

OCS Study
BOEM 2020-002
NOAA NCCOS 270

Regional Essential Fish Habitat Geospatial Assessment and Framework for Offshore Sand Features

Volume 4: Development of ShoalMATE: Shoal Map Assessment Tool for Essential Fish Habitat



US Department of the Interior
Bureau of Ocean Energy Management
Headquarters (Sterling, VA)

BOEM
Bureau of Ocean Energy
Management

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Regional Essential Fish Habitat Geospatial Assessment and Framework for Offshore Sand Features

Volume 4: Development of ShoalMATE: Shoal Map Assessment Tool for Essential Fish Habitat

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Authors:
Alexa Ramirez

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By
Quantum Spatial, Inc.
10033 MLK Street N, Suite 200
St. Petersburg, Florida 33716 USA

**US Department of the Interior
Bureau of Ocean Energy Management
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DISCLAIMER

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REPORT AVAILABILITY

To download a PDF file of this report, go to the US Department of the Interior, Bureau of Ocean Energy Management [Data and Information Systems webpage](http://www.boem.gov/Environmental-Studies-EnvData/) (<http://www.boem.gov/Environmental-Studies-EnvData/>), click on the link for the Environmental Studies Program Information System (ESPIS), and search on 2020-002. The report is also available at the National Technical Reports Library at <https://ntrl.ntis.gov/NTRL/>.

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List of Abbreviations and Acronyms

AOI	area of interest
BMP	best management practices
BOEM	Bureau of Ocean Energy Management
DOI	US Department of the Interior
EFH	Essential Fish Habitat
ETL	Extract-Transform-Load
fGDB	file geodatabase
GIS	Geographic Information System
HAPC	Habitat Areas of Particular Concern
MGET	Marine Geospatial Ecology Tools
MMP	Minerals Management Program
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
ShoalMATE	Shoal Map Assessment Tool for EFH
SST	sea surface temperature

Abstract

QSI was contracted to build a standardized reporting tool to facilitate better communication between BOEM and NOAA during Essential Fish Habitat (EFH) assessments required for dredging projects on the Outer Continental Shelf (OCS). QSI initiated development by gathering requirements from BOEM's Marine Minerals Program and NOAA's Habitat Conservation Division. We then designed the database architecture and workflow to meet the needs of access and usability for stakeholders with varying levels of familiarity with GIS. We ran the data necessary to support the tool (e.g., habitat descriptors, species models, project boundaries) through a series of custom scripts that store information describing each identified shoal in a database specifically designed for expedited queries within the front-end application. The front-end application presents this queried information within a web browser and generates a template report, as a Microsoft Word document, that can be edited by analysts to create a final, tangible product.

1 Background to the Tool Development Process

One of the primary goals of this project was to develop a standardized geographically and temporally based reporting tool for use by the Bureau of Ocean Energy Management’s (BOEM’s) Marine Minerals Program (MMP) practitioners in the Atlantic and Gulf of Mexico region to support Essential Fish Habitat (EFH) consultations for dredging. The ShoalMATE (Shoal Map and Assessment Tool for EFH) tool allows a user to share their assessment logic in a consistent manner. Having the information readily available to review will improve communications between agencies and provide more power and transparency in the EFH consultation process.

The results of the literature review completed as part of Volume 1 of this report, and additional data exploration associated with the tool development revealed numerous data sources that could help to characterize bottom habitats, particularly those of sandy shoals utilized for dredging operations. The development team identified a set of required information to be included in a template version of an assessment document in consultation with members of the MMP and the National Oceanic and Atmospheric Administration (NOAA) Habitat Conservation Division, as well as external subject matter experts, and through review of previous EFH Assessments for dredging projects, (**Table 1-1**).

Table 1-1. List of required components in an EFH Assessment document.

Requirement
A description of the proposed project area
Overview of the location
Bathymetry
Bottom current direction
Substrate type
Recovery potential/accretion of sand resource
Previous dredge events
A list of federally managed species with overlapping EFH polygons (from NOAA)
Evaluation of potential impacts on those species based on known habitat affinities or predicted distribution of fish and shrimp species
Proposed mitigations and best management practices
Results and conclusions
References

Data to support these requirements were compiled into an ESRI file geodatabase (fGDB) if hosted web services were not available. Data sources included MarineCadastre.gov, BOEM’s Marine Minerals Information System, and personal communications with BOEM and NOAA stakeholders. Remotely sensed data (sea surface temperature (SST), chlorophyll-*a*, current velocity, etc.) were compiled as 10-year monthly averages using the Marine Geospatial Ecology Tools (MGET) developed by the Marine Geospatial Ecology Lab at Duke University (Roberts et al. 2010). We utilized NOAA’s EFH polygons but created additional related tables to store information digitized from EFH source documentation compiled by regional Fishery Management Councils. The table also documents where Volume 1 identified additional sources of information on managed species exceeding the information in the official documentation. Once all available datasets were combined into a fGDB, the data was loaded into ESRI MXD files and published as web services for use in the application.

2 Application Development

BOEM was interested in creating a simple interactive mapping application for users with minimal to moderate Geographic Information System (GIS) skills and experience. This ruled out developing an add-in package to be used in conjunction with desktop mapping software such as ESRI ArcMap, as access to software licenses would be limiting. We determined the solution to be a web-based mapping application that could be operated through any internet browser. The chosen technologies (**Figure 2-1**) were selected to be consistent with other applications developed for BOEM. A more detailed description of the technical architecture can be found in **Appendix A**.

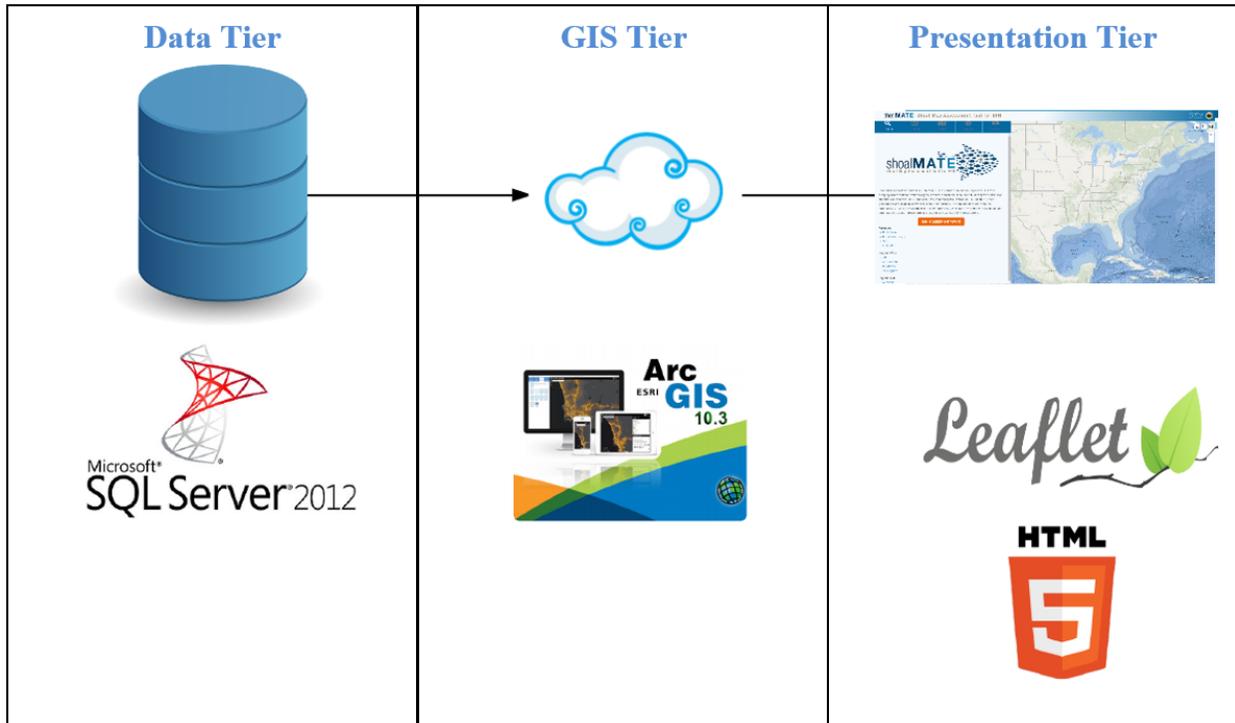


Figure 2-1. High-level architecture for the ShoalMATE application.

The high-level workflow for ShoalMATE involves five main steps (**Figure 2-2**).

- **Step 1: Select Shoal** – The user chooses an area of interest (AOI) and selects the relevant seasons in which dredging may occur.
- **Step 2: Review Results** – The user can review the results of intersecting the selected shoal feature with various data that will be utilized in the generated report.
- **Step 3: Review Maps** – The user can select and review a set of default maps with preset layers.
- **Step 4: Create Custom Maps** – To tell a more detailed story of the shoal, the user can choose to generate additional maps to include in the report by choosing from a variety of provided data layers.
- **Step 5: Generate Report** – The Reporting Tool compiles all the user inputs and results into an editable report in Microsoft Word document format.

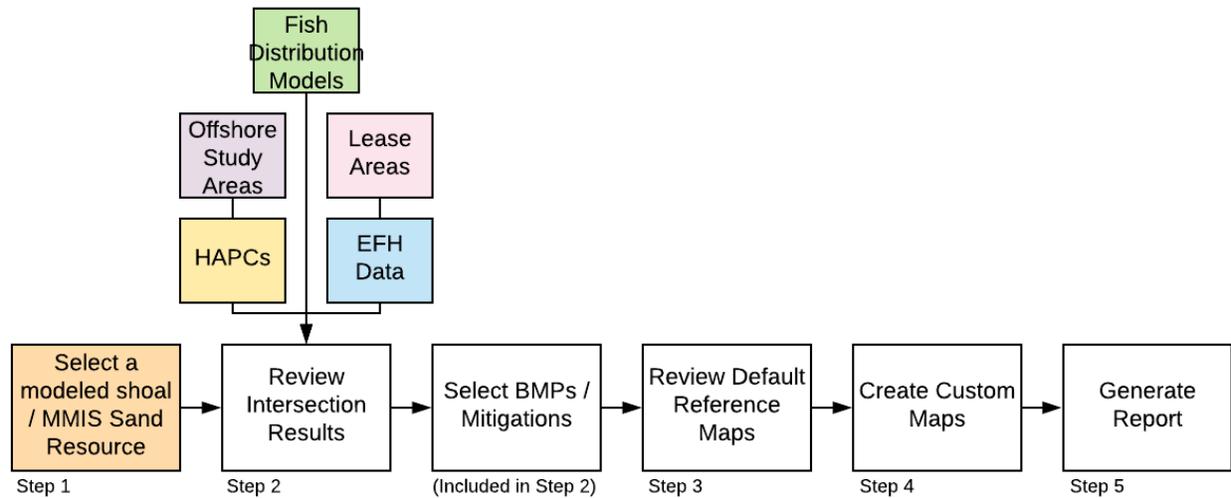


Figure 2-2. High-level workflow for the ShoalMATE application.

2.1 Data Development

To optimize the application’s processing time, an Extract-Transform-Load (ETL) script was developed utilizing Python to compile data layer values into a shoal feature class, which became the scale of analysis for the tool. The feature class is a combination of the modeled shoals developed as part of this project and existing Marine Minerals Sand Resources. The analysis area available for ShoalMATE (**Figure 2-3**) includes Federal waters of the OCS to a 50-m depth. This range was driven by the depth limitations of dredge operations. Because of the large area covered, this “canning” of the data allows for significant performance improvements over conducting the analyses on the fly with each run of the tool.

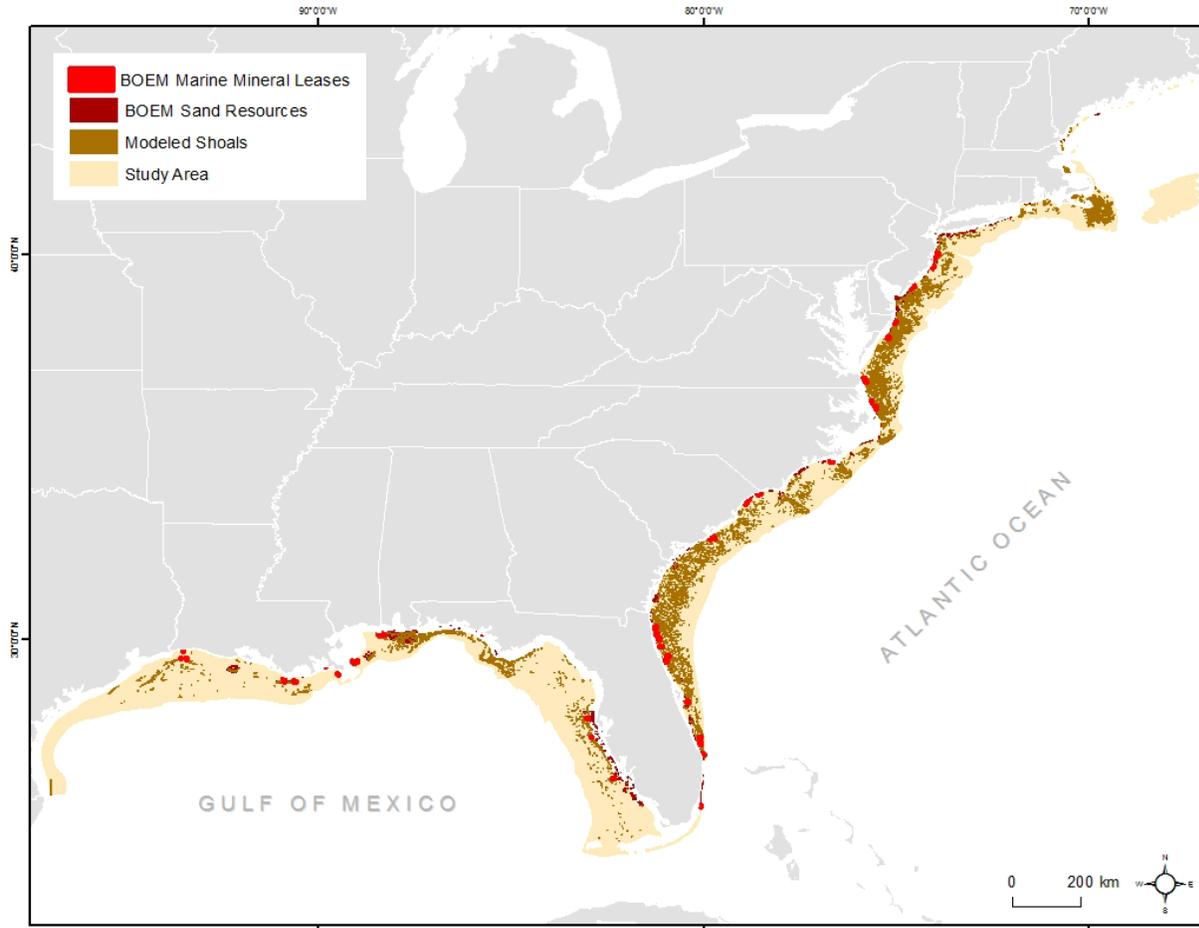


Figure 2-3. Extent of the ShoalMATE Tool represented in beige. Shoals and MMIS sand resources within this boundary are available for analysis within the tool.

Two primary categories of data exist within the ShoalMATE source database: vector data that characterizes presence, absence, or count of a seabed or political feature (e.g., seagrass or MMP leases) and continuous data (point and raster) that indicate a value (e.g., depth and SST).

For each shoal, the ETL performs one of two analyses on each data layer. For vector data, the script runs a spatial intersect and records the intersecting features as attributes for each shoal. For continuous data, a minimum, maximum, average or sum is calculated over the extent of the shoal and the value is stored as an attribute for each feature. This process was iterated for temporally discrete data layers so that an attribute exists for SST in January, SST in February, etc. The result is a set of over 10,000 shoals with a variety of information associated that can be used to describe the habitat of each one.

A second ETL was also developed to store the results of six intersections completed between individual shoals and six key datasets that provide critical information about a particular shoal's use (by fish species and humans) along with external resources to aid in further describing the shoal habitat in sufficient detail for meeting the requirements of a complete EFH Assessment. These results are presented in the tool and are populated in the generated report to resolve the requirements established in **Table 1-1** or to provide the user with additional resources to reference in the completion of the EFH Assessment document.

- **EFH Species Intersection** – Comparison between the shoal feature and the EFH polygons. Generates a list of species/life stage combinations that intersects with the shoal. Perform

additional analysis to rank the potential for a species/life stage to be impacted by dredge operations within a certain time frame. Assign a qualitative value of High, Medium, or Low to each combination based on if the shoal habitat meets the documented habitat preferences of the species/lifestage (**Figure 2-4**).

- **Predicted Relative Abundance Models Intersection** – Summarizes shoal features with fish and invertebrate species distribution models developed or acquired as part of this study. Reports values of predicted mean relative abundance within the shoal alongside the predicted mean abundance for the surrounding area (within 20 km) and predicted abundance within each species' geographic range within each region (e.g., Gulf of Mexico). In this way, the data shows the importance of the shoal in the context of other available habitat in the region.
- **Predicted Probability of Presence Models Intersection** – Summarizes shoal features with fish and invertebrate species distribution models developed or acquired as part of this study. Reports values of predicted probability of presence within the shoal alongside the predicted probability of presence for the surrounding area (within 20 km) and within each species' geographic range within each region (e.g., Gulf of Mexico). In this way, the data shows the importance of the shoal in the context of other available habitat in the region.
- **Habitat Areas of Particular Concern (HAPC) Intersection** – Knowing what, if any, HAPCs intersect the shoal will allow for additional consideration of those areas and the species that may be affected.
- **MMIS Lease Area Intersection** – The intersection of a shoal with a previous lease indicates that the shoal has likely been dredged in the past. Information on the volume removed and what is still available as well as information to direct the user to the lease documentation which may include prior EFH Assessments that can aid in the completion of the manual portions of the generated report. This table is empty if there has been no prior dredging at the site.
- **MMIS Study Intersection** – This intersection may provide additional resources the user can reference when developing the report. A list of BOEM-funded studies by the MMP is provided and a link to the reports are included if available.

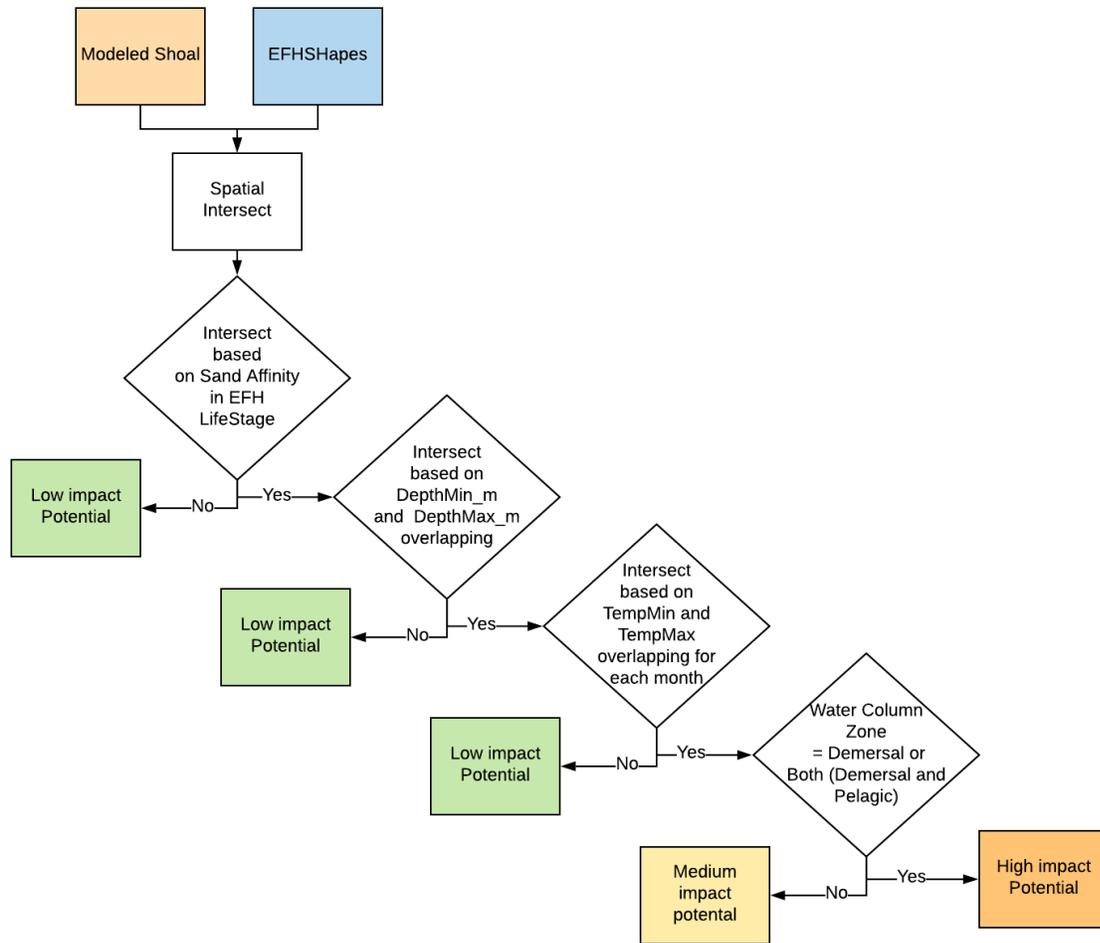


Figure 2-4. Impact potential logic.

Sand dredging impact potential for marine fish is assumed to be based on four main factors as depicted in the diagram: sand affinity, depth range, temperature range, and water column zone. The rankings result in either low, medium, or high potential impact.

A detailed user manual is provided in the Appendix, but a summary of the tool workflow is provided below.

2.2 Step 1 – Select Shoal

After initiating ShoalMATE, the user can zoom in to their AOI to select a shoal or sand resource of their choice. If multiple shoals are present where the user clicked, the user will have to specify by selecting one (**Figure 2-5**). The user must also select one or more seasons during which dredge is anticipated to occur.

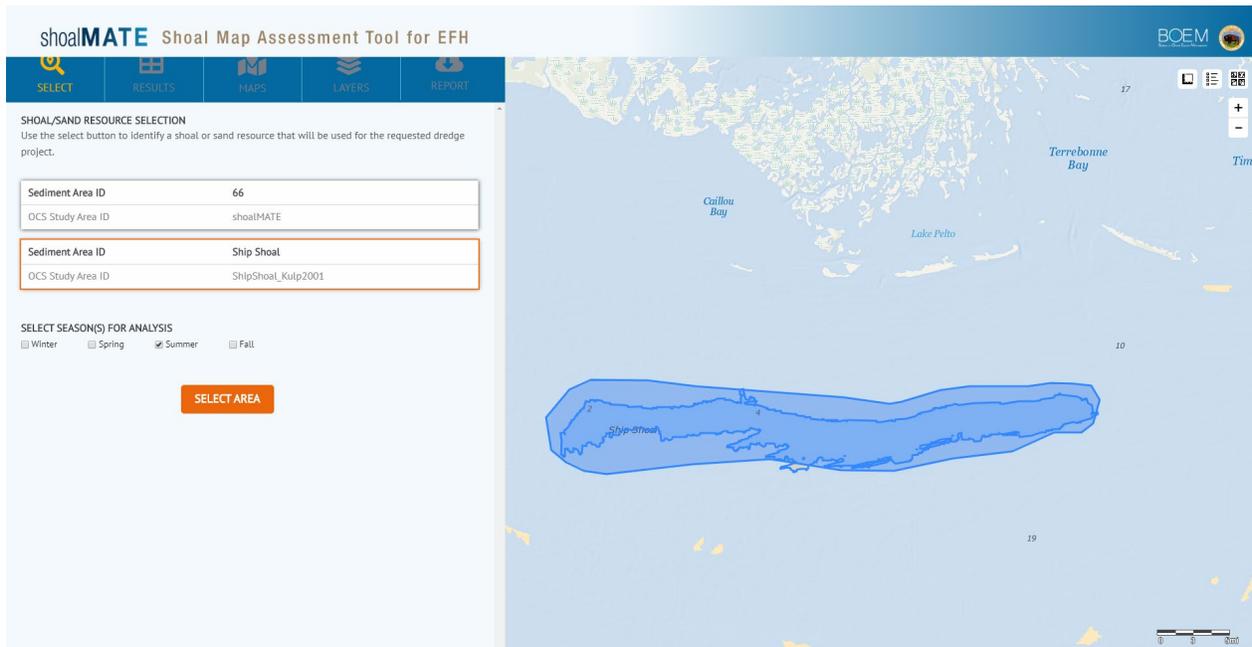


Figure 2-5. Selecting shoal/sand resource.

Available shoals in the selected area are shaded in blue. The shoal highlighted in orange on the left is the one selected for analysis during the summer season.

2.3 Step 2 – Review Results

Each “View” button will display the tabular information that will be carried into the generated report. The user can review this information before selecting mitigations and best management practices from the final “Continue” button. The tool provides a list of standard options that are found among the many existing EFH Assessment documents reviewed for this study (**Figure 2-6**). Several Best Management Practice (BMPs) and Mitigation Measure options have been included to capture past NOAA Conservation Recommendations, and these should be considered for each project.

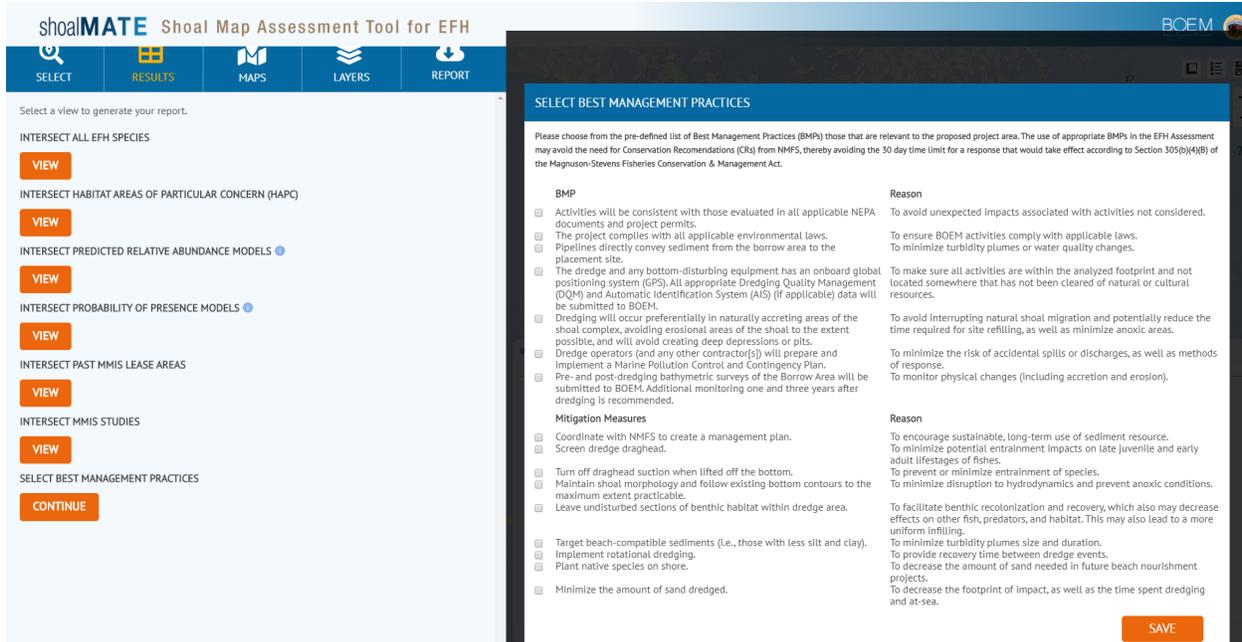


Figure 2-6. Pop up window for selecting BMPs and mitigation measures to be included in the report.

2.4 Step 3 – Review Maps

Step three of the workflow contains five preset maps (**Figure 2-7**) developed to meet the requirements of the EFH Assessment.

- 1) Overview Map – to provide a sense of location of the shoal
- 2) Bathymetry Map – to provide a view of the surrounding elevation as well as the prevailing current directions for the seasons selected at the start of the tool.
- 3) Substrate Map – to indicate the characteristics of the surrounding substrate and any substrate features that are known to influence fish distribution (e.g., artificial reef, oil platforms, natural reefs)
- 4) Accretion Map – for areas where two or more previous dredge events have occurred, accretion maps are generated by determining the difference between dredge events using pre- and post-dredge surveys. This allows some insight into how the area has recovered between events. Note that these data are still in prototype and not available in all dredged sites yet.
- 5) Dredge Exposure Map – displays in time units how long a dredge vessel was within an area. This data is currently only available for hopper dredges and is not available for all dredged sites.

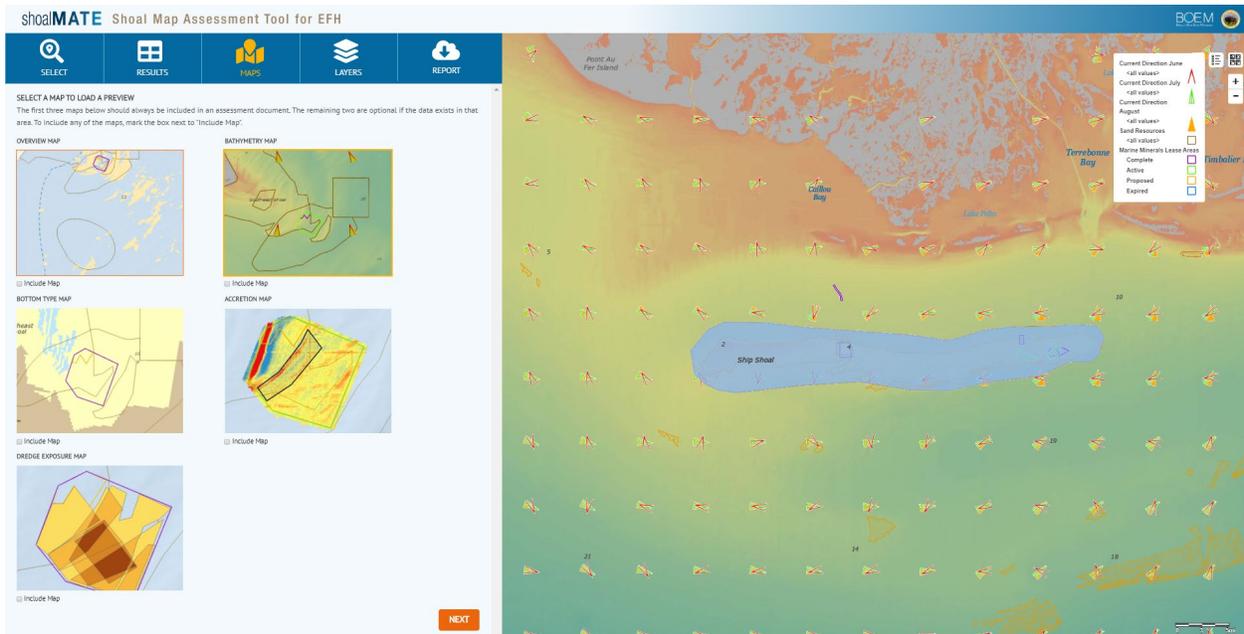


Figure 2-7. Selecting a map to load a preview.

(Left) Thumbnails of available preset maps. At a minimum, the overview, bathymetry, and bottom type maps should always be included. (Right) Bathymetry map with prevailing bottom current directions for summer months overlaid.

2.5 Step 4 – Create Custom Maps

Additional data sources accumulated for this project are also available to generate maps outside of the five default maps to include in the report. A selection of over 100 data layers are available to map. The user can create multiple custom maps (for individual species distributions, for instance) by saving them to the report and then clearing the layers and starting over (**Figure 2-8**).

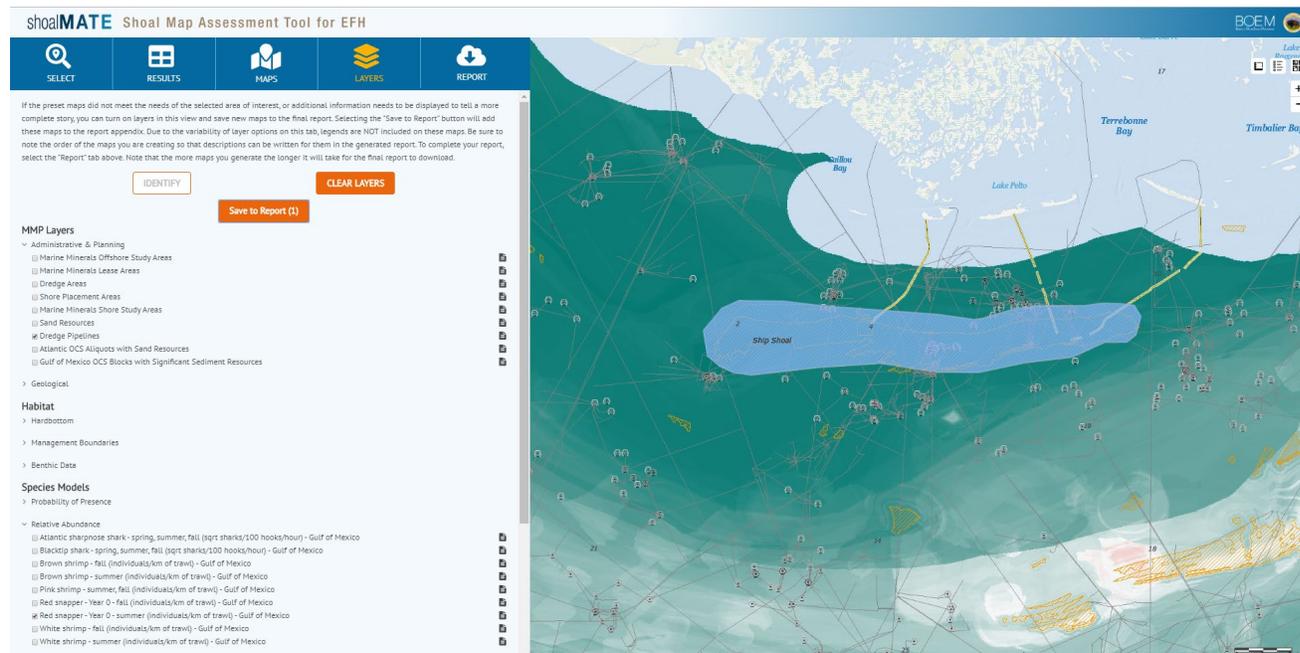


Figure 2-8. A custom map displaying juvenile red snapper relative abundance in relation to OCS drilling platforms and oil and gas pipelines.

2.6 Step 5 – Generate Report

User selections are stored throughout the run of the tool, so a report containing a summation of results can be generated upon completion (**Figure 2-9**). The report is exported as a Word document to be stored locally (**Appendix B: Example Report from ShoalMATE Reporting Tool**). The generated report is formatted and includes all information gathered from the tool. Within the report are additional prompts that users must manually complete to satisfy the remaining requirements for the EFH Assessment. Having a large portion of this information already identified via the intersection tables gives the user easy access to share it with planning partners.

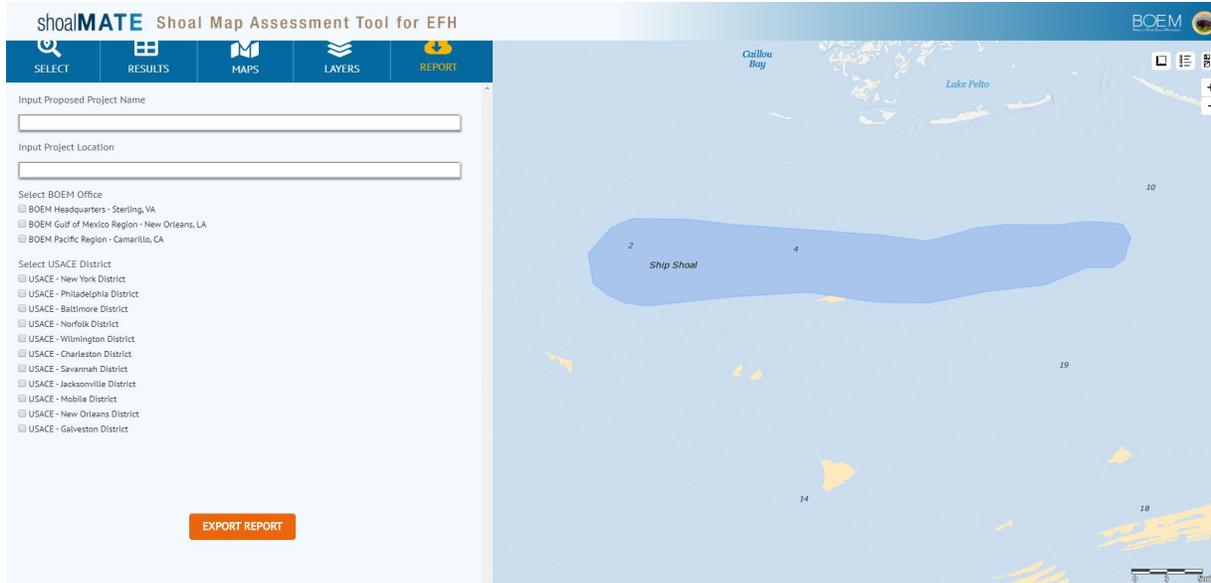


Figure 2-9. Preview of the report export page of the ShoalMATE tool.

2.7 Potential Improvements and Future Work

Through the course of development, new needs were generated that exceeded the scope and/or timeline of this project. The implementation of these needs would result in a more accurate and/or more robust tool and should be considered. A list of key suggestions is provided in **Table 2-1**.

Table 2-1. Suggested improvements to the ShoalMATE tool for future development

ID	Improvements	Logic	Effort
1	Create a user-friendly interface for the back-end data processing	To update the shoal feature class on regular intervals as new MMIS sand resources are identified, the ETL processes need to be re-run to include the new feature in the tool. Currently, the process is run through a series of Python scripts with minimal graphical user interface (GUI). Advanced users only should update the database.	Low
2	Incorporate additional project data	Identify how to incorporate cutter head dredge operations into the exposure raster generation process so that those maps can be completed. Determine workflows for fully developing the accretion rasters to make that information more widely available.	Medium
3	Add additional habitat descriptors to the report	Provide distance to hard bottom features in the study region.	Low

Appendix A: User Manual for ShoalMATE: Shoal Map Assessment Tool for EFH

The following pages contain the complete user manual for ShoalMATE. It is presented in original format to be consistent with the ShoalMATE reporting tool.



Reporting Tool User Manual

Authors: Emily Sandrowicz

Revision: 1.0, 9/16/2019



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1 Summary

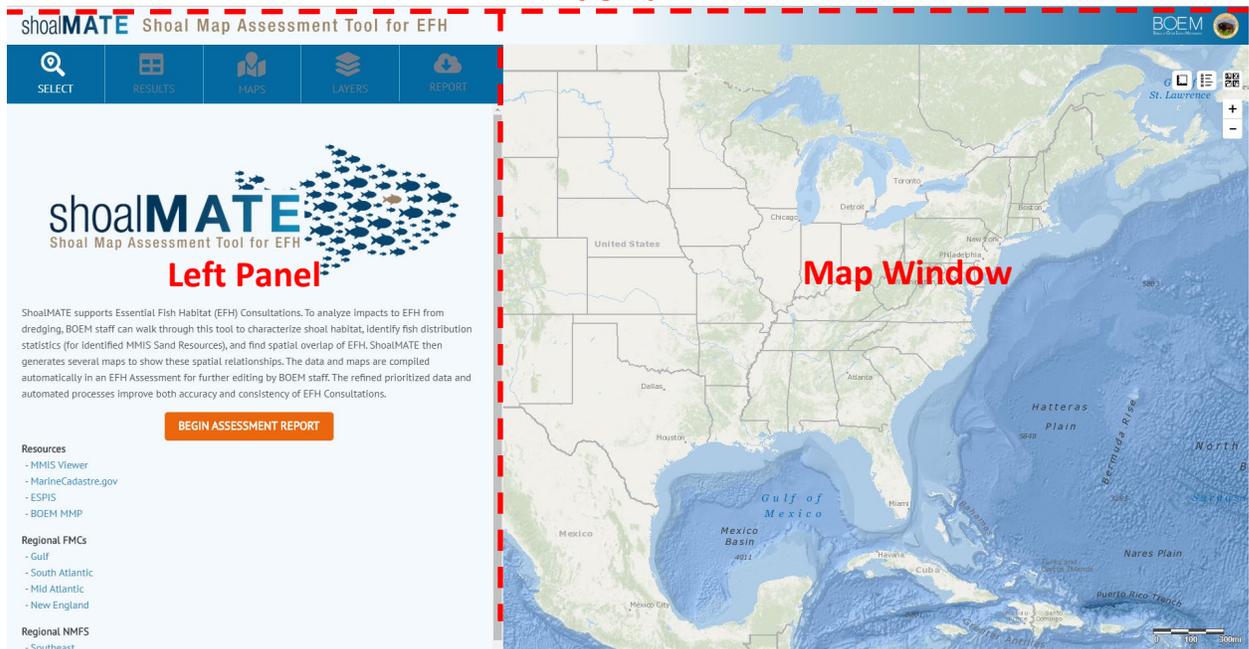
Quantum Spatial, Inc. (QSI) was contracted by the National Oceanic and Atmospheric Administration (NOAA), through an interagency agreement with the Bureau of Ocean Energy Management (BOEM), to develop an assessment tool that integrates multiple data sources within a simple and standardized user interface to support environmental assessments.

BOEM's Marine Minerals Program (MMP) is tasked with managing the use of marine minerals on the Outer Continental Shelf (OCS) in an environmentally responsible way. Through execution of this project, BOEM will develop a tool to help analyze the impact of dredging on Essential Fish Habitat (EFH). Such OCS sediment resource dredging projects are designed to support shore protection and coastal restoration projects along the Atlantic and Gulf of Mexico coasts. The purpose of the tool is to generate reports intended to assist in EFH consultations with the National Marine Fisheries Service (NMFS) by analyzing shoal habitat, identifying fish distribution statistics, and finding resulting overlap of EFH in a user-specified area and season. Information for this tool was gathered from EFH documentation, literature reviews, scientific models, readily available data sources, subject matter experts, and the MMIS.

This document contains information on how to use the Shoal Map Assessment Tool for EFH (shoalMATE) reporting tool. Also included is information on how to interpret the results and the logic that went into getting them.

2 Getting Started

1. Open a web browser from within the DOI network and navigate to <https://mmisdev.bc.doi.net/shoalMATE>. The shoalMATE homepage has three sections, the **Title Bar**, **Left Panel** and **Map Window**.



2. The **Title Bar** holds links to various webpages that users may find helpful.
 - a. Clicking on the shoalMATE Logo will return users to the shoalMATE home screen
 - b. Clicking on the BOEM or DOI Logo will open the respective entity's home page

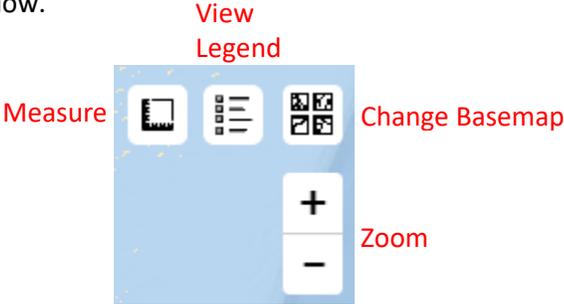


3. There are also links to other resources at the bottom of the **Left Panel**, including additional data portals, regional FMCs, and regional NMFSs.

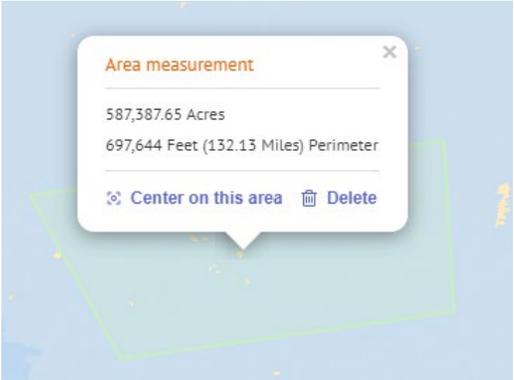
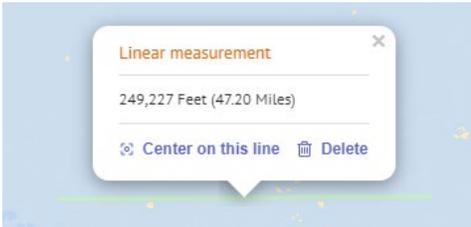
- Resources
 - MMIS Viewer
 - MarineCadastre.gov
 - ESPIS
 - BOEM MMP
- Regional FMCs
 - Gulf
 - South Atlantic
 - Mid Atlantic
 - New England
- Regional NMFS
 - Southeast
 - Greater Atlantic

2.1 Map Window

The **Map Window** displays the mappable area and also contains useful tools. Users can measure distances and areas, view the legend, switch the base map and zoom in/out with the tools in the top right corner of the Map Window.



1. To measure, select the white measuring square and click [Create a new measurement](#) from the popup.
2. Lines are measured by left clicking on the map where the desired measurement is to begin, then double-clicking where the line is to end.
3. Areas are measured in a similar manner, but with additional vertices added via left click in between the starting and ending points. Click again at the next point in the measurement.
4. Measurements are removed from the map by clicking the Delete icon in the measurement dialog box.



2.2 Left Panel

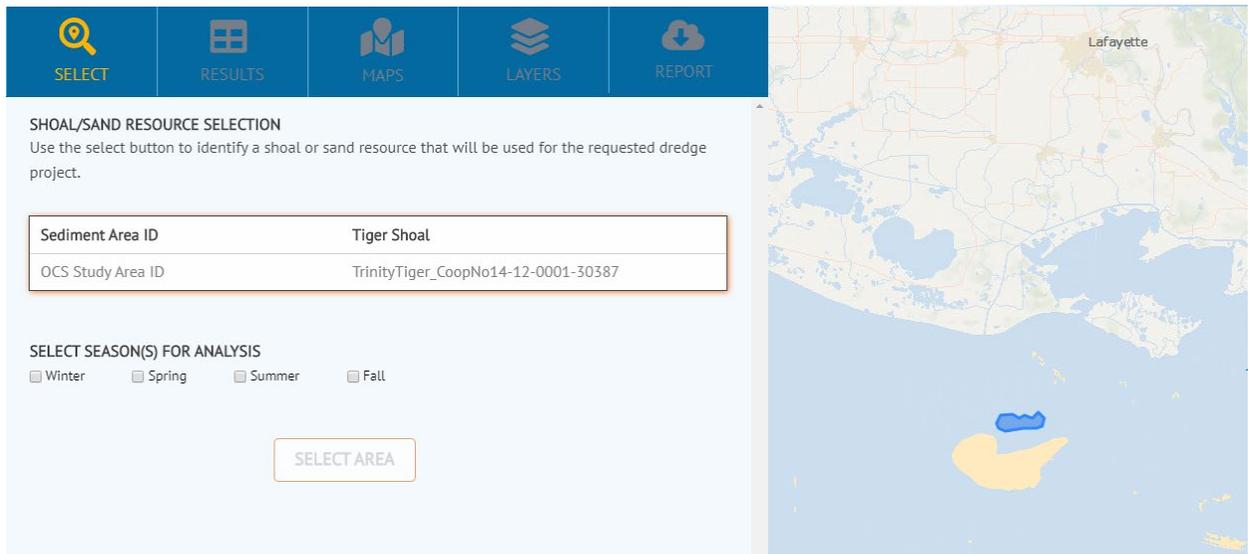
Users will be guided through the tabs on the **Left Panel** as they select criteria to customize their report.



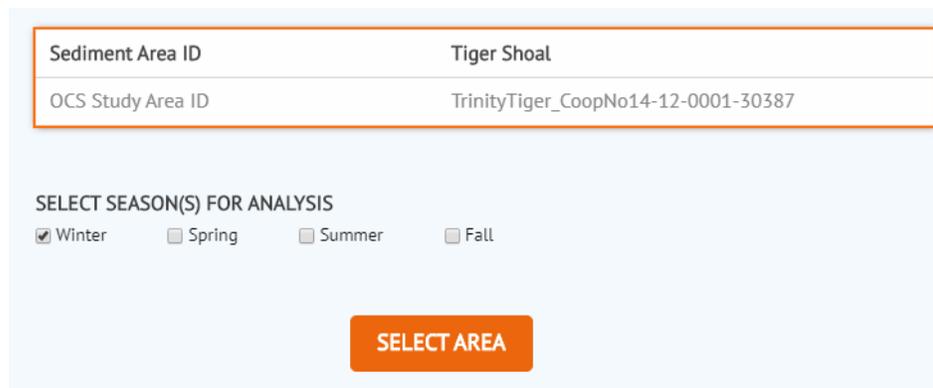
3 Generating Reports

3.1 SELECT Tab

1. Begin by clicking the **BEGIN ASSESSMENT REPORT** button on the **SELECT Tab** homepage.
2. Pan and zoom the map until the desired area is centered in the **Map Window**. Click on a shoal to view its details.

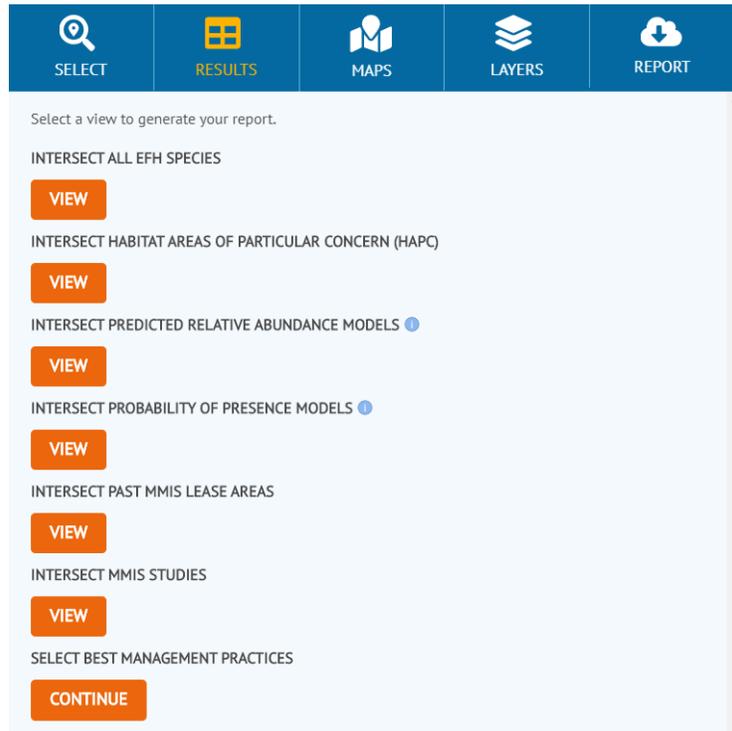


3. Select the shoal by clicking on the table containing the Sediment Area ID and the OCS Study Area ID. An orange border will appear around the selected table. Then, select which season(s) will be included in the analysis. This will affect data visible in the results table and maps. Once the selections are made, click the **SELECT AREA** button to advance to the **RESULTS Tab**. In this example Tiger Shoal and Winter have been selected.



3.2 RESULTS Tab

1. The **RESULTS Tab** provides access to 6 data tables and a list of Best Management Practices.



2. Each of the 6 result reports contains the subset of data from the stated source that intersects the selected shoal and season. For this example, by clicking on the **VIEW** button below the INTERSECT ALL EFH SPECIES heading, users can view all EFH Species that have the same spatial and/or temporal extent as Tiger Shoal during the winter.

INTERSECT ALL EFH SPECIES - Click table header to sort data

Species/CommonName	LifeStage	Season	TimeRange	WaterColumnZone	SandAffinity	DepthRange	ImpactPotential
Almaco Jack	Adults	Winter	unk	X			Low
Almaco Jack	Juveniles	Winter		X			Low
Atlantic Sharpnose Shark	Juveniles	All	X	X	X	X	High
Atlantic Sharpnose Shark	Neonate/NDY	All	X	X	X	X	High
Atlantic Sharpnose Shark	Adults	All	X	unk	X	X	Medium
Banded Rudderfish	Adults	Winter	unk		X		Low
Banded Rudderfish	Eggs	All	unk	unk	X		Low
Banded Rudderfish	Juveniles	Winter	unk		X		Low
Banded Rudderfish	Larvae	Winter	unk		X		Low
Banded Rudderfish	Spawning Adults	Winter	unk		X		Low
Black Grouper	Adults	All	X				Low
Black Grouper	Eggs	All	unk				Low
Black Grouper	Juveniles	Winter	unk	X		X	Low
Black Grouper	Larvae	All	unk				Low
Black Grouper	Spawning Adults	Winter		X			Low
Blackfin Snapper	Adults	Winter	unk	X	X		Low
Blackfin Snapper	Eggs	Winter	unk				Low
Blackfin Snapper	Juveniles	All	unk	X			Low
Blackfin Snapper	Larvae	All	unk	unk			Low
Blacktip Shark	Neonate/NDY	All	X	X	X	X	High
Blacktip Shark	Juveniles/Adults	All	X	unk	X	X	Medium
Blueline Tilefish	Adults	All	X	X			Low
Blueline Tilefish	Eggs	All	unk				Low

3. Clicking on the **CONTINUE** button below the SELECT BEST MANAGEMENT PRACTICES heading brings up a list of Best Management Practices (BMP) and Mitigation Measures and their associated reasons for implementation. Users will check the box next to the BMP and Mitigations Measures that are relevant to their project. Each checked box will trigger the inclusion of associated pre-written text about the BMP or Mitigation Measure in the final report. The use of appropriate BMPs and/or Mitigation Measures in the EFH Assessment may avoid the need for Conservation Recommendations (CRs) from NMFS.

SELECT BEST MANAGEMENT PRACTICES

Please choose from the pre-defined list of Best Management Practices (BMPs) those that are relevant to the proposed project area. The use of appropriate BMPs in the EFH Assessment may avoid the need for Conservation Recommendations (CRs) from NMFS, thereby avoiding the 30 day time limit for a response that would take effect according to Section 305(b)(4)(B) of the Magnuson-Stevens Fisheries Conservation & Management Act.

<p>BMP</p> <ul style="list-style-type: none"> <input type="checkbox"/> Activities will be consistent with those evaluated in all applicable NEPA documents and project permits. <input type="checkbox"/> The project complies with all applicable environmental laws. <input type="checkbox"/> Pipelines directly convey sediment from the borrow area to the placement site. <input type="checkbox"/> The dredge and any bottom-disturbing equipment has an onboard global positioning system (GPS). All appropriate Dredging Quality Management (DQM) and Automatic Identification System (AIS) (if applicable) data will be submitted to BOEM. <input type="checkbox"/> Dredging will occur preferentially in naturally accreting areas of the shoal complex, avoiding erosional areas of the shoal to the extent possible, and will avoid creating deep depressions or pits. <input type="checkbox"/> Dredge operators (and any other contractor[s]) will prepare and implement a Marine Pollution Control and Contingency Plan. <input type="checkbox"/> Pre- and post-dredging bathymetric surveys of the Borrow Area will be submitted to BOEM. Additional monitoring one and three years after dredging is recommended. <p>Mitigation Measures</p> <ul style="list-style-type: none"> <input type="checkbox"/> Coordinate with NMFS to create a management plan. <input type="checkbox"/> Screen dredge draghead. <input type="checkbox"/> Turn off draghead suction when lifted off the bottom. <input type="checkbox"/> Maintain shoal morphology and follow existing bottom contours to the maximum extent practicable. <input type="checkbox"/> Leave undisturbed sections of benthic habitat within dredge area. <input type="checkbox"/> Target beach-compatible sediments (i.e., those with less silt and clay). <input type="checkbox"/> Implement rotational dredging. <input type="checkbox"/> Plant native species on shore. <input type="checkbox"/> Minimize the amount of sand dredged. <input type="checkbox"/> Dredge over large, shallow areas rather than in deep pits. <input type="checkbox"/> Dredge shoal crests and higher areas of shoals. <input type="checkbox"/> Dredge shoals in <30 m depths. <input type="checkbox"/> Dredge shoals with Relative Shoal Height (defined as Height/Base Depth) of more than 0.5. 	<p>Reason</p> <p>To avoid unexpected impacts associated with activities not considered.</p> <p>To ensure BOEM activities comply with applicable laws. To minimize turbidity plumes or water quality changes.</p> <p>To make sure all activities are within the analyzed footprint and not located somewhere that has not been cleared of natural or cultural resources.</p> <p>To avoid interrupting natural shoal migration and potentially reduce the time required for site refilling, as well as minimize anoxic areas.</p> <p>To minimize the risk of accidental spills or discharges, as well as methods of response.</p> <p>To monitor physical changes (including accretion and erosion).</p> <p>Reason</p> <p>To encourage sustainable, long-term use of sediment resource. To minimize potential entrainment impacts on late juvenile and early adult lifestages of fishes.</p> <p>To prevent or minimize entrainment of species. To minimize disruption to hydrodynamics and prevent anoxic conditions.</p> <p>To facilitate benthic recolonization and recovery, which also may decrease effects on other fish, predators, and habitat. This may also lead to a more uniform infilling.</p> <p>To minimize turbidity plumes size and duration. To provide recovery time between dredge events. To decrease the amount of sand needed in future beach nourishment projects.</p> <p>To decrease the footprint of impact, as well as the time spent dredging and at-sea.</p> <p>To decrease the potential for anoxic areas. To facilitate more rapid sediment reworking and site infilling. To facilitate regrowing after dredging. To facilitate regrowing after dredging.</p>
--	--

Users also have the option to compose their own BMP for inclusion in the report at the bottom of the page. Scroll down to access this section. Click the **SAVE** button when complete.

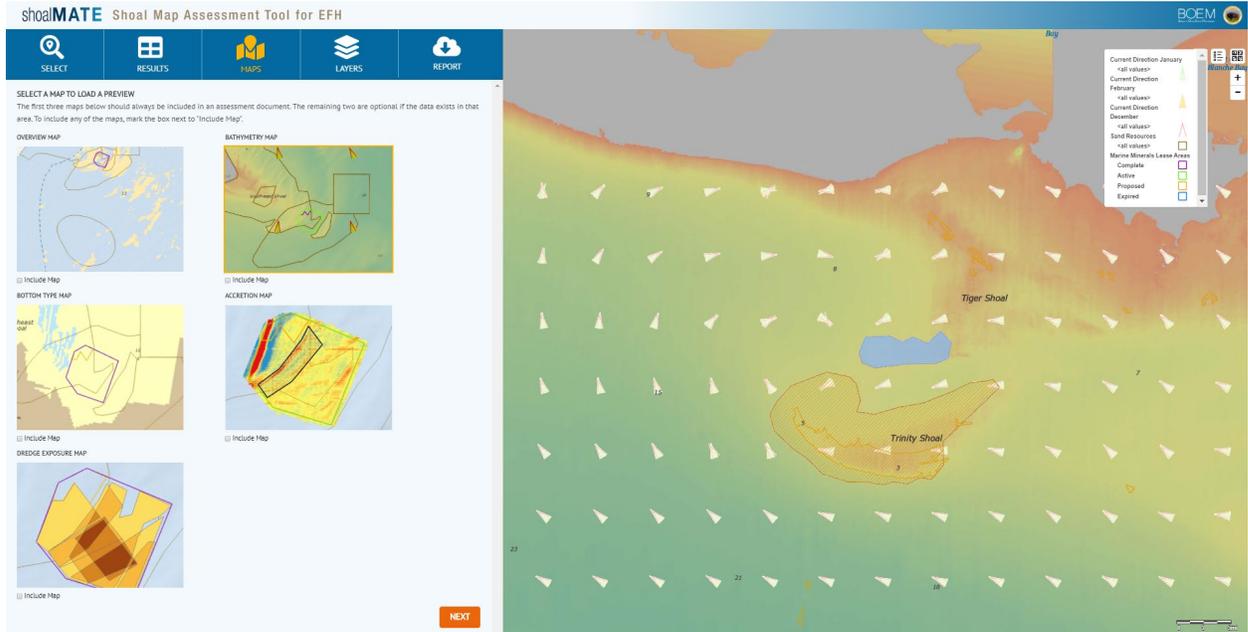
Add New Best Management Practice

SAVE

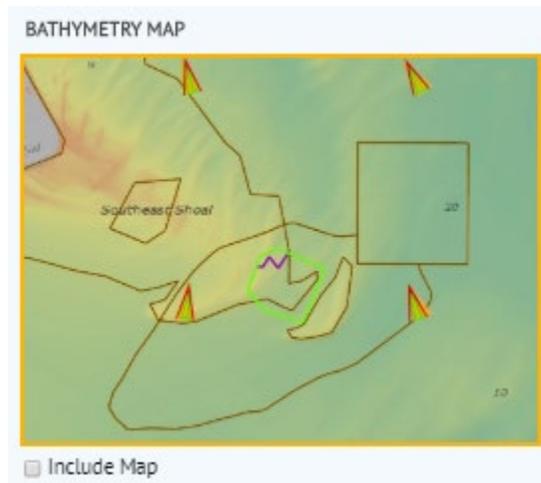
3.3 MAPS Tab

The **MAPS Tab** allows users to view 5 pre-defined map products and select which, if any, will be included in their report.

1. Clicking on a map's thumbnail image displays a preview of the map in the Map Window. When activated, an orange border will appear around the thumbnail.



2. To include a map in the final report, check the INCLUDE MAP box below the appropriate thumbnail.



3. Currently the Accretion Map and Dredge Exposure Map are still under development and will not yield any data for display.

3.4 LAYERS Tab

The **LAYERS Tab** enables users to create their own cartographic products for inclusion in their final report. This functionality should be used when the preset maps available on the MAPS Tab do not meet all of the needs of the selected area of interest, or if additional information would be helpful in telling a more complete story.

The **IDENTIFY** button provides additional information on the features in the available layers.

1. Expand the Administrative and Planning dataset by clicking on the arrow next to the heading. Then, check the box next to Marine Minerals Offshore Study Areas.
2. Activate the tool by clicking on the **IDENTIFY** button.
3. Click on Tiger Shoal in the Map Window. Information on the shoal and the overlapping Marine Minerals Offshore Study Areas will appear in a Results window.

The screenshot shows the software interface with the **LAYERS** tab selected. On the left, a list of layers is shown under 'MMP Layers', with 'Marine Minerals Offshore Study Areas' checked. The map displays the Gulf of Mexico with 'Tiger Shoal' and 'Trinity Shoal' highlighted in yellow. Below the map, the 'Identify Results' window is open, displaying two tables:

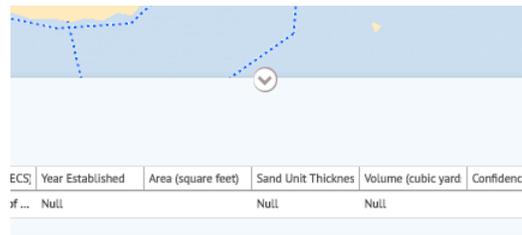
EFH Shoals											
OCS Study Area ID	Sediment Area ID	State	EcolRegion (EMEC)	Year Established	Area (square feet)	Sand Unit Thickness	Volume (cubic yard)	Confidence	Depth Min (meters)	Depth Max (meters)	Feature Orientation
TrinityTiger_Corp...	Tiger Shoal	LA	Northern Gulf of ...	NAI	NAI	NAI	NAI	NAI	-6	-5	86.0527129125

Marine Minerals Offshore Study Areas			
Global Link ID	State	OCS Study Area ID	Year
(E7FB0489-048A-4185-9980-2459C8518956)	LA	TrinityTiger_CorpHCS14-12-0001-10387	NAI
(F675A20E-985D-400C-9F8F-578EC90AEAC)	NAI	GulfOfMexico_NHPS-SEFSC-483_N	2002
(D9132C418-43EE-4765-8121-0A213D2618C8)	LA	OffshoreLA_LAC05531983_4	1983

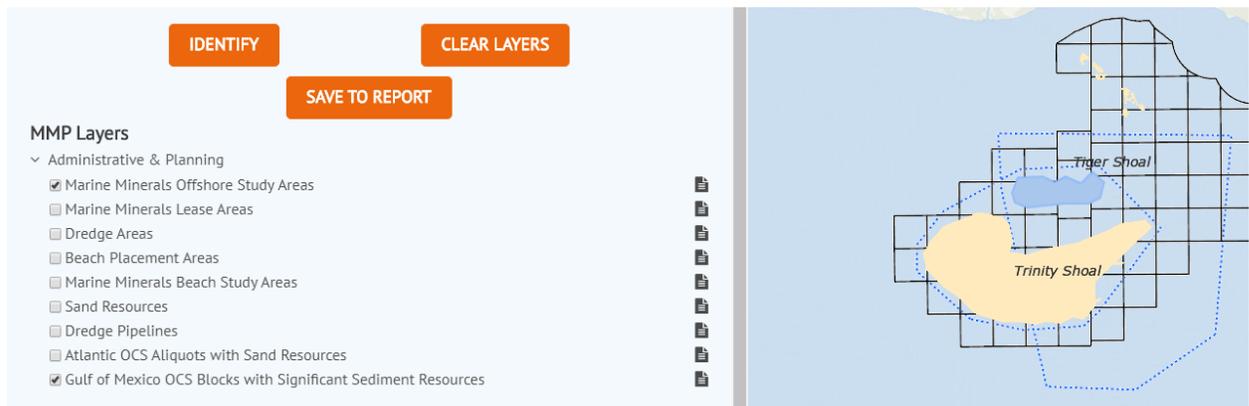
4. **Metadata** for each layer can be accessed by clicking on the metadata icon  next to the layer name when available. Some layers were provided by individual communication and do not contain complete FGDC metadata.

Users can create multiple maps for inclusion in the report, each showing one or more layers, with the use of the **SAVE TO REPORT** and **CLEAR LAYERS** buttons.

- Minimize the Identify Results by clicking on the down arrow in the top center of the window.



- Turn on the Gulf of Mexico OCS Blocks with Significant Sediment Resources by checking the box next to the layer.
- Click the **SAVE TO REPORT** button to export a map with the selected layers to the final report.



- Click the **CLEAR LAYERS** button to deactivate all selected layers and return to a blank map.



- Continue creating and exporting additional maps as desired in this fashion. A count of custom maps is noted on the **SAVE TO REPORT** button. Importantly, the user should keep a chronological record of the layers included in each custom map. Due to the variability of layer combinations a legend is not included in the exported map and the user will have to describe the map contents in the caption.

NOTE: The more custom maps that are saved to the report the longer the final export of the report will take.

3.5 REPORT Tab

Additional formatting can be added on the **REPORT Tab**.

1. Type the appropriate information in the Input Proposed Project Name and Input Project Location fields. The tool will automatically enter these values on the title page and at other predetermined locations in the final report.
2. Select the BOEM Office(s) and, as applicable, USACE District(s) involved in the project from the available lists. The tool will add the appropriate office addresses to the title page of the report based on these selections.

Input Proposed Project Name
Test Project

Input Project Location
Tiger Shoal

Select BOEM Office

- BOEM Headquarters - Sterling, VA
- BOEM Gulf of Mexico Region - New Orleans, LA
- BOEM Pacific Region - Camarillo, CA

Select USACE District

- USACE - New York District
- USACE - Philadelphia District
- USACE - Baltimore District
- USACE - Norfolk District
- USACE - Wilmington District
- USACE - Charleston District
- USACE - Savannah District
- USACE - Jacksonville District
- USACE - Mobile District
- USACE - New Orleans District
- USACE - Galveston District

Essential Fish Habitat
Assessment for

Test Project
Tiger Shoal
2019-09-1d

Prepared by

BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

45400 Woodland Rd
Sterling, VA 20166

USACE - New York District
26 Federal Plaza
New York, NY 10278

USACE - Philadelphia District
The Wissinaker Building 100 Penn Square East
Philadelphia, PA 19107

3. Click the **EXPORT REPORT** button to create the final report in .doc format.

4. The report will be populated with all the information selected on the previous tabs. However, there are some sections that will need to be populated manually after the report is created, such as the opening paragraph of the Introduction Section shown here.

I. Introduction

[The following information should be input manually:

- *Description of why project is proposed/why they need sand on the beach.*
- *Brief description of past projects, if any. This section is expanded on in Section 3.*
- *Who prepared this assessment and why ([1 paragraph](#))*
- *Description of the physical location of the project and coastal features that it is most adjacent to. This section is expanded on in Section 3.]*

See Maps 1-3 for more information on the proposed borrow area and its surrounding environment including bathymetry, bottom currents, and seafloor substrate.

Additional information regarding the proximity of the proposed project to features of interest not covered in this report can be obtained through BOEM and NOAA's Ocean Reporting Tool (NOAA 2018b).

5. Do a document search for brackets ([]) to ensure all manual portions of the report have been addressed.
6. Remove any default map captions that were not selected for inclusion in the report.
7. Appendix A of the report contains the variables utilized in the species models associated with the region of the selected feature
8. Appendix B includes all custom maps.

Appendix B: Example Report from ShoalMATE Reporting Tool

The following pages contain an example EFH assessment report from ShoalMATE. It is presented in original format to be consistent with the ShoalMATE reporting tool.

Essential Fish Habitat Assessment for

Sand Dredging Test1

2019-12-19

Prepared by



45600 Woodland Rd
Sterling, VA 20166

USACE - Wilmington District
69 Darlington Ave
Wilmington, NC 28403

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Appendix B: Custom Maps.....	Error! Bookmark not defined.

[Table of Contents may need to be updated after export and editing of this report.]

List of Abbreviations and Acronyms

BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
cm	centimeter(s)
CMECS	Coastal and Marine Ecological Classification Standard
cy	cubic yards
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
FMC	Fisheries Management Council
FMP	Fisheries Management Plan
ft	foot/feet
GOM	Gulf of Mexico
in	inch(es)
km	kilometer
m	meter(s)
m ³	cubic meters
mm	millimeter(s)
MMP	Marine Minerals Program
MSFCMA	Magnuson-Stevens Fisheries Conservation & Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ppt	parts per thousand
TSS	total suspended sediments
SS	suspended sediments
unk	unknown
USACE	U.S. Army Corps of Engineers

I. Introduction

[The following information should be input manually:

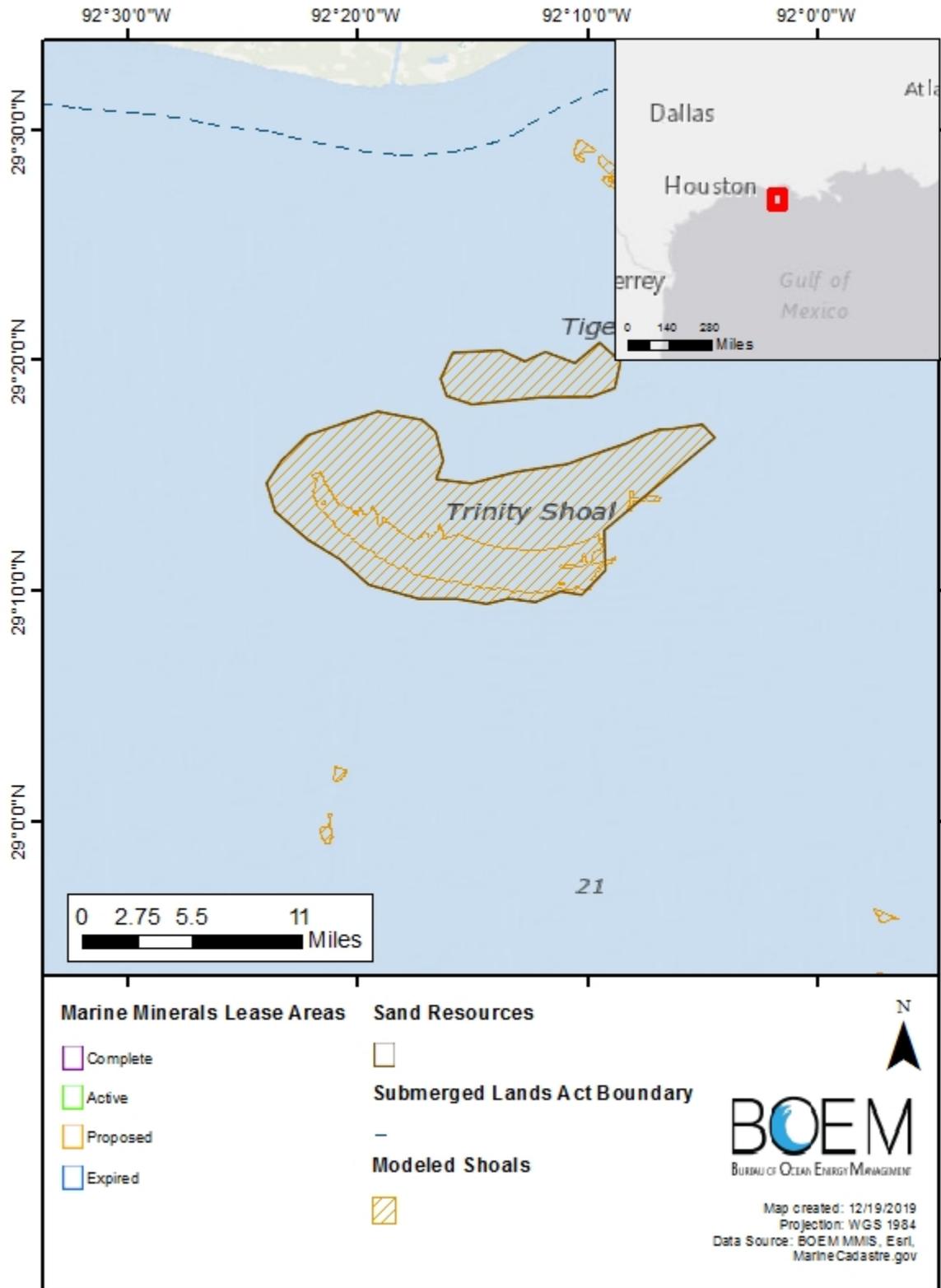
- *Description of why project is proposed/why they need sediment on the beach.*
- *Brief description of past projects, if any. This section is expanded on in Section 3.*
- *Who prepared this assessment and why (1 paragraph)*
- *Description of the physical location of the project and coastal features that it is most adjacent to. This section is expanded on in Section 3.]*

See Maps 1-3 for more information on the proposed borrow area and its surrounding environment including bathymetry, bottom currents, and seafloor substrate.

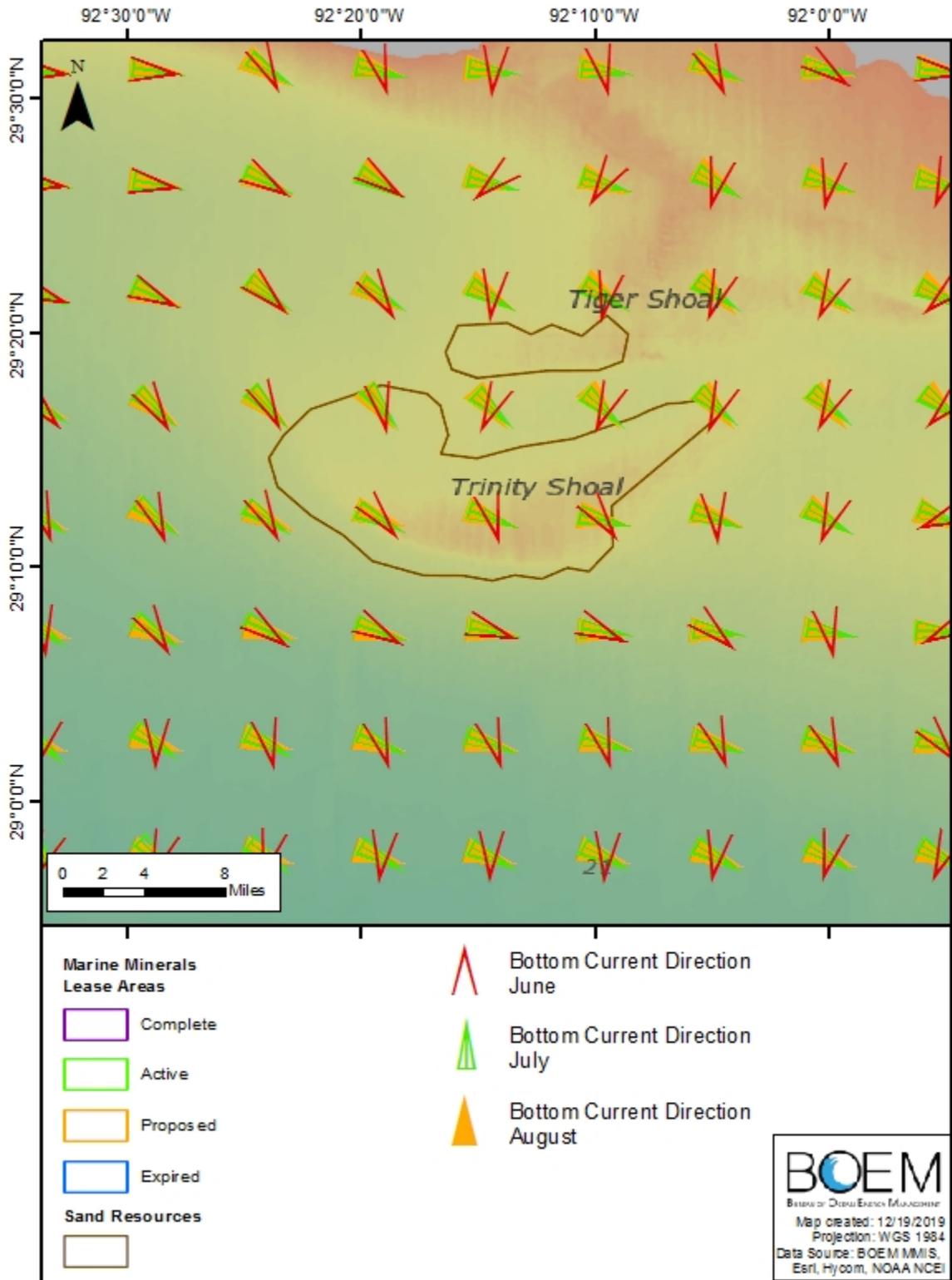
Additional information regarding the proximity of the proposed project to features of interest not covered in this report can be obtained through BOEM and NOAA's Ocean Reporting Tool (NOAA 2018b).

[If Maps 1-3 do not all exist, edit the above reference and the map headers below as applicable.]

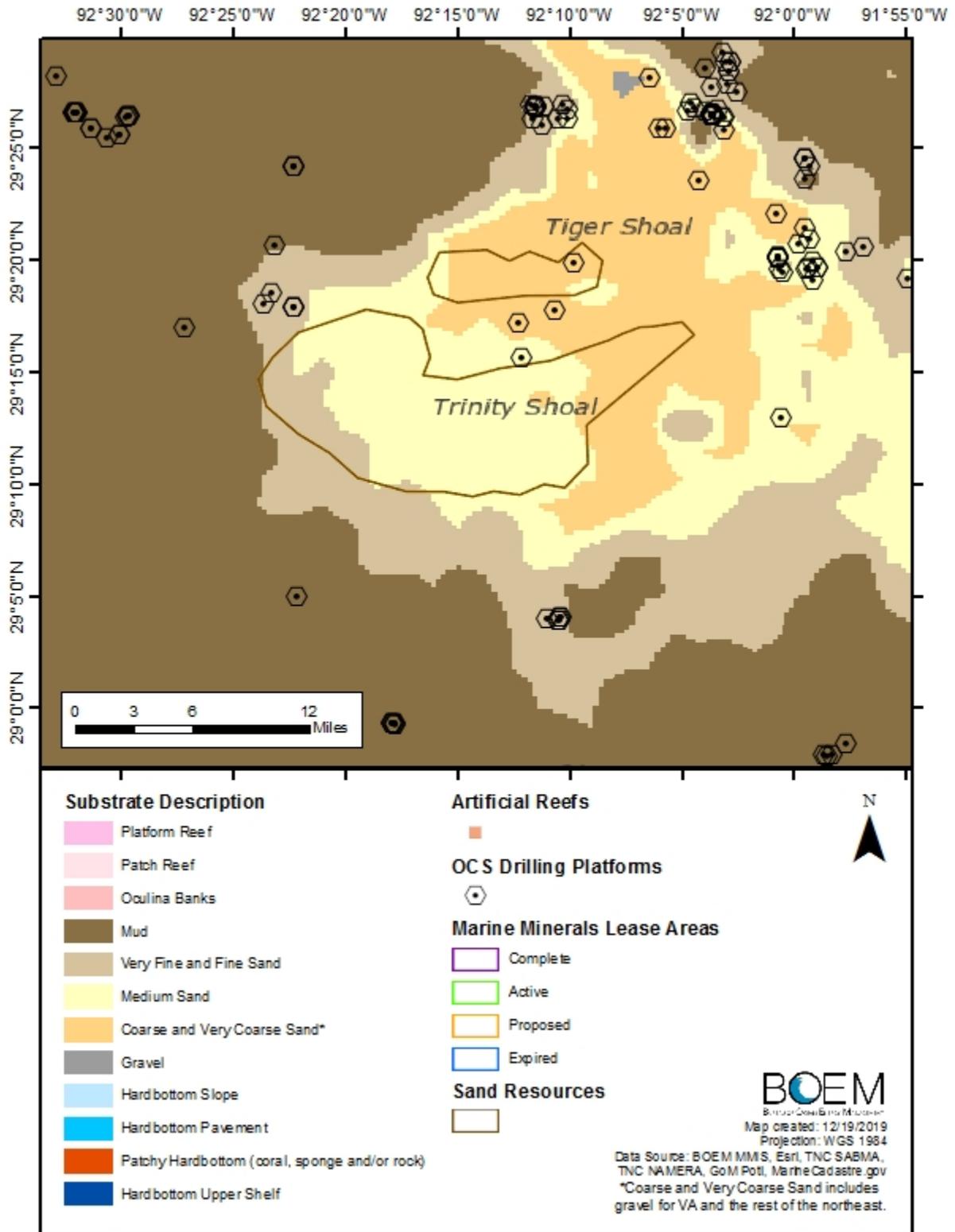
Map 1: Proposed Project Area



Map 2: Bathymetry and Bottom Currents



Map 3: Proposed Borrow Area and Surrounding Benthic Substrate



II. Purpose

Provisions of the MSFCMA (16 USC 1801) require that EFH areas be identified for each species managed under a fishery management plan, and that all Federal agencies consult with the NMFS on all Federal actions that may adversely affect EFH. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity.” This EFH assessment is being prepared pursuant to Section 305(b)(2) of the MSFCMA and includes the following required parts: 1) identification of species of concern; 2) a description of the proposed action; 3) an analysis of the effects of the proposed action; 4) proposed mitigation; and 5) the Federal agency’s views regarding the effects of the proposed action. The purpose of this consultation process is to address specific federal actions that may adversely affect EFH, but do not have the potential to cause substantial adverse impact.

III. Proposed Project

[The following information should be input manually:

- *How many cubic yards (cy) of sediment are to be removed.*
- *Location of removal on the shoal/sediment resource. ‘Leeward’ vs. ‘windward’ side; cardinal direction; relation of removal location to other prominent features on the landscape.*
- *What equipment will be used. Type of dredge. Buoys/pump-out stations used? Pipelines for pump outs on shore used? Bulldozers and/or graders used on the shore?*
- *What type of sediment is going to be mined. CMECS description.*
- *When sediment is proposed to be mined. Months or season.*
- *If applicable, Alternative A*
- *If applicable, Alternative B*
- *If applicable, more Alternatives (C-Z)]*

The selected borrow area, which has been allocated for sediment extraction for this project, is in the NGM ecoregion as defined by CMECS. This sediment feature ranges in depth from 3.0m (9.84ft) to approximately 10.0m (32.8ft). It is classified under CMECS as Geoform Component (GC) Origin None. The predominant CMECS classification for the material contained within this feature is Substrate Component (SC) Origin Geologic, SC Class Unconsolidated Mineral, SC Subclass Fine Unconsolidated. For additional CMECS variables that define this resource please see Table 1.

Table 1: Classification and values associated with the proposed borrow area (modified from CMECS)

Attribute	Value	Unit	Classification
Magnitude of Bottom Current - June	0.0614551168677	m/s	
Magnitude of Bottom Current - July	0.0683867815434	m/s	
Magnitude of Bottom Current - August	0.0630514614566	m/s	
Rugosity	1.0		
Slope Range	0.0 - 0.5	Degrees	
Substrate Descriptor			unk
Surface Pattern			
Orientation	272.2838978287	Degrees	
Shelf Position			unk
Accretion Status			unk
Bathymetric Position Index (BPI)	1.04		
Temporal Persistence			unk
Disturbance Regime			unk
Dissolved Oxygen Minimum	4.3911190033	mg/L	
Temperature Range	15.6353683472 - 30.4577026367	Degrees C	
Anthropogenic Impact			unk

[More information about the resource, if available. Eg. Description of surrounding area, prevalent underwater features nearby, anthropogenic features nearby, results of video surveys, accretion studies, or other types of studies potentially derived from studies provided in Table 2.] Additional information relevant to this sediment resource may be available from past studies (see Table 2 for further details).

[Any information on species known to use the resource, with focus on species that need the seafloor habitat(s) for one or more life stages. E.g. Number of species (fish, marine mammals, sea turtles).]

Table 2: MMIS Studies overlapping the proposed borrow area

Study ID	Report Link
OffshoreLA_LACOSS1983_4	Geophysics Log; LACOSS IV
GulfofMexico_NMFS-SEFSC-483_N	Compilation of Data Sets Relevant to the Identification of Essential Fish Habitat on the Gulf of Mexico Continental Shelf and for the Estimation of the Effects of Shrimp Trawling Gear on Habitat
TrinityTiger_CoopNo14-12-0001-30387	Assessment of Sand Resources in the Trinity Shoal Area

Previous dredging in this area has occurred 0 times between 10000 and 0. Over that time, 0 cy (0.0 m³) of material has been removed for beach nourishment projects. See Table 3 for further information, including links to associated BOEM documents. Map 4 shows the amount of accretion that has occurred between the previous two dredge events. The raster was calculated by subtracting the pre-dredge survey from the most recent dredge event from the post-dredge survey of the second most recent event. The result is the change in elevation, in meters, between the two projects which may be used as an indicator of the recovery potential of the sediment resource after construction.

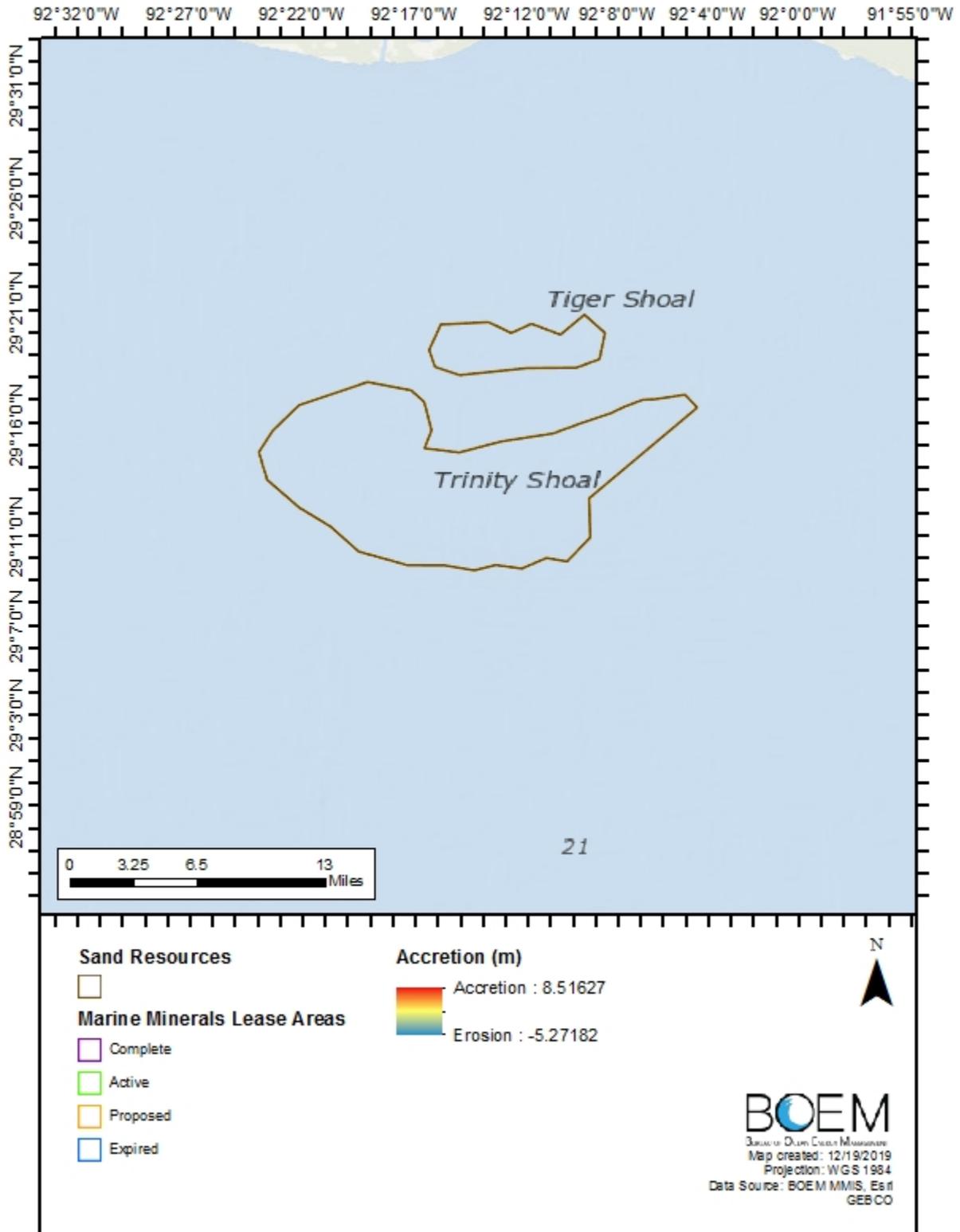
Sediment resources within a 3 km radius of the proposed project cover <area of sand resources in a 3 km radius>. Of that area, <area dredged> have previously been mined. This accounts for <x>% of the sediment resources within a 3 km radius of the proposed burrow area.

[If Map 4 does not exist, edit the text above.]

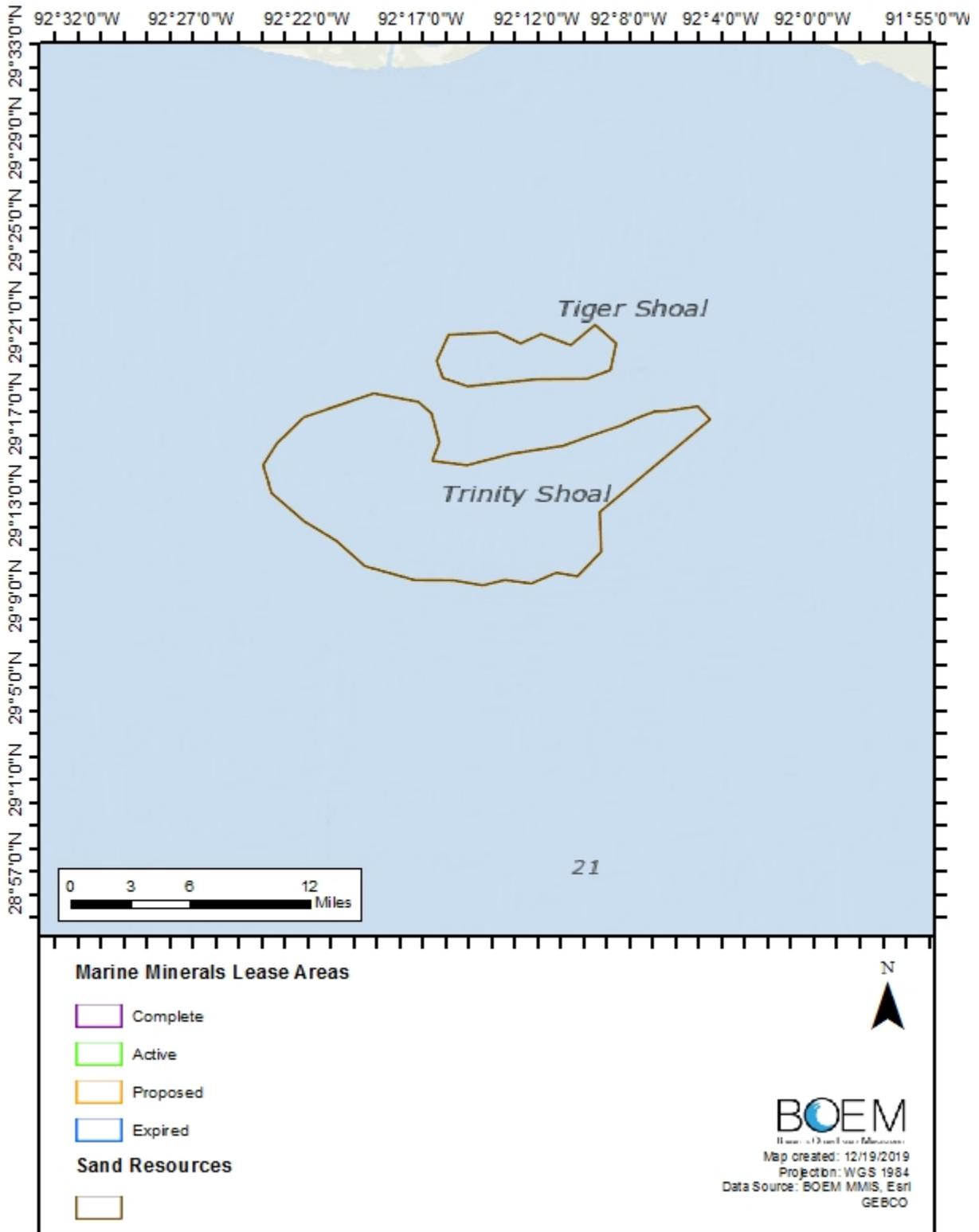
Table 3: Past Dredging Projects- No Results Found

Lease #	Volume allocated (cy)	Volume dredged (cy)	Fiscal Year	BOEM Web Link	EA	FONSI	EIS	ROD	NEPA
---------	-----------------------	---------------------	-------------	---------------	----	-------	-----	-----	------

Map 4: Sediment Accretion in Proposed Borrow Area, <Fiscal Year - 2>-<Fiscal Year - 1>



Map 5: Past Dredge Events in Proposed Borrow Area



[Delete the Map headings above if not applicable.]

Results of On-Site Inspection, if applicable.

Views of recognized experts on the habitat or species that may be affected, if applicable.]

IV. Identification of Managed Species

Table 4: Essential Fish Habitat species and life stages that overlap the proposed borrow area. Information in this table was gathered from official EFH documentation when available or other well recognized studies of sand affinity (noted in the shoalMATE study report). X's indicate that the proposed area matches the habitat criteria for the species/life stage combination to determine the possibility that a species/life stage with an overlapping EFH polygon may utilize the proposed area. The use of "unk" indicates that the habitat parameter was not defined for that species/lifestage combination in the documentation and is treated as a match to indicate that particular care should be taken in researching the impacts on these species. An "X" in the Water Column Zone field indicates the species is known to be demersal for some portion of that lifestage (as opposed to pelagic). The impact potential is a qualitative assessment based on the combination of results for the four parameters (defined in the shoalMATE study report).

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Atlantic Sharpnose Shark	Neonate/YOY	All	X	X	X	X	High
Atlantic Sharpnose Shark	Mating/Birthing	Summer	unk	unk	X	unk	High
Atlantic Sharpnose Shark	Juveniles	All	X	X	X	X	High
Atlantic Sharpnose Shark	Adults	All	X	unk	X	X	High
Banded Rudderfish	Eggs	All	unk	unk	X	X	High
Blacktip Shark	Neonate/YOY	All	X	X	X	X	High
Blacktip Shark	Juveniles;Adults	All	X	unk	X	X	High
Bonnethead Shark	Neonate/YOY	Summer	X	unk	X	X	High

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Bonnethead Shark	Juveniles	Summer	X	unk	X	X	High
Bonnethead Shark	Adults	Summer	X	unk	X	X	High
Bull Shark	Neonate/YOY	All	X	X	X	X	High
Bull Shark	Juveniles;Adults	All	X	unk	X	X	High
Gag	Juveniles	Summer	X	X	X	X	High
Gray Snapper	Spawning Adults	Summer	unk	X	X	X	High
Gray Snapper	Juveniles	All	X	X	X	X	High
Gray Snapper	Adults	All	X	X	X	X	High
Gray Triggerfish	Spawning Adults	All	unk	X	X	unk	High
Gray Triggerfish	Juveniles	All	unk	X	X	X	High
Gray Triggerfish	Eggs	Summer	unk	X	X	X	High
Gray Triggerfish	Adults	All	unk	X	X	X	High
Lane Snapper	Larvae	Summer	X	X	X	X	High
Lane Snapper	Juveniles	Summer	X	X	X	X	High
Lane Snapper	Adults	All	X	unk	X	X	High
Red Drum	Spawning Adults	Summer	X	unk	X	unk	High
Red Drum	Larvae	Summer	X	X	X	unk	High
Red Drum	Adults	Summer	X	unk	X	X	High

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Red Grouper	Juveniles	All	X	X	X	X	High
Red Grouper	Adults	All	X	X	X	X	High
Red Snapper	Adults	Summer	X	X	X	X	High
Spinner Shark	Spawning Adults	Summer	unk	unk	X	unk	High
Spinner Shark	Neonate/YOY	All	X	unk	X	unk	High
Spinner Shark	Juveniles	All	X	unk	X	X	High
Spinner Shark	Adults	All	unk	unk	X	X	High
Almaco Jack	Spawning Adults	Summer	unk	unk		unk	Low
Almaco Jack	Juveniles	Summer	X	X		X	Low
Almaco Jack	Eggs	Summer	unk			unk	Low
Almaco Jack	Adults	Summer	unk	X			Low
Black Grouper	Larvae	All	unk			X	Low
Black Grouper	Juveniles	Summer	unk	X		X	Low
Black Grouper	Eggs	All	unk				Low
Black Grouper	Adults	All	X			X	Low
Blackfin Snapper	Spawning Adults	Summer	unk	X			Low
Blackfin Snapper	Larvae	All	unk	unk			Low
Blackfin Snapper	Juveniles	All	unk	X		X	Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Blackfin Snapper	Eggs	Summer	unk				Low
Blackfin Snapper	Adults	Summer	unk	X	X		Low
Blueline Tilefish	Spawning Adults	Summer		unk			Low
Blueline Tilefish	Larvae	All	unk				Low
Blueline Tilefish	Juveniles	All	unk	unk			Low
Blueline Tilefish	Eggs	All	unk				Low
Blueline Tilefish	Adults	All	X	X			Low
Brown Shrimp	Sub-adults	Summer		X		X	Low
Brown Shrimp	Spawning Adults	Summer	unk	X			Low
Brown Shrimp	Late Postlarvae; Juveniles	Summer	X	X			Low
Brown Shrimp	Larvae; Pre-settlement Postlarvae	Summer	X			X	Low
Brown Shrimp	Adults	Summer	X	X			Low
Cobia	Spawning Adults	Summer		unk	X	unk	Low
Cobia	Juveniles	Summer			X	X	Low
Cobia	Adults	Summer			X	X	Low
Cubera Snapper	Spawning Adults	Summer	X	X		X	Low
Cubera Snapper	Larvae	All	unk	unk		X	Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Cubera Snapper	Juveniles	All	X	X		X	Low
Cubera Snapper	Eggs	Summer	unk			X	Low
Cubera Snapper	Adults	All	unk	unk		X	Low
Gag	Adults	Summer		X	X		Low
Goldface Tilefish	Adults	All	unk	unk		unk	Low
Goliath Grouper	Spawning Adults	Summer	unk	X			Low
Goliath Grouper	Larvae	Summer	unk				Low
Goliath Grouper	Juveniles	Summer	unk	X		X	Low
Goliath Grouper	Eggs	Summer	unk				Low
Goliath Grouper	Adults	All	X	X		X	Low
Gray Snapper	Larvae	Summer		X	X	X	Low
Greater Amberjack	Larvae	Summer	unk			unk	Low
Greater Amberjack	Juveniles	Summer	unk	X		unk	Low
Greater Amberjack	Adults	Summer	unk	X		X	Low
Hogfish	Spawning Adults	Summer	unk	X		X	Low
Hogfish	Larvae	All	unk			unk	Low
Hogfish	Eggs	Summer	unk			unk	Low
Hogfish	Adults	Summer	X	X		X	Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
King Mackerel	Spawning Adults	Summer	X	unk	X		Low
King Mackerel	Larvae	Summer	X		X		Low
King Mackerel	Eggs	Summer	unk		X		Low
Lane Snapper	Spawning Adults	Summer	unk	X	X		Low
Lesser Amberjack	Juveniles	Summer	unk	X			Low
Lesser Amberjack	Adults	Summer	unk	X			Low
Mutton Snapper	Spawning Adults	Summer	unk	X			Low
Mutton Snapper	Larvae	Summer	unk			unk	Low
Mutton Snapper	Juveniles	Summer	unk	X		unk	Low
Mutton Snapper	Eggs	Summer	unk			unk	Low
Mutton Snapper	Adults	Summer	unk	X		unk	Low
Pink Shrimp	Sub-adults	Summer	X	X		X	Low
Pink Shrimp	Spawning Adults	Summer	X	X		X	Low
Pink Shrimp	Late Postlarvae; Juveniles	Summer	X	X		X	Low
Pink Shrimp	Larvae; Pre-settlement Postlarvae	Summer	X			X	Low
Pink Shrimp	Fertilized Eggs	Summer	X	unk		X	Low
Pink Shrimp	Adults	Summer	X	X		X	Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Queen Snapper	Spawning Adults	Summer	unk	unk			Low
Queen Snapper	Juveniles	All	unk				Low
Queen Snapper	Eggs	All	unk				Low
Queen Snapper	Adults	All	X	X			Low
Red Grouper	Spawning Adults	Summer		X	X		Low
Red Grouper	Larvae	Summer			X		Low
Red Snapper	Spawning Adults	Summer		X	X		Low
Red Snapper	Larvae	Summer	X		X		Low
Red Snapper	Juveniles	Summer	X	X	X		Low
Red Snapper	Eggs	All	unk		X		Low
Royal Red Shrimp	Spawning Adults	Summer	unk	unk			Low
Royal Red Shrimp	Larvae	All	unk	unk			Low
Royal Red Shrimp	Juveniles	All	unk	unk			Low
Royal Red Shrimp	Eggs	Summer		unk			Low
Royal Red Shrimp	Adults	Summer		X			Low
Scamp	Spawning Adults	Summer	X	X			Low
Scamp	Juveniles	All	unk	X			Low
Scamp	Adults	All	X	X			Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Silk Snapper	Spawning Adults	Summer	unk	unk			Low
Silk Snapper	Larvae	Summer	unk	unk			Low
Silk Snapper	Juveniles	Summer	unk	unk			Low
Silk Snapper	Eggs	Summer	unk	unk			Low
Silk Snapper	Adults	Summer		unk			Low
Snowy Grouper	Spawning Adults	Summer	unk	X			Low
Snowy Grouper	Larvae	Summer	unk				Low
Snowy Grouper	Juveniles	All	X	X		X	Low
Snowy Grouper	Eggs	All	unk				Low
Snowy Grouper	Adults	All	X	X			Low
Speckled Hind	Spawning Adults	Summer	unk	X			Low
Speckled Hind	Larvae	All	unk				Low
Speckled Hind	Juveniles	All	unk	unk			Low
Speckled Hind	Eggs	All	unk				Low
Speckled Hind	Adults	All	unk	X			Low
Tilefish	Spawning Adults	Summer	unk		X		Low
Tilefish	Spawning Adults	Summer	unk	unk	X		Low
Tilefish	Larvae	Summer	unk		X		Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Tilefish	Juveniles	All	unk	X	X		Low
Tilefish	Eggs	Summer	unk		X		Low
Tilefish	Adults	All		X	X		Low
Vermilion Snapper	Spawning Adults	Summer	unk	unk		unk	Low
Vermilion Snapper	Larvae	Summer	unk				Low
Vermilion Snapper	Juveniles	All	unk	X			Low
Vermilion Snapper	Eggs	All	unk				Low
Vermilion Snapper	Adults	Summer		X			Low
Warsaw Grouper	Spawning Adults	Summer	unk	X			Low
Warsaw Grouper	Larvae	All	unk				Low
Warsaw Grouper	Juveniles	All	unk	X			Low
Warsaw Grouper	Eggs	All	unk				Low
Warsaw Grouper	Adults	All	X	X			Low
Wenchman	Spawning Adults	Summer	unk	X			Low
Wenchman	Larvae	Summer	unk				Low
Wenchman	Juveniles	All	unk	unk			Low
Wenchman	Eggs	Summer	unk				Low
Wenchman	Adults	Summer		X			Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
White Shrimp	Sub-adults	Summer	X	X		X	Low
White Shrimp	Spawning Adults	Summer	unk	unk		X	Low
White Shrimp	Late Postlarvae; Juveniles	Summer	X	X			Low
White Shrimp	Larvae; Pre-settlement Postlarvae	Summer		unk		X	Low
White Shrimp	Fertilized Eggs	Summer	unk	unk		X	Low
White Shrimp	Adults	Summer	X	X		X	Low
Yellowedge Grouper	Spawning Adults	Summer	unk	X			Low
Yellowedge Grouper	Larvae	Summer	unk				Low
Yellowedge Grouper	Juveniles	All	unk	X		X	Low
Yellowedge Grouper	Eggs	All	unk				Low
Yellowedge Grouper	Adults	All	X	X			Low
Yellowfin Grouper	Spawning Adults	Summer	unk	X			Low
Yellowfin Grouper	Larvae	All	unk	unk			Low
Yellowfin Grouper	Juveniles	All	unk	X		X	Low
Yellowfin Grouper	Eggs	All	unk	unk			Low
Yellowfin Grouper	Adults	All	X	X		X	Low
Yellowmouth Grouper	Spawning Adults	All	unk	unk			Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Yellowmouth Grouper	Larvae	All	unk				Low
Yellowmouth Grouper	Juveniles	All	unk	unk			Low
Yellowmouth Grouper	Eggs	All	unk				Low
Yellowmouth Grouper	Adults	All	X	X			Low
Yellowtail Snapper	Spawning Adults	Summer	unk	unk		unk	Low
Yellowtail Snapper	Larvae	All	unk			X	Low
Yellowtail Snapper	Juveniles	All	X	X		X	Low
Yellowtail Snapper	Eggs	Summer	unk			X	Low
Yellowtail Snapper	Adults	All	X	X		X	Low
Banded Rudderfish	Spawning Adults	Summer	unk		X	X	Medium
Banded Rudderfish	Larvae	Summer	unk		X	X	Medium
Banded Rudderfish	Juveniles	Summer	unk		X	X	Medium
Banded Rudderfish	Adults	Summer	unk		X	X	Medium
Cobia	Larvae	Summer	X		X	X	Medium
Cobia	Eggs	Summer	X		X	unk	Medium
Gray Snapper	Eggs	Summer	unk		X	X	Medium
Gray Triggerfish	Larvae	All	unk		X	unk	Medium
King Mackerel	Juveniles	Summer	unk		X	X	Medium

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
King Mackerel	Adults	All	X		X	X	Medium
Lane Snapper	Eggs	Summer	unk		X	X	Medium
Red Drum	Eggs	Summer	X		X	unk	Medium
Spanish Mackerel	Spawning Adults	Summer	X		X	X	Medium
Spanish Mackerel	Larvae	Summer	X		X	X	Medium
Spanish Mackerel	Juveniles	Summer	X		X	X	Medium
Spanish Mackerel	Eggs	Summer	unk		X	X	Medium
Spanish Mackerel	Adults	All	X		X	X	Medium

V. Evaluation of Impacts on EFH Species

Fish species' presence within waters of the project impact area is highly variable, both spatially and temporally. Presence can vary for highly migratory species, among life stages, and seasonally.

The short-term impacts of dredging on fish include entrainment, physiological or behavioral changes due to human-made sounds, loss of prey/food web effects, loss of bottom substrate, and effects due to suspended and resuspended sediment plumes, sedimentation of the seafloor, and the potential release of contaminants (Kim et al. 2008; Suedel et al. 2008; Wenger et al. 2017). Hopper and cutterhead dredges use hydraulic suction fields to obtain and transport unconsolidated sediments from aquatic ecosystems. These actions may result in the *entrainment* of fish and shellfish, as defined as the direct uptake of organisms due to the hydraulic suction field generated by a draghead or cutterhead dredge (Reine et al. 1998).

Sounds from dredging operations are produced from vessels in transit to/from the dredging location, supporting vessels, and the dredging operation itself (see Reine et al. 2014a; Reine et al. 2014b; Robinson et al. 2012; Pickens and Taylor 2020). Underwater sounds emitted from dredging operations are of the amplitude to affect the behavior of fish at a considerable distance from the dredge operation (~400-1,200 m). However, the maximum sound levels emitted by dredge activities are restricted to approximately 0-300 m from the source of the vessel. These sounds are not at a level that would result in mortality or severe injury. At the closest proximities, effects may include permanent or temporary hearing impairment. Expected behavioral changes where sound is above ambient conditions may include avoidance, masking of conspecific communication, masking of predator or prey detection, or other behavioral changes. Avoidance could have severe consequences if the particular area is critical for spawning, habitat is limited in the near vicinity, migratory corridors are blocked, or the area is important for other life history requirements (Pickens and Taylor 2020).

Regarding suspended sediments, the rotation of the cutterhead itself (for cutterhead dredges) produces substantial sediment resuspension in the lower part of the water column; plume concentrations at the surface of the water column may be half of the concentration at the bottom (Havis 1988). Overflow from hopper dredges can be extremely turbid in close proximity to the dredge, as fine-grained TSS may reach >750 mg/L (Havis 1988). Additionally, undesirable fine sediments may be discarded in the sorting and screening process (Michel et al. 2013; Sutton et al. 2009). Havis (1988) compared trailing suction hopper dredges (TSHD) and cutterhead dredges, and showed TSS concentrations were much greater for TSHD (with overflow allowed), particularly at greater depths. Potential responses of fish to SS are avoidance, changes in foraging and predation rates, physiological stress, reduced growth, physical damage, and mortality of adults, juveniles, larvae, or eggs (Kjelland et al. 2015; Wilber and Clarke 2001). Fish eggs and larvae are particularly susceptible to sedimentation and SS; this may be because of their lack of mobility, relatively high oxygen demand, and/or anatomy (Appleby and Scarratt 1989; Wilber and Clarke 2001). The reaction distance of adult fish in response to planktonic prey are directly and negatively related to turbidity (Utne-Palm 2002; Wilber and Clarke 2001). Negative impacts to fish habitat may also include sedimentation of hard bottom or damage/mortality of corals from sedimentation or SS (Erftemeijer et al. 2012; Linderman and Snyder 1999; Pickens and Taylor 2020).

Long-term impacts to fish from offshore dredging operations include loss of physical habitat and suspended/resuspended sediment plumes. Although most studies measure turbidity over hours to a few days following dredging, Fisher (2015) showed turbidity fluxes over 1 ½ years after dredging; turbidity fluxes were not observed >2 km from the initial dredge site. Overall, the pattern has emerged that extremely high turbidity occurs for a relatively short duration (10-15 minutes) during and immediately following dredging. The area most affected by high TSS and sedimentation is generally 300-600 m from the dredge site, but some effects are expected to 3 km. Under certain oceanographic conditions, sediments plumes may extend up to 20 km from the dredge site. Recommendations for best practices for dredging near corals, and coral reefs, are further provided by PIANC (2010). All species listed in Table 4 may have long-term impacts due to dredging operations.

Some species/life stages classified as 'low' in the 'Impact Potential' column in Table 4 may lack a depth of information regarding the environmental conditions at which they have been observed and/or they lack information on their temporal presence within the proposed borrow area as specified in Fisheries Management Plans. Further review of the existing body of scientific literature may reveal information which can be used to fill in these knowledge gaps. Another important note regarding this report is that distribution and/or abundance information specifically for important forage species for EFH species was not considered but may exist as part of species models or as part of the data that was used in the creation of EFH GIS shapes.

1 EFH Species with High Potential for Impacts

The species listed below are those with some combination of variables that indicate potential use of the proposed borrow area from Table 4. Details for each species include links to official EFH descriptions and relevant background information. Some species are lumped into groups for EFH purposes and therefore will have identical EFH descriptions.

1.1 Atlantic Sharpnose Shark

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Neonate/YOY

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Mating/Birthing

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Juveniles

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Adults

<https://www.fisheries.noaa.gov/webdam/download/69616917>

1.1.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.2 Banded Rudderfish

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Eggs

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

1.2.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.3 Blacktip Shark

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Neonate/YOY

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Juveniles;Adults

<https://www.fisheries.noaa.gov/webdam/download/69616917>

1.3.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.4 Bonnethead Shark

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Neonate/YOY

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Juveniles

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Adults

<https://www.fisheries.noaa.gov/webdam/download/69616917>

1.4.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.5 Bull Shark

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Neonate/YOY

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Juveniles;Adults

<https://www.fisheries.noaa.gov/webdam/download/69616917>

1.5.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.6 Gag

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Juveniles

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

1.6.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.7 Gray Snapper

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Spawning Adults

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

[Juveniles](#)

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

[Adults](#)

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

[1.7.1 \[Potential Project Impacts\]](#)

[Insert further applicable information manually if available. Delete if this section is empty.]

[1.8 Gray Triggerfish](#)

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

[Spawning Adults](#)

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

[Juveniles](#)

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

[Eggs](#)

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

[Adults](#)

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

[1.8.1 \[Potential Project Impacts\]](#)

[Insert further applicable information manually if available. Delete if this section is empty.]

1.9 Lane Snapper

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Larvae

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Juveniles

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Adults

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

1.9.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.10 Red Drum

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Spawning Adults

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Larvae

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Adults

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

1.10.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.11 Red Grouper

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Juveniles

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Adults

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

1.11.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.12 Red Snapper

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

Adults

http://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-plus-App-A-and-B_Final_12-2016.pdf

1.12.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

1.13 Spinner Shark

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Spawning Adults

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Neonate/YOY

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Juveniles

<https://www.fisheries.noaa.gov/webdam/download/69616917>

Adults

<https://www.fisheries.noaa.gov/webdam/download/69616917>

1.13.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

2 EFH Species with Medium Potential for Impacts

The species listed in Table 4 with a value of Medium in the 'Impact Potential' column have EFH GIS shapes which spatially overlap the project boundaries, have an observed affinity for sand/sediment resources (Rutecki, et al. 2014), and have observed depth, temporal, and temperature ranges which also overlap the project area. However, these species and life stages are observed to be within the water column, somewhere between a few feet above the seafloor and the surface. Due to their presence in the water column instead of bottom habitats, these species and life stages may experience fewer dredge-related impacts than demersal species.

1.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

3 EFH Species with Low Potential for Impacts

The species and life stages listed in Table 4 with a value of Low in the 'Impact Potential' column have EFH GIS shapes which spatially overlap the project boundaries, however, data from fishery management plans and scientific research (Rutecki, et al. 2014) indicate that it is unlikely that those species and life stages will be found within the project area. This determination was made due to one or more of the following factors: they have not been observed to have affinity for using sand/sediment resources (Rutecki, et al. 2014), they have not been observed within the depth range of the project, they have not been observed within the project area during the season and/or month of the project, or they have not been observed within the anticipated water temperature range of the project. Because these important characteristics do not overlap, these species have the lowest potential of those categorized to be impacted during dredging.

Another group of species with a value of Low in the 'Impact Potential' column of Table 4 are those that

are lacking information in fishery management plan documentation with regards to observed depth ranges, seasonality, temperature ranges, or whether the species or life stage is found in the water column or on, near, or within the seafloor substrate. A review of the existing body of scientific literature may reveal more data than what exists in the fishery management plans reviewed in preparation of this document.

1.1 [Potential Project Impacts]

[Insert further applicable information manually if available. Delete if this section is empty.]

4 Predicted Relative Abundance or Probability of Presence of Selected Species

Species distribution models are state-of-the-art statistical models that predict the distribution of species based on species-habitat relationships (Guisan and Zimmermann 2000; Robinson et al. 2011). Distribution models were developed based on fishery-independent survey data from 2003-2017 combined with remote sensing data on oceanographic conditions, substrate, geography, and the surrounding ecosystems of wetlands and estuaries (see Pickens and Taylor 2020 for details). Prey species' distributions were also included as predictor variables. Predictive models of shrimp and fish were assessed with independent validation data, and all models presented explained 30-45% of the deviance (equivalent to an r^2 for count data) in validation data. Species distribution models predicting the probability of presence were >80% accurate as measured by Area Under the Curve (AUC) statistics; this shows very good predictive ability (Manel et al. 2001). Data and results for shrimp and snapper species represent summer and fall seasons, while shark distribution models represent spring, summer, and fall seasons. We selected species to model based on their socio-economic value, use of shoals, data availability, representation of key trophic levels (e.g., prey and apex predators) and guilds (e.g., demersal, juveniles of species that use hard bottom habitats as adults). Species modeled include: brown shrimp (adults), pink shrimp (adults), white shrimp (adults), lane snapper (age-0 and 1), red snapper (age-0 and 1), Atlantic sharpnose shark (juveniles and adults), blacktip shark (juveniles and adults), and spinner shark (juveniles and adults). The relative abundance or probability of presence for the selected species that overlap with this area are listed in Tables 5a - 5b and further indicate the relative importance of the proposed area to the species compared to surrounding habitats. Appendix A lists the most influential variables that went into each model. Models represent the relative abundance or probability of presence for species' life stages sampled in federal waters, and do not extend to state waters or estuaries.

Brown shrimp (*Penaeus aztecus*), pink shrimp (*Penaeus duorarum*), and white shrimp (*Penaeus setiferus*):

All three shrimp species are demersal, depend on estuaries in early life stages, and inhabit offshore waters as adults. Brown-, pink-, and white shrimp have high economic value in the Gulf of Mexico. In 2016, commercial fisheries landed were brown shrimp (\$157 million), white shrimp (\$206 million), and pink shrimp (\$24.4 million) (NOAA NMFS Office of Science and Technology 2019). In particular, brown

shrimp have been documented as an integral part of the Gulf of Mexico food web, as they are described as prey of small pelagic fish, small demersal fish, flatfish, king mackerel, Spanish mackerel, benthic feeding sharks, several snapper and grouper species, black drum, red drum, and others (Tarnecki et al. 2016).

Red snapper (*Lutjanus campechanus*):

Red snapper use shoals and sand/mud substrates as demersal juveniles before inhabiting natural and artificial reefs as adults (Gallaway et al. 2009). Red snapper are particularly important to commercial and recreational fisheries; in 2016, commercial landings totaled \$26.5 million for the Gulf of Mexico (NOAA NMFS Office of Science and Technology 2019).

Lane snapper (*Lutjanus synagris*):

Lane snapper is a subtropical, reef-associated species that have a demersal juvenile stage well-documented to inhabit shallow waters with sand/mud bottoms, including shoal habitats (Mikulas and Rooker 2008; Wells et al. 2009). Commercial landings of lane snapper are modest and occur primarily in Florida where landings totaled \$86,219 in 2016 (NOAA NMFS Office of Science and Technology 2019). They are a regular recreational catch offshore of Florida as well.

Blacktip shark (*Carcharhinus limbatus*):

Blacktip shark is a large coastal shark species that primarily preys on teleost fishes (Cortés 1999) and is listed as 'vulnerable' globally by the IUCN (Burgess and Branstetter 2000). Blacktip sharks are one of most valuable sharks to commercial fisheries of the Atlantic Ocean (Castro 1996). In the western Gulf of Mexico (west of -88° longitude), 207 metric tons of blacktip shark were harvested in 2017, whereas 32 metric tons were harvested in the eastern Gulf of Mexico. In the Gulf of Mexico, juvenile blacktip shark feed mostly on Clupeidae, particularly Gulf menhaden *Brevoortia patronus*, followed by croaker (Bethea et al. 2004).

Atlantic sharpnose shark (*Rhizoprionodon terraenovae*):

Atlantic sharpnose shark are relatively small, demersal sharks that feed on crustaceans and teleost fishes (Cortés 1999). In the Gulf of Mexico, Atlantic sharpnose are regularly caught in recreational and commercial fisheries.

Spinner shark (*Carcharhinus brevipinna*):

Spinner shark is listed as 'near threatened' globally by the IUCN (Burgess 2009) and is a common target by commercial fisheries. Spinner shark primarily prey on teleost fishes (Cortés 1999), particularly Gulf menhaden *Brevoortia patronus*, which are an important prey species in the Gulf of Mexico (Geers et al. 2016).

Table 5a: Predicted relative abundance of selected EFH species in the project area and the surrounding marine environment. All items are all mean values. According to their lengths, the vast majority of sharks were juvenile and adults. There were a small fraction of young-of-the-year (0.002%-2% of individuals). Modeled shrimp species are also predominantly adults.

Species	Age group(s)	Season	Unit	Within Shoal/ Borrow Area	Within 20km	Within Species' Geographic Range Within the Region
Atlantic sharpnose shark	All detected in surveys	Spring;Summer;Fall	sharks/100 hooks/hour	11.96	11.07	8.29
Brown shrimp	All detected in surveys	Summer	individuals/km of trawl	77.96	50.51	77.42
Red snapper	Year 0	Summer	individuals/km of trawl	0.45	0.21	0.32
White shrimp	All detected in surveys	Summer	individuals/km of trawl	11.31	9.02	2.46

Table 5b: Probability of presence for selected EFH species in the project area and the surrounding marine environment. All items reported are mean values.

Species	Age group(s)	Season	Within Shoal/ Borrow Area	Within 20km	Within Species' Geographic Range within the Region
Lane snapper	Year 1	All	0.02	0.01	0.31
Red snapper	Year 1	All	0.03	0.07	0.16
Spinner shark	All detected in surveys	Spring;Summer;Fall	0.42	0.73	0.13
Blacktip shark	All detected in surveys	Spring;Summer;Fall	0.86	0.85	0.38
Lane snapper	Year 0	Summer	0.07	0.05	0.23
Pink shrimp	All detected in surveys	Summer;Fall	0.07	0.14	0.51

5 Habitat Areas of Particular Concern (HAPC)

Habitat Areas of Potential Concern (HAPC) are subsets of EFH that have been identified for special consideration during planning due to the rarity of the environment, stressors from development, importance to federally managed species, or vulnerability to anthropogenic degradation (BOEM; NOAA 2018a). HAPCs that overlap the proposed area are listed in Table 6 and have been considered within this assessment.

Table 6: List of HAPCs that overlap the project area.

No Results Found

Site Name	Link
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6 Forage Species for EFH Species

Certain forage species may be important indicators for the presence of EFH species. However, these forage species themselves may not be listed as EFH. *[If, after a manual review of source literature below and any additional literature, information is revealed which may be important to this assessment, fill in here. For example, are there a list of important forage species for an EFH species that ShoalMATE has indicated as having high impact potential for this project? Or, are there non-EFH listed forage species that are known to be in the area of the project and are important for a variety of EFH species?]*

For further information on forage species for EFH, see Tarnecki et al. 2016. *[Add any additional sources identified during manual review].*

7 Areas Closed to Fishing

[The author of this report should also evaluate the area of interest for possible fishery closures. Fisheries may be closed by season, by gear type, by species, or by other metrics. Federal, state, and local closures should be included here.]

VI. Proposed Mitigation

Measures to minimize or avoid effects on EFH and managed species will be implemented based on consultation with federal agencies. Overarching measures to mitigate impacts are as follows: 1) implementation of best management and engineering practices, 2) completion of hydrographic surveys pre- and post- dredging; and 3) coordination with the NMFS to create a management plan to guide future replenishment so that mining of the sediment resource remains sustainable.

[Additional mitigations specific to this project not available in the tool.]

VII. Conclusion and Agency Review

The severity of the impact to EFH and supported species is dictated by: 1) the spatial extent of the impact and 2) the chronic or long-term nature of the impact. A review of international literature has shown heightened levels of turbidity regularly occur within 3 km (or 1.86 miles) of dredging sites; turbidity, as a direct result of dredging, often settles within minutes to hours, but long-term monitoring of dredge sites has also shown resuspension of sediments occurs up to 1 ½ years after the dredging event (Pickens and Taylor 2020). Mortality of fish from turbidity is unlikely, but avoidance of the area by fish is a strong possibility (Pickens and Taylor 2020). Underwater sounds and fish entrainment are more local effects that occur over short time periods during the dredging event itself.

The areas that have been designated as EFH in the project area have been given this classification because they are believed to be “those waters and substrate necessary to fish for spawning, breeding,

feeding, or growth to maturity” (16 U. S. C. 1802). HAPC, a separate designation within EFH, is based on one or more of the following considerations: 1) the importance of the ecological function, 2) extent to which the habitat is sensitive to human-induced degradation, 3) whether and to what extent development activities are stressing the habitat type, or 4) rarity of habitat type [50 CFR 600.815(a)(8)].

As discussed and evaluated in this assessment, offshore dredging, dredge transit, and placement along the shoreline are not expected to impact “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” to any appreciable extent over a significantly large area or over any significant period of time. Impacts would be limited and short-term. From a finfish perspective, demersal species, early life stages (i.e., eggs, larvae), dormant life stages, spawning individuals, and habitats that are important for species’ migration are predicted to most impacted (Pickens and Taylor 2020). Other pelagic species and life stages are predicted to be minimally impacted. Given the relatively small-size of the impacted area relative to the large geographic ranges of transitory fishes, the proposed activities are likely to have only minor impacts on the populations of finfish evaluated in this analysis.

Accordingly, it has been determined that the proposed project may have adverse effects on EFH for Federally managed species, but adverse effects on EFH species, due to construction, will largely be temporary and localized within the dredged footprints and beach nourishment areas in the surf zone. In conclusion, the project is not anticipated to significantly impact EFH species or habitat that may be in the project area.

VIII. References

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[Additional information to be filled in manually based on the items cited in manually updated sections above.]

<Additional references from the tool output's table of cited sources>

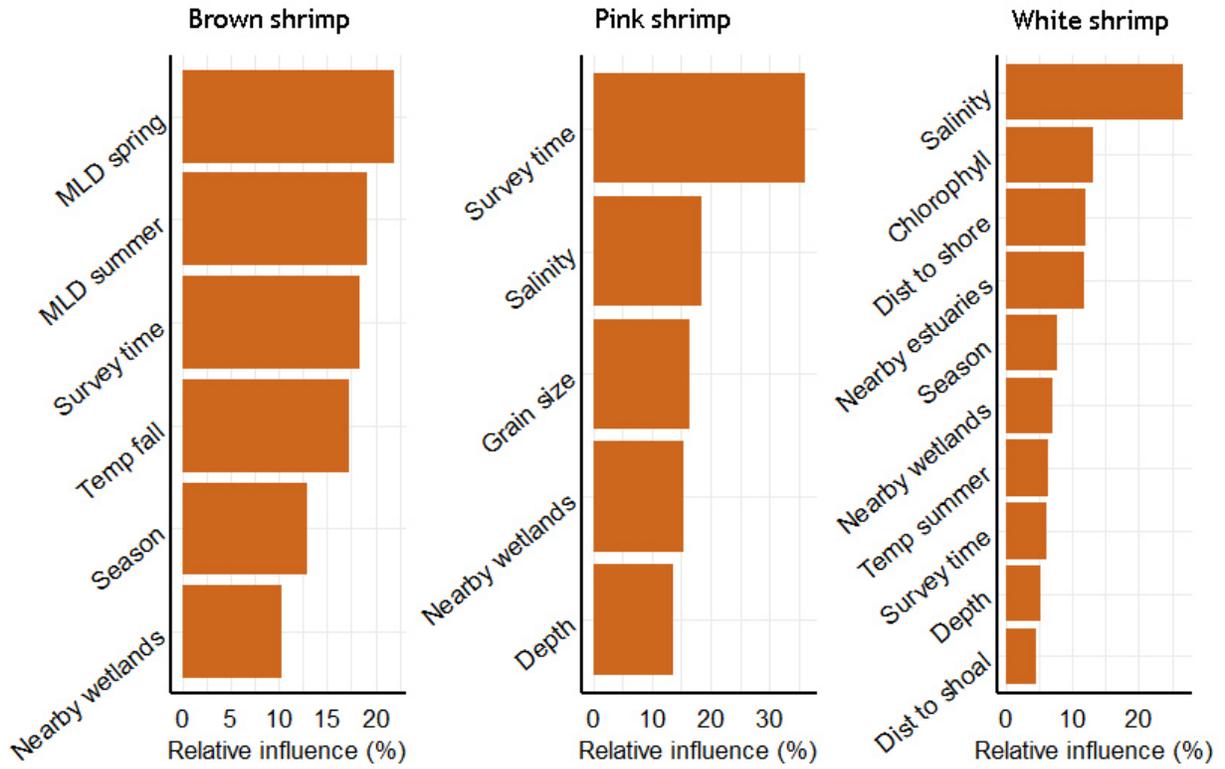
<Possible additional references input here via linking to Endnote document>

Appendix A: Variables in Predictive Models

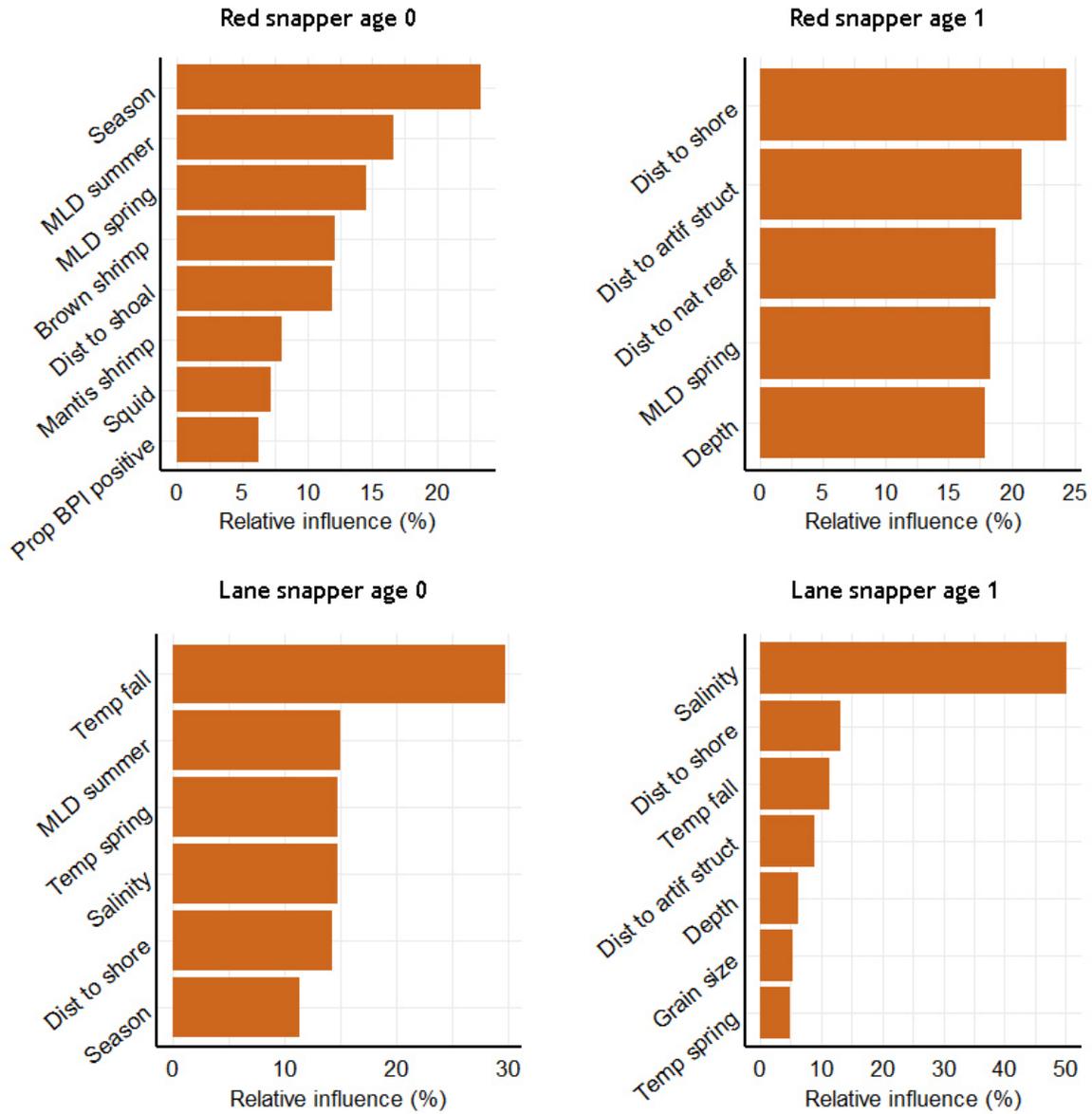
Variable	Description
Bott temp	Bottom temperature
Brown shrimp	Prey species distribution modeled
Chlorophyll	Concentration of chlorophyll in surface waters (mg m ⁻³)
Chlorophyll sum	Concentration of chlorophyll in the surface waters during summer (mg m ⁻³)
Croaker	(<i>Micropogonias undulatus</i>) prey species distribution
Current-U sum	Velocity of west to east currents
Dist to shoal	Distance to shoal (km)
Dist to shore/shoreline	Distance to shoreline (km)
Dist to artif reef	Distance to artificial reef (km) (includes oil platforms/other artificial reefs)
Dist to Gulf Stream	Distance to shoreline
Dist to reef	Distance to natural reef
DOY	Day of year
Nearby estuaries	km ² of estuarine waters within 160 km of location
Grain size	Sediment grain size (mm)
Hypoxia	Probability of hypoxia
Mantis shrimp	(species in Order Stomatopoda) prey species distribution
MLD	Mixed layer depth (m)
Pink shrimp	(<i>Pandalus borealis</i>) prey species distribution modeled
Salinity	Minimum annual bottom salinity
Season	Summer or Fall
Squid	Prey species distribution
Survey time	Time that the survey was conducted (00:00)
Temperature/Temp	Bottom water temperatures (°C)
Wetlands/Nearby wetlands	km ² of estuarine wetlands within 160 km of location

GULF OF MEXICO MODELS

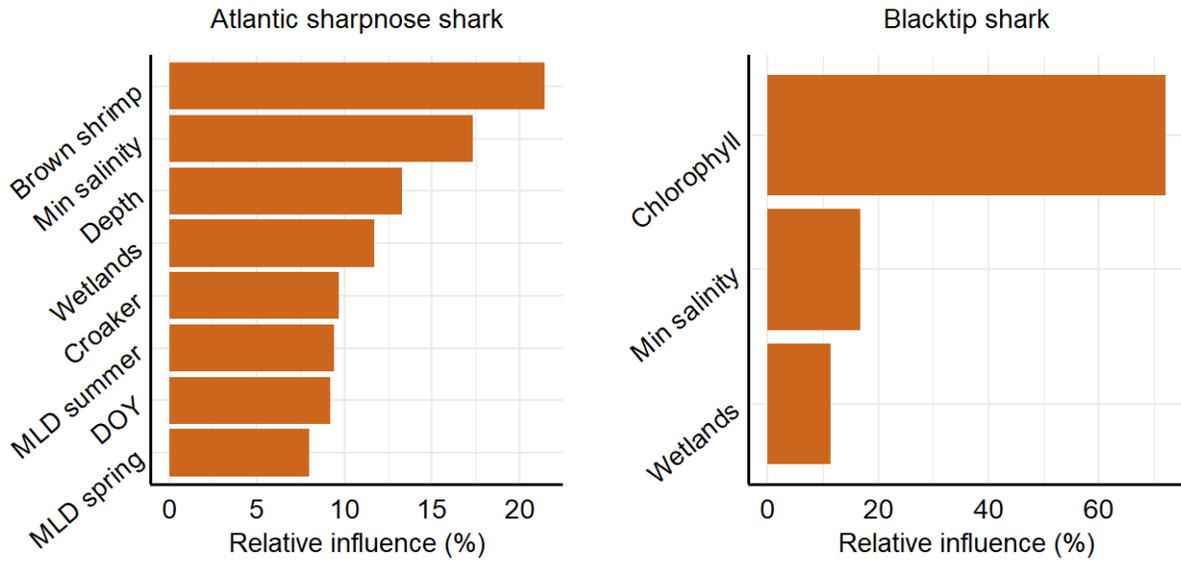
Shrimp Model Variables



Snapper Model Variables



Shark Model Variables





Department of the Interior (DOI)

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.



Bureau of Ocean Energy Management (BOEM)

The mission of the Bureau of Ocean Energy Management is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.

BOEM Environmental Studies Program

The mission of the Environmental Studies Program is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments. The proposal, selection, research, review, collaboration, production, and dissemination of each of BOEM's Environmental Studies follows the DOI Code of Scientific and Scholarly Conduct, in support of a culture of scientific and professional integrity, as set out in the DOI Departmental Manual (305 DM 3).