entering assessment information into the Catalog. Directions and tips are included for each field.

#### 3.1 General Directions

- Log in to the online platform located on the Restore the Gulf website and fill in the webform as completely as possible
- If you are having trouble accessing the webform, contact webform IT lead for support
- Aim for a maximum of 30–45 minutes spent on each record
- Work through each field one at a time
- When fields cannot be populated, or you are unsure of how to populate, **leave them blank**
- Acronyms should be placed in parentheses after the first usage (see OCEANSAT-2 example below)
- Use semicolons as the standard delimiter to separate strings of text
- For fields with open text, use the Tab button to enter (\*However, this is not true for the Executing Agency field—use the Enter key)
- **When the initial round of data entry has been completed, the person entering the data should click the “Submit for review” button on the webform**

#### *Tips*

- If unsure of how to populate a field, reference existing records in the Catalog to view examples of the type of information that is needed.
- Use the search function in either the web browser or .pdf document to search for general parameter keywords.

Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

3.2 Descriptions and Tips for Field Population

General Assessment Source Information

All of these fields should be completed as much as possible in the first round of data entry. Much of the information here is bibliographic.

Table A3.4. General assessment information.

FIELD	FIELD DESCRIPTION	TIPS
<b>Assessment title</b>	<i>Title of the assessment</i>	<ul style="list-style-type: none"> <li>• Full report titles only, no chapters</li> <li>• The first letter of all words other than “a, an, and, the, of, etc.” should be capitalized</li> <li>• <b>Do not include program or agency name in title unless officially part of the title</b></li> </ul>
<b>Assessment description</b>	<i>Abstract or brief description of the assessment</i>	<ul style="list-style-type: none"> <li>• Description should focus on the assessment being reported/conducted</li> <li>• If you are writing the description, focus on the who, what, when, where, and how.</li> </ul>
<b>Assessment Source Category</b>	<i>Type of source assessment comes from</i>	<ul style="list-style-type: none"> <li>• Select only one option; selection of more than one option is on a case-by-case basis</li> <li>• If source isn’t listed, add source type</li> </ul>
<b>Authors</b>	<i>List of lead authors or cited agency</i>	<ul style="list-style-type: none"> <li>• Lastname F.M.</li> <li>• Use semi-colons between multiple entries</li> <li>• Do not include affiliations for authors</li> </ul>
<b>Agency</b>	<i>Agency or organization leading the program</i>	<ul style="list-style-type: none"> <li>• Multiple entries can be listed</li> <li>• Use semi-colon and space to separate entries</li> </ul>
<b>Agency Type</b>	<i>Type of agency(ies) leading the assessment</i>	<ul style="list-style-type: none"> <li>• Multiple selections allowed</li> <li>• Include only lead agencies in authorship</li> </ul>
<b>Report Date</b>	<i>Date of publication</i>	<ul style="list-style-type: none"> <li>• Use the format YYYY</li> <li>• Same date as used in citation</li> </ul>
<b>Earliest Date</b>	<i>The start date of data reported and used in assessment</i>	<ul style="list-style-type: none"> <li>• Use the format MM/YYYY or YYYY</li> <li>• Earliest date of data summarized/reported for assessment</li> </ul>
<b>Recent Date</b>	<i>The end date of data reported and used in assessment</i>	<ul style="list-style-type: none"> <li>• Use the format MM/YYYY or YYYY</li> <li>• Most recent date of data summarized or reported for assessment</li> </ul>
<b>DOI</b>	<i>Digital Object Identifier</i>	<ul style="list-style-type: none"> <li>• If available, not required</li> </ul>
<b>ISBN or ISSN</b>	<i>International Standard Book Number or International Standard Serial Number</i>	<ul style="list-style-type: none"> <li>• Standardization codes for book and serial publications</li> <li>• If available, not required</li> </ul>
<b>Record Citation</b>	<i>Recommended citation obtained from source</i>	<ul style="list-style-type: none"> <li>• Recommended citation obtained from source (only if the document provides a citation)</li> <li>• If available</li> </ul>
<b>Recurring</b>	<i>Part of a recurring series or published at various intervals?</i>	<ul style="list-style-type: none"> <li>• Yes or No</li> </ul>
<b>Publication Website</b>	<i>URL of publication</i>	<ul style="list-style-type: none"> <li>• Direct link for publication access (i.e., web address for .pdf or download link)</li> </ul>
<b>Associated Website</b>	<i>URL for associated websites (descriptor or landing page)</i>	<ul style="list-style-type: none"> <li>• Can be main page for publication with links to other publications</li> <li>• May be landing pages and multiple URLs allowed</li> <li>• Not required</li> </ul>



Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

Assessment Setting

All of these fields should be completed as much as possible in the first round of data entry. Much of the information here is bibliographic.

Table A3.5. Assessment setting information.

FIELD	FIELD DESCRIPTION	TIPS
<b>Assessment Type</b>	<i>Is the assessment a water quality, habitat monitoring, or mapping assessment?</i>	<ul style="list-style-type: none"> <li>Multiple selections can be made</li> <li>Parameters collected for each Assessment Type can be found in Section 2–Assessment Inclusion Criteria.</li> </ul>
<b>Coverage</b>	<i>Geographic coverage of the program</i>	<ul style="list-style-type: none"> <li>Choose “Gulf-wide” if assessment reports on every Gulf State is included in the assessment</li> <li>Choose “Multistate” if assessment reports on multiple, but not all, Gulf States</li> <li>Choose “Statewide” if assessment reports throughout all or most of a single state</li> <li>Choose “Local” if assessment reports at a smaller scale than “Statewide”</li> </ul>
<b>States</b>	<i>State(s) where the program/project operates</i>	<ul style="list-style-type: none"> <li>If outside of state boundaries, select “Federal-Marine”</li> <li>Multiple selections allowed</li> </ul>
<b>Waterbody Keywords</b>	<i>Sea areas, water bodies, etc. where program/project operates</i>	<ul style="list-style-type: none"> <li>Manual entry</li> <li>Multiple entries allowed. Use semi-colon space to separate entries</li> <li>Consistent entry of names</li> </ul>
<b>Habitat Types with Aquatic Settings</b>	<i>Matrix of Habitat Types and the Hydrologic Setting/stratum falling within program extent</i>	<ul style="list-style-type: none"> <li>Multiple selections can be made</li> <li>Each Habitat Type will have at least one Aquatic Setting selected for it</li> <li>Multiple selections can be made for each Habitat Type</li> <li>Ensure that habitat types and aquatic settings adhere to the matrix below</li> </ul>

Table A3.6. Aquatic setting and associated habitat types.

Habitat Type	Upland	Riverine	Palustrine	Lacustrine	Estuarine	Marine Nearshore	Marine Offshore	Marine Oceanic
Agriculture	X							
Artificial reef					X	X	X	X
Barrier island	X		X	X	X	X		
Beach/dune	X				X	X		
Coral Reef						X	X	
Deep sea benthic communities							X	X
Emergent marsh		X	X	X	X			
Forest	X	X	X					
Hard bottom		X	X	X	X	X	X	X
Karst/Barren	X							
Mangrove		X			X	X		
Oyster/Bivalve bed					X	X		
Sargassum/Floating macroalgae						X	X	X
SAV		X	X	X	X	X		
Shrub/Grassland	X	X	X	X	X			
Soft bottom		X	X	X	X	X	X	X
Tidal flat					X	X		
Urban	X							
Water column	X	X	X	X	X	X	X	X

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Assessment Type Information

Table A3.7. Assessment type information

FIELD	FIELD DESCRIPTION	TIPS
WQMetricIndex	Does the assessment report on metric(s) combining one or more water quality parameter?	<ul style="list-style-type: none"> <li>• Yes or No</li> </ul>
WQParameterGen	List of general and detailed water quality parameters	<ul style="list-style-type: none"> <li>• Select any general water quality parameters summarized in the assessment, defined in the glossary section</li> <li>• Multiple selections allowed</li> </ul>
HabMetricIndex	Does the assessment report on metric(s) combining one or more habitat parameter?	<ul style="list-style-type: none"> <li>• Yes or No</li> </ul>
HabParametersGrp	List of general habitat monitoring parameters. Combines the group and parameters together in one metric	<ul style="list-style-type: none"> <li>• Select any of the habitat monitoring grouped parameters summarized in the assessment, defined in the glossary section</li> <li>• Multiple selections allowed</li> </ul>
MapMetricIndex	Does the assessment report on metric(s) combining one or more mapping parameter?	<ul style="list-style-type: none"> <li>• Yes or No</li> </ul>
MapParameter	List of parameters	<ul style="list-style-type: none"> <li>• Select the parameters, raw quantifiable measurements, or derived products the assessment reports or produces</li> <li>• Multiple selections allowed</li> </ul>

Internal Fields

All of these fields should be completed as much as possible in the first round of data entry.

Table A3.8. Internal fields for data entry and review. Used by CMAP team.

FIELD	FIELD DESCRIPTION	TIPS
Comment	An internal comments/notes field	<ul style="list-style-type: none"> <li>• Include any pertinent information here</li> </ul>
RecReviewDate	Date record was reviewed	<ul style="list-style-type: none"> <li>• Use MM/DD/YYYY format</li> </ul>
ReviewedBy	Name of staff member that reviewed record	<ul style="list-style-type: none"> <li>• Use email address as format</li> <li>• Populate at same time as review date</li> </ul>
Final	Is the record complete and final	<ul style="list-style-type: none"> <li>• Populate 'Yes' when completed to finalize record</li> </ul>

\*\*\*Hit the “Submit for Review” button at the top of the webform when you are finished with the entry\*\*\*

Section 4 - Questionable/Deferred Assessments

This section focuses on records that are deferred or questionable. Assessments that only report atmospheric monitoring data, conduct faunal species monitoring, or other monitoring targets outside of the Inclusion Criteria should not be added to the Catalog and should instead be added to the Questionable/Deferred assessments list. Directions and tips are included for each field.

4.1 Assessment of Questionable/Deferred Programs

If after the Initial Assessment (Section 1) of a publication/report, you are uncertain if an assessment meets the Inclusion Criteria (Questionable) or determine an assessment does not meet the Inclusion Criteria (Deferred) add the assessment to the Questionable/Deferred Programs list and complete the fields defined below.

Be sure to document the reason for a program being Questionable or Deferred within the Issue field. The seven criteria for deferral are defined below.

1. **Faunal species monitoring:** A program/project that only monitors faunal species (no habitat or water quality data collection)

## Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

2. **Atmospheric monitoring:** An assessment that collects atmospheric data (i.e., precipitation, winds, air temperature, etc.)
3. **Other monitoring targets:** An assessment that does not monitor habitat or water quality condition
4. **Geographic coverage:** An assessment in which the collection area does not overlap with the CMAP spatial extent
5. **Spatial scale:** An assessment that reports on spatial scales smaller than the watershed/estuary level
6. **Lack of data synthesis or interpretive summaries:** A report that does not include synthesized data or provides data without providing summaries or conclusions (tabular data outputs, methodologies/manuals, planning documents, etc.)
7. **Assessment source types are generally published as agency technical reports.** As such, assessments published in peer-reviewed publications are not considered as a source type for this Catalog. Exceptions may occur if the assessment meets the criteria and provides an important reference point for a particular parameter or habitat type.

### Section 5 - Catalog Record Review Process

The Inventory record review process will involve two phases:

1. Record Review
2. Record Completion

These are defined and outlined below.

#### 5.1 Phase I: Record Review

This section focuses on the review process for records that have been entered into the CMAP Inventory.

- Records should not be reviewed by the same person who initially entered the record into the Inventory
- Reviews will be done in the database webform

##### First Step

- Reviewers should indicate they are reviewing a record by typing their initials into the “Reviewed By” column of the Task 7 Assessments For Entry spreadsheet (internal use)
- Reviewers should ensure that the record they are reviewing is not duplicated elsewhere in the database
  - If a duplicate is found, the reviewer should merge the two together using the most accurate information from both records and be in contact with the original data entry person
  - When the merger is complete, let the web development team know that the record ID not used as the merged record can be removed from the database by adding the record to the database request list
- Reviewers should select “Edit” on the splash page of the database next to the program being reviewed
- When the record’s information is displayed on the screen, select “Start first review” in the upper right corner to begin the review process

##### Second Step

- Reviewers should ensure that the assessment meets the inclusion criteria
  - Should a record not meet the inclusion criteria and need to be removed, follow the same procedure as above for record removal
- Reviewers should check the content of every field in the record
  - Before removing information from an existing record, the reviewer should contact the person who initially entered the record to ensure that such edits are warranted
  - Reviewers should make note of substantial changes to existing information in the Comments field
  - Ensure that formatting rules set forth in the data entry section of this SOP are followed (i.e. Author name format)
  - Note: When chlorophyll a concentrations are reported as an indicator of algal blooms, select harmful algal bloom indicators under water quality instead of aquatic primary producers
  - Ensure that habitat types and aquatic settings adhere to the matrix provided in the previous section



## Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

- If reviewers come across fields that have been left blank, the reviewer should attempt to fill them in
  - If the reviewer cannot definitively populate a blank field, it should be left blank
  - Reviewers should check for and correct typos and other grammatical errors
  - Reviewers should check that semicolons have been used as the text delimiter throughout
- Reviewers should ensure that record titles and descriptions adhere to the below formatting rules (Tables A3.9)
  - **Formatting Rules:**
    - Formatting titles and descriptive text should be consistent using the table below to assist in this standardization. There are three main components for formatting to follow as each entry is reviewed.
      - General (ampersands, text, spacing, capitalization, etc.)
      - Acronyms
      - Title consistency

**Table A3.9. General formatting rules used by CMAP team.**

<b>'And' and ampersand</b>	Don't use ampersand in the title or text unless it is a part of an 'official' name (i.e., Texas A&M)
<b>Extra spaces (spacing)</b>	Remove extra spaces at the beginning/end of titles, middle of text. Remove any extra spacing within the descriptive text.
<b>For agencies, do not spell out US</b>	For federal agencies, do not spell out "United States" instead use US
<b>Capitalize all words in title</b>	<i>Incorrect</i> Gulf-wide assessment of habitat use and habitat-specific production estimates of nekton in turtlegrass ( <i>Thalassia testudinum</i> )  <i>Correct</i> Gulf-wide Assessment of Habitat Use and Habitat-specific Production Estimates of Nekton in Turtlegrass ( <i>Thalassia testudinum</i> )
<b>Do not include agency/entity in the title unless it is present in the official title of assessment</b>	<i>Incorrect</i> National Park Service's Gulf Coast Network water quality report: Status of water quality of Big Thicket National Preserve  <i>Correct</i> Gulf Coast Network Water Quality Report: Status of Water Quality of Big Thicket National Preserve
<b>Regardless of presence/absence of acronym, title should be entered as presented in article</b>	<i>Incorrect</i> SIMM Program: Mapping and Monitoring Report No. 2  <i>Correct</i> Seagrass Integrated Mapping and Monitoring Program: Mapping and Monitoring Report No. 2  <i>Incorrect</i> Regional Coastal Assessment Program 2004 Annual Report  <i>Correct</i> Regional Coastal Assessment Program (RCAP) RCAP 2004 Annual Report

### Final Step

- Reviewers should click the "Save Assessment" button at the bottom of the webform when they are finished reviewing (or if they need to leave the webform for any reason prior to finishing)
- Reviewers should navigate back to the record they were reviewing and click the "Finish Review" button at the top of the webform to complete their review

### Appendix 3: CMAP Assessment Inclusion Criteria and Protocols for Assessment Data Entry and Review

#### 5.2 Phase II: Record Completion

A final check must be made to denote whether an assessment within the Catalog is completed and accurate. During this stage, the Phase II (final) quality assurance (QA) check of records should occur. This phase of the QA check should primarily be conducted in a database-wide application. These steps must be taken for every record that will be used in the final product for the CMAP project. This includes all records that meet all the Assessment Inclusion Criteria. Ideally, minimal edits should be made to any records in the database.

Before a record can be considered complete, the following checks must be done:

1. Ensure that there are no duplicate records in the database; if so, follow standard protocol for handling duplicate records
2. Quality assurance check as described on previous pages

Appendix 4: Assessment Database Input Example

Seagrass Integrated Mapping and Monitoring Program: Mapping and Monitoring Report No. 2

**Description** (*Abstract or brief description of the assessment*):

The Florida Fish and Wildlife Conservation Commission's (FL FWC) Fish and Wildlife Research Institute (FWRI) developed the Seagrass Integrated Mapping and Monitoring (SIMM) program to protect and manage seagrasses in Florida by providing a collaborative resource for seagrass mapping, monitoring, and data sharing. The statewide report is the second produced by the SIMM program to provide scientists, resource managers, legislators, and other stakeholders a summary of the status of Florida seagrasses. Chapters reporting on seagrasses in Florida estuaries and coastal waters are revised and uploaded on an as-needed basis as new information becomes available. The editors organized the reports to provide information to a wide range of readers. The Executive Summary gives an overview of the stressors affecting seagrass ecosystems, monitoring and mapping efforts throughout Florida, and a statewide summary of seagrass status. The Introduction presents the history of the SIMM program and the rationale for developing it. Chapters provide information from researchers and managers on each estuary or region of Florida coastal waters. The 23 regional chapters are listed in geographical order below, beginning in the western Panhandle and ending with the northern Indian River Lagoon on Florida's east coast. In each chapter, contributors provide a concise overall assessment and color-coded "report cards" of seagrass status, as well as a map of the distribution of seagrass beds in the estuary or subregion, created using the latest available mapping product. Chapters include data and information from monitoring, mapping, and management programs. Additional information on the region is provided, including geography, geology, watershed characteristics, and human development. Water quality data and assessment, including light available to seagrasses, are presented where available. Data collection methods and availability are described, and a list of pertinent reports, scientific publications, websites, and contact information for chapter authors is provided at the end of each chapter.

**GENERAL ASSESSMENT SOURCE INFORMATION**

<b>Assessment source type</b>	<i>Type of source assessment comes from</i>	Status and/or Trends Report
<b>Authors</b>	<i>List of lead authors or cited agency</i>	Yarbro L.A.; Carlson P.R.
<b>Agency</b>	<i>Agency or organization leading the program</i>	Florida Fish and Wildlife Conservation Commission (FL FWC) Florida Fish and Wildlife Research Institute (FWRI)
<b>Agency Type</b>	<i>Type of agency(ies) leading the assessment</i>	State
<b>Report Date</b>	<i>Date of publication</i>	2018
<b>Earliest Date</b>	<i>The start date of data reported and used in assessment</i>	1987
<b>Recent Date</b>	<i>The end date of data reported and used in assessment</i>	2018
<b>DOI</b>	<i>Digital Object Identifier</i>	N/A
<b>ISBN or ISSN</b>	<i>International Standard Book Number or International Standard Serial Number</i>	N/A
<b>Record citation</b>	<i>Recommended citation obtained from source</i>	N/A
<b>Recurring</b>	<i>Is this a part of a recurring series or published at various intervals?</i>	Yes
<b>Publication website</b>	<i>URL of publication</i>	<a href="https://f50006a.eos-intl.net/F50006A/OPAC/Common/Pages/GetDoc.aspx?ClientID=MF50006A&amp;MediaCode=1584570">https://f50006a.eos-intl.net/F50006A/OPAC/Common/Pages/GetDoc.aspx?ClientID=MF50006A&amp;MediaCode=1584570</a>
<b>Associated Website</b>	<i>URL for associated websites (descriptor or landing page)</i>	<a href="http://myfwc.com/research/habitat/seagrasses/projects/active/simm/simm-reports/">http://myfwc.com/research/habitat/seagrasses/projects/active/simm/simm-reports/</a>



## Appendix 4: CMAP Assessment Example

### ASSESSMENT SETTING

<b>Assessment Category</b>	<i>Is the assessment water quality, habitat monitoring, or mapping assessment?</i>	Water Quality; Habitat Monitoring; Mapping
<b>Coverage</b>	<i>Geographic coverage of the program</i>	Statewide
<b>States</b>	<i>State(s) where the program/project operates</i>	Florida
<b>Waterbody Keywords</b>	<i>Sea areas, water bodies, etc. where program/project operates</i>	Perdido Bay; Pensacola Bay; Choctawhatchee Bay; St. Andrew Bay; St. Joseph Bay; Apalachicola Bay; Apalachee Bay; Waccasassa Bay; Cedar Key; Seahorse Key; Big Bend Coast; Suwannee Sound; Springs Coast; Tampa Bay; Clearwater Harbor; Boca Ciega Bay; St. Joseph Sound; Manatee River; Sarasota Bay; Anna Maria Sound; Palma Sola Bay; Roberts Bay; Blackburn Bay; Charlotte Harbor; Pine Island Sound; Estero Bay; Lemon Bay; Myakka River; Peace River; Dona Bay; Caloosahatchee River; Naples Bay; Rookery Bay; Johnson Bay; Gullivan Bay; Marco Island; Clam Bay; Chokoloskee Bay; Whitewater Bay; Florida Bay; Cape Sable; Everglades; Lower Keys; Middle Keys; Upper Keys; Keys; Tortugas; Marquesas; Barnes Sound; Card Sound; Biscayne Bay; Loxahatchee River; Lake Worth Lagoon; Mosquito Lagoon; Banana River Lagoon; Indian River Lagoon; St. Lucie River; St. Johns River; Nassau River; Matanzas River
<b>Habitat Types with Aquatic Settings</b>	<i>Matrix of Habitat Types and the Hydrologic Setting/stratum falling within program extent</i>	Water column – Estuarine; Water column – Marine Nearshore (0-30 m depths); SAV - Estuarine; SAV - Marine Nearshore (0-30 m depths)

### ASSESSMENT TYPE INFORMATION

#### Water Quality

<b>WQMetricIndex</b>	<i>Does the assessment report on metric(s) combining one or more water quality parameter?</i>	Yes
<b>WQParameterGen</b>	<i>List of general and detailed water quality parameters</i>	Nutrients; Harmful algal bloom indicators; Sediment; Field parameters; Aquatic primary producers

#### Habitat Information

<b>HabMetricIndex</b>	<i>Does the assessment report on metric(s) combining one or more habitat parameter?</i>	Yes
<b>HabParametersGrp</b>	<i>List of general habitat monitoring parameters</i>	Plants/Macroalgae–Ecological Metrics; Plants/Macroalgae–Physiology

#### Mapping

<b>MapMetricIndex</b>	<i>Does the assessment report on metric(s) combining one or more mapping parameter?</i>	Yes
<b>MapParameter</b>	<i>List of parameters</i>	Area of habitat types; Hyperspectral Imagery; Multispectral Imagery; Digital photography











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**Compilation of Existing Habitat and Water Quality Monitoring, and Mapping Assessments for the Gulf of Mexico Region**

NOAA Technical  
Memorandum  
NOS NCCOS 262

