Aquaculture Spatial Planning in Florida: A Pilot Study to Assess Potential Offshore Aquaculture Zones along Florida's Gulf Coast

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EXECUTIVE SUMMARY

It is widely recognized that the sustainable development of offshore aquaculture relies on proper siting for production facilities. Positive outcomes for production, regulation, management, and environmental sustainability are heavily influenced by characteristics such as water depth, current speed, proximity to other industries and uses, and location relative to sensitive habitats and natural resources. Appropriate planning and siting for offshore aquaculture takes place through a comprehensive and quantitatively rigorous spatial analysis process, including consideration of the many different users and natural resources present in the area of interest. When combined with best management practices, proactive and effective siting can mitigate or eliminate potential conflicts with other users and potential environmental impacts.

The Florida Department of Agriculture and Consumer Services (FDACS) initiated a partnership with NOAA's National Centers for Coastal and Ocean Science (NCCOS) in 2019 to investigate specific coastal ocean areas where the potential for offshore aquaculture operations may exist. With growing interest in offshore aquaculture, both in Florida and throughout the U.S., FDACS and NCCOS developed this spatial planning analysis to determine areas that may hold potential for aquaculture operations in state waters along Florida's Gulf coast. This technical report presents the results from that planning analysis.

This report represents a novel analysis and "first look" at areas that could be suitable for offshore aquaculture development in state waters along Florida's Gulf coast (up to 9 nm from the shore). Over 160 data layers representing various ocean uses (i.e., national security,

industry and navigation, fishing and aquaculture, and cultural and natural resources) as well as the biophysical, oceanographic, and environmental characteristics of sites were included in the analysis, with data sourced from a range of federal and state agencies. Once complete, the analysis identified 34 potentially suitable sites for offshore aquaculture development in Florida state waters between Pensacola and Venice, ranging from 204 to 7,407 acres in size and totaling 54,904 acres.

The aim of this project was to identify Potential Offshore Aquaculture Zones (hereafter referred to as POAZs) in state waters along Florida's Gulf coast. A Multi-Criteria Decision Analysis (MCDA), commonly used in marine spatial planning, was used to identify potentially suitable areas for offshore aquaculture development. The siting analysis utilized the best available, high-resolution spatial data to represent potential environmental and space use conflicts that could constrain the siting of offshore aquaculture operations. Siting aquaculture within coastal waters of Florida will present challenges when planning for changing ocean conditions, mitigating conflicting uses of ocean space (e.g., shipping lanes, commercial and recreational fishing, and tourism), minimizing interactions with military operations, and conservation of sensitive habitats and species.

This work is concurrent with initiatives led by FDACS to further identify growth sectors and opportunities for the aquaculture industry that align with industry and stakeholder interests. In December 2018, FDACS assembled a "Mariculture Technical Advisory Committee" (MTAC), consisting of industry, academic, and regulatory stakeholders who provided quantitative and qualitative input to inform this spatial planning analysis. The results of this spatial analysis and additional information collected from past and future stakeholder engagement will provide important feedback for strategic planning for aquaculture development in Florida state waters, adding objectivity and statistical rigor to the decision-making process. This analysis and planning process will increase regulatory confidence in aquaculture operations and aims to increase sustainability, economic viability, and responsible farming.

The initial POAZs, or delineated areas of potential aquaculture space, reported here will require further agency and stakeholder engagement and review, as well as environmental review and site-specific investigation prior to any final recommendations for industry development or regulatory action. See the *Conclusions and Next Steps* section below for a more in-depth discussion to this point. Although the authors utilized a highly effective evaluation process for site selection, **this report does not recommend any specific final locations and does not seek to advance any regulatory or permitting decision**. Instead, this report offers a starting point to assess the potential for offshore aquaculture development in Florida. Future analysis efforts (for example, with expanded or updated data) will help reduce data gaps, test statistical assumptions of the analysis, and refine results. Feedback from and collaboration with multiple local stakeholders will be crucial next steps before any regulatory or permitting steps can proceed. The FDACS Division of Aquaculture will conduct deliberate and collaborative stakeholder engagement in order to refine the results presented here and make a fully informed decision, along with federal partners, about potential placement of offshore aquaculture production facilities in state waters.

By providing the baseline information needed to determine suitable offshore aquaculture locations, this report helps remove one of the major barriers to entry for many producers. The data and analysis presented in this report require computational power, analytical expertise, and in some cases connections within academia, state or federal agencies that are not readily available for many potential industry entrants. The Division intends to publicly share this report as well as all future refinements of this analysis, so individuals who wish to investigate permitting an offshore operation can have more accurate information. Accordingly, the results in this report stand to help streamline the regulatory and permitting process for offshore aquaculture and thereby assist with efficient, equitable and sustainable development of seafood production in Florida state waters.

BACKGROUND

Technological innovations in the aquaculture field have made it possible to culture nutritious seafood in the coastal and offshore environments (Froehlich et al. 2017, Kumar et al. 2018). Although there are many variations in definition (Froehlich et al. 2017), offshore aquaculture is generally defined as taking place in the open ocean with significant exposure to wind and wave action, and where there is a requirement for infrastructure to withstand and operate in episodic severe storm conditions (Drumm 2010, Kapetsky et al. 2013). The offshore aquaculture industry is currently a small fraction of commercial aquaculture production in the U.S. This sector currently consists of an offshore fish farm in Hawaii state waters and a small number of shellfish and seaweed farms around the nation. The aquaculture industry, in tandem with the adoption of advanced aquaculture and planning techniques, has begun to realize that a large amount of untapped potential lies in some state waters and the U.S. Exclusive Economic Zone (EEZ). For instance, Froehlich et al. (2019) reported that growing seaweed in just 3.8% of federal waters off the California coast could completely offset the state's carbon dioxide emissions from agriculture. NOAA and the Bureau of Economic Analysis reported that the marine economy accounted for almost 2% of U.S. gross domestic product, generated $665.7 billion in sales and supported 2.4 million jobs in 2019; commercial fishing, including aquaculture, contributed $27 billion of the total. In addition, growth of the marine economy was nearly double the growth of the entire U.S. economy in the same year (Nicolls et al. 2020, BEA 2021).

Currently, imports account for 70-85% of the seafood consumed in the U.S., more than half of which are produced from aquaculture in other countries, resulting in a $17.0 billion seafood trade deficit in 2020 (NMFS 2022). Expanding offshore aquaculture operations would help alleviate some of this seafood trade deficit, contribute to domestic food supply chains, strengthen domestic food security, and supply direct and indirect jobs in working waterfront communities. Aquaculture also has the potential to enhance or restore ecosystem services, habitat, and biodiversity in marine ecosystems (Alleway et al. 2018, Gentry et al. 2020, Theuerkauf et al. 2019a, 2022); mitigate the impacts of climate change (Duarte et al. 2017, Froehlich et al. 2019); provision food for a growing global population (Gentry et al. 2017a, Gephart et al. 2021); contribute to fisheries management objectives (Costello et al. 2020); and contribute to emerging technologies and novel markets like biofuels and bioplastics (Rajkumar et al. 2014).

The aquaculture industry and seafood sector have expressed interest in developing additional aquaculture farms (finfish, shellfish, and macroalgae) in the Gulf of Mexico, particularly in the coastal ocean along Florida and its neighboring states. At present within the eastern Gulf of Mexico, there is a pilot-scale seaweed farm permitted and operational, a pilot-scale finfish project permitted (not yet operational), a commercial-scale finfish project in permit review, and an Integrated Multi-Trophic Aquaculture project in a scoping and pre-permitting phase. Additionally, industry is conducting exploratory studies and surveys along the Florida Keys to prospect for areas suitable for farming.

Spatial planning is a critically important priority for offshore aquaculture development in the region. Accounting for all potential space use conflicts and conducting the environmental surveys required for permitting is expensive, time intensive, and requires specialized equipment and expertise. Generally, the resources to conduct such surveys and analysis are not possible for all but the largest and most well-funded businesses or academic institutions. These limitations are a significant hurdle to future development of offshore aquaculture in state or federal waters. The analysis presented in this report seeks to alleviate some of this permitting burden by providing a “first look” at potential options for siting offshore aquaculture operations in Florida state waters of the Gulf of Mexico. The primary audience for this document includes FDACS and cooperating agencies with the State of Florida, all other state and federal agencies engaged in aquaculture governance, the aquaculture industry, and community stakeholders. Data and products from this research are intended to inform coastal planners; resource managers; policy makers; fishing, aquaculture, and maritime industry stakeholders; academic and extension professionals; and potential investors of offshore aquaculture along Florida’s Gulf coast.

Planning and siting for marine aquaculture operations requires thorough synthesis and spatial analyses of critical environmental and ocean space use conflicts (Kapetsky et al. 2013). Aquaculture siting analyses require Geographic Information Systems (GIS) to integrate pertinent spatial data and generate map-based products that can inform policy and permitting decisions for aquaculture operations within a given area of interest. Implementing spatial planning strategies as part of the aquaculture planning process allows initial compatibility to be assessed, while also increasing efficiency in communications within and among regulatory agencies and applicants seeking permits. The spatial complexity, variability, and dynamics of the ocean environment make proactive spatial planning for aquaculture particularly important (Gentry et al. 2017b). There is an increasing emphasis globally on proactive planning and zoning for offshore aquaculture, thus highlighting the need for comprehensive scientific guidance for aquaculture development.

This siting analysis used the best available spatial data relevant to offshore aquaculture to assess potential compatibility of aquaculture operations within state waters from 3 to 9 nautical miles (nm) offshore, and beyond to 15 nm for federal consistency checks. Spatial data were utilized to represent environmental and ocean space use conflicts that may constrain, or conditionally constrain, an aquaculture operation. An MCDA was used, which allows for

evaluation of numerous spatial data types for an area and provides a relative comparison of how suitable locations within the study area are for marine aquaculture (Longdill et al. 2008). Additionally, protected species, habitat descriptions, various fishing activities and management areas, and oceanographic and biophysical characteristics were described in the analysis.

Throughout this collaborative project, NOAA will support state agency management of trust resources and supplement state resources where needed to ensure aquaculture decision-makers are well informed as to Florida's social, economic, and ecological capacity. This technical report utilizes the NCCOS program's expertise and aquaculture spatial planning process for the 3 to 15 nm coastal zone off the Gulf coast of Florida. Additional guidelines for analysis were provided by FDACS, which were used to identify an Area of Interest and guide the identification of the final POAZ options (see Table 1).

COORDINATION WITH FEDERAL AND STATE AGENCIES

Permitting for aquaculture development may require coordination with federal and state agencies. This study does not include considerations for potential impacts for species protected under the U.S. Endangered Species Act (ESA, 16 U.S.C. § 1531-1543) and the U.S. Marine Mammal Protection Act (MMPA, 16 U.S.C. 1361). Additional coordination may be required with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service to address concerns with species protected by the ESA or MMPA. Similarly, additional information and consideration may be required for protection of military operations and national security interests. Planning for aquaculture development may require coordination with Military Aviation and Installation Assurance Siting Clearinghouse (see: https://www.acq.osd.mil/dodsc/) to assess potential impacts and identify mitigation strategies to minimize impacts. The U.S. Environmental Protection Agency may also need to be consulted for operations requiring a National Pollutant Discharge Elimination System (NPDES) permit to ensure compliance with the Clean Water Act (CWA, 33 U.S.C. §1251 et seq.). The U.S. Army Corps of Engineers may also need to be consulted to ensure compliance with Section 10 of the Rivers and Harbors Act (33 U.S.C. 403). The Florida state agencies with responsibility and authority for managing public trust and coastal resources that would be involved in discussions and review of offshore aquaculture siting, in addition to FDACS, include the Florida Fish and Wildlife Conservation Commission (FWC), Florida Department of Environmental Protection (FDEP), and the Florida Department of State.

METHODS

Overview

Initially, an Area of Interest (AOI) was developed based on the parameters provided by FDACS (Table 1). The spatial planning methods and workflow for identification of POAZs are outlined in Figure 1. After gathering the necessary farm requirements (Table 1), the initial Area of Interest (AOI) was first defined by identifying 3 to 15 nm from Florida's Gulf coast using the NOAA moderate resolution shoreline.[1] The northern boundary for the study area ended at the Alabama

[1] https://shoreline.noaa.gov/data/datasheets/medres.html

state line and the southern boundary ended at the 27 N parallel, just south of Tampa Bay. The southern boundary was determined by known constraints for southern Florida aquaculture, including shallow habitat-forming reefs, marine protected areas, and frequent harmful algal blooms. The total area for the initial AOI was estimated at 4,273,154 acres (17,293 km^2; Figure 2). Areas shallower than 10 m (33 ft.) were then removed from the initial AOI, which removed a significant amount of area in the Big Bend region, leaving 2,644,800 acres (10,703 km^2) in the final AOI (Figure 3). This minimum depth requirement was used as a constraint based on industry input solicited by FDACS on technical production specifications. The two distinct areas remaining in the AOI were then separated into North and South regions (1,914,220 acres and 730,580 acres, respectively) for the subsequent analysis steps (Figure 4).

Next, a 10-acre (4-ha) hexagonal grid was created for each region (Figure 5). The grid allowed for creation of discrete spatial units that were used in the suitability model and cluster analysis, described below. The grid cell size was determined by several factors, including the extent of the analysis, the minimum farm size, computational processing time, and the spatial resolution of data (Hengl 2006).

Once a grid was established for the entire final AOI, spatial data layers were selected and overlaid with the final AOI to construct a suitability model, run a suitability and cluster analysis, and select and characterize the final POAZ options. Significant clusters of the most highly suitable areas were selected as the final POAZs and are presented here. Spatial data for a variety of factors were considered (see *Data Inventory* below and Appendix A); a total of 41 layers were used for the suitability analysis and 25 layers for the post-analysis site characterization. The steps for the suitability analysis and cluster analysis are described in more detail below.

Table 1. Farm parameters provided by FDACS to the NCCOS Aquaculture Spatial Team.

NCCOS Request	Farm Response
Distance from shore	> 3 and ≤ 15 nautical miles from shore
Minimal operational depth	> 10 m
Minimum size of a POAZ	200 acres (0.31 mi^2) (80.9 ha) (0.81 km^2)
Federal/state waters	Plan for state and federal waters, but only identify siting alternatives in state waters, 3 to 9 nm from shore.

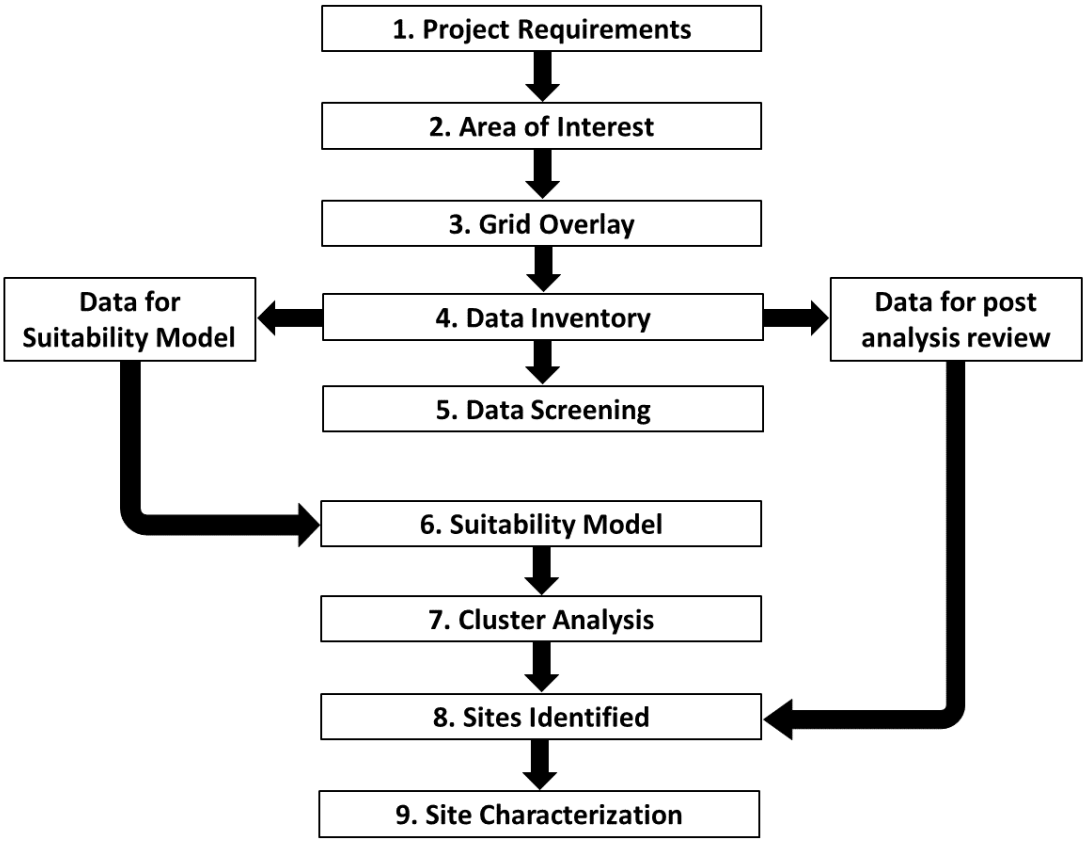

Figure 1. Overview of the project workflow.

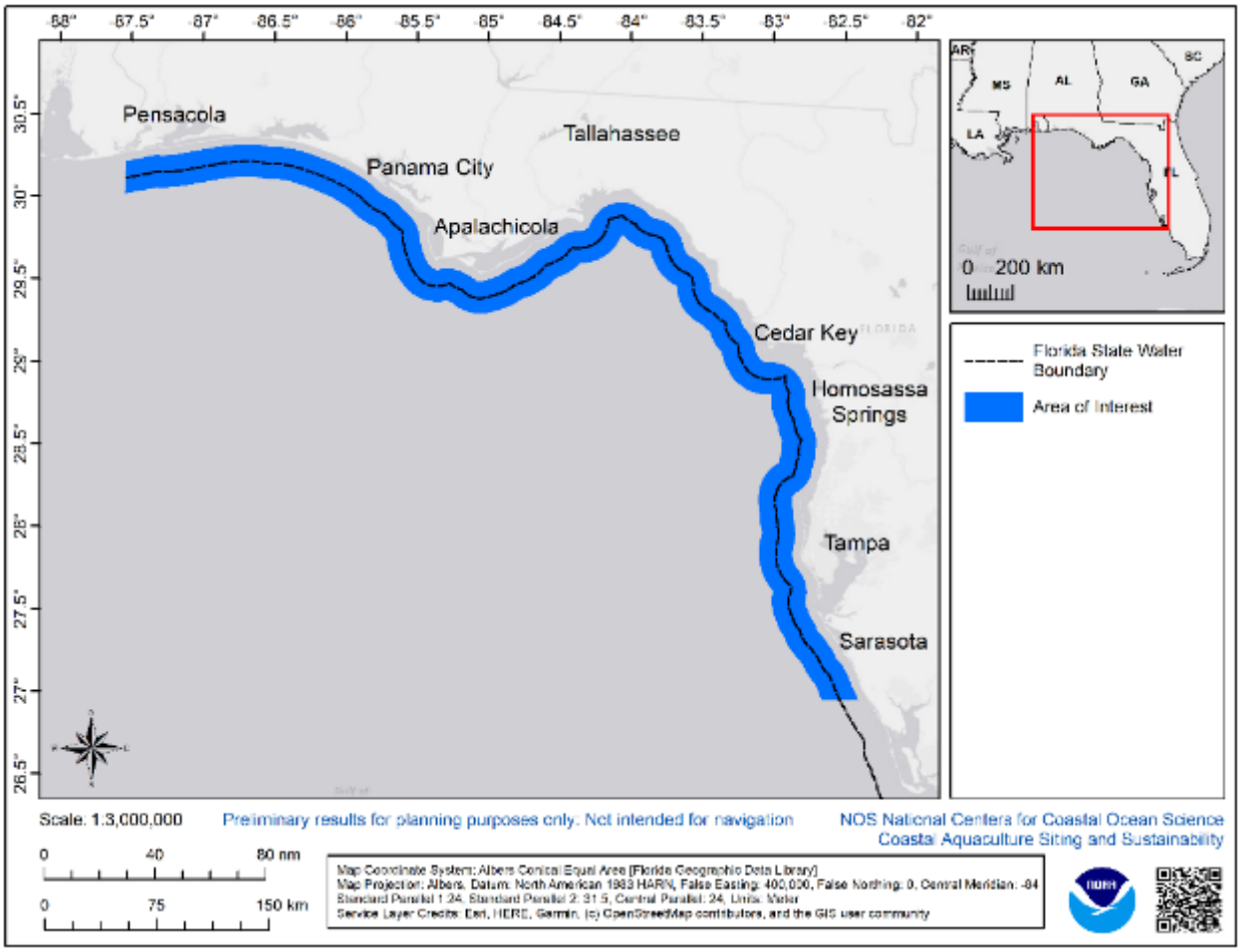

Figure 2. AOI extends from 3 to 15 nm from shore on the Florida Gulf coast. State waters include the nearshore area extending from 3 to 9 nm, delineated by the black line. Federal waters are located beyond 9 nm.

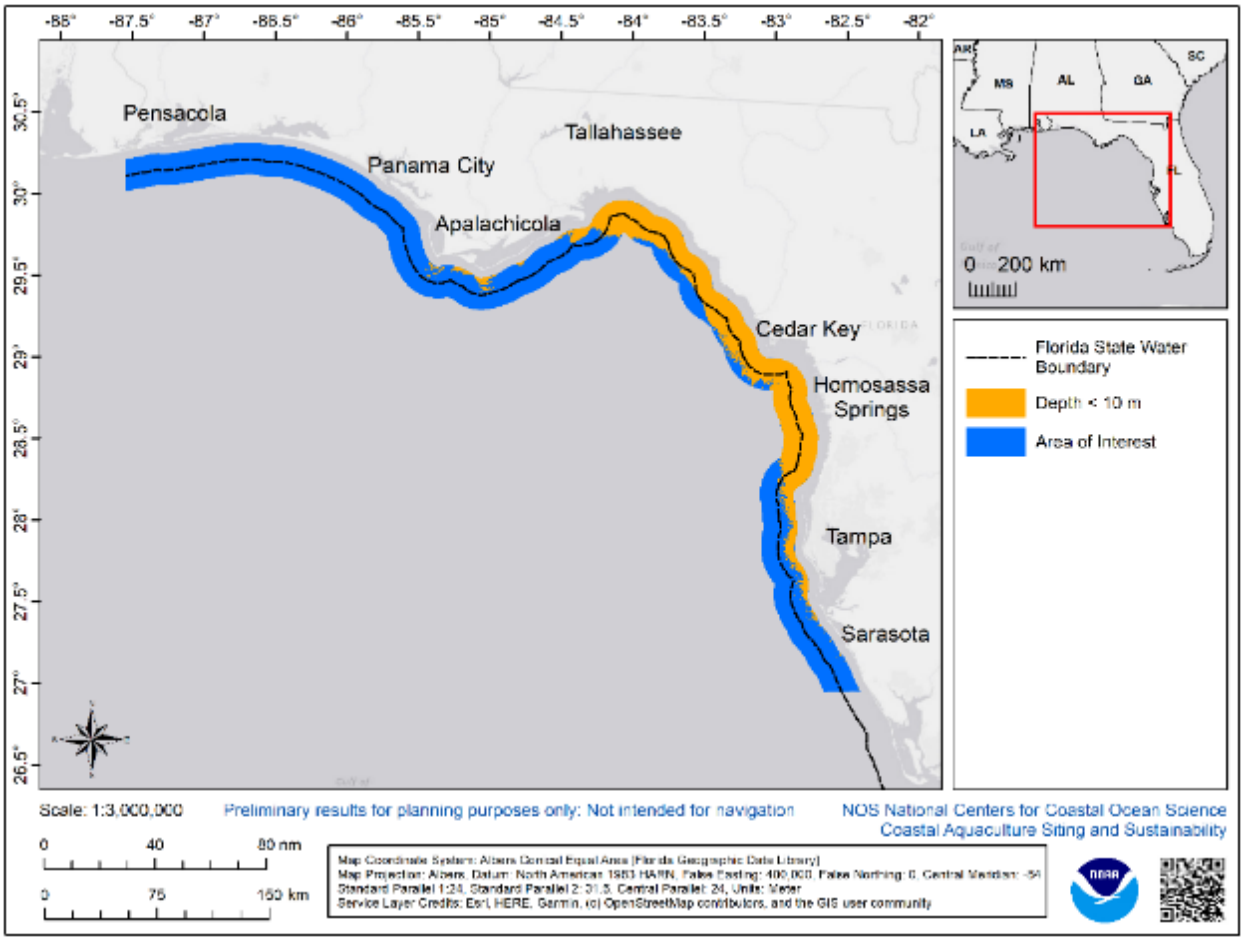

Figure 3. AOI with delineated areas shallower than 10 m in depth (orange areas). The figure shows that the central part of the AOI was the shallowest.

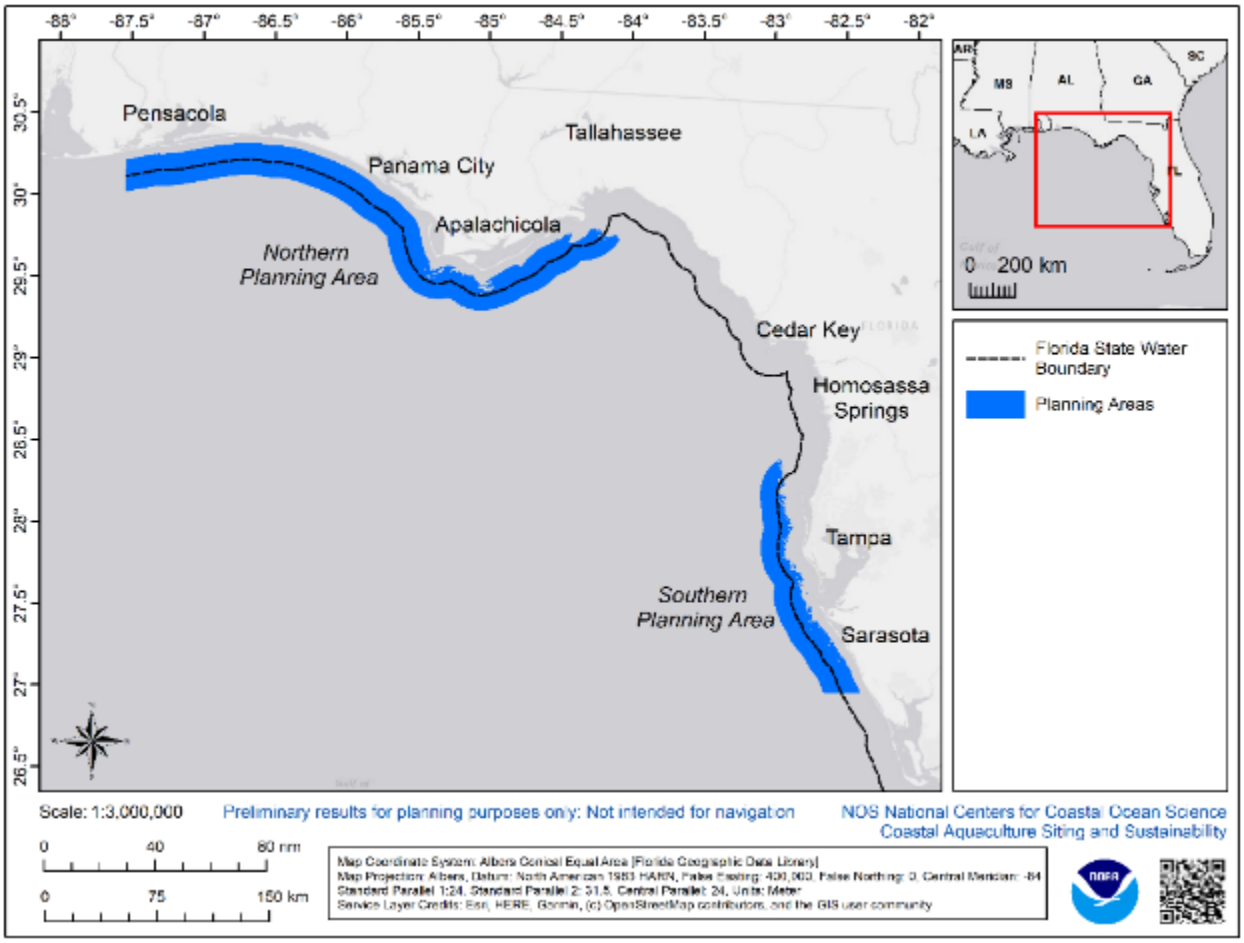

Figure 4. Final AOI for analysis and selection of POAZ options in state waters. Northern and Southern regions were identified once depths shallower than 10 m were removed. The final AOI was 2,644,800 acres (northern region: 1,914,220 acres and southern region: 730,580 acres).

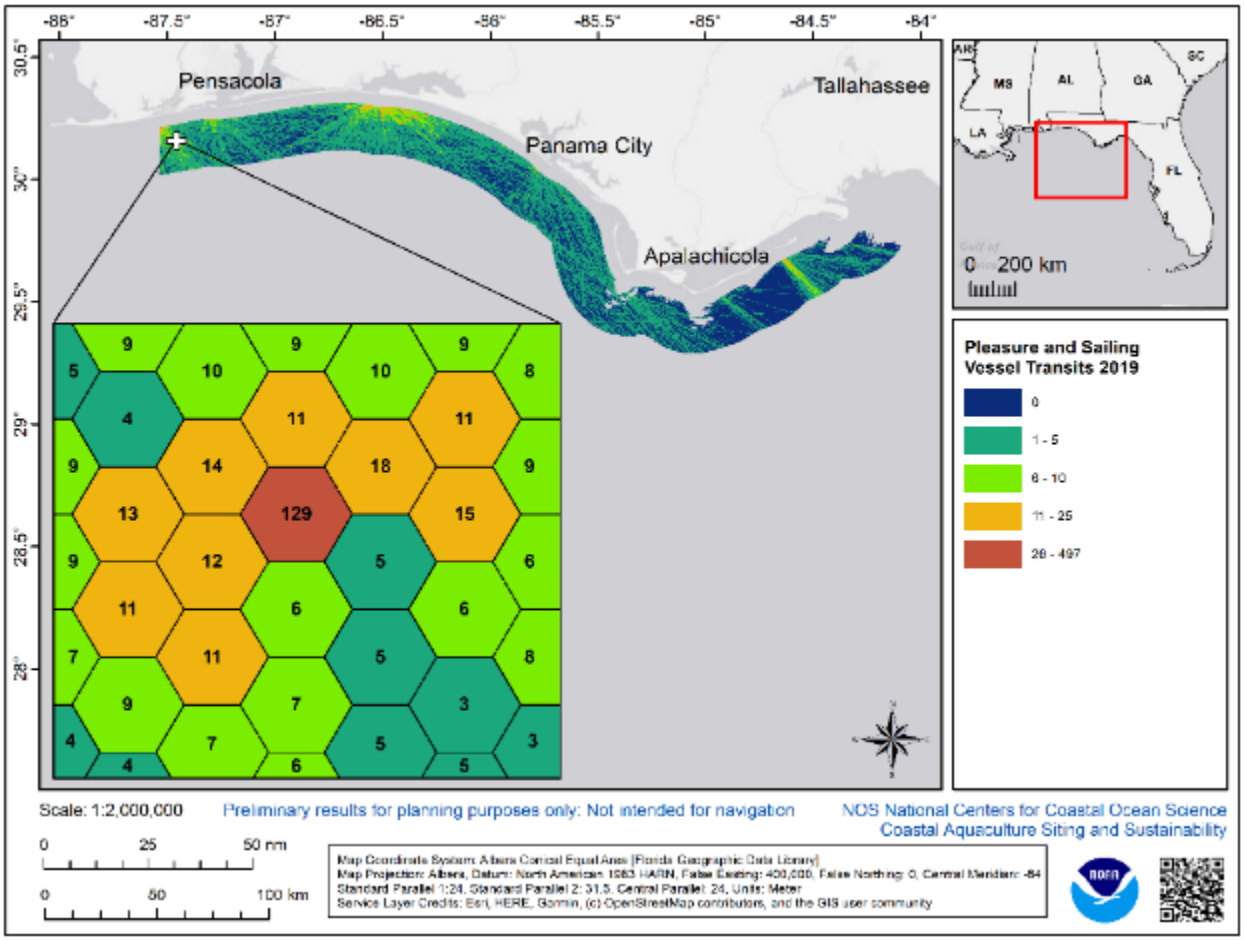

Figure 5. A 10-acre (~4-ha) hexagonal grid was created for each region to define the discrete spatial units used in the suitability analysis and cluster analysis. Spatial data were evaluated for each grid cell. The number of vessel transits from pleasure and sailing craft in 2019 is provided as an example of how data were assigned to grid cells.

Data Inventory

A comprehensive spatial data inventory was created and reviewed for the final AOI. This data inventory included data layers relevant to administrative boundaries, national security (i.e., military), navigation and transportation, energy and industry infrastructure, commercial and recreational fishing, natural and cultural resources, and oceanography (i.e., non-living resources). The data holdings were made possible by a broad suite of federal and state agencies (e.g., NOAA National Marine Fisheries Service, NOAA Office of Coastal Management, U.S. Department of Defense, Bureau of Ocean Energy Management, U.S. Geological Survey, Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, Florida Department of State, Florida Historical Society). Data were checked for completeness and quality, and the most authoritative, up-to-date sources were used. All data were projected using Albers Conical Equal Area projection, which is used by the Florida Geographic Data Library.[2] Each data set within the data inventory (n = 162 layers) was reviewed as to whether it was appropriate for inclusion in the suitability analysis (see Tables 2 through 6) or if it was more appropriate for the post-analysis characterization of the final POAZs (see Tables 7 and 8). See Appendix A for the complete data inventory generated for the spatial planning analysis, including links and metadata (Table A-1). Some data sets were considered for the suitability analysis but were ultimately not included (e.g., seagrass distribution, Rice's whale core distribution area, gulf sturgeon and smalltooth sawfish critical habitat) because they did not intersect with the final area of interest (see Table A-1). Certain data sets required some level of processing to be used within the analysis (see Appendix B).

Suitability Analysis

A gridded relative suitability analysis, commonly used in an MCDA for aquaculture siting, was performed (Longdill et al. 2008, Radiarta et al. 2008, Gimpel et al. 2015, Bwadi et al. 2019). Spatial data layers included in the suitability analysis represented potential space use conflicts with marine aquaculture operations over time, such as active national security areas, maritime navigation, ocean industries, and natural resource management. To best represent the multiple ocean space uses, four suitability sub-models were created including national security (n = 10 data layers), natural and cultural resources (n = 6 data layers), industry and navigation (n = 19 data layers), and fishing and aquaculture (n = 6 data layers; Figure 6). Each sub-model was given equal weight and a final suitability score was calculated as the geometric mean of all four sub-models. This ensured that each ocean user group was given equal representation in the final suitability model regardless of how many data layers were present in each sub-model. Due to inherent differences in user groups and the spatial data and to help eliminate any noise that might result from an analysis over a large geographical range, a separate suitability analysis was run for the Northern and Southern region, as described below.

Scoring Categorical Data

Categorical data sets (i.e., data are distinct and separate) were evaluated to determine if a feature was present or absent in each grid cell. If a feature was absent, a score of 1 was

[2] https://www.fgdl.org/metadataexplorer/fgdlfaq.html

assigned, otherwise a score of 0 or 0.5 was assigned (0 = unsuitable/hard conflict with aquaculture; 0.5 = uncertainty or potential constraint with aquaculture; 1 = suitable/no conflict with aquaculture). The feature score was determined by its relative certainty of compatibility with aquaculture. For example, a regulated shipping lane would be deemed unsuitable for aquaculture and thus receive a score of a 0. On the other hand, within certain military operating areas, uncertainty exists; even if a suitable location is found, additional communications with the military and resources may be required so a score of 0.5 was given. Categorical data layers included in the suitability analysis are listed in Tables 2 through 5 and include the score each layer was given in the model.

Scoring Numerical Data

Numerical data (i.e., data can take on any value within a given range) were reclassified on a 0 to 1 scale by using Fuzzy Logic Membership Functions (Vafaie et al. 2015, Landuci et al. 2020). Scoring of these data can be seen in Table 6. This method is similar to using a linear or non-linear functional approach (Vincenzi et al. 2006, Theuerkauf et al. 2019b), however, use of fuzzy logic accounts for additional uncertainty in the data when scoring. For each numerical dataset, a membership function was chosen based on that data's known interaction with aquaculture and empirical range of values. As a simplistic example, high vessel traffic is less suitable for aquaculture than low vessel traffic, as farm infrastructure would interfere with potential set courses of vessels. Therefore, the Z-membership function is exclusively used in this study, as this function uses polynomial curves created by using the minimum and maximum values of each data set (Equation 1, Figure 7).

One was added to the maximum value of each data set to ensure that no cells were given a score of 0 based on the numerical data sets. At this time, there is no known set value for Gulf fisheries as to when fishing effort is "too high" over time within a defined space (i.e., *If the* sum of fishing effort in a grid cell is greater than *x* vessels, *then* score as 0). Consistent with this schema, the authors found no valid value when AIS vessel transits were considered too high for industry, particularly when the shipping lanes and anchorage areas (i.e., where traffic is generally the highest) were given values of 0 in the model, eliminating the busiest transit areas. These upper limits for numerical data included in the suitability analysis will be further evaluated and explored as FDACS enters the next phase of POAZ planning.

$$f(x,a,b) = \{1, \quad x \le a \; 1 - 2\left(\frac{x-a}{b-a}\right)^2, \quad a \le x \le \frac{a+b}{2} \; 2\left(\frac{x-b}{b-a}\right)^2, \quad \frac{a+b}{2} \le x \le b \; 0, \; x \ge b$$

Equation 1. The fuzzy logic Z-membership function.

Calculation of Final Suitability Score

For each suitability sub-model (Figure 6) the scores for each grid cell were determined by summing all individual values for a grid cell across all data sets and dividing by the total number of data sets, providing a proportion from 0 to 1. Values closer to 0 represented "low suitability" and values closer to 1 represented "high suitability" relative to the other grid cells. Therefore, the final proportion calculation provides the relative suitability of that cell to the other grid cells.

Once this calculation was performed for each sub-model, the four sub-model suitability scores were summed and divided by four to provide a final relative suitability score for each grid cell (i.e., an equal 25% weight from each sub-model was given to the final suitability score). This final relative suitability score was used in the cluster analysis.

Any grid cell that contained a categorical data layer from any of the four sub-models with a relative score of 0 was given a final suitability score of 0, as these cells were considered to be unsuitable for aquaculture, regardless of the scores from other data layers. These "no compatibility" grid cells were removed from the AOI and not considered further in the analysis. These hard constraints are visualized as gray and red areas in the final suitability and POAZ maps (see the *Results* section below).

Table 2. National security sub-model parameters (10 total spatial layers) with scores used in the suitability analysis. An "x" denotes presence of that spatial data set within the Northern or Southern region. FUD = Formerly Used Defense Site.

Parameter	North	South	Score
Danger Zones and Restricted Areas	x		0
Panama City Operating Area	x		0
Pensacola Operating Area	x		0.5
Unexploded Ordnance FUDs	x	x	0.5
Special Use Airspace – W151A	x		0
Special Use Airspace – W151B	x		0
Special Use Airspace – W470A	x		0
Special Use Airspace – MOA U.S. 02214	x		0.5
Special Use Airspace – MOA U.S. 02208	x		0.5
Special Use Airspace – W155A	x		0.5

Table 3. Natural and cultural resource sub-model parameters (6 total spatial layers) with scores used in the suitability analysis. An "x" denotes presence of that spatial data set within the Northern or Southern region.

Parameter	North	South	Score
Archaeologically important sites	x		0
Artificial reefs (with 500-ft setback)	x	x	0
Fish havens (with 500-ft setback)	x	x	0
FL Parks SS *Tarpon* Preserve	x		0
FWC Potential coral hard bottom		x	0
Shipwrecks and obstructions (with 500-ft setback)	x	x	0

Note: Seagrass, critical habitat, Rice's whale, and other layers were considered in the suitability analysis, but they do not interact with the final AOI (i.e., are found in <10 m or too far offshore) and so were excluded from the analysis. See Appendix A for a list of all natural resources that were considered for the suitability analysis. Setback distances are determined by the entities providing the data.

Table 4. Industry and navigation sub-model parameters (19 total spatial layers) with scores used in the suitability analysis. An "x" denotes presence of that spatial data set within the Northern or Southern region. Vessel traffic values were the number of transits per grid cell. See Table 6 for fuzzy logic scores for numerical data.

Parameter	North	South	Score
Aids to Navigation (with 500-m setback)	x	x	0
Anchorage Areas (used/disused)	x	x	0
Coastal maintained channels (Width and ½ setback*)		x	0
Environmental Sensors and Buoys (with 500-m setback)	x	x	0
FDEP Oil Gas Permit Wells (with 500-m setback)	x	x	0
Ocean disposal sites	x		0
Pilot boarding areas and stations (with 500-m setback)	x	x	0
Pipelines (with 500-m setback)		x	0
Sand and gravel lease areas	x	x	0
Sand lease areas unrestricted		x	0
Shipping fairways (with 500-m setback)	x	x	0
Vessel Traffic 2019 - Cargo	x	x	Numerical
Vessel Traffic 2019 - Tanker	x	x	Numerical
Vessel Traffic 2019 - Tug and tow	x	x	Numerical
Vessel Traffic 2019 - Fishing	x	x	Numerical
Vessel Traffic 2019 - Passenger	x	x	Numerical
Vessel Traffic 2019 - Pleasure and sailing	x	x	Numerical
Vessel Traffic 2019 - Military	x	x	Numerical
Vessel Traffic 2019 - Other	x	x	Numerical

Note: Setback distances are determined by the entities providing the data.
**The width of the channel plus half the width of the channel is used for the setback distance, for example a 50 m wide channel would have a 75-m setback distance.*

Table 5. Fishing and aquaculture sub-model parameters (6 total spatial layers) with scores used in the suitability analysis. An "x" denotes presence of that spatial data set within the Northern or Southern region. See Table 6 for fuzzy logic scores for numerical data.

Parameter	North	South	Score
Individual aquaculture leases (with 500-m setback)	x		0
Live rock aquaculture sites (with 500-m setback)	x	x	0
Headboat trips (2014-2020)	x	x	Numerical
Shrimp trawling transits (2004-2019)	x	x	Numerical
Reef fish bandit gear trips (2007-2019)	x	x	Numerical
Reef fish longline gear trips (2007-2019)	x		Numerical

Note: Setback distances are determined by the entities providing the data.

Table 6. Information for the numerical data sets for both the Northern (N) and Southern (S) regions, including the fuzzy logic membership function used, the range of the data, and the values used for the ceiling and foot of the function. Vessel traffic values were the number of transits per grid cell. Fishing data were rescaled, however these values are not shown due to confidentiality.

Area	Data Set	Function	Range	Ceiling	Foot
N	Vessel Traffic 2019 - Cargo	Z	0-5,043	0	5,044
N	Vessel Traffic 2019 - Tanker	Z	0-33	0	34
N	Vessel Traffic 2019 - Tug and tow	Z	0-37	0	38
N	Vessel Traffic 2019 - Pleasure and sailing	Z	0-283	0	284
N	Vessel Traffic 2019 - Passenger	Z	0-320	0	321
N	Vessel Traffic 2019 - Other	Z	0-497	0	498
N	Vessel Traffic 2019 - Fishing	Z	0-12,379	0	12,380
N	Vessel Traffic 2019 - Military	Z	0-30	0	31
S	Vessel Traffic 2019 - Cargo	Z	0-25,829	0	25,830
S	Vessel Traffic 2019 - Tanker	Z	0-813	0	814
S	Vessel Traffic 2019 - Tug and tow	Z	0-917	0	918
S	Vessel Traffic 2019 - Pleasure and sailing	Z	0-439	0	440
S	Vessel Traffic 2019 - Passenger	Z	0-4,118	0	4,119
S	Vessel Traffic 2019 - Other	Z	0-162	0	163
S	Vessel Traffic 2019 - Fishing	Z	0-6,561	0	6,562
S	Vessel Traffic 2019 - Military	Z	0-13	0	14

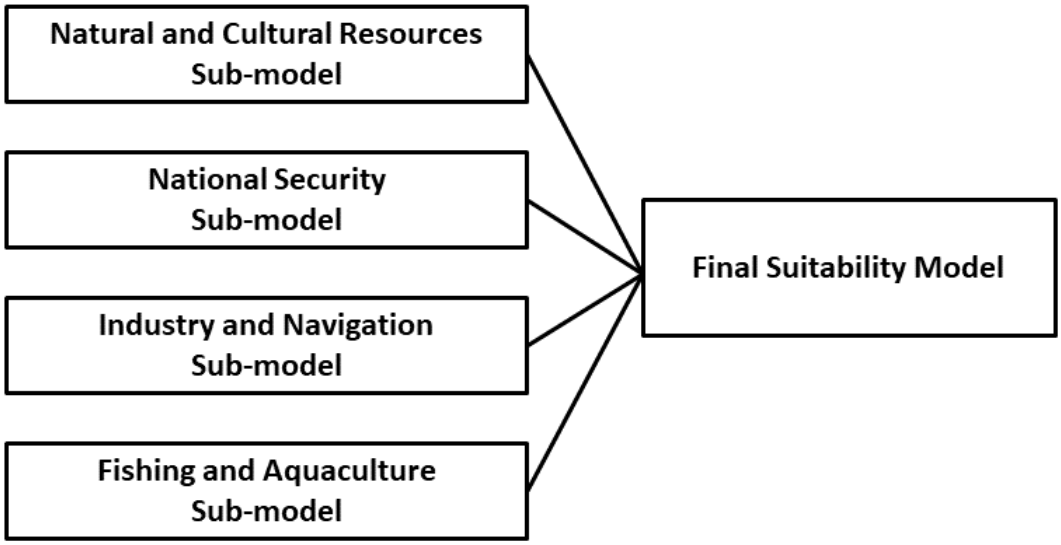

Figure 6. Overview of suitability analysis design. The final suitability model scores were calculated by taking the geometric mean of the four suitability sub-models. All sub-models were equally weighted.

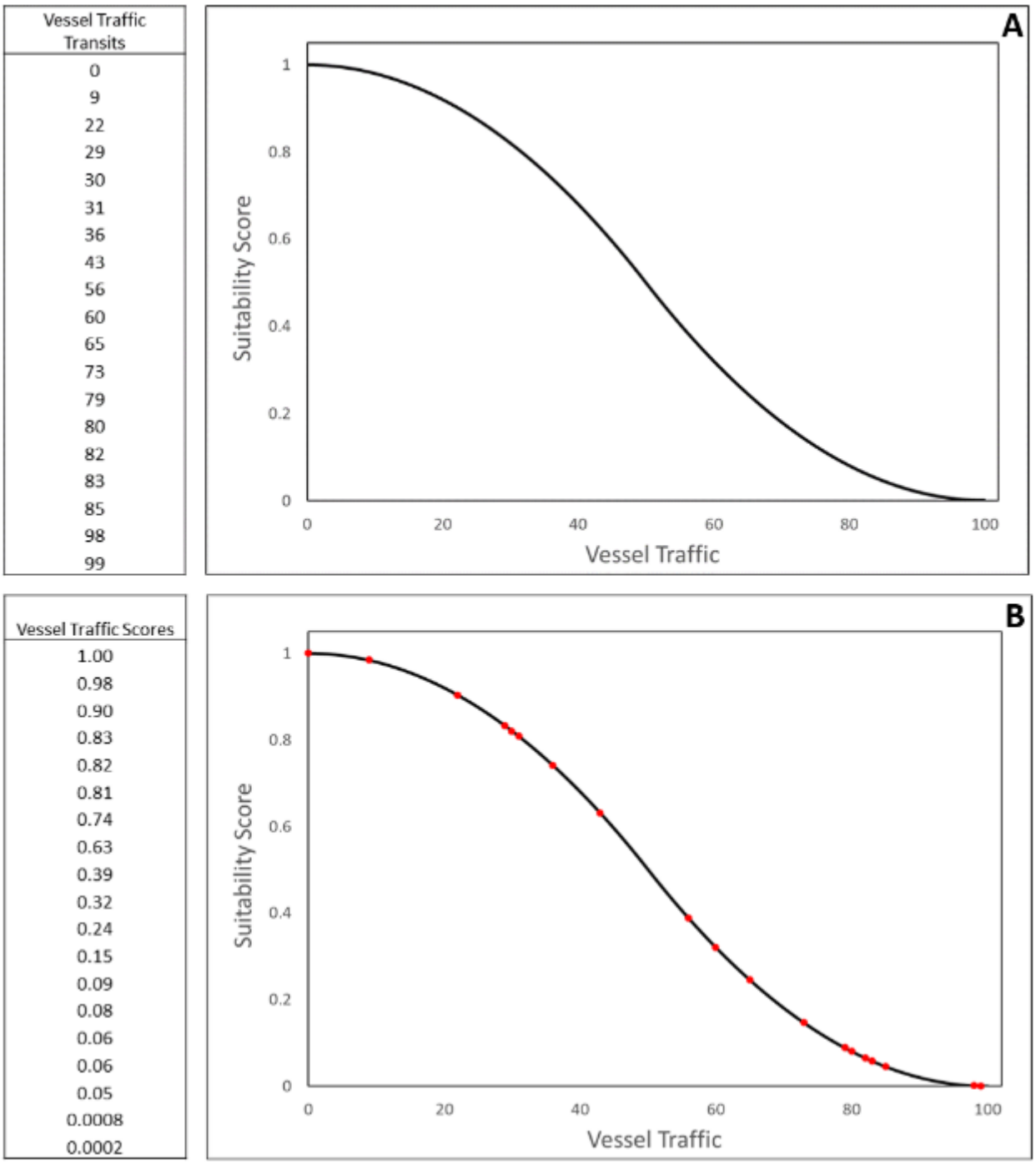

Figure 7. (A) For each numerical data set a unique fuzzy logic membership function was created. In this example using vessel transits per grid cell, the Z-membership function was created by taking the minimum value (0), and maximum value plus one (99+1) from the data set. One was added to the maximum value so zero is not assigned as a score. (B) The membership function was then used to rescale the values to a suitability score between 0 and 1. Red dots are the intersection of the vessel traffic transit data and the corresponding scores from the membership function.

Cluster Analysis

A Local Indicators of Spatial Association (LISA) analysis, which identifies statistically significant clusters and outliers within a data set, was performed on the final results of the relative suitability analysis (Anselin 1995). The Northern and Southern regions were examined individually with a LISA analysis to identify clusters of statistically significant high values ($p < 0.05$). The ESRI™ ArcGIS Pro "Cluster and Outlier Analysis" tool was used to calculate the LISA values (ESRI 2020). The fixed distance spatial conceptualization was utilized within this analysis as it allows the identification of localized clusters. The function inputs were a 250-m search distance and 9,999 iterations with row standardization and a false discovery rate correction applied to allow for more conservative results.

Selection of Final Siting Options

Statistically significant clusters ($p < 0.05$) of the highest suitability scores were identified in the LISA analysis. Any significant clusters smaller than 200 acres (900 x 900 m) were excluded, as that was the minimum size desired by FDACS (Table 1). This size would allow room for farm expansion, adequate operational space, and mooring system deployment. The Northern and Southern regions were further subdivided into Planning Areas based on geography of the final POAZ clusters. In each Planning Area, as many POAZ options as possible were identified from the statistically significant high-high suitability clusters.

Data for Site Characterization

Table 7 contains categorical datasets reviewed in the post-analysis site characterization, but not included in the suitability analysis for several reasons (e.g., incomplete coverage, no overlap with study areas). Table 8 includes numerical data used to describe the environmental and oceanographic features of siting options identified through this study. Data from the American Seas Navy Coastal Ocean Model (NCOM) oceanographic model and the MIKE 21 wave model were characterized, as these are some of the most relevant parameters for ocean-based aquaculture. Other data were beneficial in characterizing environmental and natural resource features of sites which may increase or decrease suitability for aquaculture development. For instance, the frequency of toxic *Karenia brevis* (red tide) blooms should be considered to understand potential risks to species in production. Geological data from the Florida Department of Environmental Protection's Regional Offshore Sand Source Inventory (ROSSI), including borrow areas, Holocene sand, paleo barrier islands, paleo channels, paleo ebb deltas, and paleo shoreline complexes are included for characterizing each option. Sediment composition may be important for engineering and gear considerations, such as the selection of anchors used for a mooring system. All relevant data should be considered and explored further when examining individual POAZs for potential future aquaculture siting.

Table 7. Categorical datasets not included in the suitability analysis that were used to review and characterize the final POAZ options. EFH = Essential Fish Habitat; STORET = STORage and RETrieval database; ROSSI = Regional Offshore Sand Source Inventory.

Parameter
FL Site Specific Alternative Criteria Areas
STORET stations
FDEP Watershed Information Network Monitoring Locations with Results
Oil and Gas Resource Potential
Outstanding Florida waters
Shallow Coral EFH
Coastal Migratory Pelagic EFH
Red Drum EFH
Reef Fish EFH
Shrimp EFH
Spiny Lobster EFH
Highly Migratory Species EFH
Holocene sand (ROSSI)
Paleo barrier islands (ROSSI)
Paleo channels (ROSSI)
Paleo ebb deltas (ROSSI)
FL Shoreline complex (ROSSI)
ROSSI sand samples and cores
USGS sediment classification (usSEABED)
Rice's Whale Core Distribution Area

Table 8. Numerical datasets not included in the suitability analysis that were used to review and characterize the final POAZ options. NCOM = Navy Coastal Ocean Model.

Parameter
Karenia brevis (red tide) toxic bloom frequency*
Current speed/direction (NCOM)
Water temperature (NCOM)
Salinity (NCOM)
Max significant wave height (MIKE 21)**

**Note:* Values represent the number of occurrences of a toxic *K. brevis* bloom (concentration >100,000 cells per liter) from 2000-2019). The most conservative value (i.e., highest number of toxic bloom events over 19 years) within a POAZ option was reported. The data reported are observational data only. Concentrations of 100,000 cells per liter was used as a measure of toxicity to finfish in this case, as it is the reported lethal limit before fish kills occur (Gannon et al 2009; Landsberg and Steidinger 1998; Quick and Henderson 1974). Please note that just because a bloom has never occurred in a location does not mean it will not occur in the future. There is also no relative measure of bloom magnitude in the data, which should be assessed to discern short- and long-term concerns, as well as potential risk to the finfish.

** MIKE Powered by DHI models https://www.mikepoweredbydhi.com/products/mike-21-3

National Security Considerations

National security operational areas and areas of national security interest were reviewed in and around the final gridded AOI. The eastern Gulf of Mexico is considered essential to the U.S. Department of Defense (DoD) to develop and maintain military readiness (DoD 2018). The eastern Gulf region offers ~261,590-km² of surface and airspace, making it the largest over-water DoD test and training area in the contiguous U.S. (Figure 8). Military activities include operations such as air-to-air and air-to-ground (surface) missile testing using drone targets; large force exercises; air, surface, and sub-surface mine warfare testing and training; and explosive ordnance disposal training (DoD 2018). Scheduling area W-151 is an example of a highly used area for the military where the AOI intersects, and aquaculture development would require coordination and consultation with the military (Figure 9; DoD 2018). A portion of W-151 is operated by the Panama City Operating Area, where Naval Support Activity Panama City and Tyndall Air Force Base are located, and more than 700 missions occur annually (Figure 10). Eglin Air Force Base operates out of Pensacola, Florida. The U.S. Air Force currently expends approximately 550 bombs, 580 missiles, 1,218,000 rounds, and 637,000 countermeasures annually in the Eglin Gulf Test and Training Range and in many cases, these activities occur in W-151 scheduling areas (DoD 2018). Other military activities that intersected or overlapped the AOI – particularly around the Florida panhandle – include military operating areas, danger and restricted areas, special use airspace, and unexploded ordnance sites (Formerly Used Defense Sites, or FUDS; Figure 8). Scoring of National Security areas for a suitability analysis is complex as activities change in space and time and introduce uncertainty until coordination and consultation can occur with the military. Here, we gave many of these areas a score of 0.5 within the analysis to account for this uncertainty. Planning for aquaculture development in these areas may require coordination with the Military Aviation and Installation Assurance Siting Clearinghouse.[3]

Natural and Cultural Resource Considerations

Fish havens (Figure 11) are permitted boundaries which contain artificial reefs made up of rocks, rubble, subway cars, ships, airplanes, specially designed concrete structures, and other objects placed on the ocean floor to enhance fish habitat (NOAA 2016). Fish haven boundaries were extracted from NOAA's electronic navigational chart (ENC) using the ENC Direct to GIS tool.[4] Few social and cultural activities data were available for this characterization. However, archaeologically-sensitive areas were considered and removed from the AOI.

Essential Fish Habitat (EFH) covers waters and substrate necessary for fish life history including spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802(10)).[5] EFH species data were compiled from NOAA's *Guide to Essential Fish Habitat Designations in the U.S. Gulf of Mexico* (NOAA 2014). This guide summarizes EFH designated by species and life stage for that species (i.e., eggs, larvae, juveniles, and adults). EFH that overlapped with the AOI included coastal migratory pelagic species, 17 highly migratory species, corals, red drum, reef fish,

[3] https://www.acq.osd.mil/dodsc/

[4] https://encdirect.noaa.gov/

[5] https://www.law.cornell.edu/uscode/text/16/1802

shrimp, and spiny lobster EFH (Table 9). EFH habitat designations, as well as other natural resource concerns, are depicted in Figure 12 and Figure 13.

Habitat Areas of Particular Concern (HAPC) and federally managed areas including Steamboat Lumps, Middle Grounds, and the Edges (78 FR 22952 50 CFR Part 622.34) were not present in the AOI, but are displayed on Figure 12 for reference. Other sensitive habitats in this study included submerged aquatic vegetation, hard bottom areas, deep-sea coral observations, protected areas, and designated fisheries management areas.

Industry and Navigation Considerations

Industrial activities in the AOI included ocean disposal sites; BOEM sand and gravel areas; one major pipeline; oil and gas wells, lease blocks, and platforms; deep water ports; and submarine cables (Figure 14). In the central and western Gulf of Mexico EEZ, the oil and gas industry has been operating for decades. However, a Congressional moratorium is in place for the eastern Gulf of Mexico for the preservation of military readiness (DOD 2018). For this analysis (3-15 nm from the Florida Gulf coast), the EPA regional office provided guidance on permitted wastewater treatment plants and outfalls within the region. It was determined that wastewater treatment outfalls or any required setbacks for effluent plumes do not intersect with the AOI.

Spatial planning for navigation included an assessment of aids to navigation, shipwrecks, pilot boarding stations, anchorage areas and shipping lanes (Figure 15). Data were gathered to determine relative interference with navigation and navigational routes. Automated Identification System (AIS) data were downloaded from Marine Cadastre (2020) and analyzed to determine the vessel count (i.e., vessel traffic) of each vessel type (i.e., tanker, cargo, passenger, tug and tow, pleasure and sailing craft, fishing, military, and other vessels) within the AOI (Figure 16). AIS data from 2019, the most recent year available from the NOAA Office for Coastal Management, were also used for the analysis (Figures 17 through 23).

Fishing and Aquaculture Considerations

Commercial and recreational fishing are important economic drivers for the Gulf of Mexico. Considerations of use patterns are essential for accurate ocean planning and conflict reduction with an established industry. NOAA NCCOS received several sets of fishing data from NMFS for this analysis, including number of recreational headboat trips from the Southeast Regional Headboat Survey (2014-2020; Figure 24), commercial shrimp trawling activity from vessel monitoring systems (VMS) (2004-2019; Figure 25), number of commercial reef fish bandit reel trips (2007-2019; Figure 26), and number of commercial reef fish longline trips (2007-2019)[6] to represent commercial and recreational fishing effort. Data were primarily received as point data which were subsequently aggregated and areas with less than three unique vessels were removed to preserve confidentiality. Additional descriptions of the data sets and data processing steps for the analysis can be found in Appendix B. For this analysis, areas in the AOI with greater fishing effort were considered less suitable for aquaculture. Aquaculture considerations were predominantly focused on aquaculture live rock areas off the southwest Florida coast. Live

[6] Data not shown due to confidentiality.

rock is grown at sea and harvested for the ornamental aquarium trade. These data, like most fishing data, are protected for confidentiality. Please refer to Appendix B for more specific details for each data set.

Table 9. Fish and invertebrate species managed by the National Marine Fisheries Service (NMFS), Gulf of Mexico Fishery Management Council, or South Atlantic Fishery Management Council within the AOI. These species require consideration of essential fish habitat (EFH) within the AOI. Highly migratory species (HMS) managed by NMFS are denoted with an asterisk (*). For all species listed, all life stages are present in the AOI. Life stages differ from corals, teleost fishes, and elasmobranchs.

Essential Fish Habitat Species in the AOI		
Atlantic angel shark*	Finetooth shark*	Scalloped hammerhead shark*
Atlantic sharpnose shark*	Great hammerhead shark*	Shrimp
Blacknose shark*	Lemon shark*	Smoothhound shark complex*
Blacktip shark*	Nurse shark*	Spinner shark*
Bonnethead shark*	Red drum	Spiny lobster
Bull shark*	Reef fish	Tiger shark*
Corals	Sailfish*	Whale shark*
Coastal migratory pelagic spp.	Sandbar shark*	

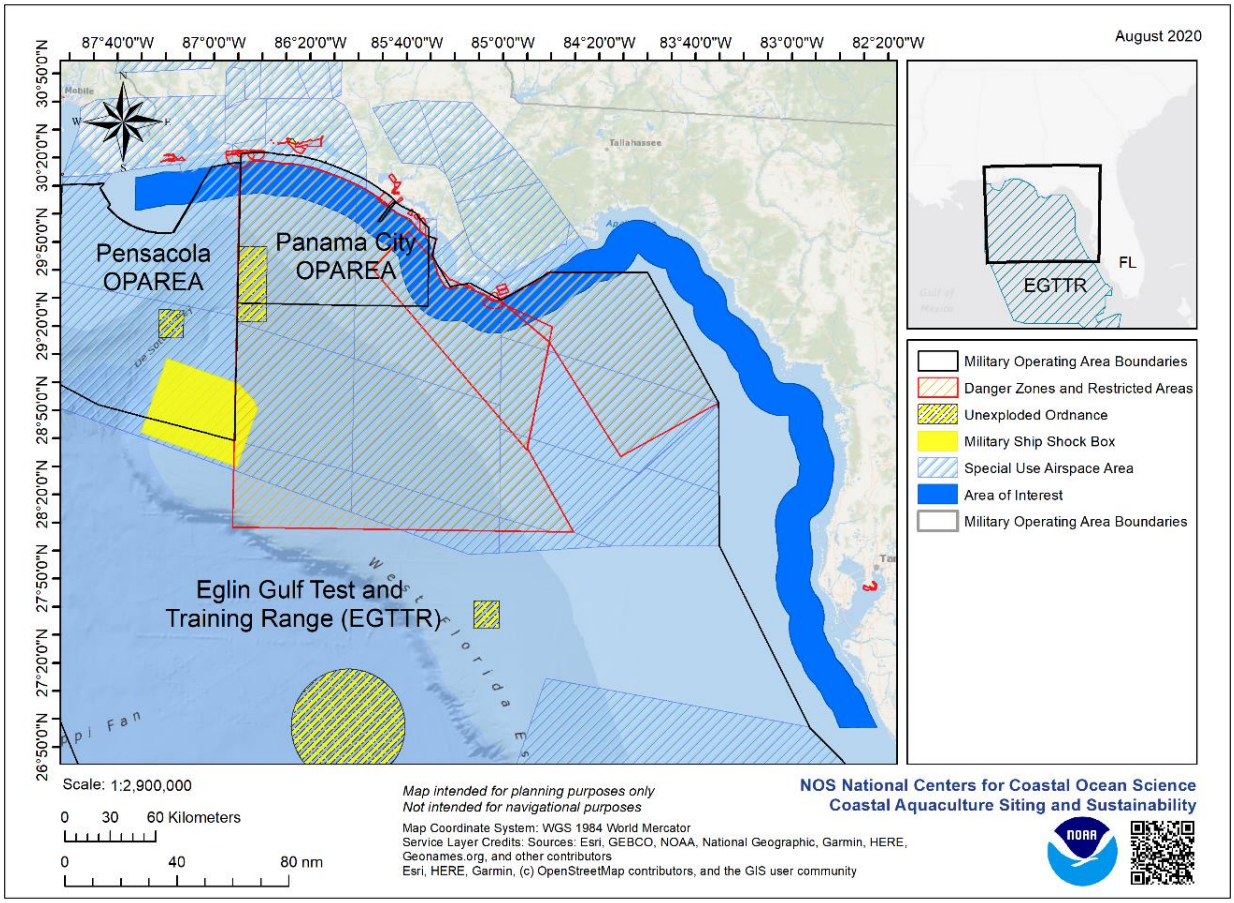

Figure 8. Military activity off the coast of western Florida. The AOI intersects military danger and restricted zones, special use airspace (SUAS), military operating areas, and unexploded ordnance FUDS area.

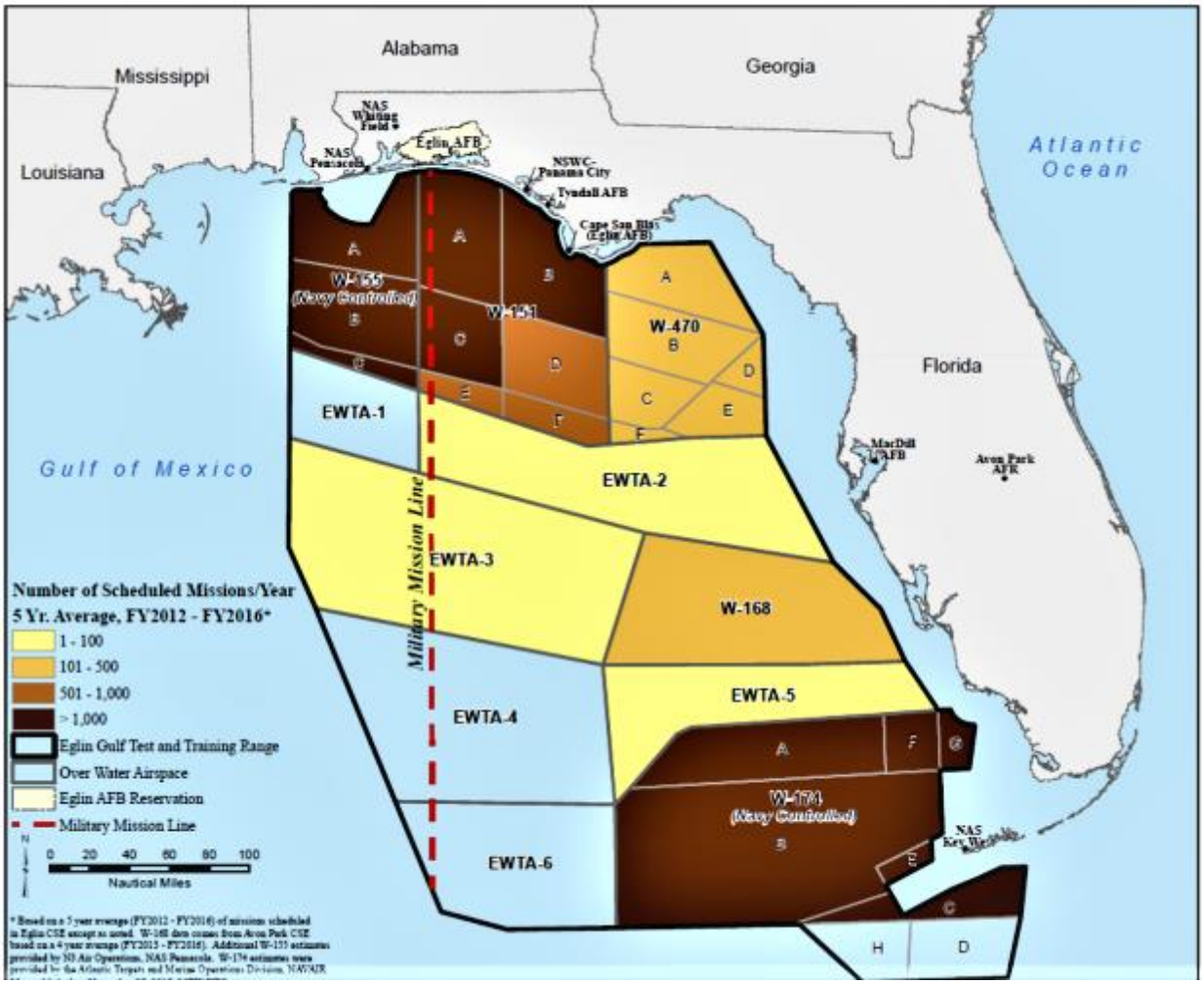

Figure 9. A five-year graphical depiction of military use data for fiscal year 2012 through fiscal year 2016. Adapted from the Department of Defense (DoD 2018).

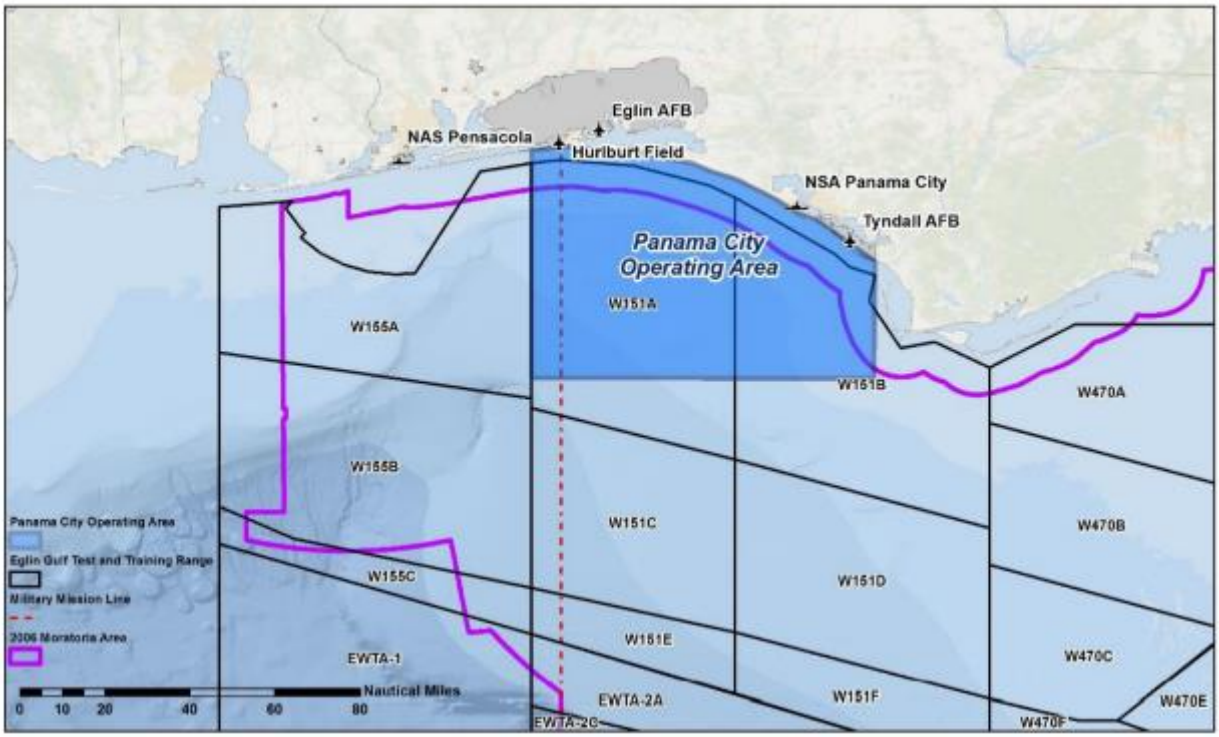

Figure 10. Panama City Operating Area, which occupies W151A and W151B and is used routinely by the Navy Diving and Salvage Training Center and the Navy School for Explosive Ordnance Disposal (DoD 2018).

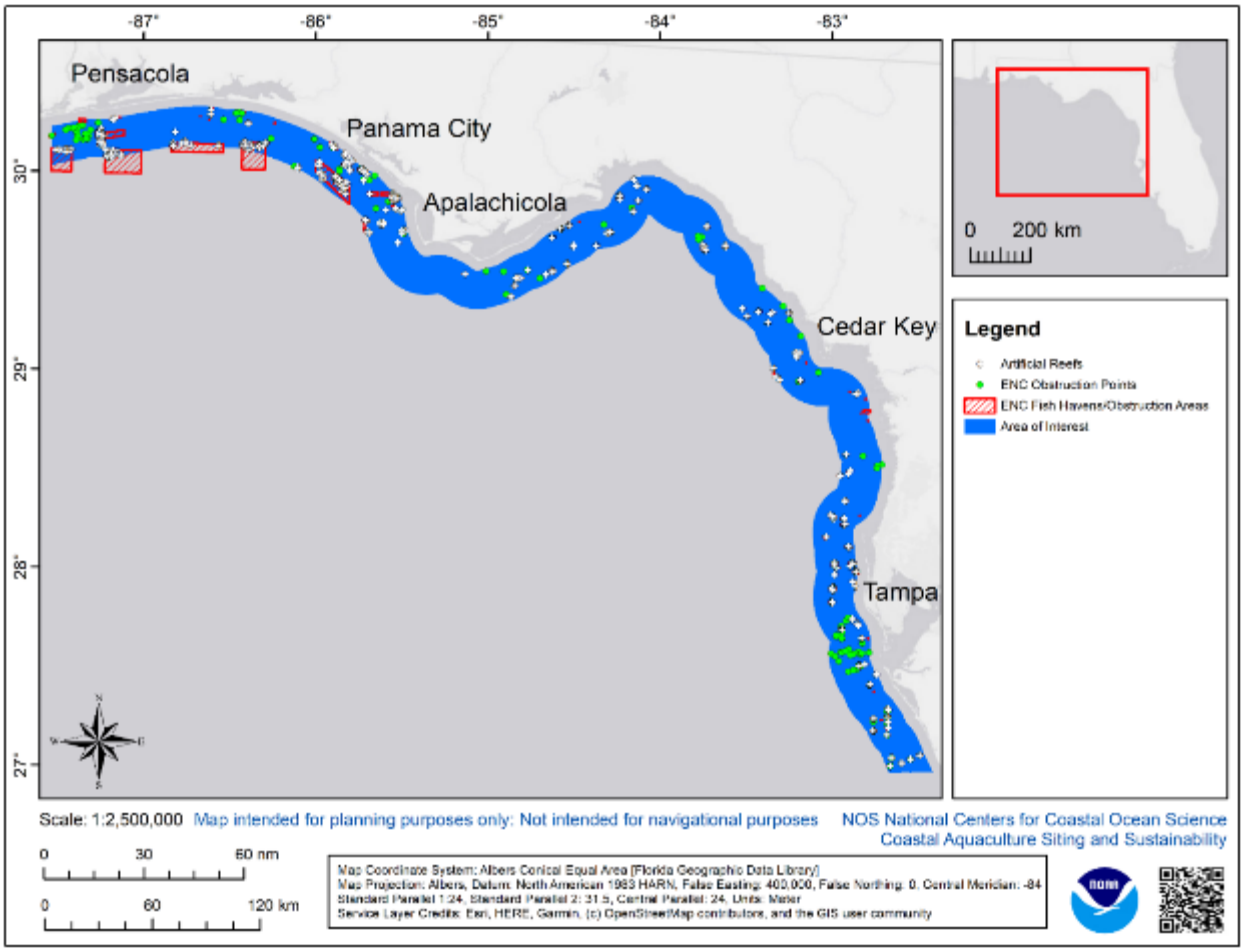

Figure 11. Artificial reefs, electronic navigational chart (ENC) obstruction points, and fish haven areas overlapping the AOI.

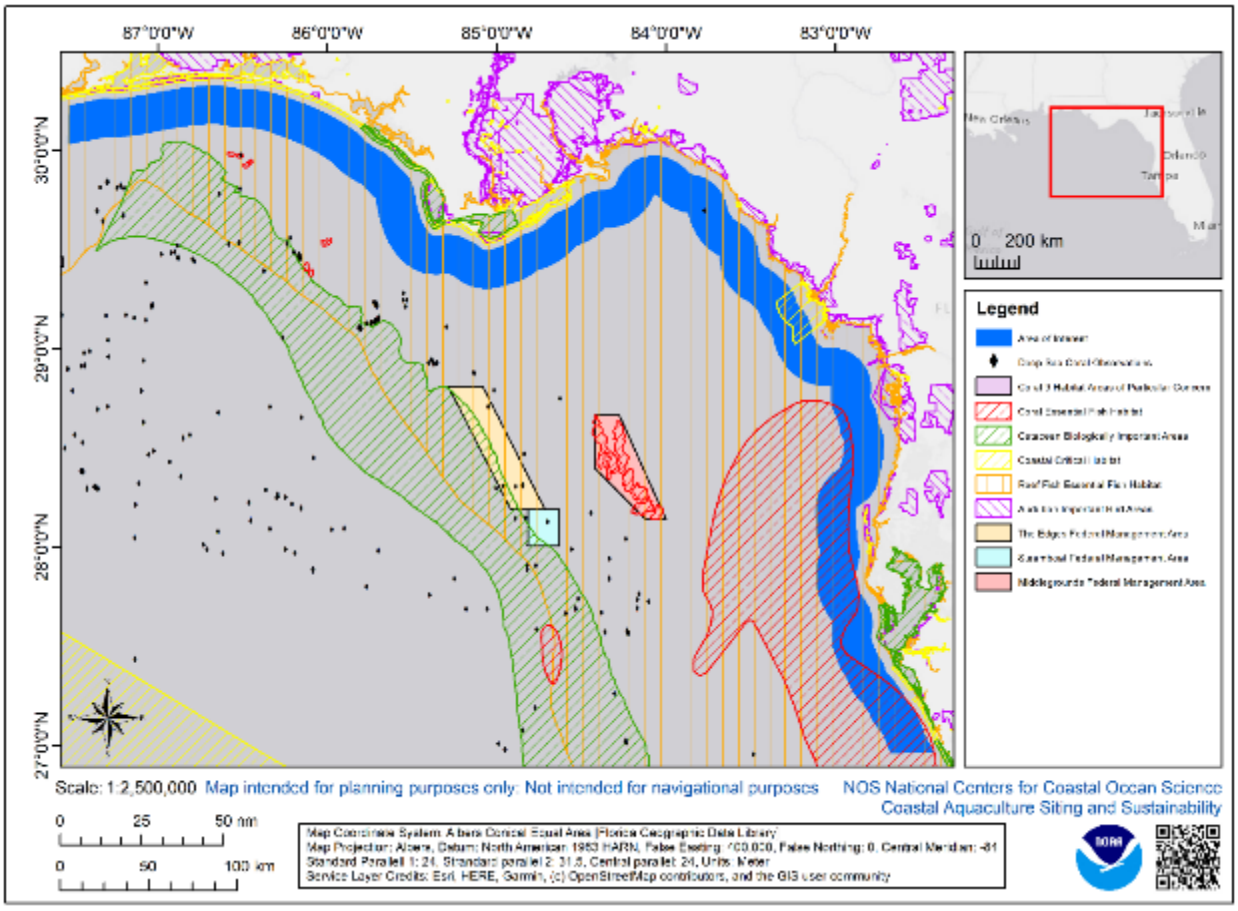

Figure 12. Natural resource spatial data in the study region. Data layers depicted here include essential fish habitat (EFH) layers, habitat areas of particular concern, critical habitat, deep-sea coral observations, and federally managed areas in the vicinity of the AOI (the Edges, Steamboat Lumps, and the Florida Middle Grounds).

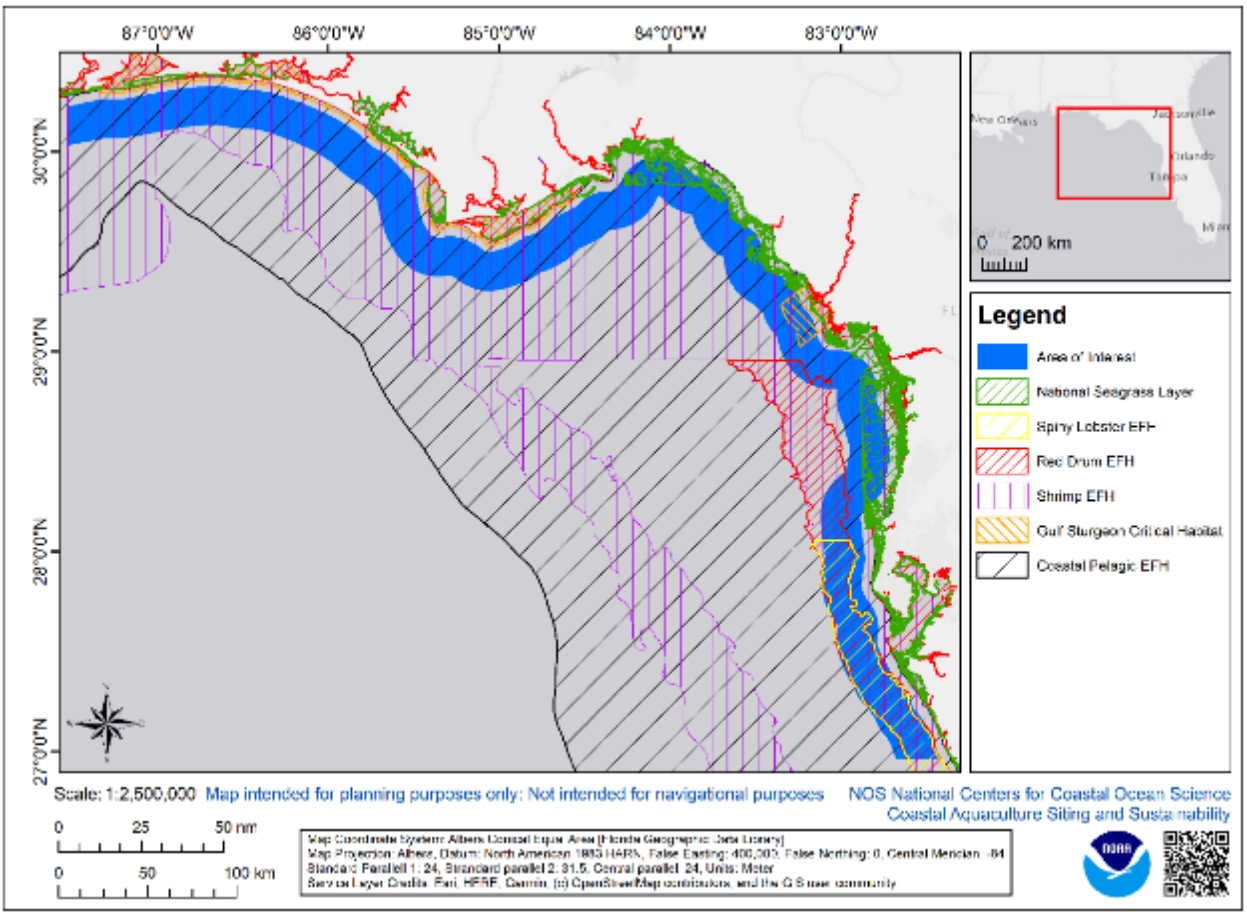

Figure 13. Natural resource spatial data in the study region. The planning visualization indicates overlap with the seagrass data layer (green bars), essential fish habitat (EFH) data layers for spiny lobster (yellow bars), red drum (red bars), shrimp (pink bars), coastal pelagics (black bars), and gulf sturgeon critical habitat (orange bars).

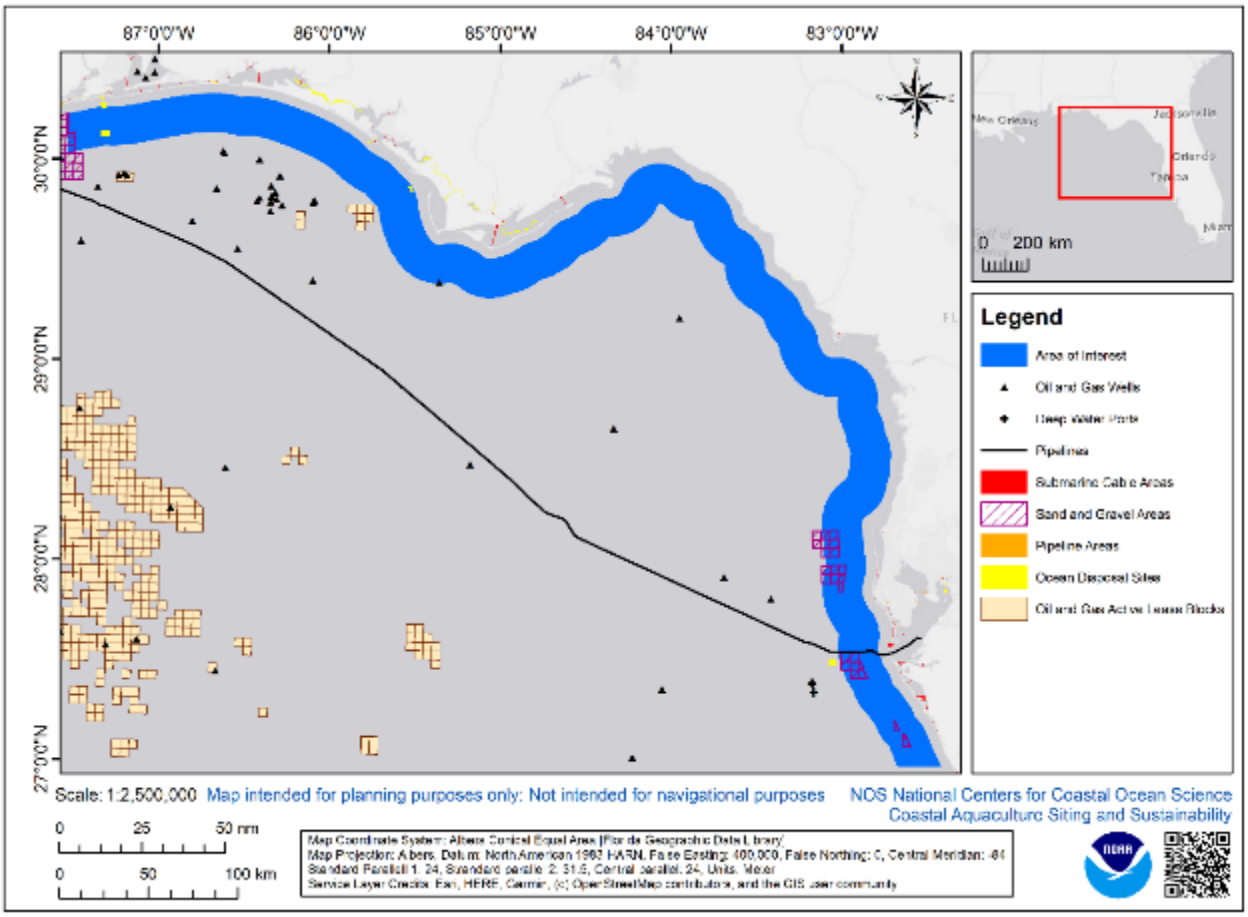

Figure 14. Industry spatial data in the study region, including oil and gas infrastructure, ocean disposal sites, submarine cables, and deep water ports.

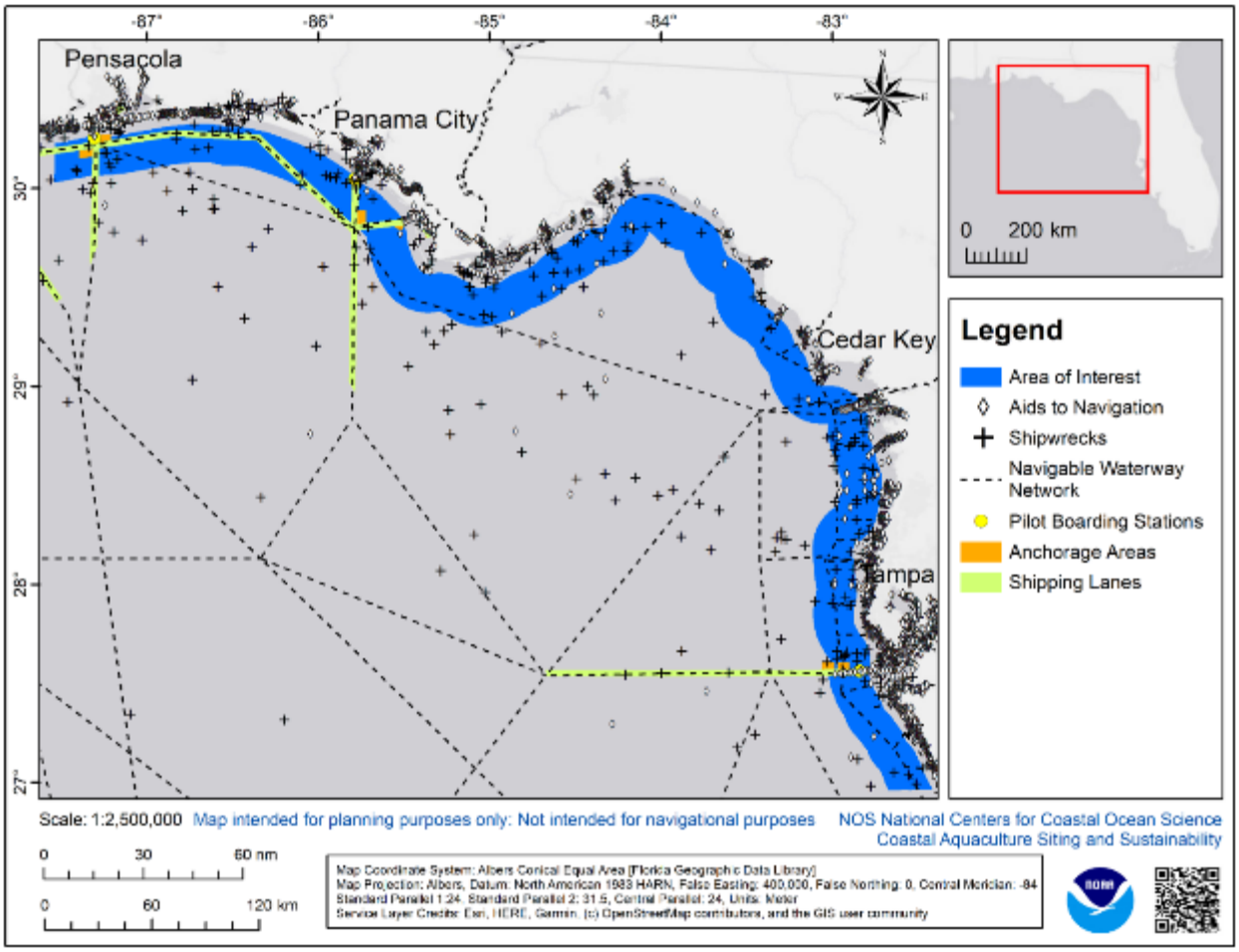

Figure 15. Navigational data layers in the study region. These include shipping lanes (light green lines), aids to navigation (diamonds), shipwrecks (+), pilot boarding stations (yellow circles), anchorage areas (orange), and navigable waterway network lines (---).

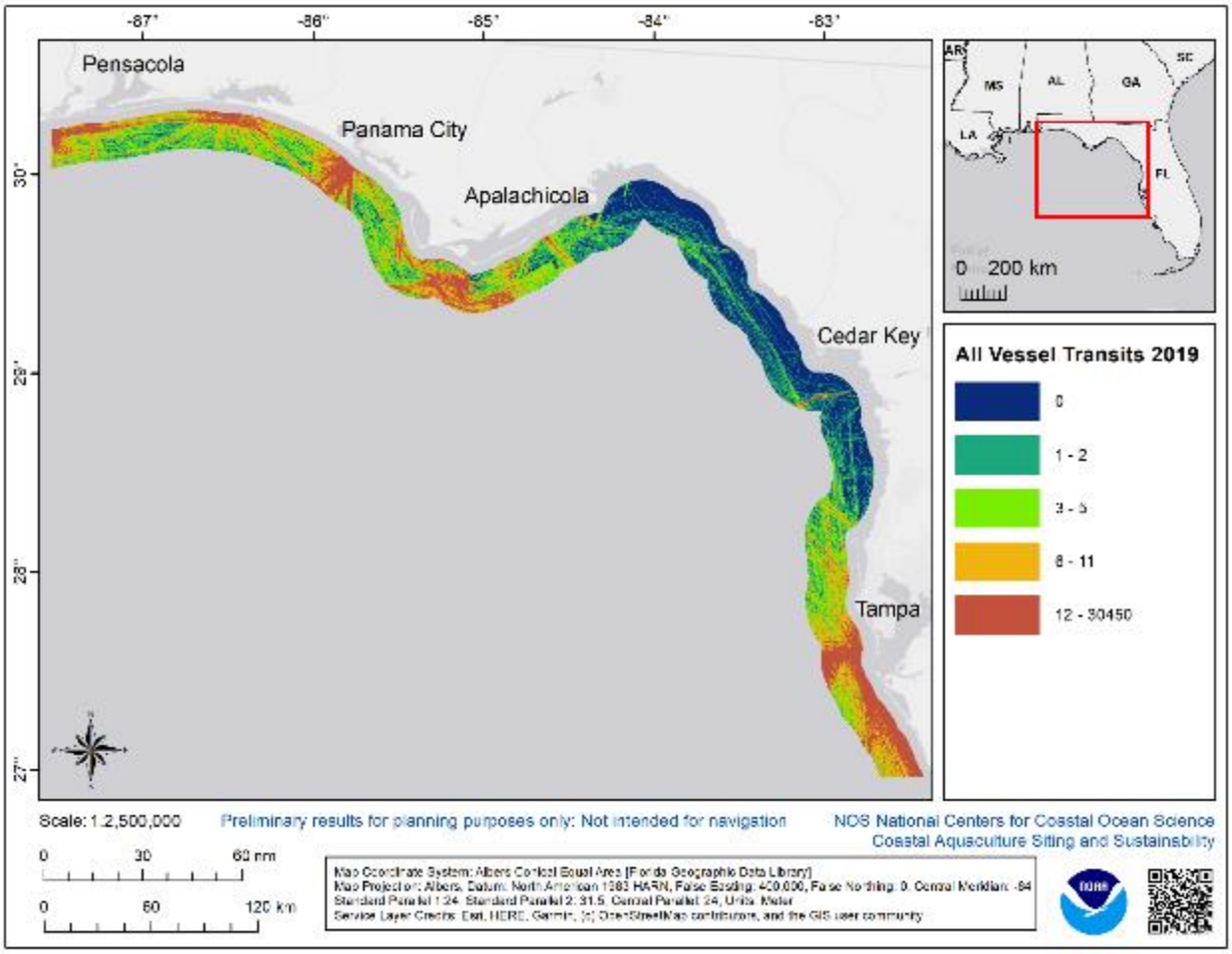

Figure 16. Automatic Identification System (AIS) number of vessel transits per 10-acre grid cell for all vessel types (cargo, tanker, passenger, tug and tow, pleasure craft and sailing, fishing, military, and other). Quantiles were used to create classifications.

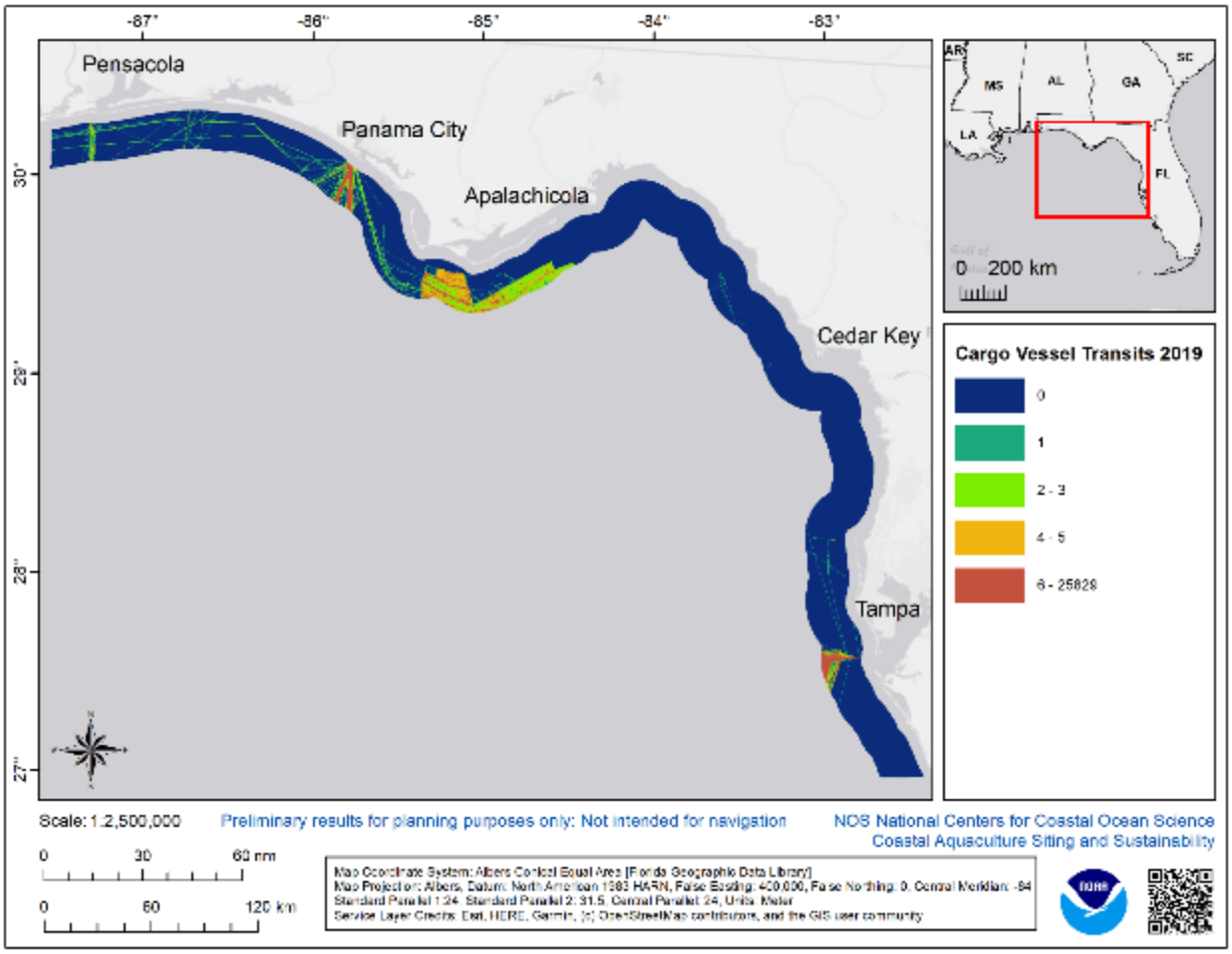

Figure 17. 2019 Automatic Identification System (AIS) cargo vessel transits aggregated to 10-acre grid cells. Quantiles were used to create classifications.

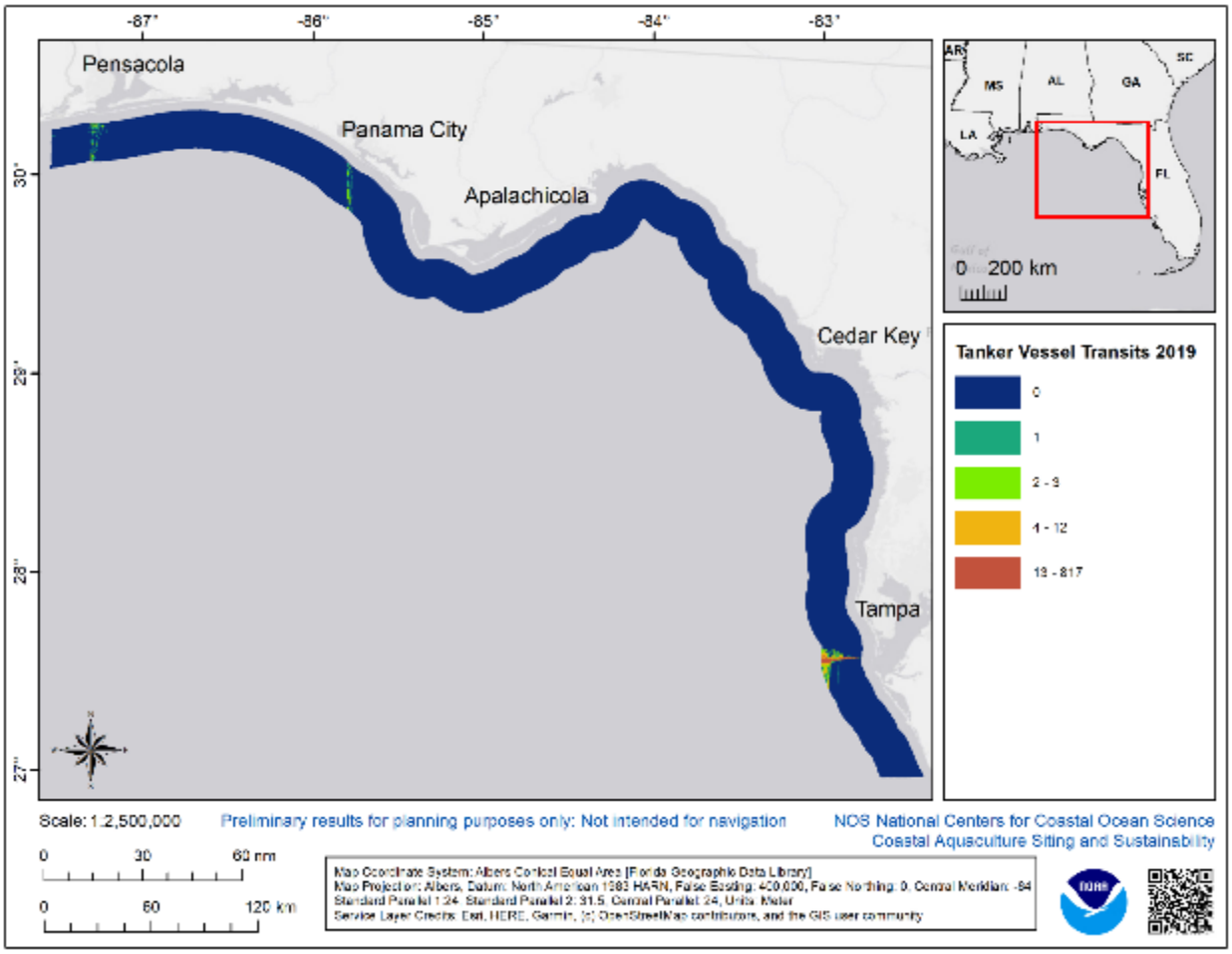

Figure 18. 2019 Automatic Identification System (AIS) tanker vessel transits aggregated to 10-acre grid cells. Quantiles were used to create classifications.

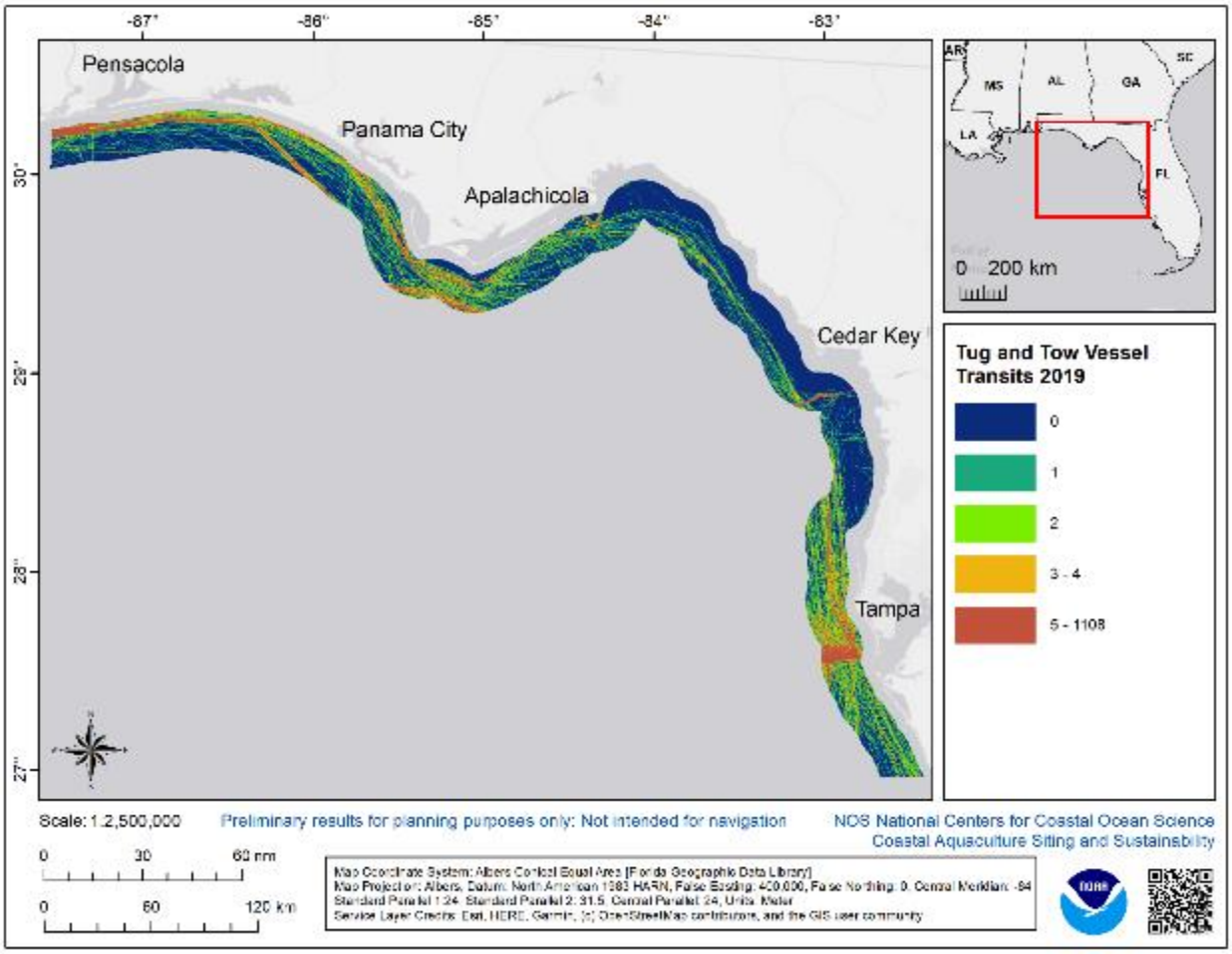

Figure 19. 2019 Automatic Identification System (AIS) tug and tow vessel transits aggregated to 10-acre grid cells. Quantiles were used to create classifications.

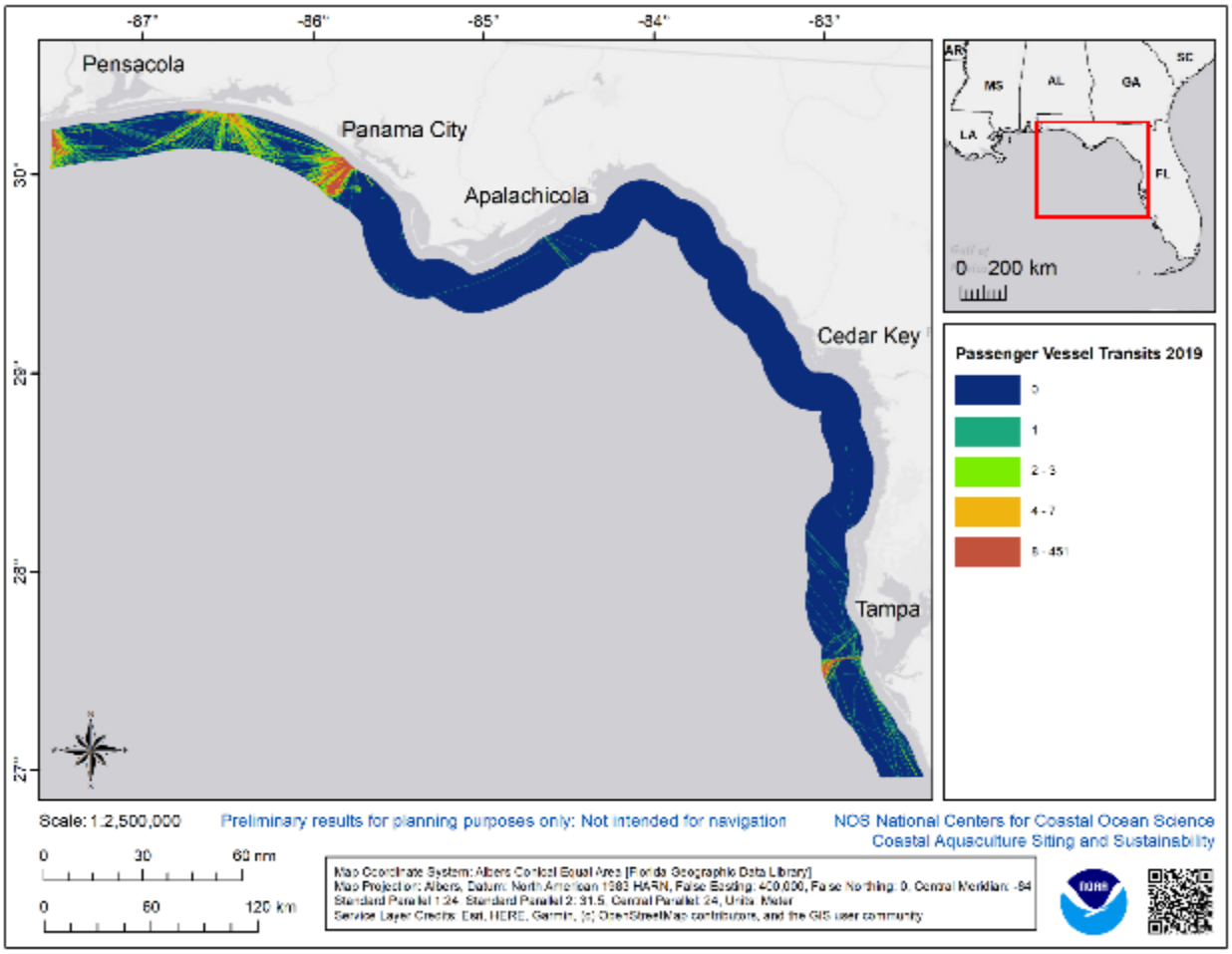

Figure 20. 2019 Automatic Identification System (AIS) passenger vessel transits aggregated to 10-acre grid cells. Quantiles were used to create classifications.

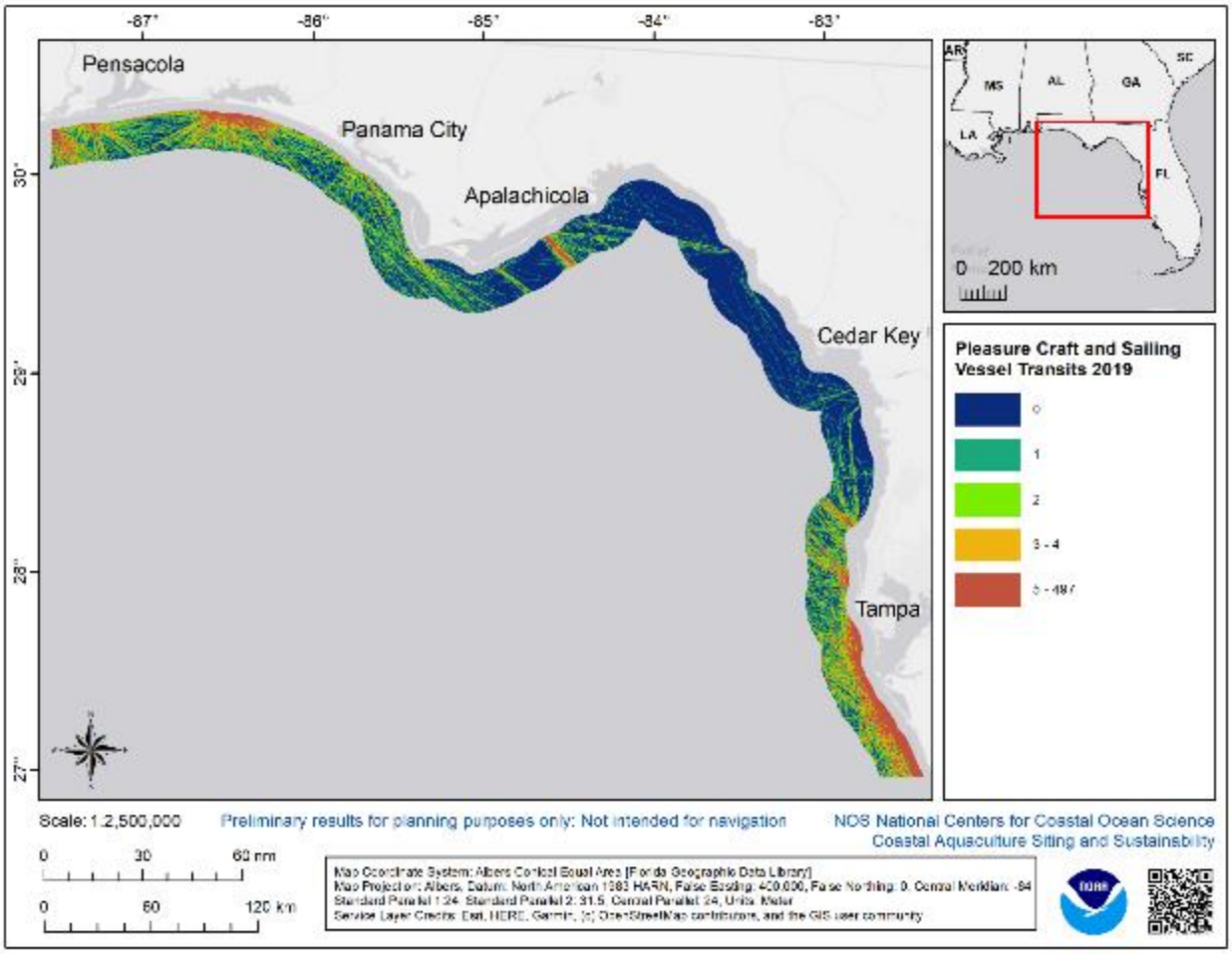

Figure 21. 2019 Automatic Identification System (AIS) pleasure and sailing vessel transits aggregated to 10-acre grid cells. Quantiles were used to create classifications.

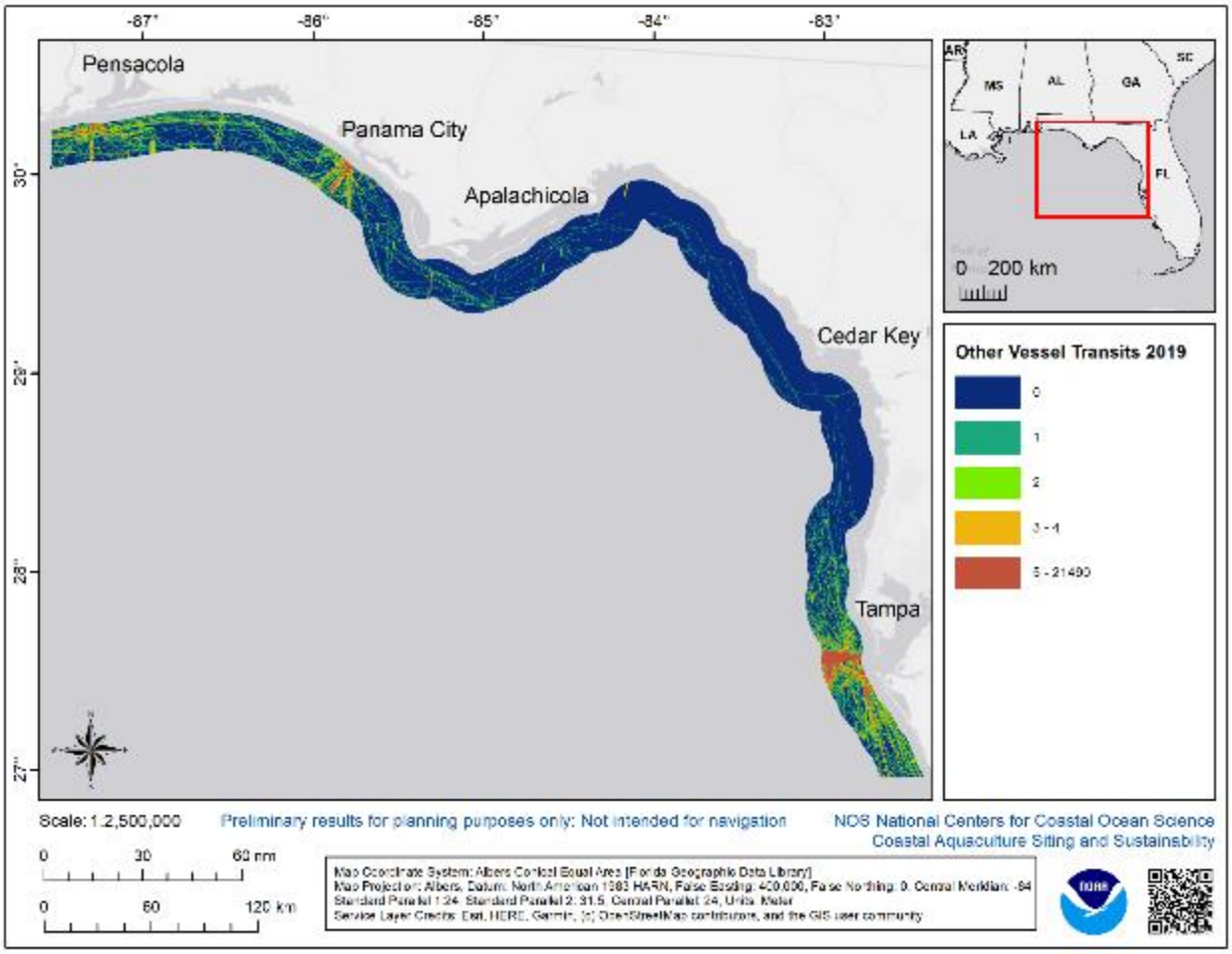

Figure 22. 2019 Automatic Identification System (AIS) other vessel transits aggregated to 10-acre grid cells. Quantiles were used to create classifications.

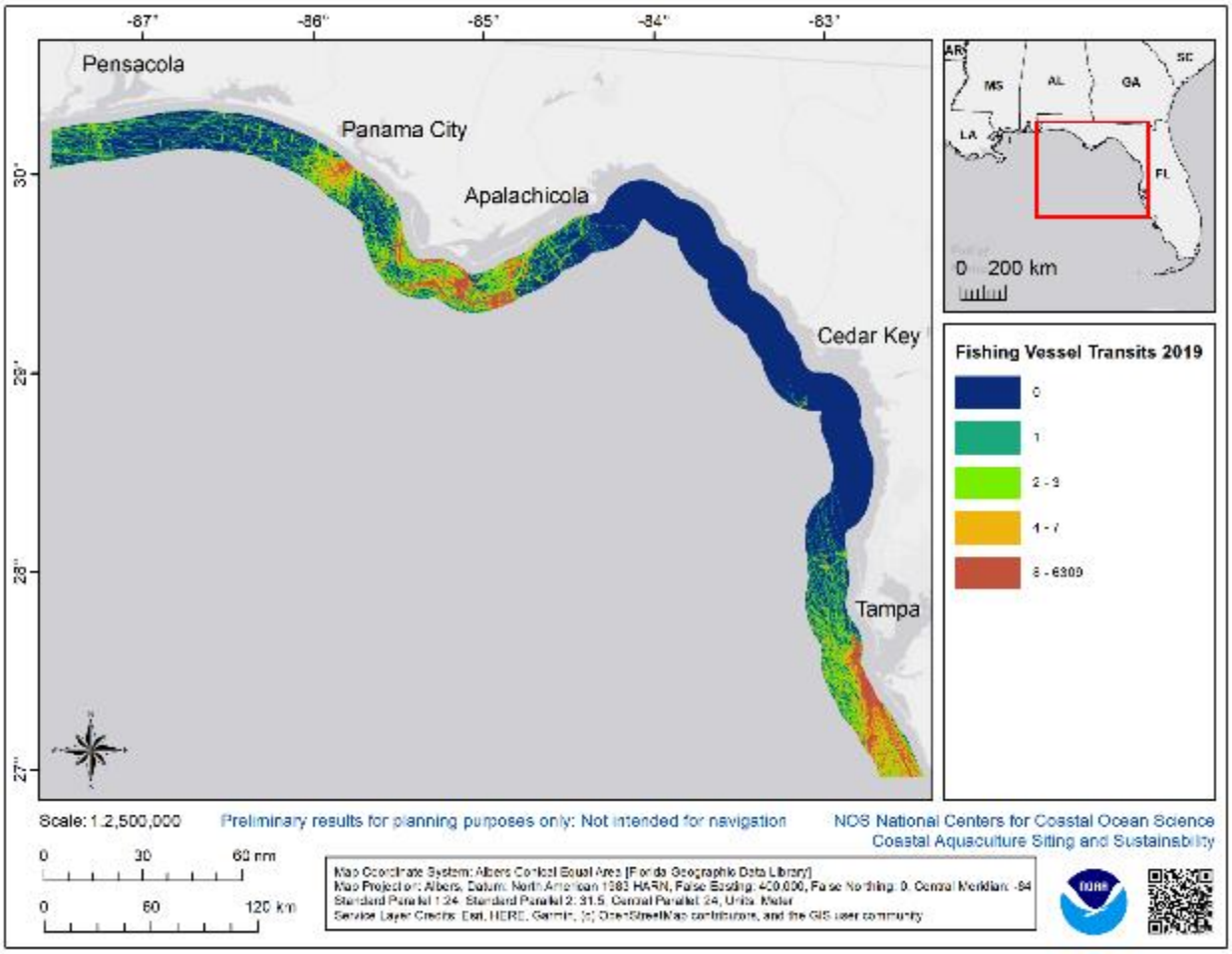

Figure 23. 2019 Automatic Identification System (AIS) total fishing vessel transits aggregated to 10-acre grid cells. Quantiles were used to create classifications.

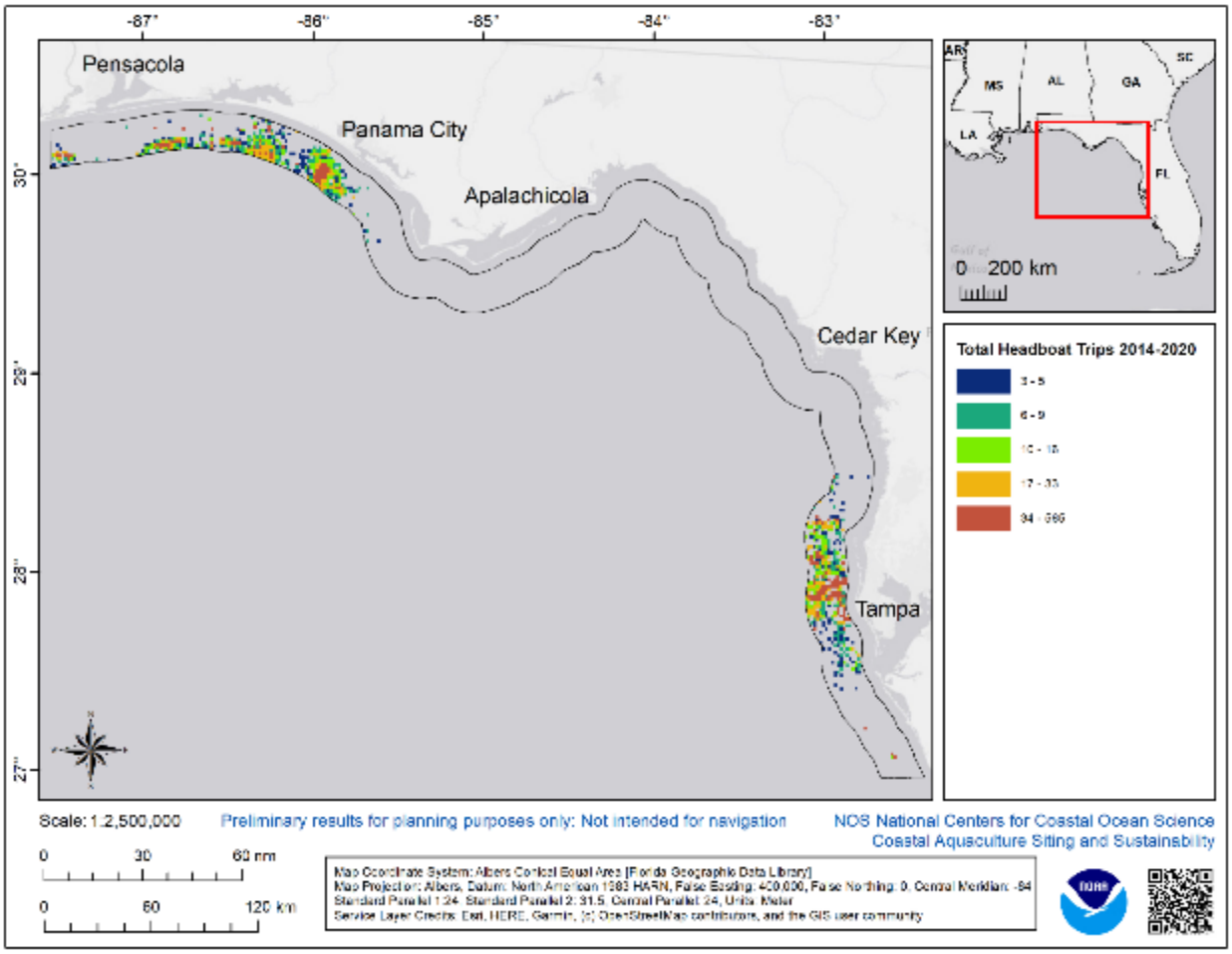

Figure 24. Total number of recreational headboat trips from 2014 through 2020 within the AOI (data aggregated to 1’ x 1’ grid cells). Red values represent the highest number of trips taken per area, green values represent moderate number of trips, and blue represents areas where low headboat trip data were recorded. Quantiles were used for classification, and any grid cell with less than three unique vessels is not displayed to maintain confidentiality of data.

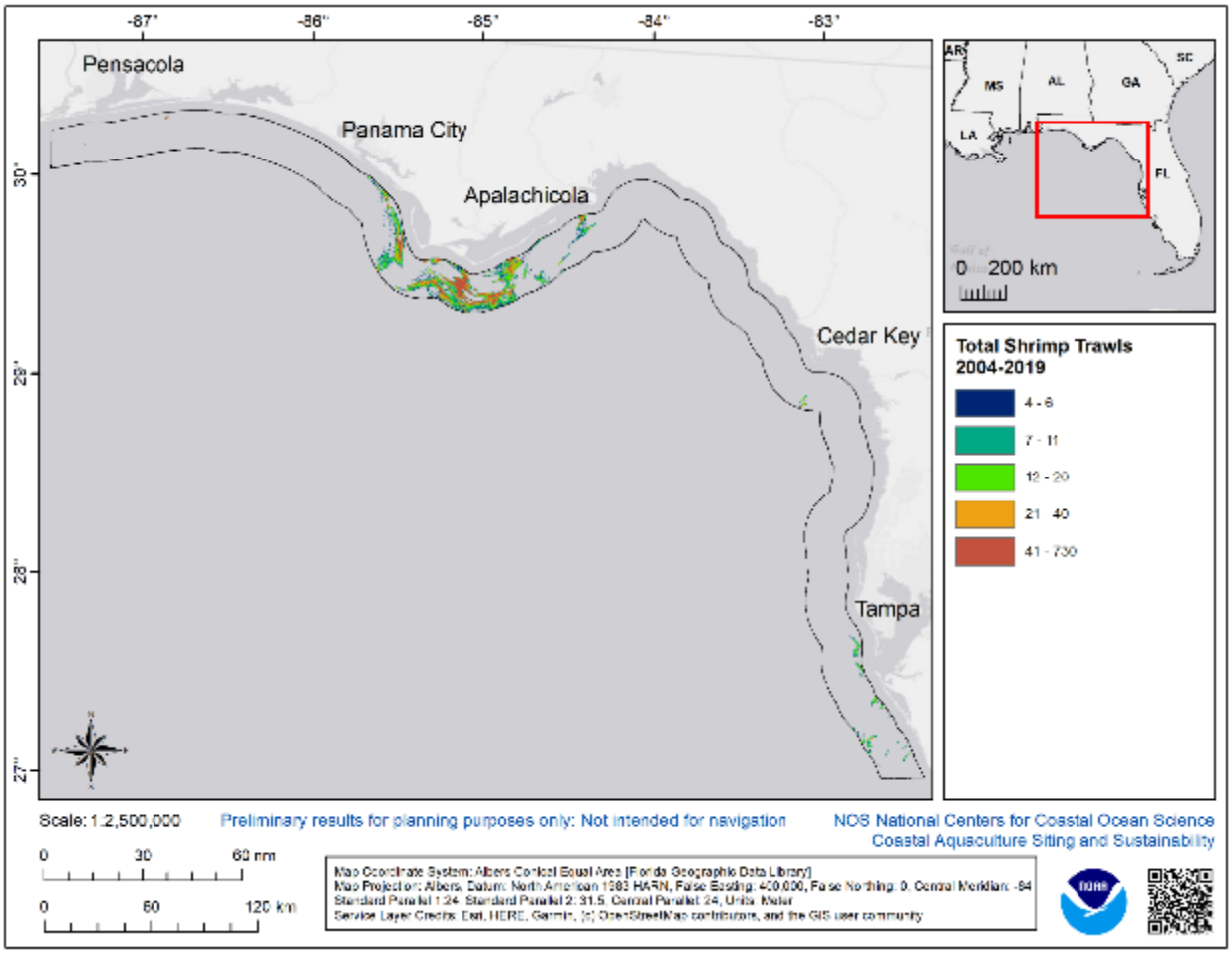

Figure 25. Total commercial shrimp trawl effort (when trawling was assumed based on speed over ground) within the AOI from 2004 through 2019 (data aggregated to 100 x 100 m cells). Red values represent the highest number of trips taken per area, green values represent moderate number of trips, and blue represents areas where low trawl data were recorded. Values are the sum of all trawls from 2004 to 2019 and include about 50 to 60% of the fleet reporting as required by National Marine Fisheries Service. Quantiles were used for classification, and all cells with less than 3 unique vessels are not displayed to maintain confidentiality.

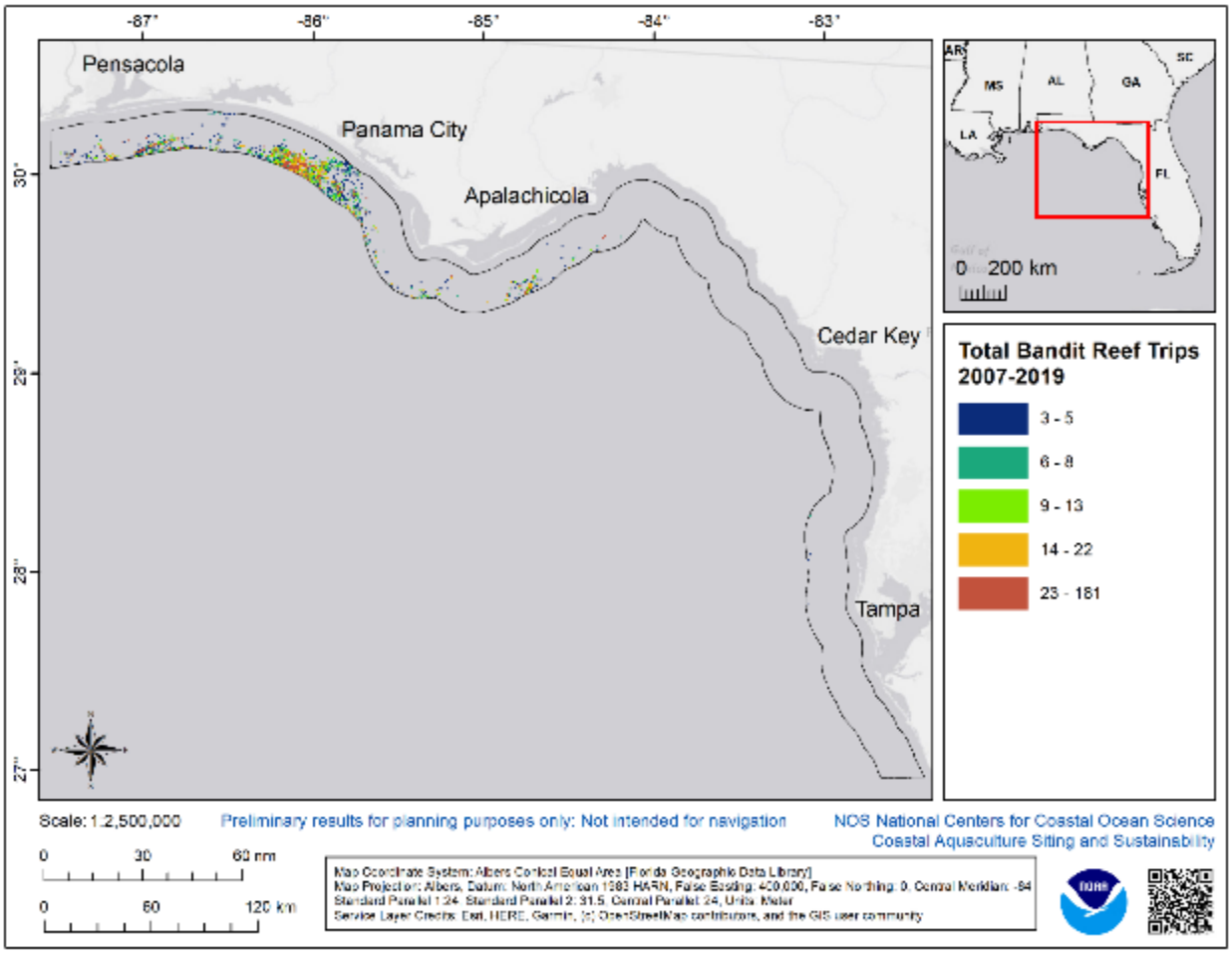

Figure 26. Total commercial reef fish bandit reel trips within the AOI from 2007 through 2019 (data aggregated to 1 x 1 km grid). Red values represent the highest number of trips taken per area, green values represent moderate number of trips, and blue represents areas where low bandit reel trip data were recorded. Quantiles were used for classifications, and any grid cell with less than 3 unique vessels is not displayed to maintain confidentiality.

RELATIVE SUITABILITY RESULTS

Summary

Overall, the relative suitability analysis identified a number of exclusions primarily driven by national security areas, vessel traffic, fishing activity, shipping lanes, and sand gravel lease areas (Table 10-11). To identify POAZs in Florida state waters, the results of the relative suitability analysis were further delineated into four individual Planning Areas from within the North and South region: Northwest, Northeast, South A, and South B (Figure 27, Table 12).

Once these four Planning Areas were identified, FDACS and NCCOS worked together to identify POAZs for further planning within the statistically high-high suitability clusters (as identified in the LISA cluster analysis). At least 200 acres was required for final selection, with no maximum area defined, thus larger POAZs were created within the statistically high clusters first, with smaller POAZs delineated next. Additionally, final POAZ polygons were contiguous to each other in some cases; setbacks between POAZs will be determined later in the planning process, as these are likely to be site specific. All final siting options identified were in Florida state waters (i.e., between 3-9 nm from shore). The specific location and characterization of the final POAZs are described in more detail below.

Importantly, when looking at maps of site options associated with POAZs, note the size of the identified areas, particularly as they relate to vessel traffic and bathymetric features within the space (i.e., the size of a feature relative to the size of the site). Comparing individual siting options on a 1:1 basis is not recommended due to the size differential among sites. Each site requires independent assessment due to size as well as a unique combination of uses and environmental considerations near each site.

Table 10. All data layers included in the suitability analysis with the score and percent of area each layer covered in the Northern Region. Layers are sorted by descending percent area present. NS = National Security; NCR = Natural and Cultural Resources; IN = Industry and Navigation; FA = Fishing and Aquaculture; FUD = Formerly Used Defense Site.

Parameter	Sub-model	Score	% Area Present
Danger Zones and Restricted Areas	NS	0	75.21
Vessel Traffic 2019 - Pleasure and sailing	IN	Numerical	62.76
Vessel Traffic 2019 - Fishing	IN	Numerical	57.23
Vessel Traffic 2019 - Tug and tow	IN	Numerical	55.29
Bandit reel trips (2007-2019)	FA	Numerical	52.82
Panama City Operating Area	NS	0	43.43
Shrimp trawling (2004-2019)	FA	Numerical	41.06
Headboats (2014-2020)	FA	Numerical	39.69
Special Use Airspace - W151B	NS	0	34.65
Vessel Traffic 2019 - Other	IN	Numerical	33.60
Vessel Traffic 2019 - Passenger	IN	Numerical	25.61
Vessel Traffic 2019 - Cargo	IN	Numerical	24.82
Special Use Airspace - W151A	NS	0	21.91
Special Use Airspace - W470A	NS	0	17.22
Shipping fairways (500-m setback)	IN	0	15.72
Fish haven (500-ft setback)	NCR	0	7.76
Special Use Airspace - W155A	NS	0.5	7.50
Pensacola Operating Area	NS	0.5	7.42
Unexploded Ordnance FUDs	NS	0.5	4.85
Vessel Traffic 2019 - Military	IN	Numerical	2.06
Anchorage Areas (used/disused)	IN	0	1.31
Artificial reefs (500-ft or 152.4-m setback)	NCR	0	1.18
Vessel Traffic 2019 - Tanker	IN	Numerical	1.14
Sand and gravel lease areas	IN	0	0.57
Special Use Airspace - MOA U.S. 02214	NS	0.5	0.39
Shipwrecks and obstructions (500-ft or 152.4-m setback)	NCR	0	0.36
Ocean disposal sites	IN	0	0.33
Longline trips (2007-2019)	FA	Numerical	0.20
FDEP Oil Gas Permit Wells (500-m setback)	IN	0	0.12
Aids to Navigation (500-m setback)	IN	0	0.09
Environmental Sensors and Buoys (500-m setback)	IN	0	0.03
Pilot boarding areas and stations (500-m setback)	IN	0	0.03
Individual Leases Aquaculture (500-m setback)	FA	0	0.02
FL Parks SS *Tarpon* Preserve	NCR	0	0.02
Live Rock Sites (500-m setback)	FA	0	0.02
Special Use Airspace - MOA U.S. 02208	NS	0.5	0.02
Archaeologically important sites	NCR	0	0.01

Table 11. All data layers included in the suitability analysis with the score and percent of area each layer covered in the Southern Region. Layers are sorted by descending percent area present. NS = National Security; NCR = Natural and Cultural Resources; IN = Industry and Navigation; FA = Fishing and Aquaculture; FUD = Formerly Used Defense Site.

Parameter	Sub-model	Score	% Area Present
Headboats (2014-2020)	FA	Numerical	82.57
Vessel Traffic 2019 – Pleasure and sailing craft	IN	Numerical	82.41
Vessel Traffic 2019 - Fishing	IN	Numerical	76.52
Vessel Traffic 2019 - Tug and tow	IN	Numerical	73.04
Vessel Traffic 2019 - Other	IN	Numerical	58.84
Shrimp trawling (2004-2019)	FA	Numerical	32.68
Sand lease areas unrestricted	IN	0	14.49
Bandit reel trips (2007-2019)	FA	Numerical	12.97
Vessel Traffic 2019 - Passenger	IN	Numerical	12.43
Vessel Traffic 2019 - Cargo	IN	Numerical	8.24
Shipping fairways (500-m setback)	IN	0	4.57
Vessel Traffic 2019 – Tanker	IN	Numerical	4.24
FWC Potential coral hard bottom	NCR	0	1.82
Anchorage Areas (used/disused)	IN	0	1.47
Live Rock Sites (500-m setback)	FA	0	1.04
Fish haven (500-ft setback)	NCR	0	0.91
Pipelines (500-m setback)	IN	0	0.80
Shipwrecks and obstructions (500-ft setback)	NCR	0	0.50
Aids to Navigation (500-m setback)	IN	0	0.49
Artificial reefs (500-ft setback)	NCR	0	0.44
Unexploded Ordnance FUDs	NS	0.5	0.30
FDEP Oil Gas Permit Wells (500-m setback)	IN	0	0.11
Sand and gravel lease areas	IN	0	0.09
Vessel Traffic 2019 - Military	IN	Numerical	0.06
Coastal maintained channels (Width and ½ setback*)	IN	0	0.05
Environmental Sensors and Buoys (500-m setback)	IN	0	0.04
Pilot boarding areas and stations (500-m setback)	IN	0	0.04

**The width of the channel plus half the width of the channel is used for the setback distance, for example a 50-m wide channel would have a 75-m setback distance*

Table 12. Number and area of suitable siting options found for each Planning Area.

Region	Planning Area	# Suitable POAZs	Siting Option #	Total acres in POAZs
North	Northwest	5	1-5	18,153
	Northeast	2	6-7	1,913
South	South A	3	8-10	8,225
	South B	24	11-34	26,615
	Total	***34***		***54,906***

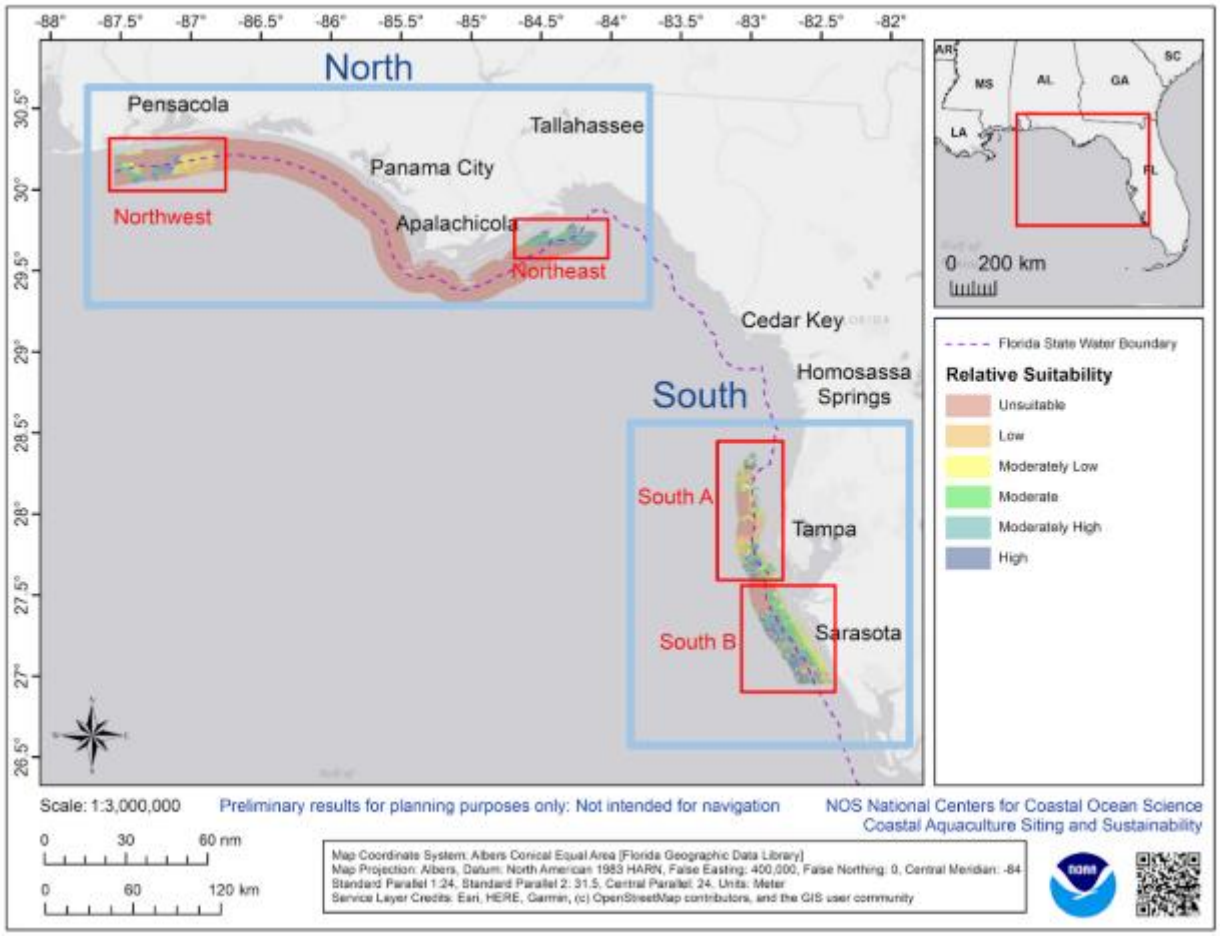

Figure 27. The relative suitability analysis identified two large regions (i.e., North and South; large blue boxes). Due to the geographic spread of suitable areas, these were further subdivided into four geographically distinct Planning Areas (i.e., Northwest, Northeast, South A, South B; small red boxes).

Northwest Planning Area: Pensacola (Siting Options 1-5)

The Northwest Planning Area is located off the coast of Pensacola Bay and Santa Rosa Sound (Figure 28). The western boundary is the Florida/Alabama state line and the eastern edge is bound by major national security constraints. The 3-9 nm distance offshore limit (i.e., remaining in Florida state waters) drove the northern and southern bounds for this area.

Overall, significant high-high clustering from the LISA analysis occurred for 23,430 acres in the Northwest Planning Area (Figure 29). High-high suitability clusters that met the minimum size requirement were identified in the north-central portion of the Planning Area, and much larger expanses in the southern outer portion. The cluster analysis was predominantly driven by national security constraints, recreational fishing (i.e., headboat trips), shrimp trawling, and vessel traffic, namely tug and tow and pleasure and sailing vessels (Table 13). Artificial reefs, fish havens, and sand and gravel areas were also present. After applying the site selection rules, five POAZs were identified in the Northwest Planning Area, totaling 18,153 acres of ocean space (Figure 30).

Detailed characterization of each POAZ option in the Northwest Planning Area (options 1-5) can be found in the following sections and examined in Table 13. The smallest siting option was 315 acres (option 2) and the largest was 6,837 acres (option 4). Option 1 had the closest distance to an inlet at 7 km to Perdido Pass. National security considerations were directly present or adjacent to some of these siting options and may require further investigation or discussion with the DoD. All five options in the Northwest Planning Area are within the essential fish habitat (EFH) for Atlantic Highly Migratory Species (HMS), coastal migratory species, shrimp, and reef fish (Table 13).

Among sites, seawater temperature ranged from 10.2°C to 32.3°C and salinity ranged from 25.07 PSU to 36.7 PSU. The highest maximum daily surface current speed was 0.61 m/s and the maximum significant wave height for the entire time period was 7.9 m. The most prevalent fishing effort across all POAZs was shrimp trawling followed by recreational headboat trips and commercial bandit reel trips; although relative intensity of each fishing type varied among POAZs. Option 1 had the highest overall vessel traffic (primarily driven by pleasure and sailing and tug and tow vessels) at 24 transits/100 acres followed (in descending order respectively) by options 2, 4, 3, and 5. Toxic red tide blooms only occurred once in POAZ options 3 and 4 over the 19-year period examined.

Table 13. Characterization of the Northwest Planning Area POAZs. Parameters of relevance are listed with the corresponding values. The distances listed for national security considerations indicate the nearest distance to the POAZ boundary from the feature. The five planning options totaled 18,153 acres.

Category	Parameters	Option 1	Option 2	Option 3	Option 4	Option 5
Geographic	Area (acres)	2,269	315	4,341	6,837	4,381
	Bathymetry Range (m)	10.2-16.7	19-26	18.1-28.6	22-29	23-31
	Distance to Pensacola Inlet (km)	17	13	16	23	22
	Distance to Perdido Pass Inlet (km)	7	36	39	12	44
National Security	Distance to Pensacola Operating Area (m)	21,571	12,330	282	17,993	173
	Distance to Unexploded Ordnance FUDs (m)	176	137	1,955	0	5,408
	Distance to Special Use Airspace – MOA U.S. 01867 (m)	5,508	0	0	11,957	5,097
	Special Use Airspace – MOA U.S. 02214	No	No	No	No	No
	Special Use Airspace – MOA U.S. 02208	No	No	No	No	No
	Distance to Special Use Airspace – W155A (m)	21,526	12,129	207	17,855	0
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes	Yes	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes	Yes	Yes	Yes
	Shrimp EFH	Yes	Yes	Yes	Yes	Yes
	Reef Fish EFH	Yes	Yes	Yes	Yes	Yes
	Red Drum EFH	No	No	No	No	No
	Spiny Lobster EFH	No	No	No	No	No
	Shallow Coral EFH	No	No	No	No	No
	Distance to Artificial Reef (m)	11,853	70	247	2,268	318
	Distance to Fish Haven (m)	10,912	6,165	6,068	1,176	64
Industry and Navigation	Distance to shipping lane (m)	613	694	583	584	584
	Distance to Sand and Gravel Areas (m)	198	31,904	34,546	74	36,329
	Cargo vessel transits 2019	0	0	0	0	1
	Tanker vessel transits 2019	0	0	0	0	0
	Tug and tow vessel transits 2019	117	20	44	40	6
	Fishing vessel transits 2019	16	6	32	25	8
	Passenger vessel transits 2019	95	4	0	290	7
	Pleasure and sailing vessel transits 2019	296	22	48	211	36
	Other vessel transits 2019	26	9	21	23	62
	Military vessel transits 2019	0	0	0	0	0
	All vessel transits 2019	550	61	145	589	120
	All vessel transits per 100 acres	24	19	3	9	3

Table 13 (continued)

Category	Parameters	Option 1	Option 2	Option 3	Option 4	Option 5
Oceanographic Data for Characterization	Mean daily temperature min/max (°C) (2013-2019)	10.2/32.3	12.5/31.8	12.4/32.1	11.9/31.4	14.0/31.1
	Mean daily salinity min/max (PSU) (2013-2019)	26.3/35.5	27.9/36.2	28.9/36.3	25.0/36.2	27.7/36.7
	Max daily current speed (m/s) (2013-2019)*	0.5	0.5	0.6	0.6	0.6
	Max significant wave height (m) (1979-2014)**	6.6	7.0	7.2	7.0	7.9
	K. brevis toxic bloom frequency (2000-19)	No Data	0	1	1	0
Geologic Data for Characterization	ROSSI Borrow Areas	No	No	No	No	No
	ROSSI Holocene Sand	No	No	No	No	No
	ROSSI Paleo Barrier Islands	No	No	No	No	No
	ROSSI Paleo channels	Yes	No	Yes	Yes	No
	ROSSI Paleo Ebb Deltas	No	No	No	No	No
	ROSSI Paleo Shoreline Complex	Yes	No	No	Yes	Yes

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

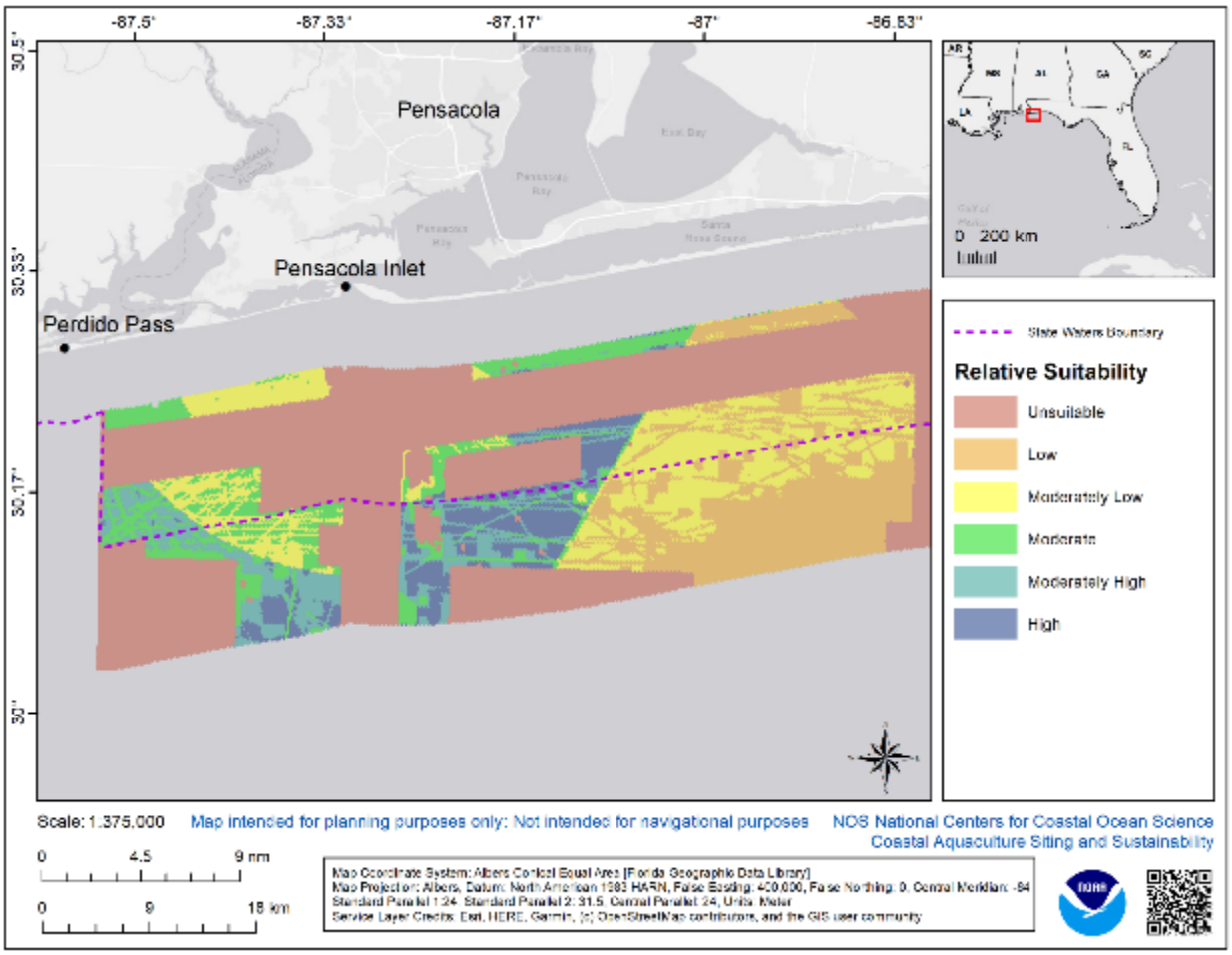

Figure 28. The relative suitability of offshore aquaculture in the Northwest Planning Area based on the four suitability analysis sub-models. Unsuitable areas (due to direct conflict with other uses) are in red. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

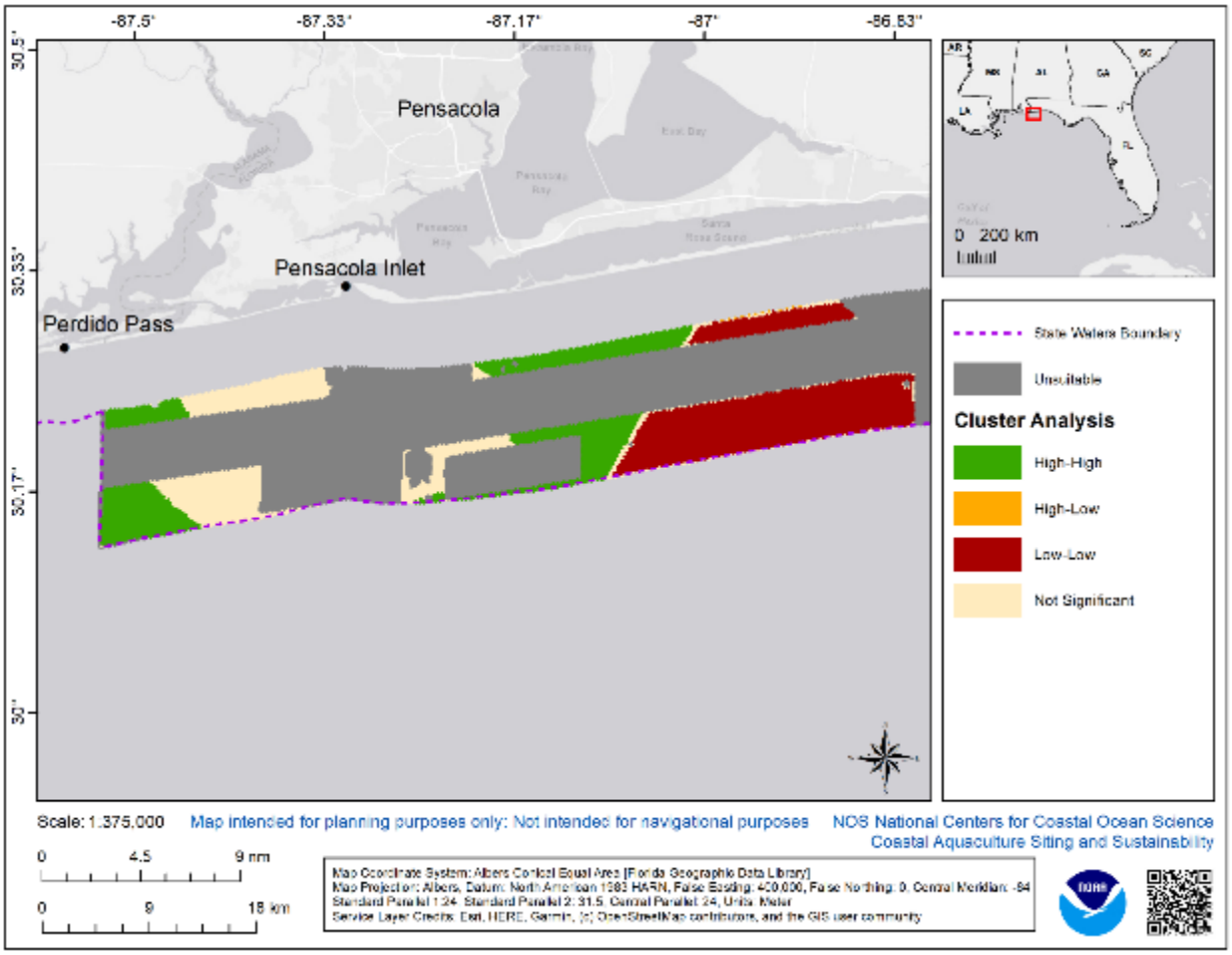

Figure 29. Output from the LISA cluster analysis for the Northwest Planning Area. Gray areas were considered unsuitable due to direct conflicts with other uses. All areas shown are in state waters (3-9 nm). The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

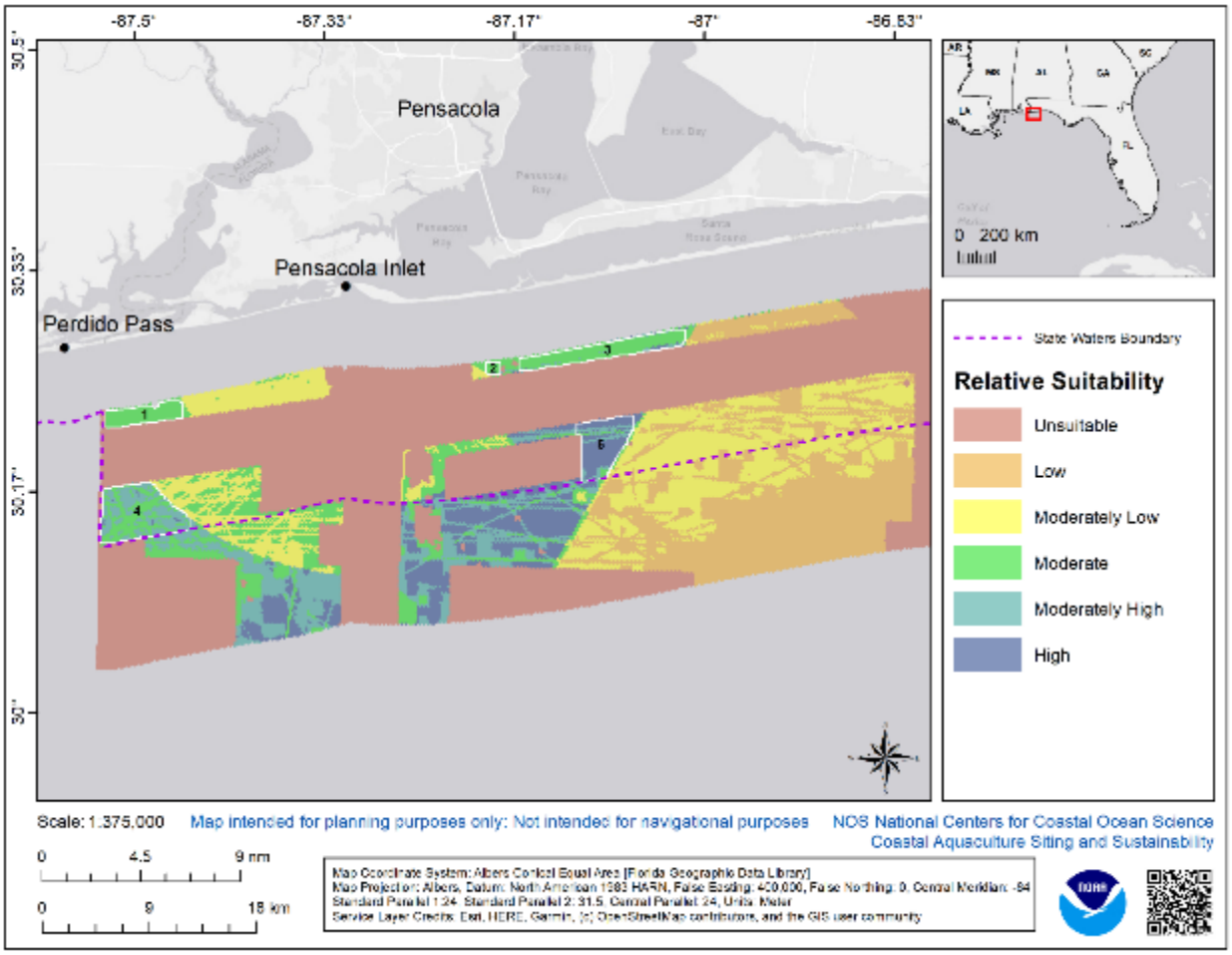

Figure 30. Final POAZ options 1-5 (white outline with associated option number) identified for further characterization within the Northwest Planning Area. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

Option 1 Characterization

POAZ option 1 is located adjacent to federal and Alabama state waters but is still within Florida state waters (Figure 31). This option is 2,269 acres (9.18 km^2) and is located 17 km from the Pensacola Bay Inlet and 7 km from the Perdido Pass Inlet, separating Alabama and Florida near Orange Beach. This option is relatively shallow (10-17 m in depth) with a slight depression located in the center. The shallowest region is in the northeast corner. A shipping lane is located 613 m to the south of the site. There is a sand and gravel area located 385 m west of this site in federal waters. There are no known national security constraints present.

This option had the highest vessel traffic per 100 acres in the Northwest Planning Area, with pleasure and sailing vessels making the most transits through the area. Commercial fishing in and around the option includes shrimp trawling and headboat operations for recreational fishing.

Salinity ranged from 26.3 PSU (September 2017) to 35.5 PSU (April 2018). This option occasionally witnessed dips in salinity that reached 26.25 PSU. Annually, seawater temperature ranged from 10.2°C in winter (February 2014) to 32.3°C in summer (August 2016). The maximum daily surface current speed between 2013 and 2019 was 0.49 m/s, and the maximum significant wave height was 6.6 m (Figure 32). There are no data present for *K. brevis* toxic bloom frequency.

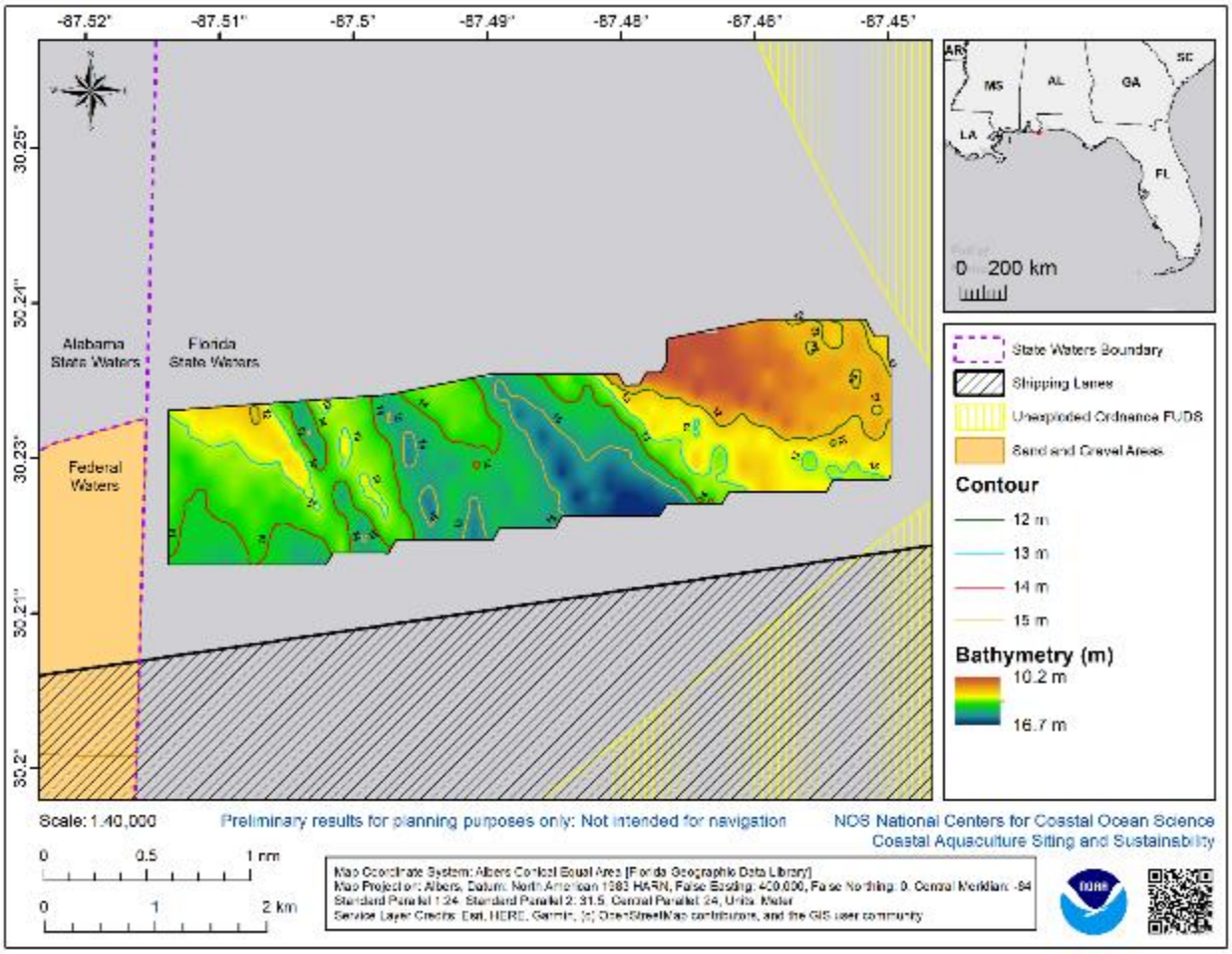

Figure 31. Northwest POAZ option 1 with nearby considerations and bathymetry. The Florida-Alabama state line is denoted on the map.

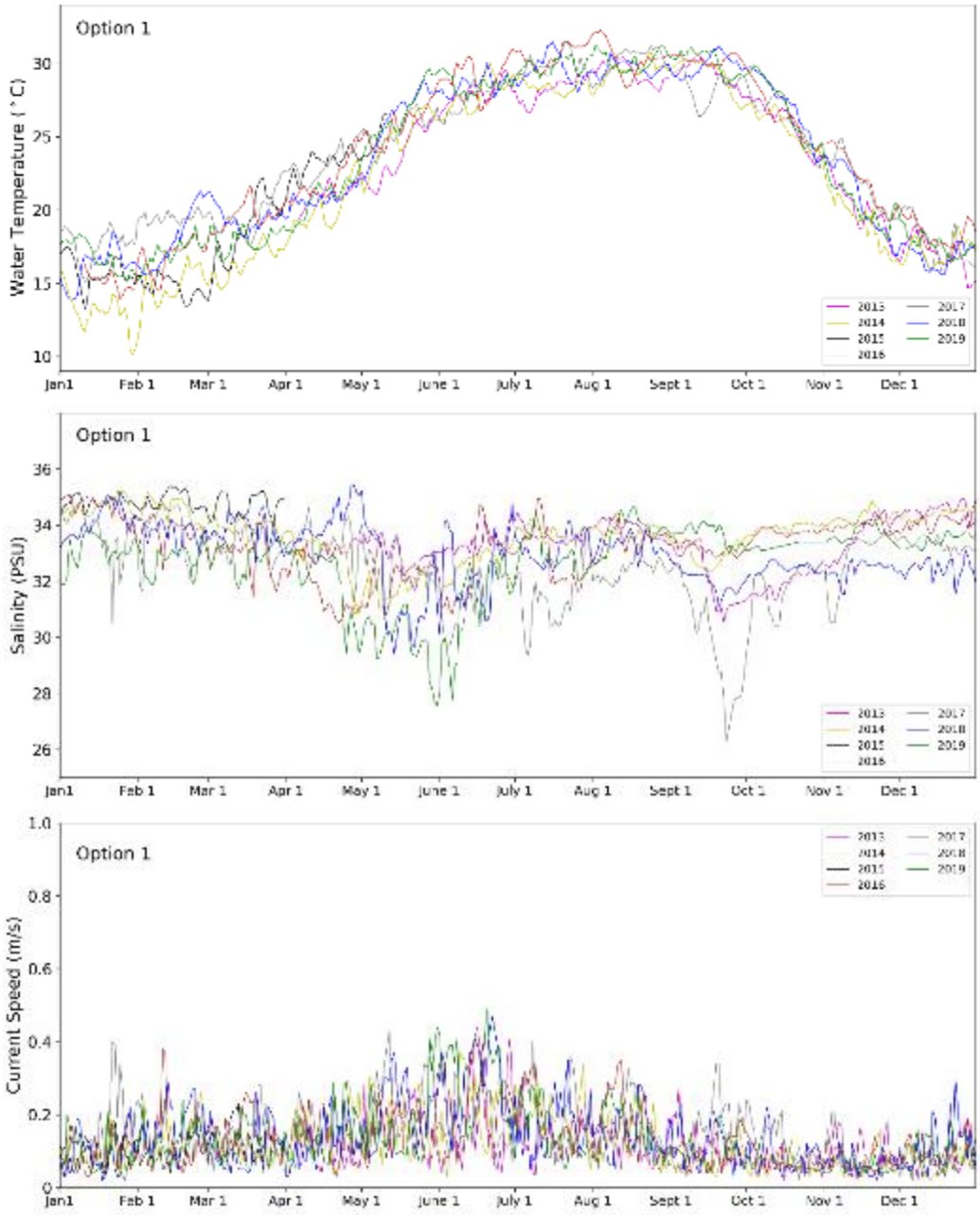

Figure 32. Northwest Planning Area, option 1 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

Option 2 Characterization

POAZ option 2 is located near an artificial reef with a 500-ft setback to the east, a shipping lane to the south, and an unexploded ordnance Formerly Used Defense Site (FUD) near the southwestern boundary (Figure 33). This option is 315 acres (1.27 km^2) and is located 13 km from the Pensacola Bay Inlet and 36 km from the Perdido Pass Inlet. This POAZ is deeper than option 1 (19-26 m depth) and is characterized by a ridge running latitudinally in the center, with increasing depth moving to the south. The shallowest waters are in the northwest corner.

This option had the second highest vessel traffic per 100 acres in the Northwest Planning Area, with pleasure and sailing and tug and tow vessels accounting for the most transits through the area. Commercial fishing in and around the option includes shrimp trawling.

Salinity ranged from 27.9 PSU (June 2019) to 36.2 PSU (January 2015). This POAZ occasionally witnessed dips in salinity that reached around 28 PSU (September 2017 and June 2019). Annually, seawater temperature ranged from 12.5°C in winter (February 2014) to 31.8°C in summer (August 2016). The maximum daily surface current speed between 2013 and 2019 was 0.54 m/s, and the maximum significant wave height was 7 m (Figure 34). There were no toxic red tide blooms at the site from 2000-2019 (Table 13).

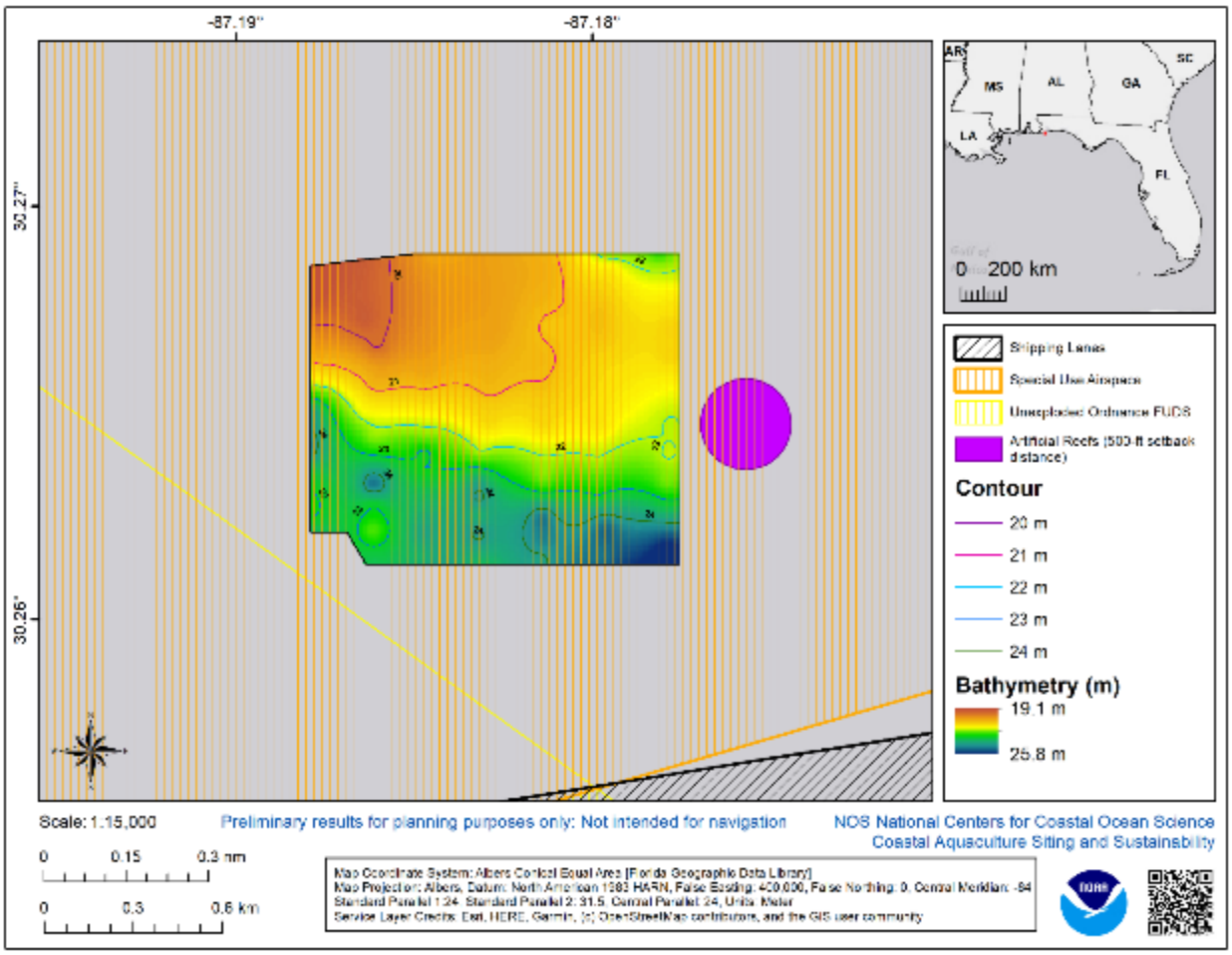

Figure 33. Northwest POAZ option 2 with nearby considerations and bathymetry. The artificial reef 500-ft setback (pink circle) is placed around the feature centroid or boundary.

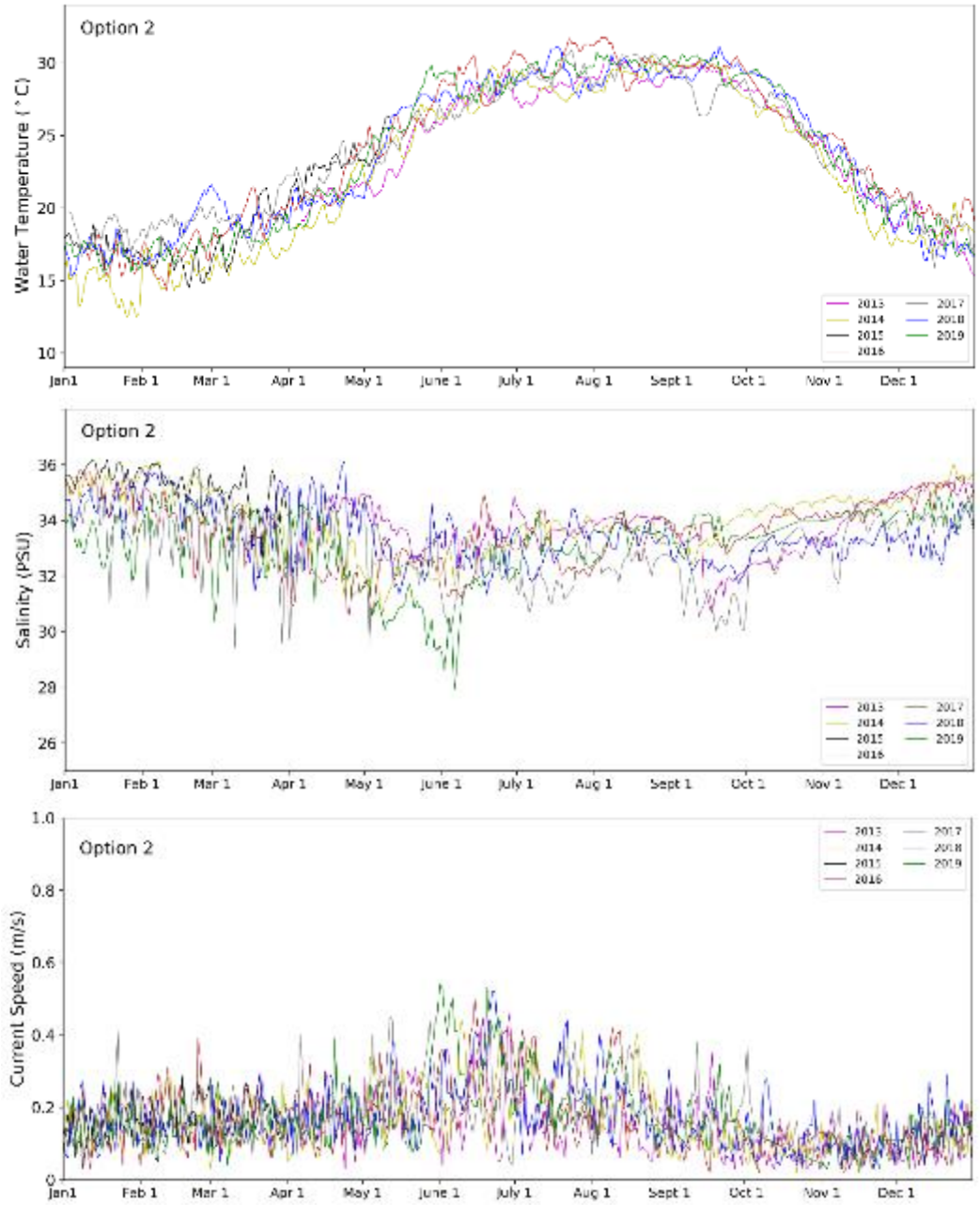

Figure 34. Northwest Planning Area, option 2 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

Option 3 Characterization

POAZ option 3 is located near a major shipping lane to the south, two artificial reefs to the west and the U.S. Navy Pensacola Operating Area and a military Special Use Airspace to the east (Figure 35). This option is 4,341 acres (17.57 km^2) and is located 16 km from the Pensacola Bay Inlet and 39 km from the Perdido Pass Inlet. This option ranges between 18-27 m in depth and is characterized as an elongated area running parallel to the coast. Ridges seem to be the predominant feature of this siting option, with the deepest portion located in the southwest corner. The majority of the site only has moderate depth changes (± 2 m) occurring.

This option had one of the lowest vessel traffic transits per 100 acres in the Northwest, with tug and tow, pleasure and sailing, and fishing vessels accounting for the most transits through the area. Commercial fishing in and around the option included shrimp trawling and reef fish targeted with bandit fishing gear.

Salinity ranged from 28.9 PSU (June 2019) to 36.3 PSU (April 2018). Throughout the year, seawater temperature ranged from 12.4°C in winter (February 2014) to 32.1°C in summer (August 2016). The maximum daily surface current speed between 2013 and 2019 was 0.6 m/s, and the maximum significant wave height was 7.2 m (Figure 36). There was one toxic red tide event at the site between 2000-2019 (Table 13).

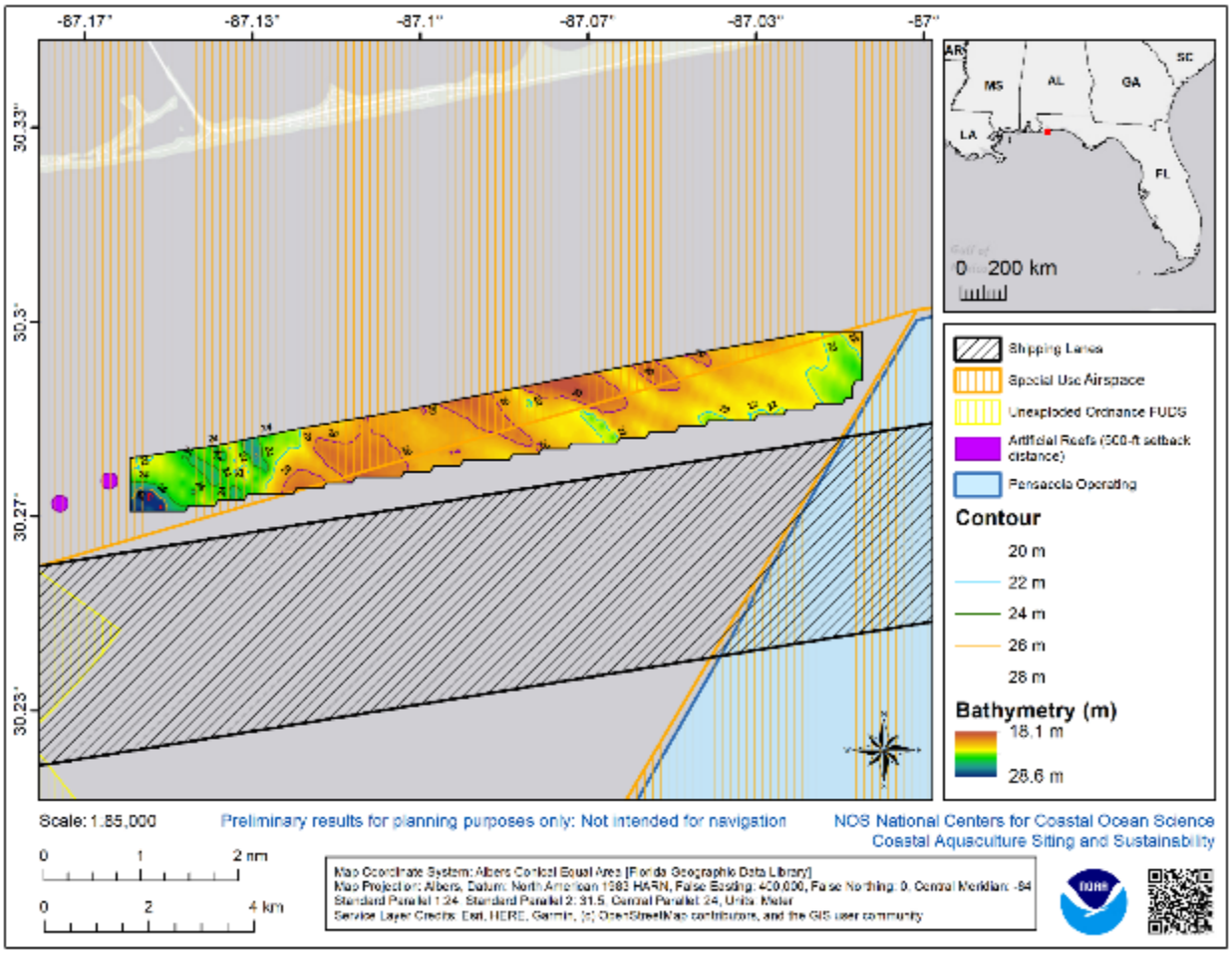

Figure 35. Northwest POAZ option 3 with nearby considerations and bathymetry. The artificial reef 500-ft setbacks (pink circles) are placed around the feature centroid or boundary.

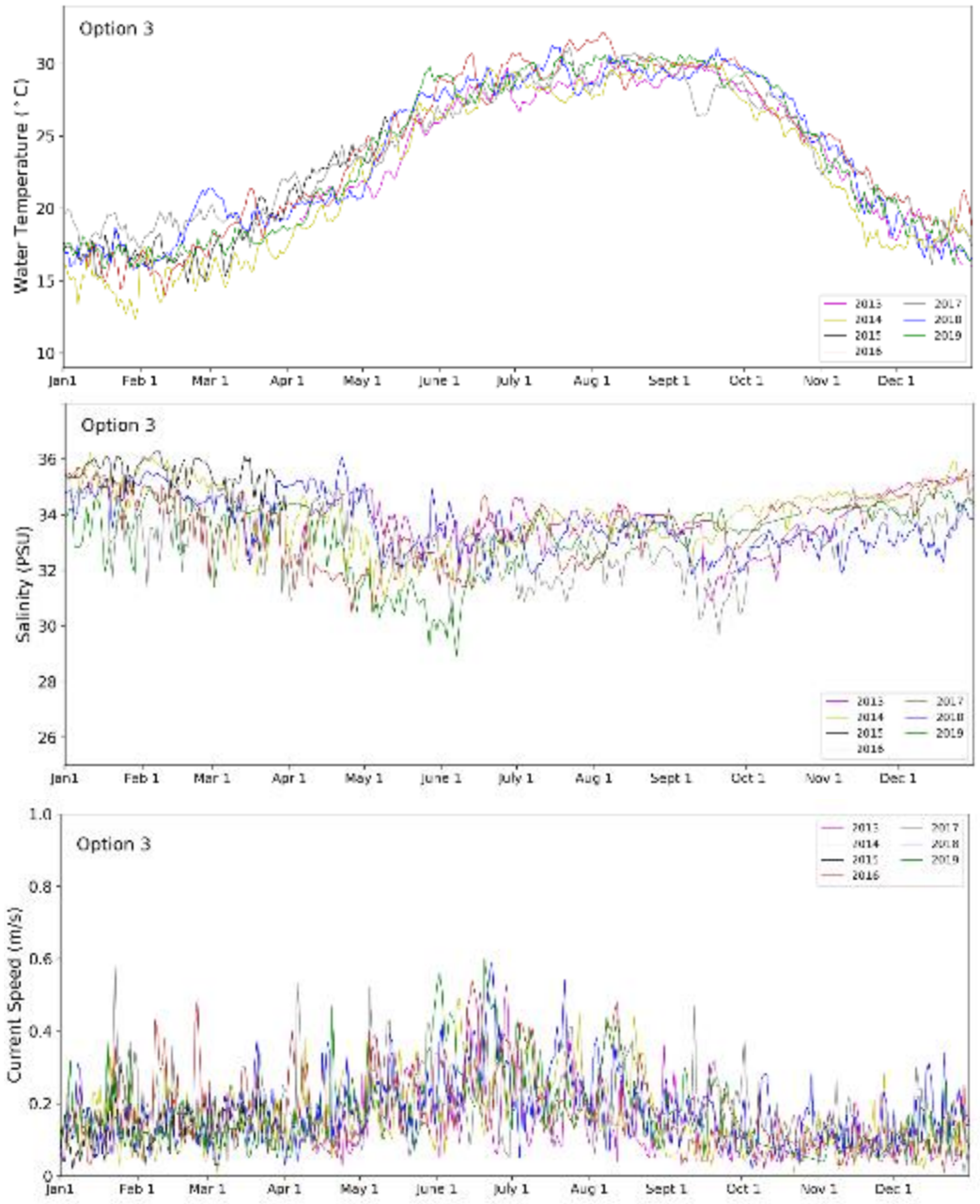

Figure 36. Northwest Planning Area, option 3 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

Option 4 Characterization

POAZ option 4 is located near an unexploded ordnance FUD to the east, a major shipping lane to the north, sand and gravel lease areas in federal waters, and a fish haven in federal waters to the south (Figure 37). This option sits just next to the state and federal water boundary. This option is 6,837 acres (27.67 km^2) in size and located 12 km from the Perdido Pass Inlet and 23 km from the Pensacola Bay Inlet. This option is relatively deeper than the previous three Northwest options (22-29 m depth). This area is characterized with ridges and grooves throughout and dimpled by two depressions occurring in the midwest section.

This option had moderate vessel traffic relative to other Northwest options, with nine transits per 100 acres. Passenger vessels and pleasure and sailing vessels accounted for the most transits through the area. Commercial fishing in and around the option included shrimp trawling, reef fish captured with bandit reels, and headboat operations for recreational fishing.

Salinity ranged from 25 PSU (September 2017) to 36.2 PSU (April 2017). Annually, seawater surface temperature ranged from 11.9°C in winter (February 2014) to 31.4°C in summer (July 2013). The maximum daily surface current speed from 2013-2019 was 0.6 m/s, and the maximum significant wave height was 7 m (Figure 38). There was one toxic red tide event at the site between 2000-2019 (Table 13).

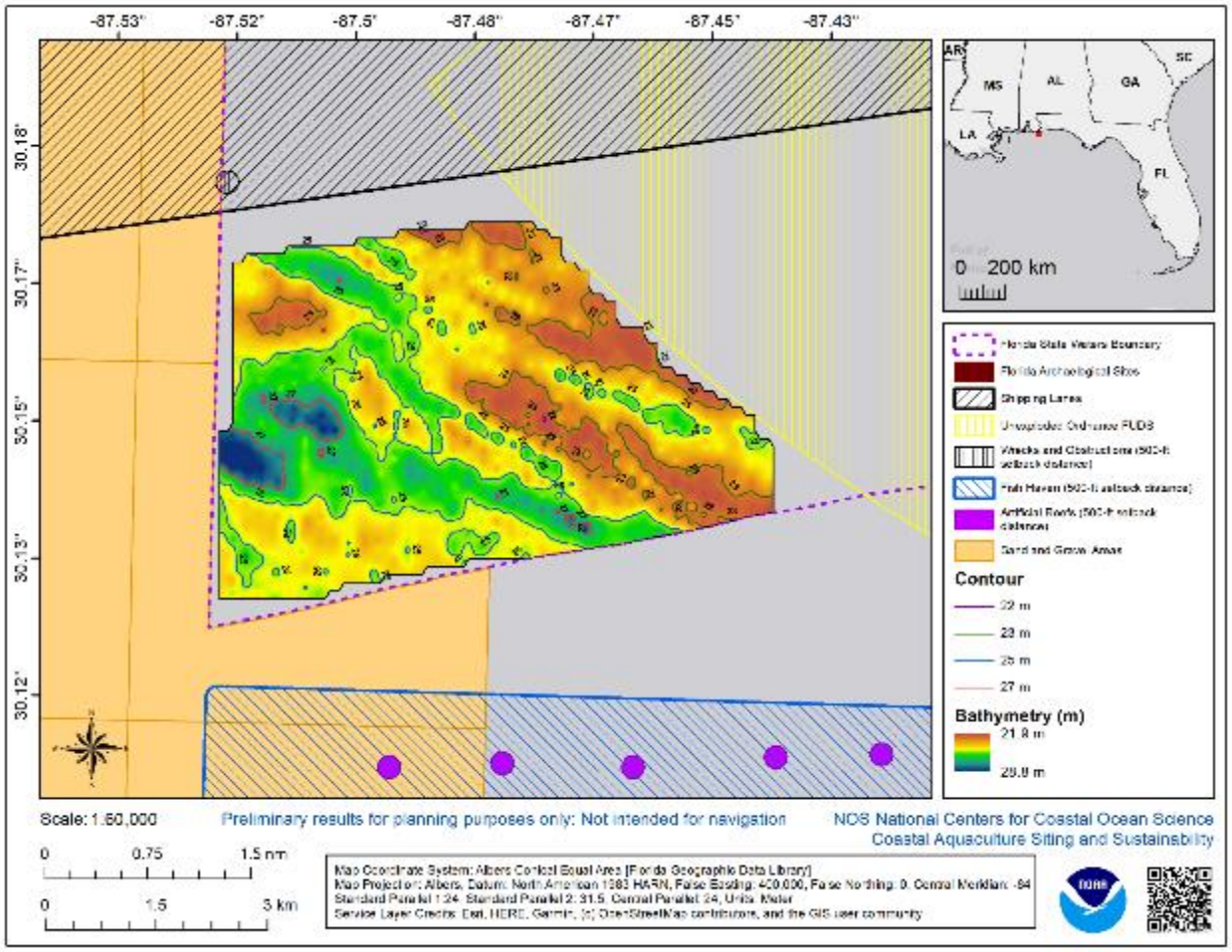

Figure 37. Northwest POAZ option 4 with nearby considerations and bathymetry. The 500-ft fish haven setbacks (blue diagonal bars) are in federal waters. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

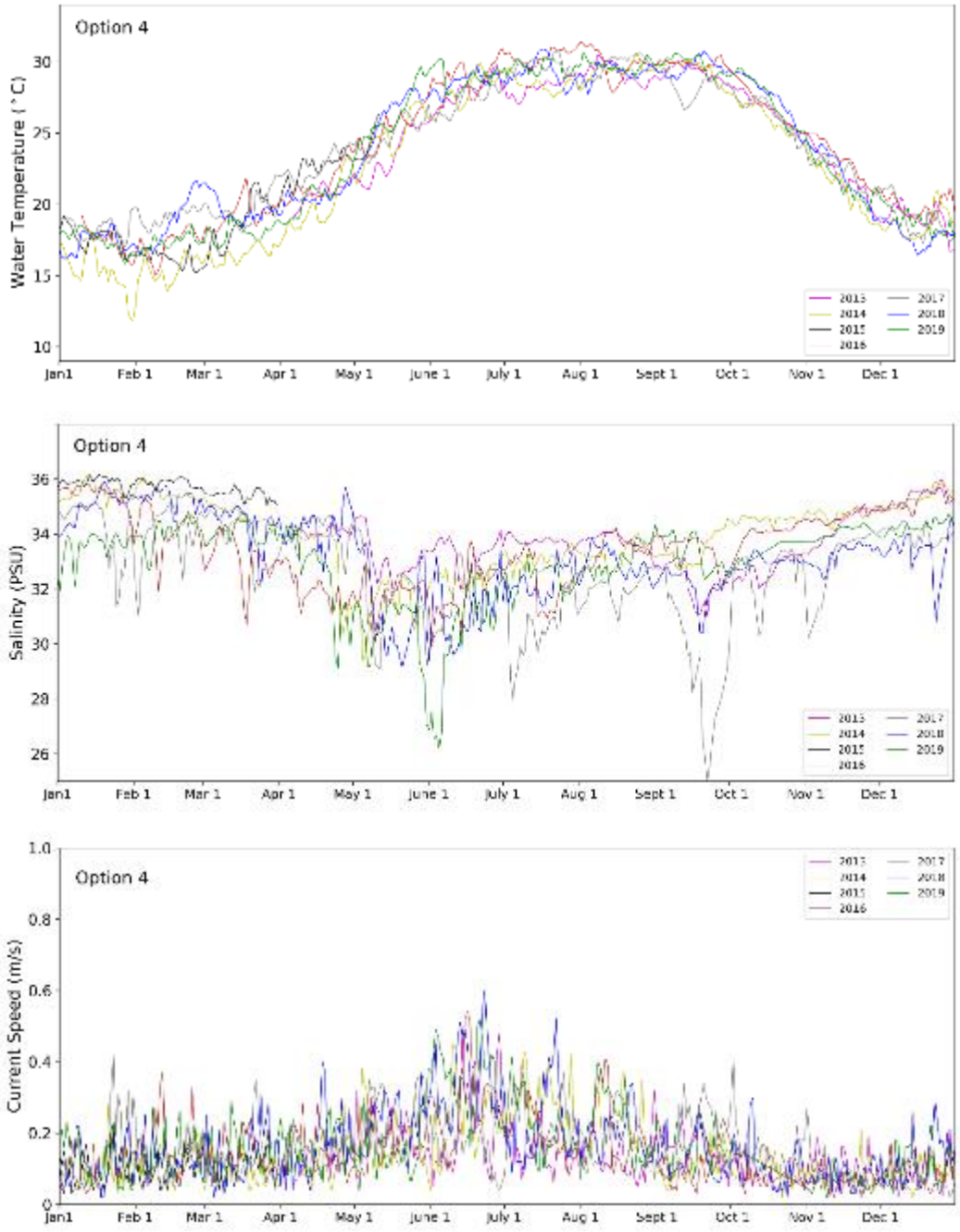

Figure 38. Northwest Planning Area, option 4 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

Option 5 Characterization

POAZ option 5 is located near a major shipping lane to the north, a military Special Use Air Space and the Pensacola Operating Area to the east, an archeological sensitive area to the east, and a fish haven and artificial reef to the west (Figure 39). This option is 4,381 acres (17.73 km^2) in size and located 22 km from the Pensacola Bay Inlet and 44 km from the Perdido Pass Inlet. This option has the deepest waters in the Northwest Planning Area (23-31 m depth). This POAZ is characterized by a relatively shallow ridge occupying most of the northern portion of the site. A large groove with dimpled depressions stretches diagonally across the POAZ, separating the ridge area. The southern portion of the site increases in depth, with grooves and depressions running along the eastern boundary (i.e., the deepest edge) of the site.

This option had one of the lowest vessel traffic transits per 100 acres in the Northwest, with pleasure and sailing and “other” vessels accounting for the most transits through the area. Commercial fishing in and around the option included shrimp trawling and capture of reef fish using bandit reels.

Salinity ranged from 27.7 PSU (June 2019) to 36.7 PSU (March 2015). Annually, seawater temperature ranged from 14°C in winter (February 2014) to 31.1°C in summer (June 2019). The maximum daily surface current speed between 2013 and 2019 was 0.0.61 m/s, and the maximum significant wave height was 7.9 m (Figure 40). There were no toxic red tide blooms at the site from 2000-2019 (Table 13).

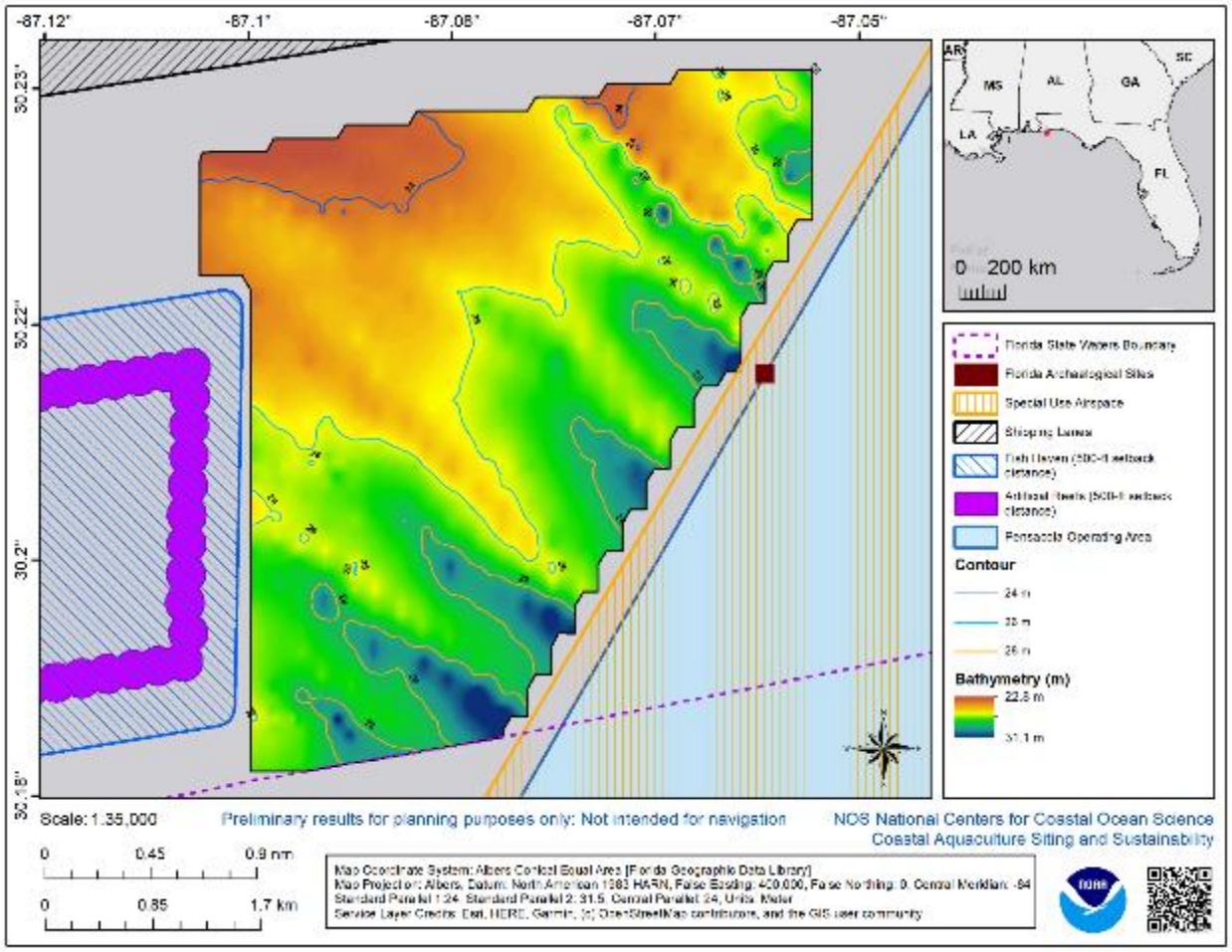

Figure 39. Northwest POAZ option 5 with nearby considerations and bathymetry. The 500-ft artificial reef (pink) and fish haven (blue diagonal bars) setbacks are placed around the feature centroid or boundary. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

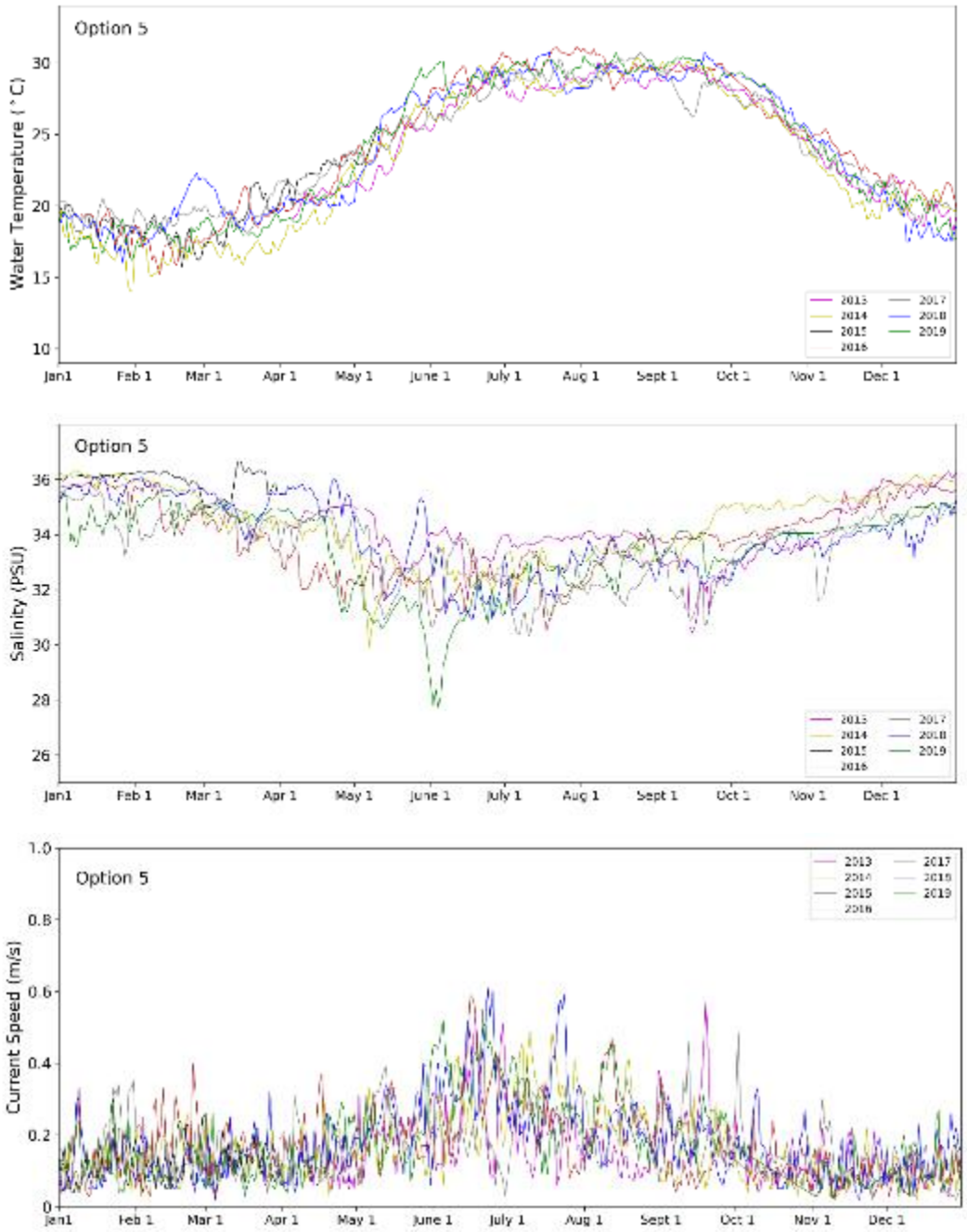

Figure 40. Northwest Planning Area, option 5 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

Northeast Planning Area: Apalachicola (Siting Options 6-7)

The Northeast Planning Area is located in the panhandle of Florida off the coast of St. James Island (Figure 41). The 3-9 nm distance offshore limit drove the eastern and western bounds, while discrete constraints from national security danger zones determined the southern bounds and shallow depths determined the northern bounds.

Overall, significant high-high clustering from the LISA analysis occurred for 7,520 acres in the Northeast Planning Area (Figure 42). High-high suitability clusters that met the minimum size requirement were located in the northeast and north-central regions of the Planning Area. Fishing and vessel traffic constraints were few, but an artificial reef and fish haven were present (Table 14). After applying the site selection rules, two final POAZs were identified in the Northeast Planning Area, totaling 1,913 acres of ocean space (Figure 43).

Detailed characterization of each POAZ option in the Northeast Planning Area (options 6-7) can be found in the following sections and examined in Table 14. The smallest siting option was 269 acres (option 6) and the largest was 1,644 acres (option 7). Option 7 had the closest distance to an inlet at 12 km to Alligator Point. National security considerations were not present within these siting options. Both siting options in the Northeast Planning Area are within the EFH for Atlantic HMS, coastal migratory species, shrimp, and reef fish (Table 14).

Among sites, seawater temperature ranged from 10.9°C to 32.4°C and salinity ranged from 30.2 PSU to 36.0 PSU. The highest maximum daily surface current speed was 0.38 m/s and maximum significant wave height was 3.8 m. Vessel traffic and fishing effort were low overall in the Planning Area. There were no toxic red tide blooms at either POAZ over the time period examined.

Table 14. Characterization of the Northeast Planning Area POAZs. Parameters of relevance are listed with the corresponding values. The two planning options totaled 1,913 acres.

Category	Parameters	Option 6	Option 7
Geographic	Area (acres)	269	1,644
	Bathymetry Range (m)	10.1-12.5	10.2-12.6
	Distance to Carrabelle (km)	20	35
	Distance to Alligator Point (km)	13	12
National Security	Pensacola Operating Area	No	No
	Unexploded Ordnance FUDs	No	No
	Special Use Airspace	No	No
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes
	Shrimp EFH	Yes	Yes
	Reef Fish EFH	Yes	Yes
	Red Drum EFH	No	No
	Spiny Lobster EFH	No	No
	Shallow Coral EFH	No	No
	Distance to Artificial Reef (m)	334	7,121
	Distance to Fish Haven (m)	58	8,395
Industry and Navigation	Sand and Gravel Areas	No	No
	Cargo vessel transits 2019	0	0
	Tanker vessel transits 2019	0	0
	Tug and tow vessel transits 2019	0	0
	Fishing vessel transits 2019	3	0
	Passenger vessel transits 2019	0	0
	Pleasure and sailing vessel transits 2019	5	3
	Other vessel transits 2019	0	0
	Military vessel transits 2019	0	0
	All vessel transits 2019	8	3
	All vessel transits per 100 acres	3	0.2

Table 14 (continued)

Category	Parameters	Option 6	Option 7
Oceanographic Data for Characterization	Daily temperature min/max (°C) (2013-2019)	11.2/32.4	10.9/32.3
	Daily salinity min/max (PSU) (2013-2019)	30.2/36.0	31.7/36.0
	Max daily current speed (m/s) (2013-2019)*	0.32	0.38
	Max daily significant wave height (m) (1979-2014)**	3.8	3.5
	K. brevis toxic bloom frequency (2000-2019)	0	0
Geologic Data for Characterization	ROSSI Borrow Areas	No	No
	ROSSI Holocene Sand	No	No
	ROSSI Paleo Barrier Islands	No	No
	ROSSI Paleo channels	No	No
	ROSSI Paleo Ebb Deltas	No	No
	ROSSI Paleo Shoreline Complex	No	No

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

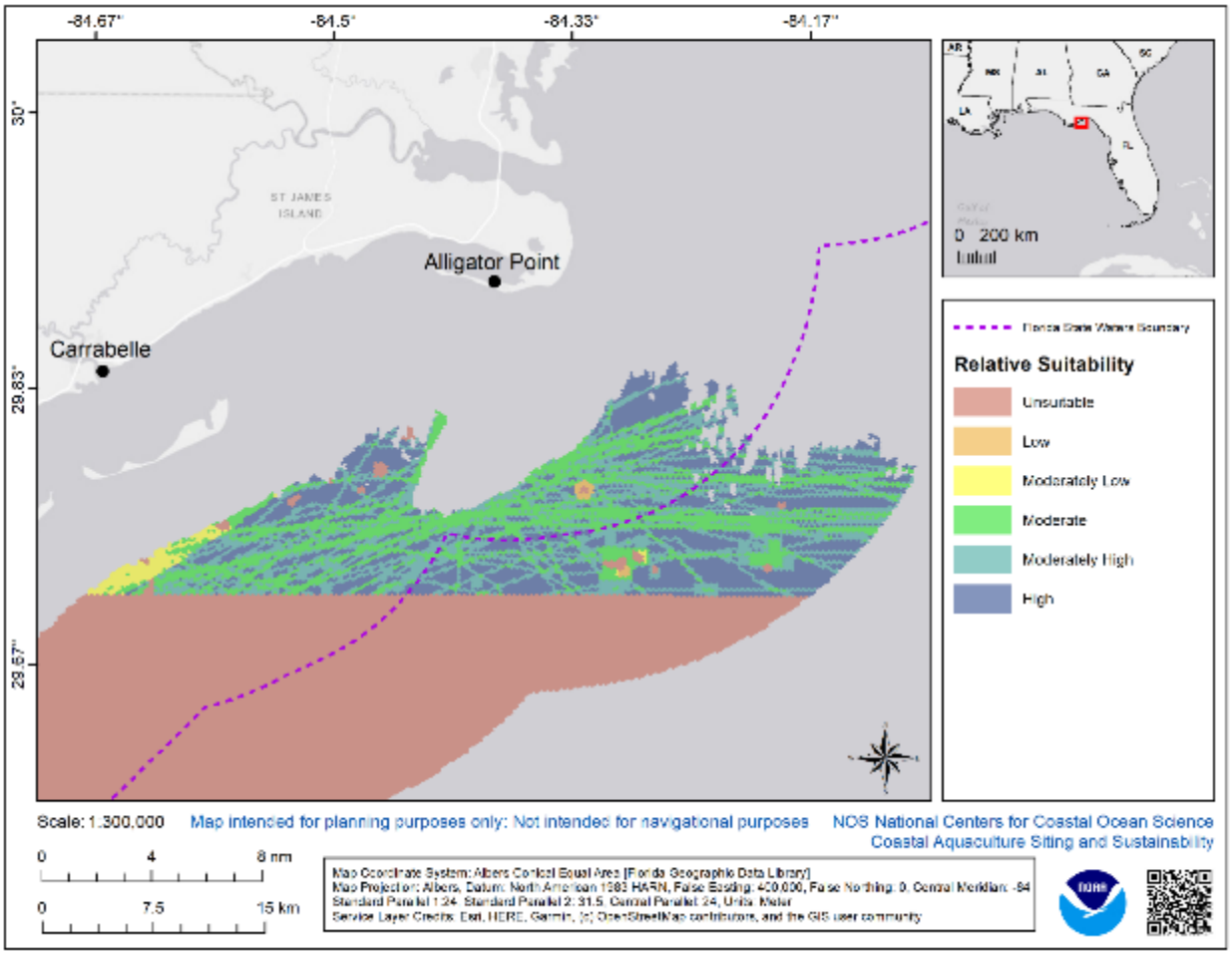

Figure 41. The relative suitability of offshore aquaculture in the Northeast Planning Area based on the four suitability analysis sub-models. Unsuitable areas (due to direct conflict with other uses) are in red. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

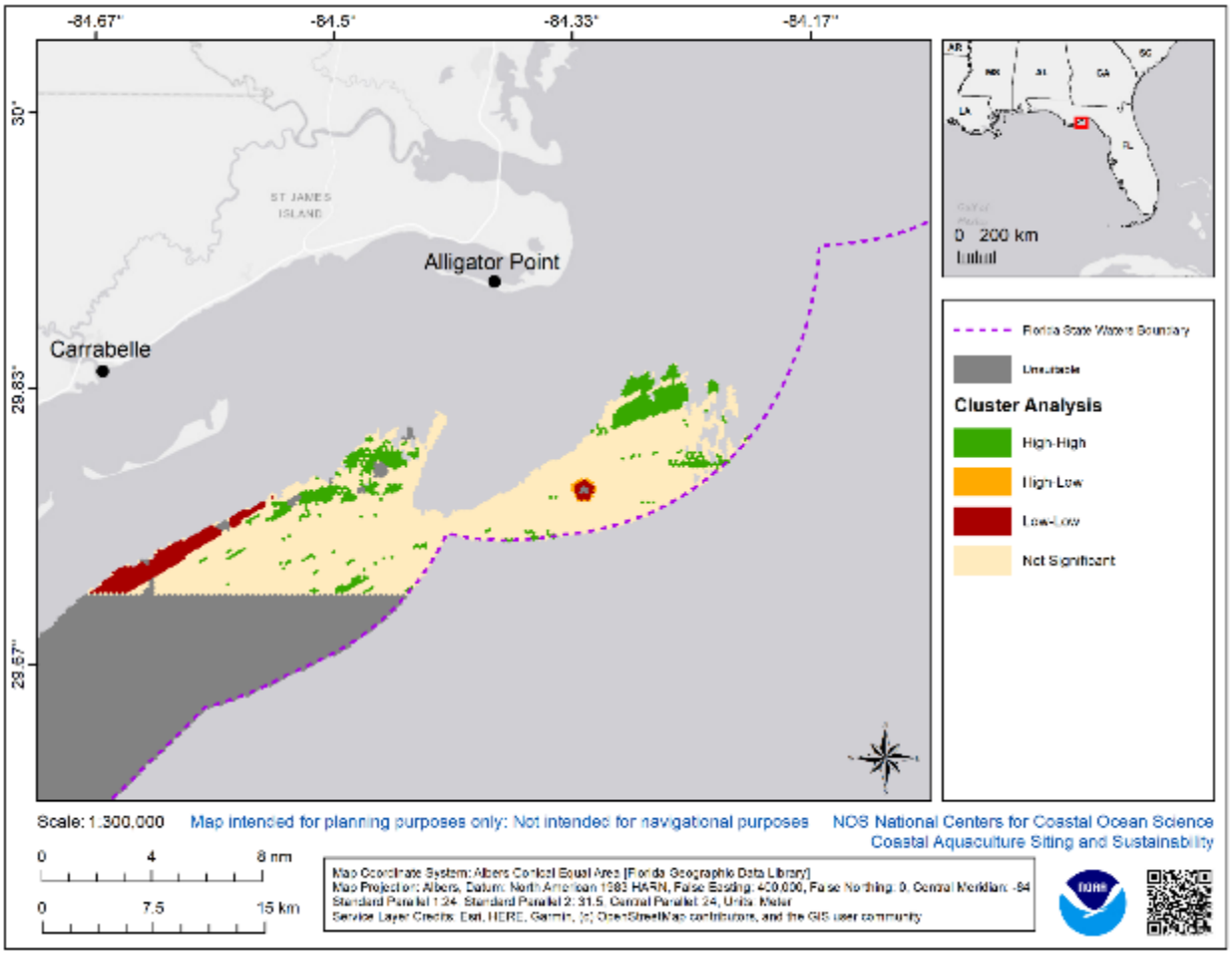

Figure 42. Output from the LISA cluster analysis for the Northeast Planning Area. Gray areas were considered unsuitable due to direct conflicts with other uses. All areas shown are in state waters (3-9 nm). The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

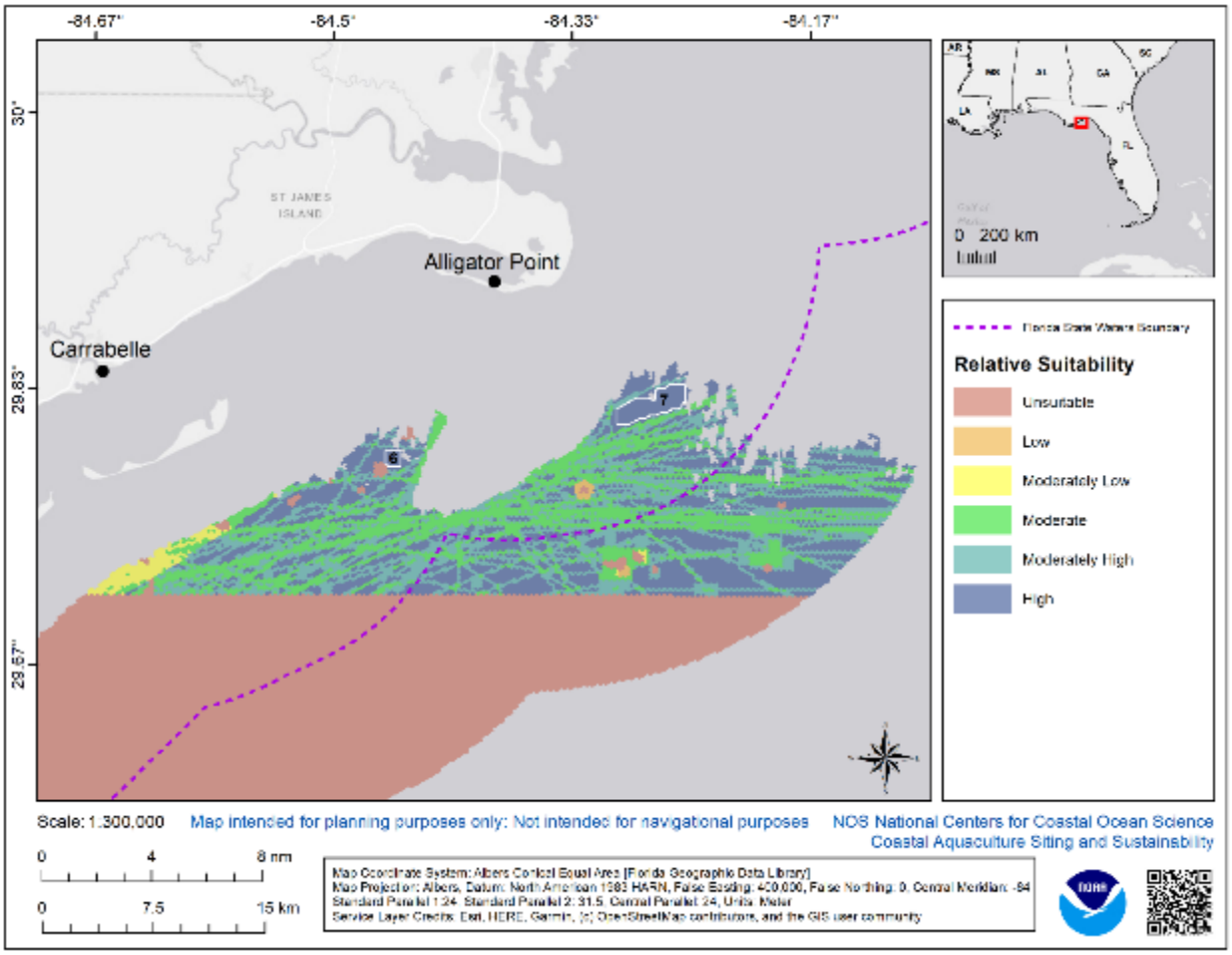

Figure 43. Final POAZ options 6-7 (white outline with associated option number) identified for characterization within the Northeast Planning Area. The Florida state water boundary (at 9 nm) is denoted with the dotted pink line.

Option 6 Characterization

POAZ option 6 is 269 acres (1.1 km^2) in size and is located 13 km from Alligator Point and 20 km from Carrabelle (Figure 44). There is an artificial reef and fish haven located off the southwest corner (334 m and 58 m away, respectively). Option 6 is relatively shallow (10.1-12.5 m depth) and is characterized by two ridges, one in the center and one in the northwest corner. There is also a slightly deeper depression in the center of the two ridges.

There was very little AIS vessel traffic in 2019 in this Planning Area overall. This option had three vessel traffic transits per 100 acres in 2019, with five pleasure and sailing transits and three fishing vessel transits. Commercial fishing in and around the option included shrimp trawling.

Salinity ranged from 30.2 PSU (January 2017) to 36.0 PSU (January 2016). Annually, seawater temperature ranged from 11.2°C in winter (January 2018) to 32.4°C in summer (August 2016). The maximum daily surface current speed between 2013 and 2019 was 0.32 m/s, and the maximum significant wave height was 3.8 m (Figure 45). There were no toxic red tide blooms at this option from 2000-2019 (Table 14).

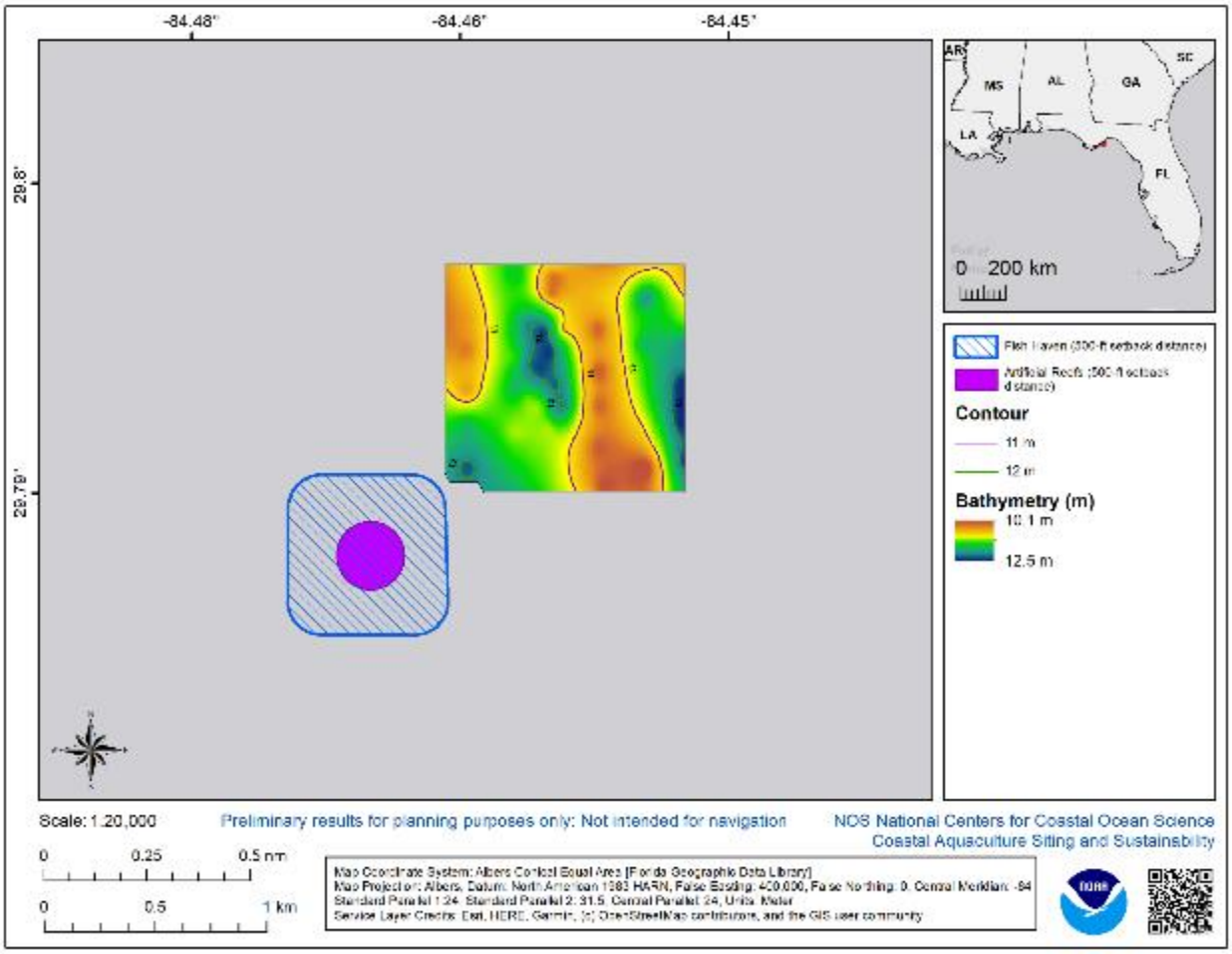

Figure 44. Northeast POAZ option 6 with nearby considerations and bathymetry. The 500-ft artificial reef (pink) and fish haven (blue diagonal bars) setbacks are placed around the feature centroid or boundary.

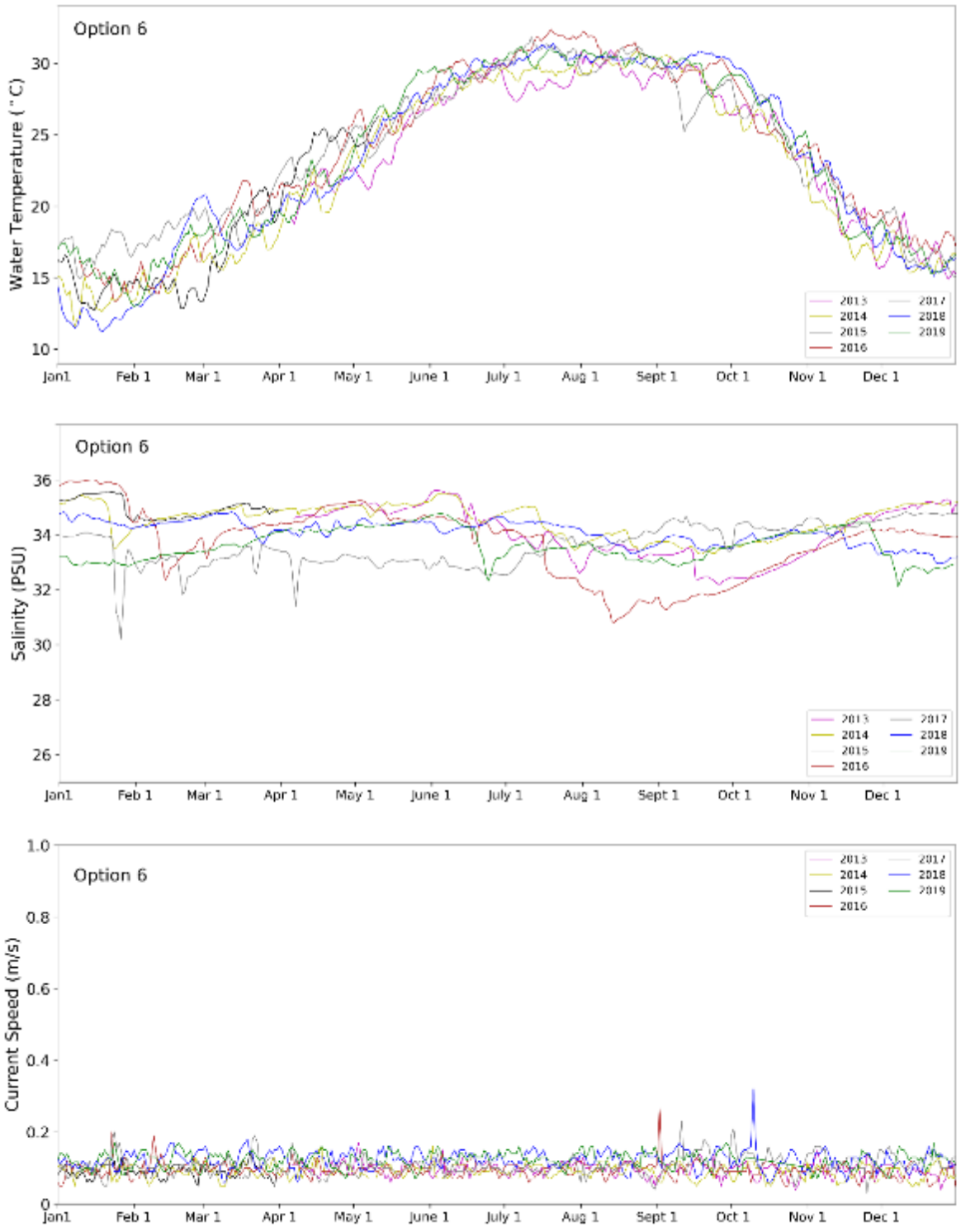

Figure 45. Northeast Planning Area, option 6 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

Option 7 Characterization

POAZ option 7 is 1,644 acres (6.7 km^2) in size and is located 12 km from Alligator Point and 35 km from Carrabelle (Figure 46). Option 7 is relatively shallow (10.2-12.6 m depth) and is characterized by alternating ridges and depressions throughout the POAZ. There are no known resource or national security constraints present.

There was very little vessel traffic in 2019 in this Planning Area overall. This option had only pleasure and sailing vessel transits in 2019, for a total of 0.2 vessel traffic transits per 100 acres. Neither recreational or commercial fishing effort were observed in and around this option.

Salinity ranged from 31.7 PSU (August 2016) to 36.0 PSU (January 2016). Annually, seawater temperature ranged from 10.9°C (January 2018) in winter to 32.3°C (July 2016) in summer. The maximum daily surface current speed between 2013 and 2019 was 0.38 m/s, and the maximum significant wave height was 3.5 m (Figure 47). There were no toxic red tide blooms at this option from 2000-2019 (Table 14).

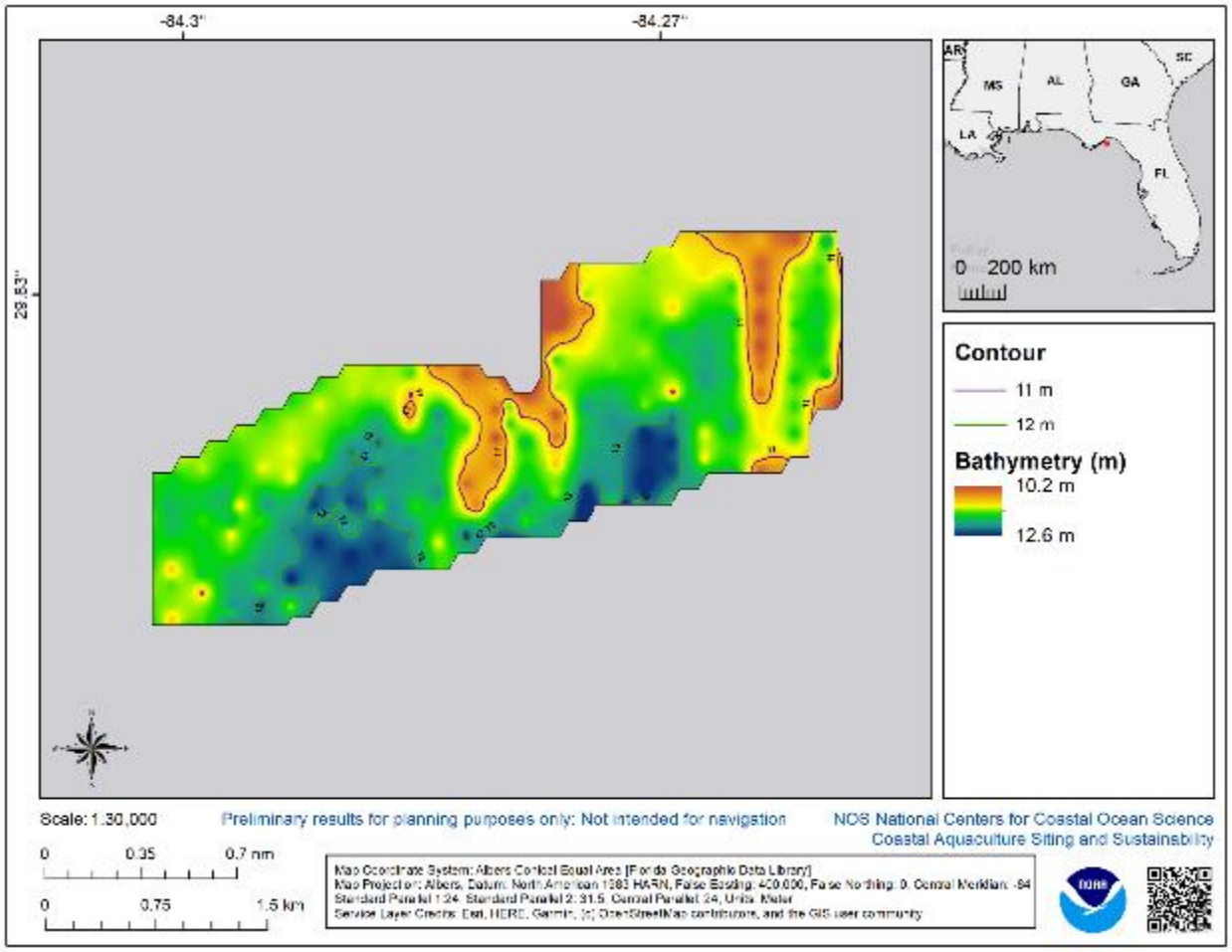

Figure 46. Northeast POAZ option 7 with bathymetry. There are no known natural resource or national security constraints present.

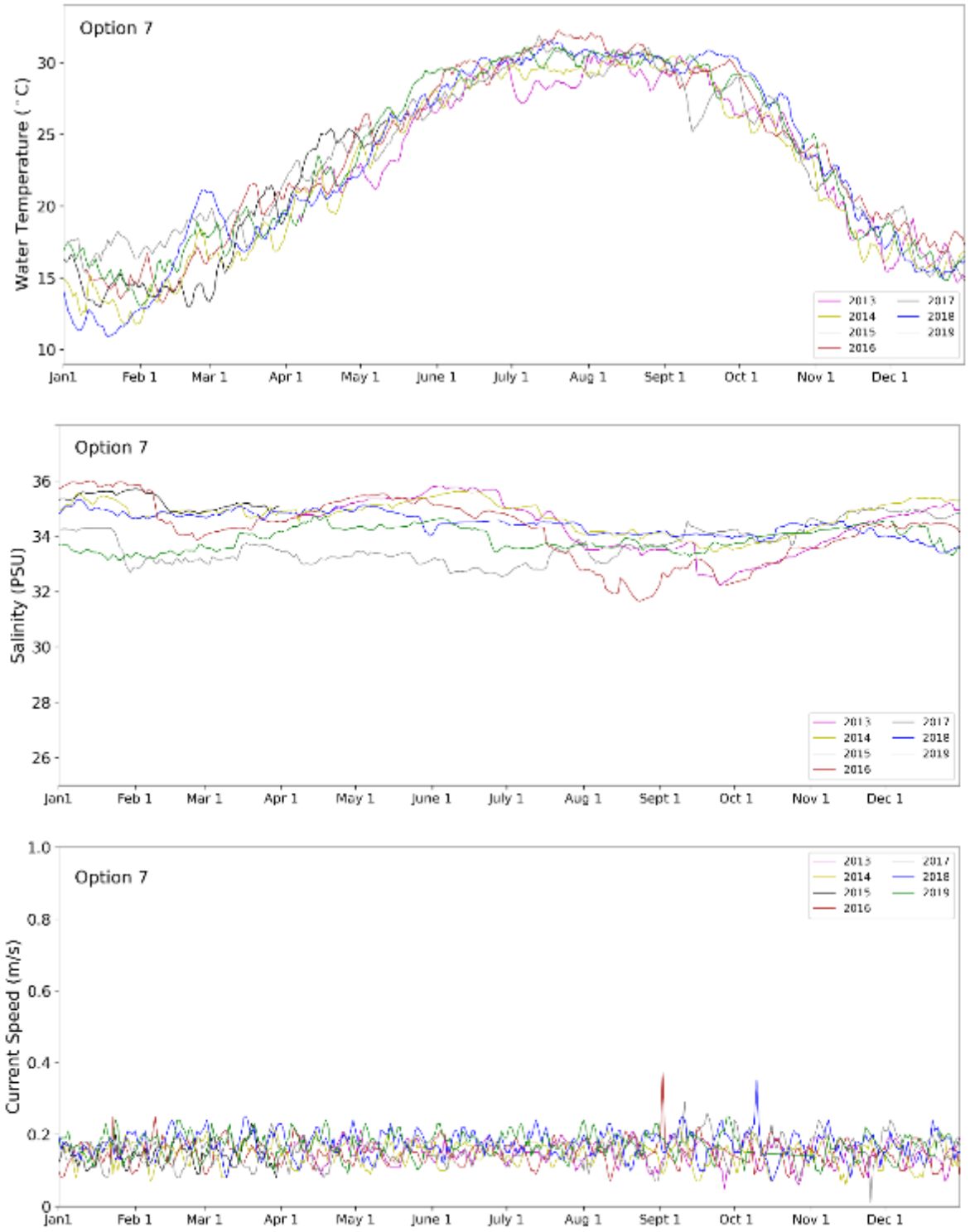

Figure 47. Northeast Planning Area, option 7 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

South A Planning Area: St. Petersburg (Siting Options 8-10)

The South A Planning Area is located off the coast of Clearwater and St. Petersburg (Figure 48). Note that depth for this Planning Area is relatively shallow for some types of aquaculture (maximum depth of 13.6 m), which led the depth to be the major constraint for this planning area. Other notable constraints are Sand and Gravel areas in federal waters and a shipping lane coming out of Tampa Bay.

Overall, significant high-high clustering from the LISA analysis occurred for 14,630 acres, primarily in the southern portion of the Planning Area (Figure 49). The suitability analysis and subsequent cluster analysis were predominantly driven by recreational fishing (i.e., headboat trips) and vessel traffic, namely tug and tow, pleasure and sailing, and fishing vessels (Table 15). An artificial reef and fish havens were also present. After applying the site selection rules, three final POAZs were identified in the South A Planning Area, totaling 8,225 acres of ocean space (Figure 50).

Detailed characterization of each POAZ option in the South A Planning Area (options 8-10) may be found in the following sections and examined in Table 15. The smallest siting option was 1,249 acres (option 10) and the largest was 5,104 acres (option 8). Option 10 had the closest distance to an inlet at 12 km to John's Pass. There were no national security considerations in the Planning Area for any POAZ. All siting options in the South A Planning Area were within the EFH for Atlantic HMS, coastal migratory species, shrimp, reef fish, red drum, spiny lobster, and shallow coral (Table 15).

Among sites, seawater temperature ranged from 13.3°C to 32.6°C and salinity ranged from 32.6 PSU to 36.8 PSU. The highest maximum daily surface current speed was 0.50 m/s and maximum significant wave height was 4.8 m. There was significantly more vessel traffic in this Planning Area than in the Northeast. Option 10 had the highest overall vessel traffic (driven by tug and tow and pleasure and sailing craft) at 16 transits/100 acres, followed (in descending order respectively) by option 9 and 8. The most prevalent fishing effort considered across all three POAZs was recreational fishing (i.e., headboat trips). There was one toxic red tide bloom event in option 8 and two in option 10 between 2000-2019.

Table 15. Characterization of the South A Planning Area POAZs. Parameters of relevance are listed with the corresponding values. The three planning options totaled 8,225 acres.

Category	Parameters	Option 8	Option 9	Option 10
Geographic	Area (acres)	5,104	1,872	1,249
	Bathymetry Range (m)	10-13.6	10-12.3	10.3-12.3
	Distance to Clearwater Pass (km)	19	25	26
	Distance to John's Pass (km)	21	18	12
National Security	Unexploded Ordnance FUDs	No	No	No
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes	Yes
	Shrimp EFH	Yes	Yes	Yes
	Reef Fish EFH	Yes	Yes	Yes
	Red Drum EFH	Yes	Yes	Yes
	Spiny Lobster EFH	Yes	Yes	Yes
	Shallow Coral EFH	Yes	Yes	Yes
	Distance to Wrecks and Obstructions (m)	5,220	677	2,568
	Distance to Artificial Reef (m)	755	2,787	827
	Distance to Fish Haven (m)	631	2,729	756
Industry and Navigation	Distance to Sand and Gravel Areas (m)	221	10,518	15,180
	Cargo vessel transits 2019	1	0	0
	Tanker vessel transits 2019	0	0	0
	Tug and tow vessel transits 2019	69	34	88
	Fishing vessel transits 2019	23	19	26
	Passenger vessel transits 2019	1	0	7
	Pleasure and sailing vessel transits 2019	41	24	48
	Other vessel transits 2019	25	6	26
	Military vessel transits 2019	0	0	0
	All vessel transits 2019	160	83	195
	All vessel transits per 100 acres	3	4	16
Oceanographic Data for Characterization	Daily temperature min/max (°C) (2013-2019)	13.3/32.1	13.3/32.3	13.3/32.6
	Daily salinity min/max (PSU) (2013-2019)	33.3/36.8	33.1/36.7	32.6/36.7
	Max daily current speed (m/s) (2013-2019)*	0.50	0.48	0.44
	Max significant wave height (m) (1979-2014)**	4.7	4.8	4.8
	K. brevis toxic bloom frequency (2000-2019)	1	0	2

Category	Parameters	Option 8	Option 9	Option 10
Geologic Data for Characterization	ROSSI Borrow Areas	No	No	No
	ROSSI Holocene Sand	No	No	No
	ROSSI Paleo Barrier Islands	No	No	No
	ROSSI Paleo channels	No	No	No
	ROSSI Paleo Ebb Deltas	No	No	No
	ROSSI Paleo Shoreline Complex	No	No	No

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

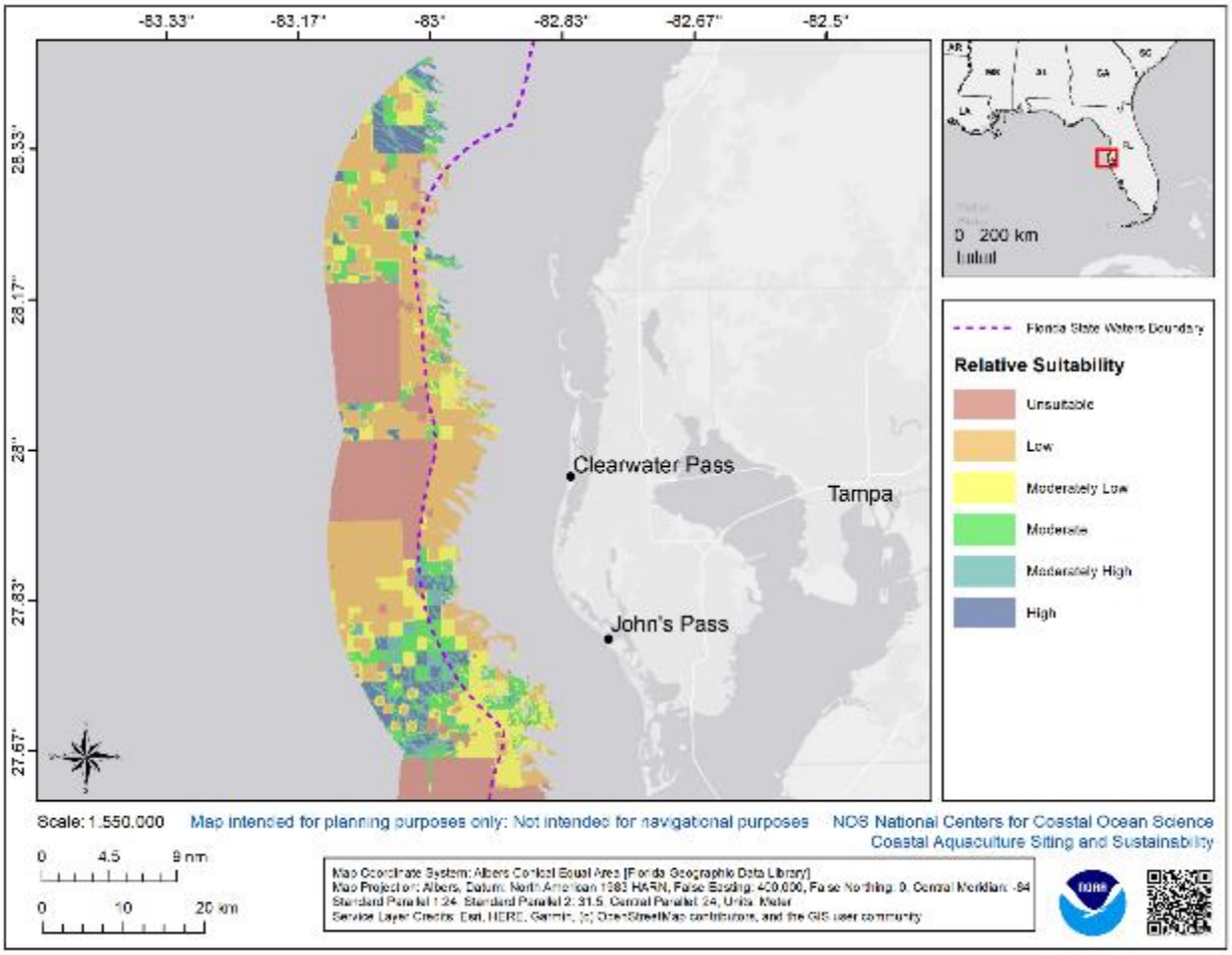

Figure 48. The relative suitability of offshore aquaculture in the South A Planning Area based on the four suitability analysis sub-models. Unsuitable areas (due to direct conflict with other uses) are in red. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

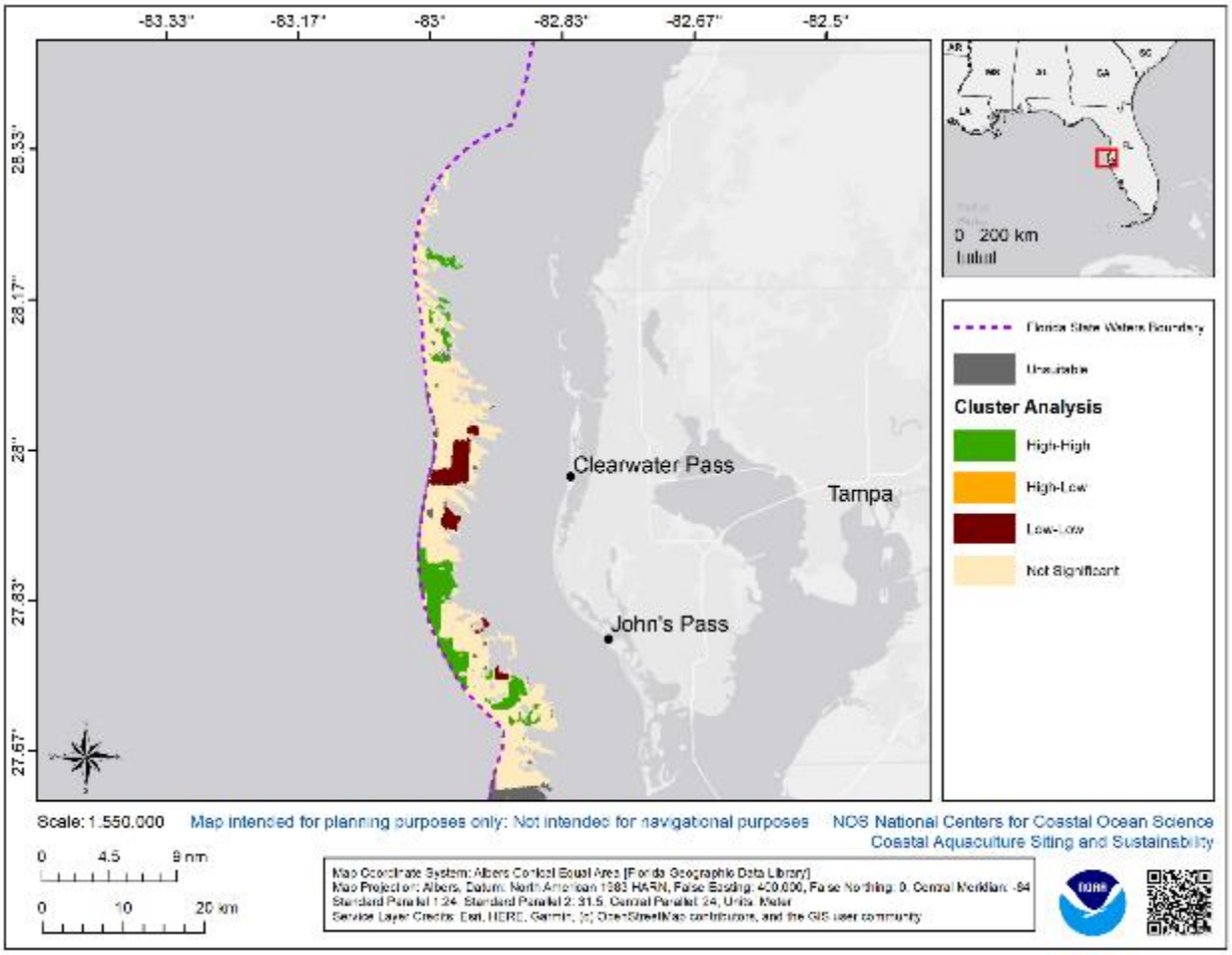

Figure 49. Output from the LISA cluster analysis for the South A Planning Area. Gray areas were considered unsuitable due to direct conflicts with other uses. All areas shown are in state waters (3-9 nm). The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

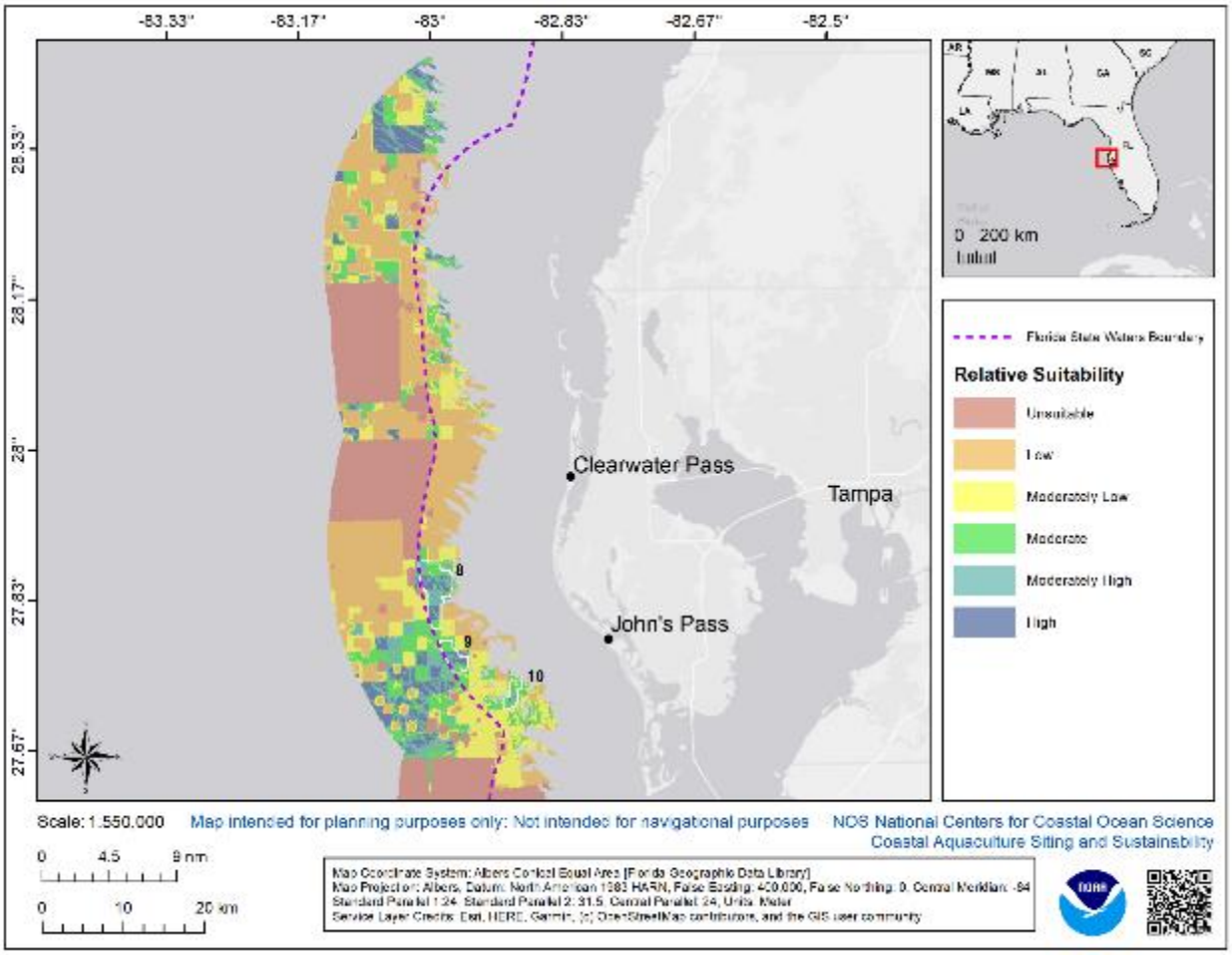

Figure 50. Final POAZ options 8-10 (white outline with associated option number) identified for characterization within the South A Planning Area. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

Option 8 Characterization

POAZ option 8 is 5,104 acres (20.66 km^2) in size and is located 19 km from Clearwater Pass and 21 km from John's Pass (Figure 51). This POAZ is relatively shallow (10.0-13.6 m depth) and is characterized by a shallow ridge in the eastern portion, with increasing depths moving westward. There are also three patchy collections of ridges moving westward from the eastern ridge. Option 8 is near a fish haven and artificial reef in the west (755 m and 631 m, respectively, both located in federal waters), a live rock aquaculture area is located nearby (not shown on map due to confidentiality), and a sand and gravel area in federal waters located to the north (221 m).

This POAZ had three vessel traffic transits per 100 acres in 2019, with tug and tow, pleasure and sailing, fishing, and other comprising the majority of vessel activity. Commercial fishing in and around the option includes shrimp trawling and headboat operations for recreational fishing.

Salinity ranged from 33.3 PSU (December 2019) to 36.8 PSU (July 2013). Annually, seawater temperature ranged from 13.3°C in winter (January 2018) to 32.1°C in summer (July 2016). The maximum daily surface current speed between 2013 and 2019 was 0.50 m/s, and the maximum significant wave height between 1979 and 2014 was 4.7 m (Figure 52). There was one toxic red tide bloom in this option between 2000-2019 (Table 15).

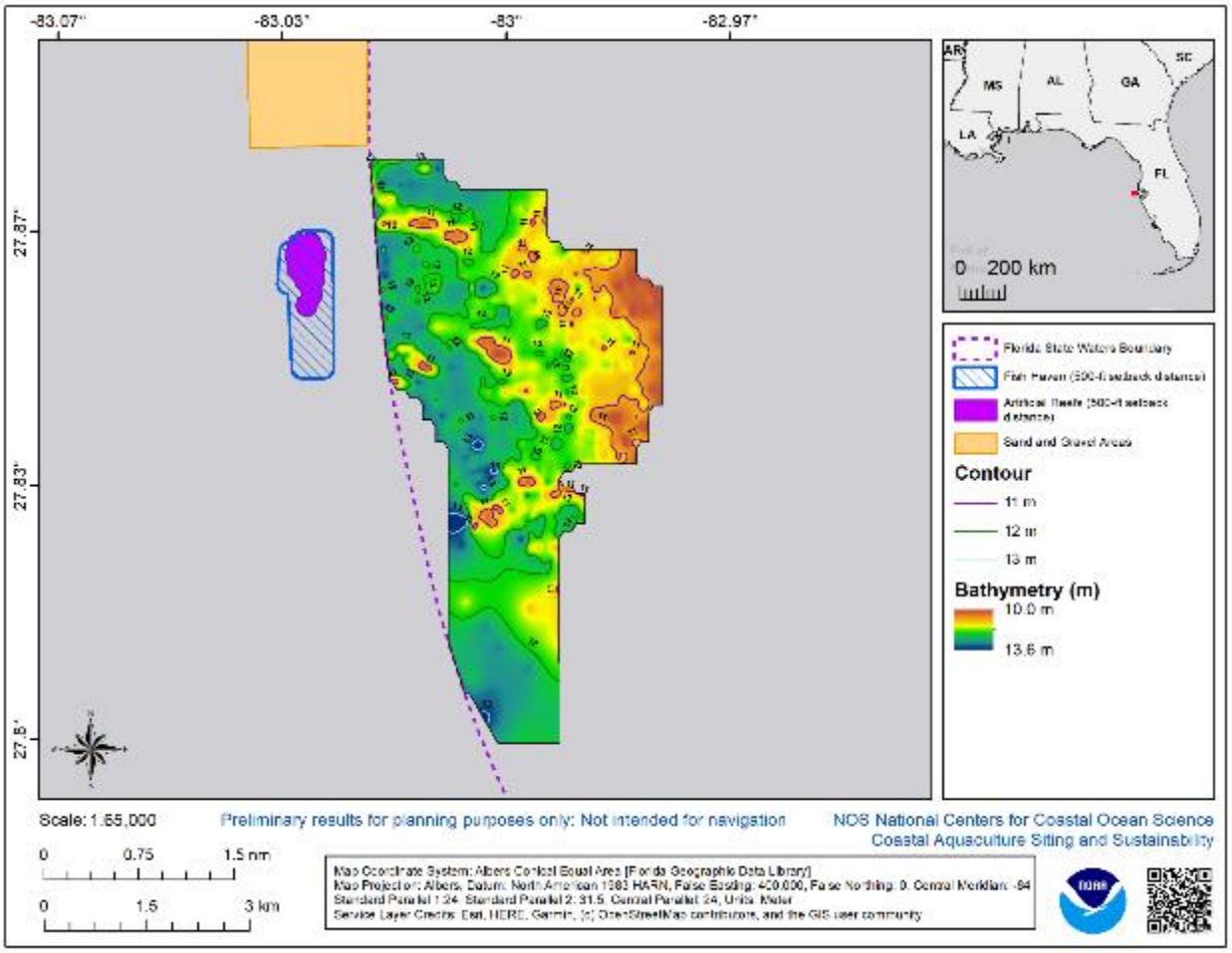

Figure 51. South A POAZ option 8 with nearby considerations and bathymetry. The 500-ft artificial reef (pink) and fish haven (blue diagonal bars) setbacks are placed around the feature centroid or boundary. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

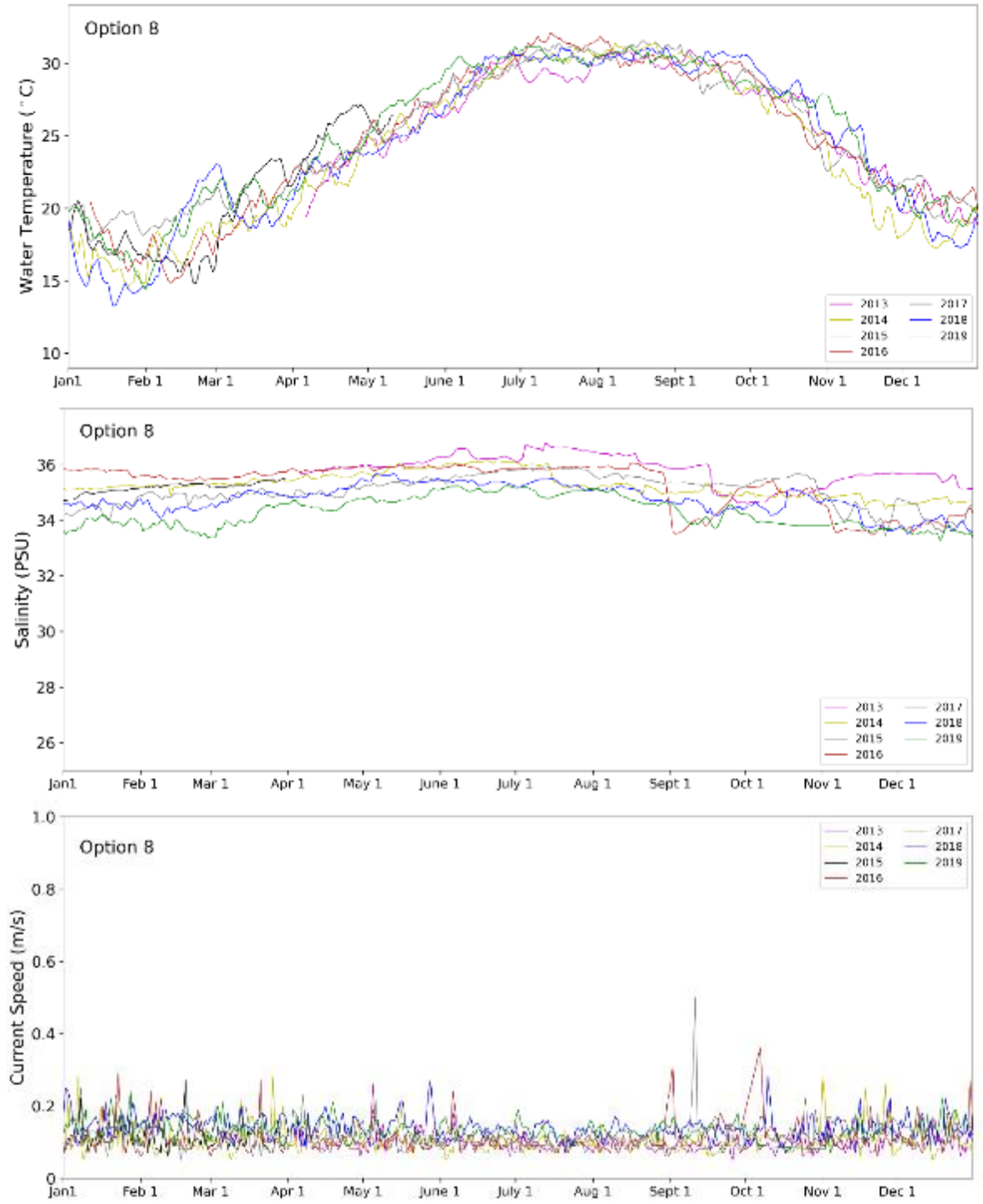

Figure 52. South A Planning Area, option 8 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

Option 9 Characterization

POAZ option 9 is 1,872 acres (7.58 km^2) in size and is located 25 km from Clearwater Pass and 18 km from John's Pass (Figure 53). This POAZ is relatively shallow (10.0-12.3 m depth) and is characterized by shallow ridges in the east with some deeper depressions in the west. Option 9 has a navigation obstruction to the east, 677 m away.

This POAZ had less overall vessel traffic than option 8, but more per unit area. There were four vessel traffic transits per 100 acres in 2019, with tug and tow, pleasure and sailing, fishing, and other comprising most of the vessel activity. Commercial fishing in and around the option includes shrimp trawling and headboat operations for recreational fishing.

Salinity ranged from 33.1 PSU (December 2019) to 36.7 PSU (July 2013). Annually, seawater temperature ranged from 13.3°C in winter (January 2018) to 32.3°C in summer (July 2016). The maximum daily surface current speed between 2013 and 2019 was 0.48 m/s, and the maximum significant wave height from 1979 to 2014 was 4.8 m (Figure 54). There were no toxic red tide bloom events at this option from 2000-2019 (Table 15).

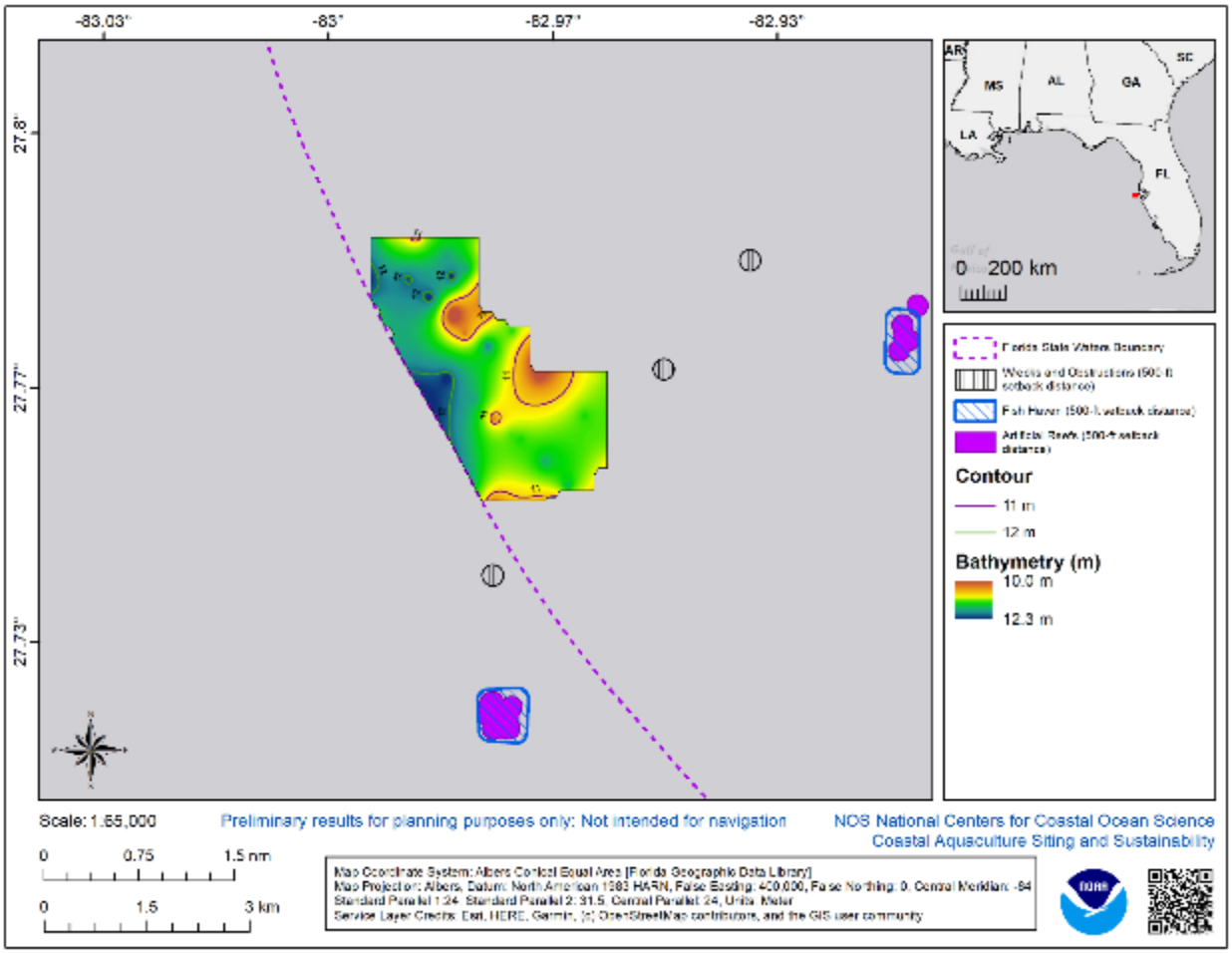

Figure 53. South A POAZ option 9 with nearby considerations and bathymetry. The 500-ft navigational obstruction setback is placed around the feature centroid or boundary. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

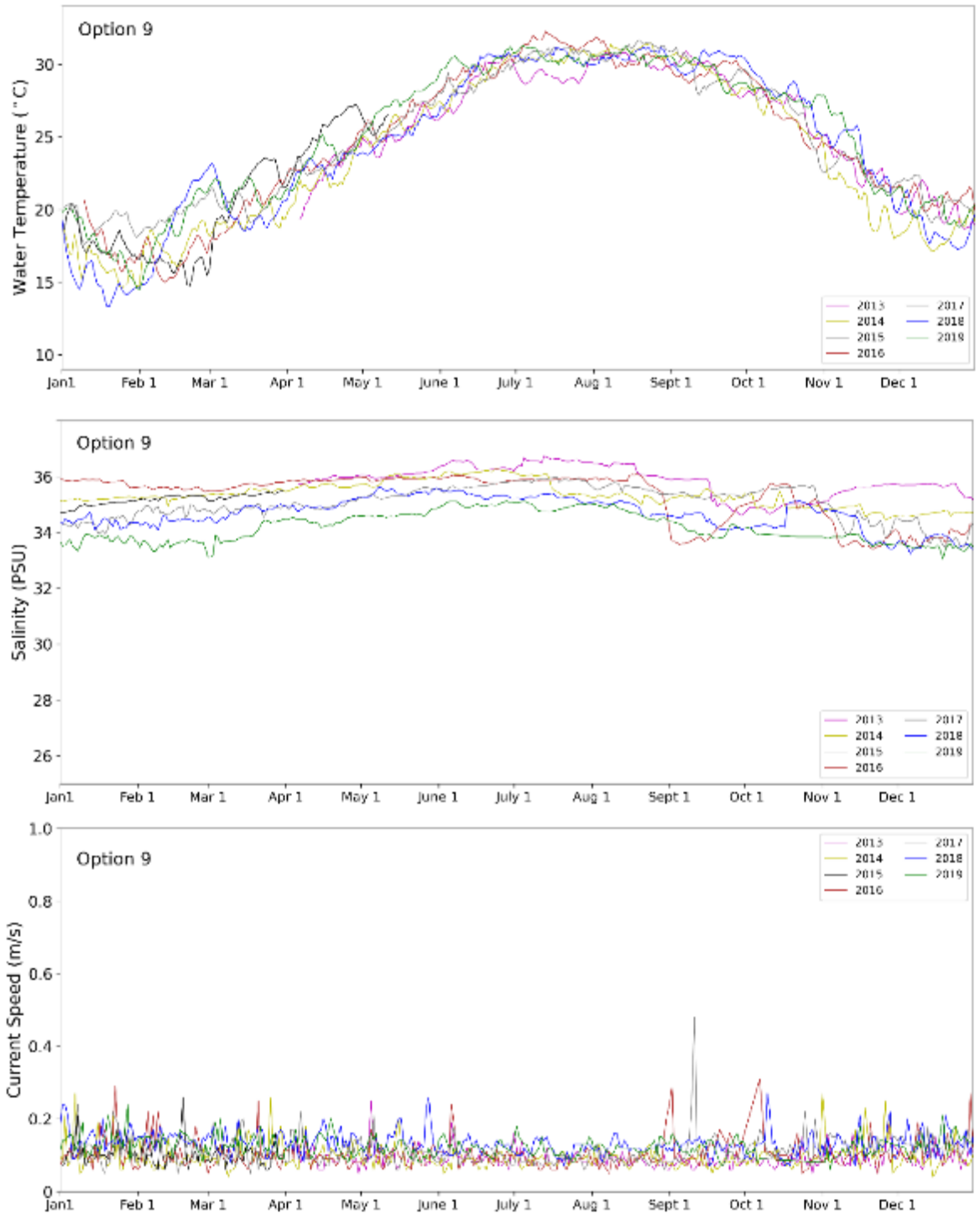

Figure 54. South A Planning Area, option 9 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

Option 10 Characterization

POAZ option 10 is 1,249 acres (5.05 km^2) in size and is located 26 km from Clearwater Pass and 12 km from John's Pass (Figure 55). This POAZ is relatively shallow (10.3-12.3 m depth) and is characterized by three wide ridges in the northeast, southeast and southwest corners with a gentle slope from the ridges to shallow depressions in the center. There is a fish haven and artificial reef located to the northeast 756 m and 827 m away, respectively.

This POAZ had the most vessel traffic of all three options in the South A Planning Area. There were 16 vessel traffic transits per 100 acres in 2019, with tug and tow, pleasure and sailing, fishing, and other making up most of the vessel activity. Commercial fishing in and around the option includes shrimp trawling and headboat operations for recreational fishing.

Salinity ranged from 32.6 PSU (December 2019) to 36.7 PSU (June 2013). Annually, seawater temperature ranged from 13.3°C in winter (January 2018) to 32.6°C in summer (July 2016). The maximum daily surface current speed between 2013 and 2019 was 0.44 m/s, and the maximum significant wave height was 4.8 m (Figure 56). There were two toxic red tide blooms in this option between 2000-2019 (Table 15).

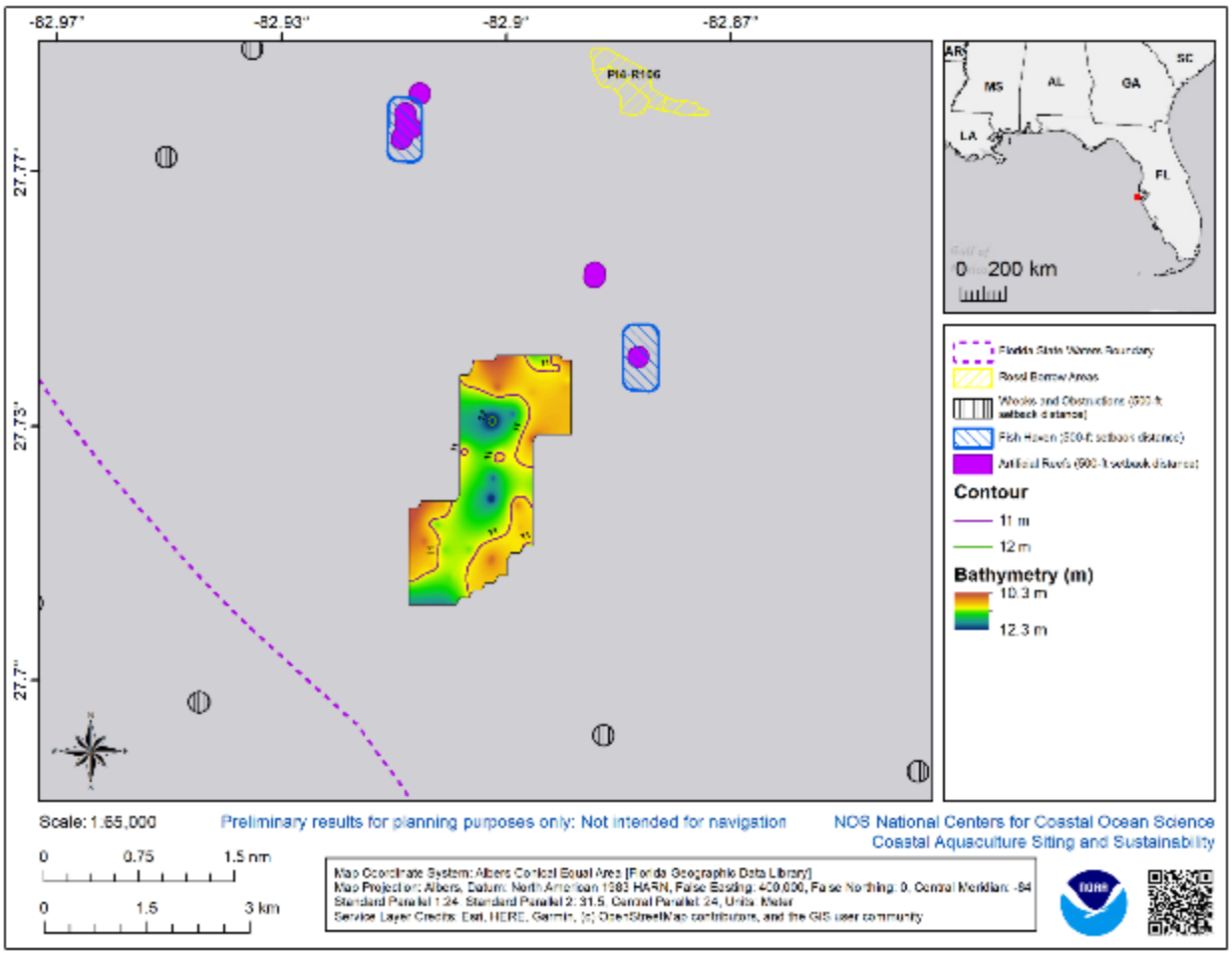

Figure 55. South A POAZ option 10 with nearby considerations and bathymetry. The 500-ft fish haven setback (blue diagonal bars) is placed around the feature centroid or boundary.

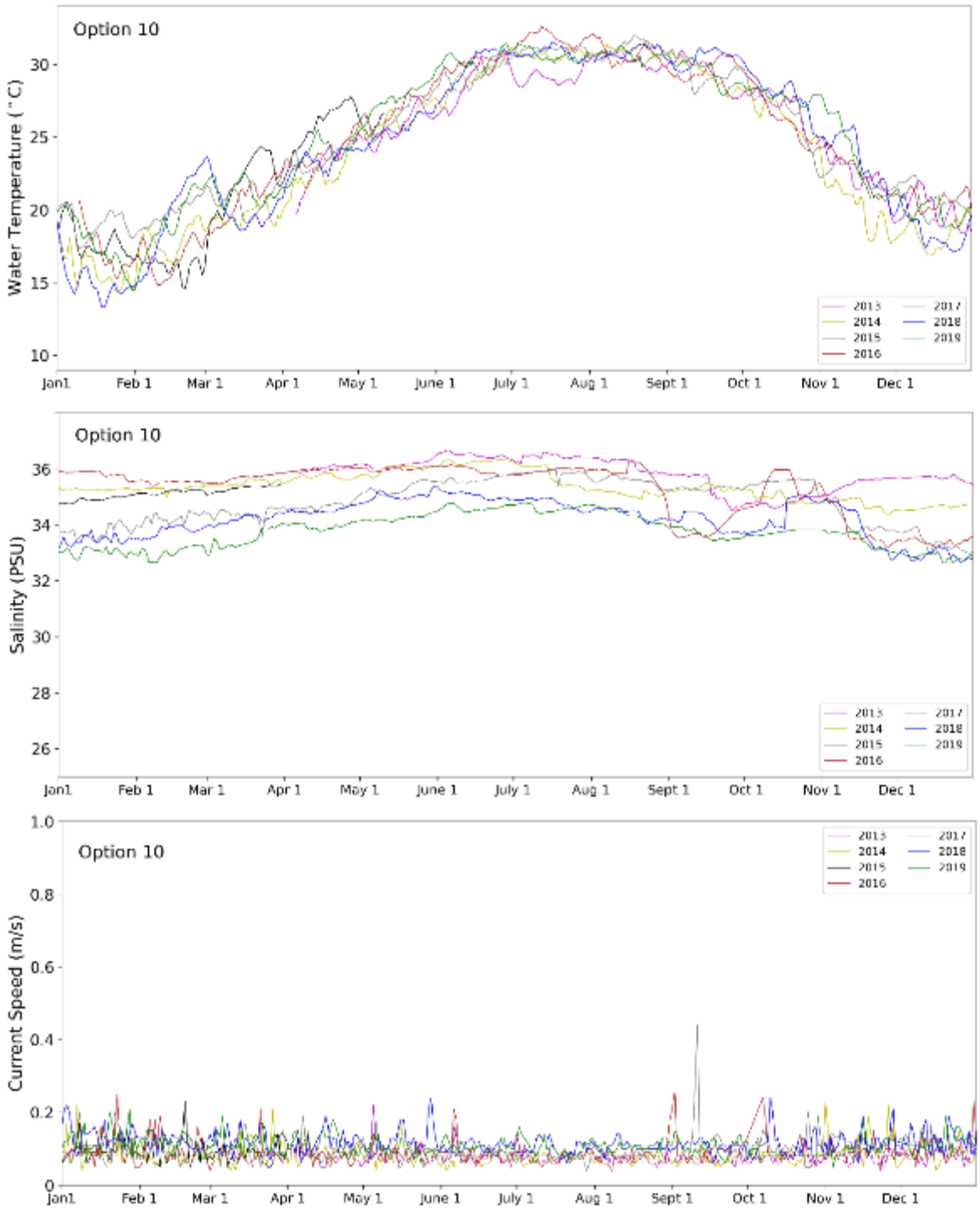

Figure 56. South A Planning Area, option 10 Navy Coastal Ocean modeled oceanographic features from 2013 to 2019 at the surface for water temperature (top panel), salinity (middle panel), and current speed (bottom panel).

South B Planning Area: Sarasota (Siting Options 11-34)

The South B Planning Area is located roughly off the coast of Sarasota, from the mouth of Tampa Bay in the north to Venice in the south (Figure 57). Bathymetry overall throughout the Planning Area ranged from 10.0-17.1 m. The smallest siting option was 204 acres (option 17 in group 1) and the largest was 7,407 acres (option 19 in group 2). The closest distance to port ranged from 12-14 km for at least one POAZ in each group; the furthest distance to port was 54 km for option 18 (Tables 16-21). There were no national security constraints in this Planning Area.

Overall, significant high-high clustering from the LISA analysis occurred for 46,740 acres, primarily on the western edge of the area near the state water boundary (Figure 58). The suitability analysis and subsequent cluster analysis in South B were predominantly driven by recreational fishing (i.e., headboat trips), pleasure and sailing craft vessel traffic, and natural and cultural resources (i.e., fish havens, artificial reefs, wrecks, and potential coral hard bottom) (Tables 16-21). Unique to this Planning Area, there were shipwrecks near the POAZs and a pipeline in the northernmost region.

After applying the site selection rules, 24 final POAZs siting options were identified in the South B Planning Area, totaling 26,615 acres of ocean space (Figure 59). As a result of the number of sites identified in this Planning Area, the final POAZ siting options were further divided into six groups for subsequent characterization (Figure 60).

Notably, each group in the South B Planning Area contained POAZs that experienced toxic red blooms. POAZ option 33 in the southernmost group off the coast of Venice (group 6) had the most, at 5 toxic level blooms between 2000 and 2019. POAZ option 28 and 31 had 3 blooms each.

Detailed characterization of each POAZ option in the South B Planning Area (options 11-34) can be found in the following sections and examined in Tables 16 through 21 below. Due to the high number of POAZs in the Planning Area, the characterization descriptions are organized by group.

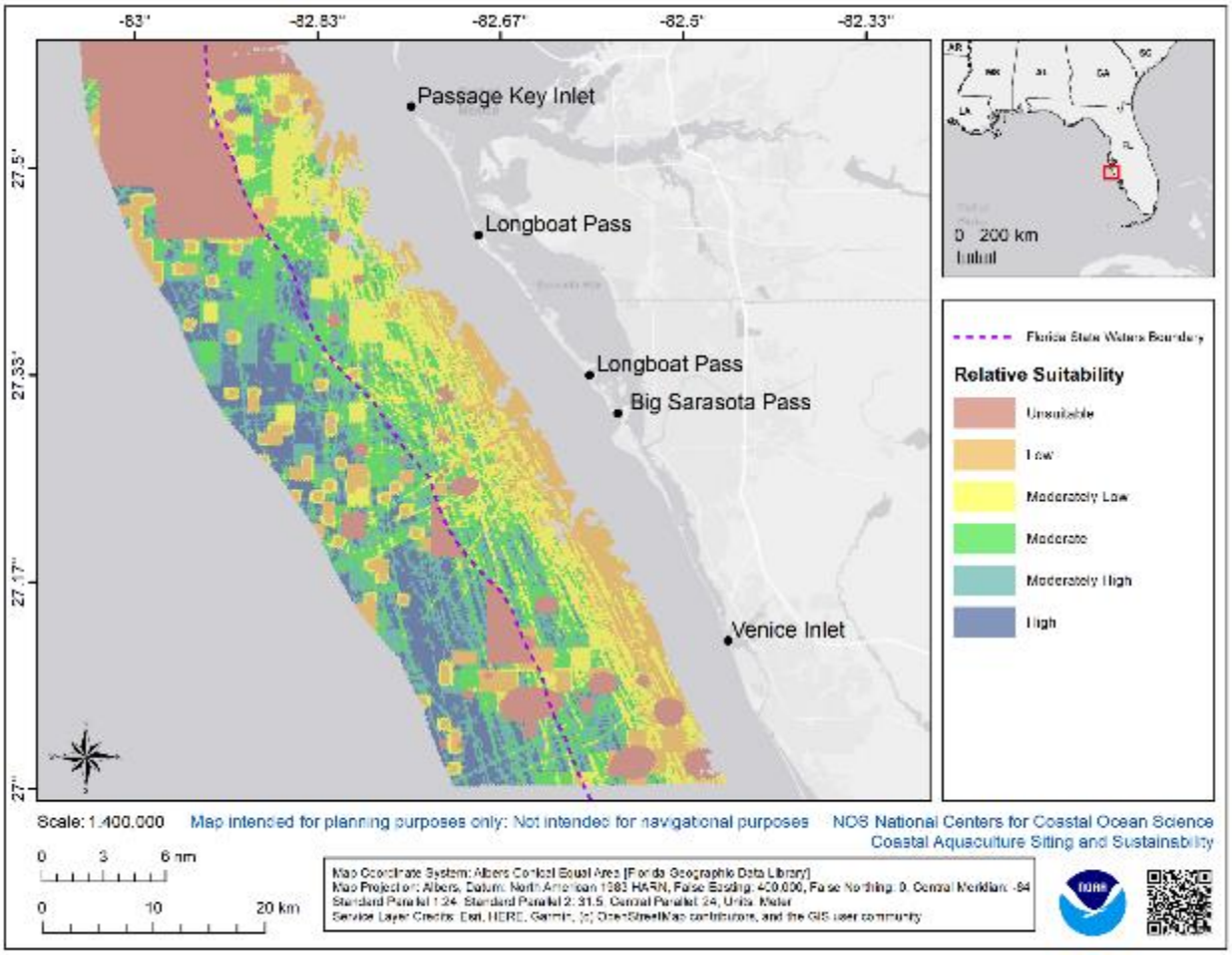

Figure 57. The relative suitability of offshore aquaculture in the South B Planning Area based on the four suitability analysis sub-models. Unsuitable areas (due to direct conflict with other uses) are in red. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

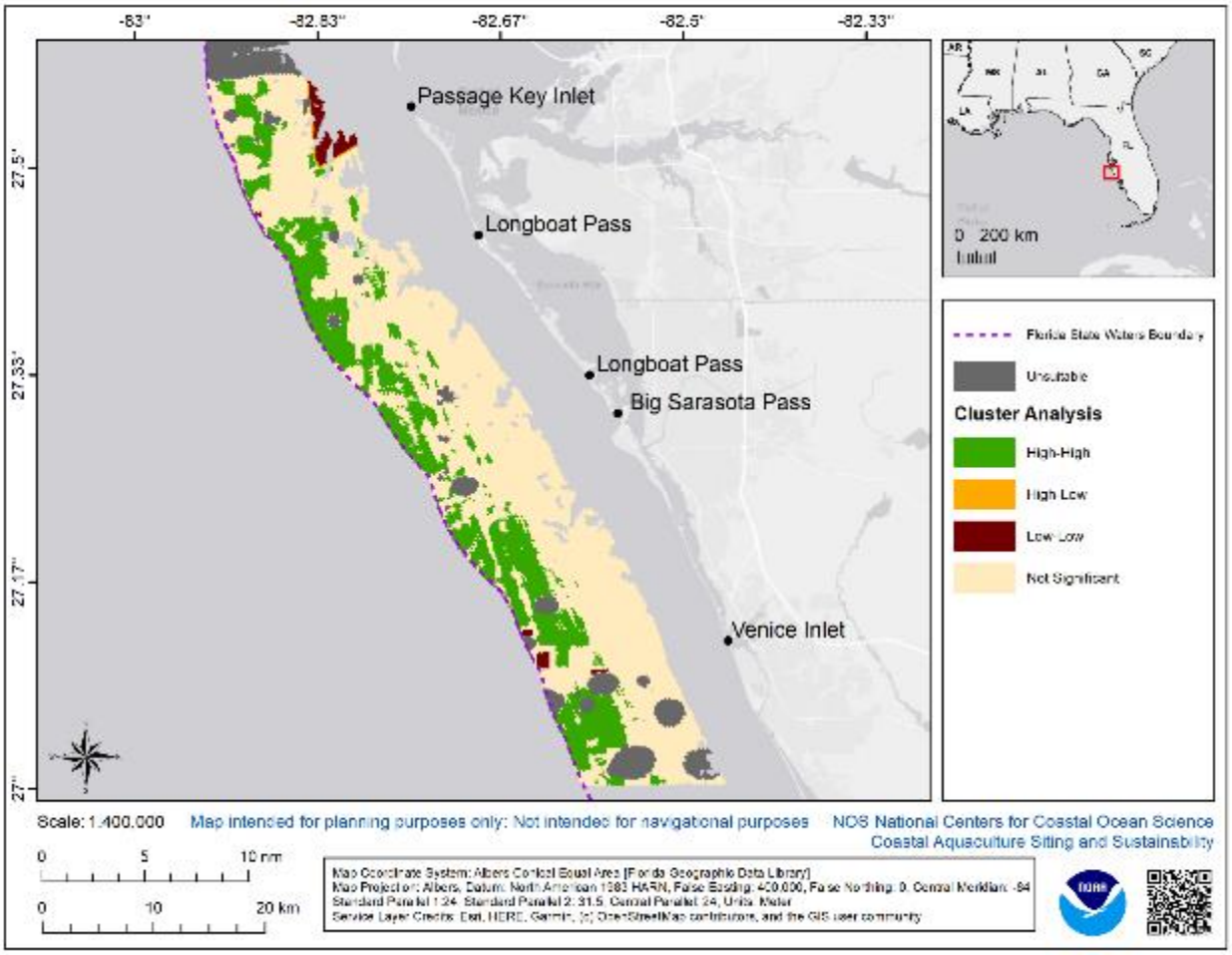

Figure 58. Output from the LISA cluster analysis for the South B Planning Area. Gray areas were considered unsuitable due to direct conflicts with other uses. All areas shown are in state waters (3-9 nm). The Florida state water boundary (at 9 nm) is denoted with the dotted pink line.

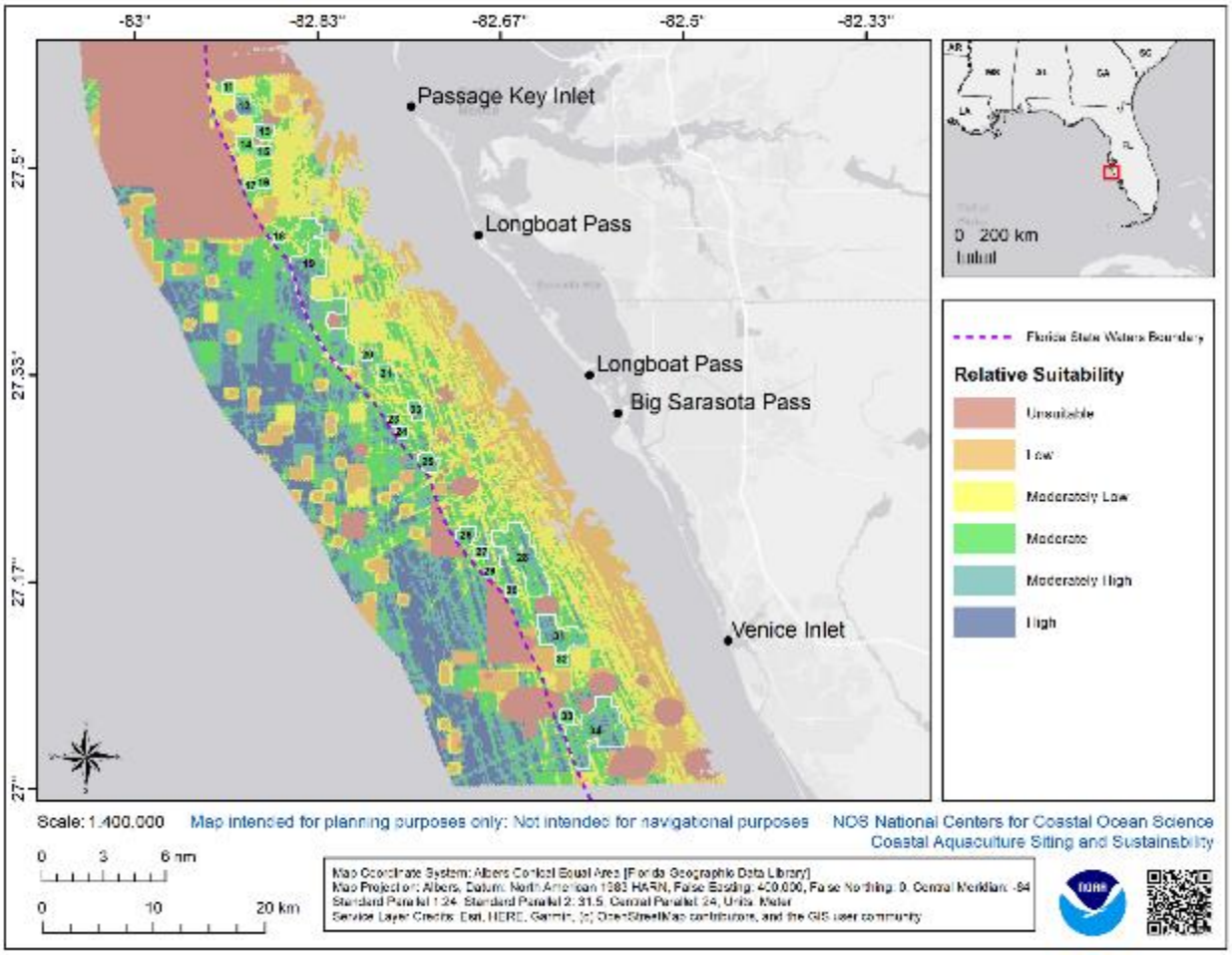

Figure 59. Final POAZ options 11-34 (white outline with associated option number) identified for characterization within the South B Planning Area. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

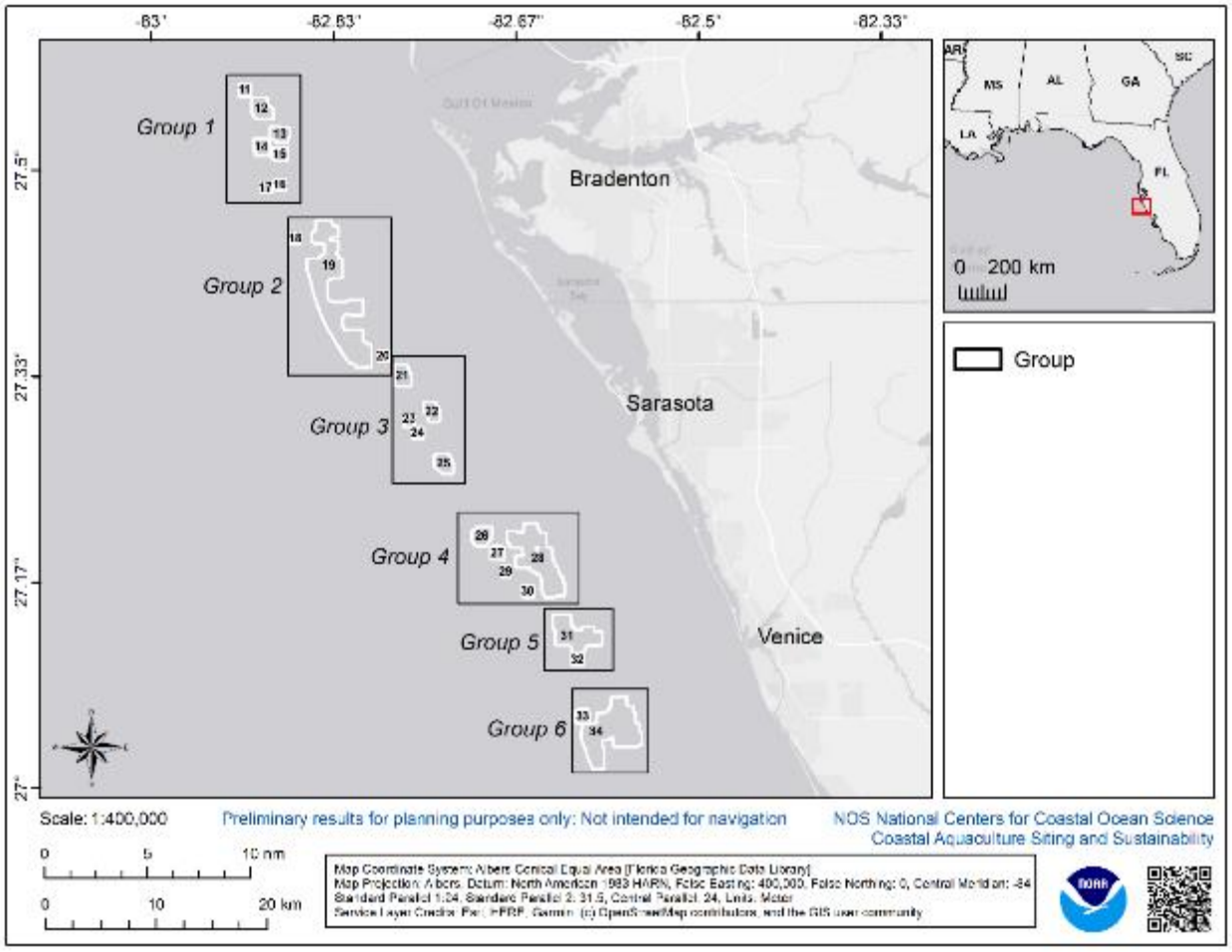

Figure 60. South B Planning Area POAZs were further arranged into six groups to simplify the characterization and visualization of the options in reference to one another.

South B/Group 1 Characterization (Options 11-17)

South B/Group 1 includes POAZs 11-17 (Figure 61). Siting options totaled 3,096 acres (12.5 km^2) in size and ranged in depth from 10.9-15.8 m. Depths became shallower moving from north to south. The smallest siting option was 204 acres (option 17) and the largest was 805 acres (option 12). Options 13 and 15 had the closest distance to port at 13 km to Passage Key Inlet.

Unique to this Planning Area, there is a pipeline to the north of this group, with option 11 being the closest at 254 m away. There are also wrecks and obstructions in this group near options 12, 13, 14 and 15. All siting options in the South B/Group 1 are within the EFH for Atlantic HMS, coastal migratory species, shrimp, reef fish, red drum, and spiny lobster. There are two fish havens located near option 12 (745 m) and option 13 (111 m) (Table 16). There are also several live rock aquaculture areas in state and federal waters to the north and west of options 11 and 12 (not shown on the map to protect confidentiality).

Total vessel traffic was highest in option 14 (106 transits in 2019) but greatest per area in option 17 (28 transits per 100 acres). Vessel traffic overall was predominantly tug and tow, fishing, pleasure and sailing, and other vessels (Table 16). Commercial fishing in and around these options includes shrimp trawling and headboat operations for recreational fishing.

Within South B/Group 1 salinity ranged from 33.2 PSU (December 2019) to 36.8 PSU (July 2013). Annually, seawater temperature ranged from 13.8°C in winter (January 2018) to 32.3°C in summer (July 2016). The maximum daily surface current speed between 2013 and 2019 was 0.45 m/s, and the maximum significant wave height was 5.4 m (Figure 62). There were two toxic red tide blooms each in options 11-15 and one in option 16 between 2000-2019. No red tide data were available for option 17.

Table 16. Characterization of the South B Planning Area/Group 1 POAZs. Parameters of relevance are listed with the corresponding values. The seven planning options totaled 3,096 acres.

		Option #						
Category	**Parameters**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Geographic	Area (acres)	308	805	571	523	408	277	204
	Bathymetry Range (m)	12.5-15.4	11.7-15.8	10.9-13.4	11.4-14.1	10.9-13.6	11.5-13.9	11.4-13.8
	Distance to Passage Key Inlet (km)	16	14	13	15	13	14	15
	Distance to Longboat Pass (km)	25	22	20	22	20	19	20
	Distance to New Pass (km)	41	38	36	37	35	34	35
	Distance to Big Sarasota Pass (km)	45	42	40	41	39	38	39
National Security	Unexploded Ordnance FUDs	No	No	No	No	No	No	No
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Shrimp EFH	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Reef Fish EFH	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Red Drum EFH	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Spiny Lobster EFH	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Shallow Coral EFH	No	No	No	No	No	No	No
	Distance to Fish Haven (m)	3,384	745	111	1,692	1,949	4,701	5183
	Distance to Wrecks and Obstructions (m)	2,617	901	0	192	375	3,137	3229
Industry and Navigation	Distance to Pipeline (m)	254	1,560	4,323	5,237	6,264	9,041	9255
	Distance to Sand and Gravel Areas (m)	1,387	2,123	2,658	784	1,961	1,346	250
	Cargo vessel transits 2019	0	1	0	1	0	0	0
	Tanker vessel transits 2019	0	0	0	0	0	0	0
	Tug and tow vessel transits 2019	7	9	16	9	8	5	10
	Fishing vessel transits 2019	17	23	24	45	25	27	14
	Passenger vessel transits 2019	0	0	1	1	0	0	0
	Pleasure and sailing vessel transits 2019	11	26	22	18	14	8	13
	Other vessel transits 2019	13	36	34	32	21	19	21
	Military vessel transits 2019	0	0	0	0	0	0	0
	All vessel transits 2019	48	95	97	106	68	59	58
	All vessel transits per 100 acres	16	12	17	20	17	21	28

Table 16 (continued)

Category	Parameters	Option # 11	12	13	14	15	16	17
Oceanographic Data for Characterization	Daily temperature min/max (°C) (2013-2019)	13.9/32.1	13.9/32.1	13.8/32.3	14.0/32.0	14.0/32.2	14.0/32.2	14.2/31.9
	Daily salinity min/max (PSU) (2013-2019)	33.5/36.8	33.5/36.8	33.2/36.8	33.6/36.8	33.4/36.7	33.4/36.7	33.8/36.7
	Max daily current speed (m/s)* (2013-2019)	0.45	0.45	0.45	0.45	0.45	0.45	0.45
	Max significant wave height (m) (1979-2014)**	5.0	5.0	4.9	5.4	4.9	4.8	4.8
	K. brevis toxic bloom frequency (2000-2019)	2	2	2	2	2	1	No data
Geologic Data for Characterization	Distance to ROSSI Borrow Areas (m)	5,618	2,843	1,104	892	661	259	742
	ROSSI Holocene Sand	No	No	No	No	No	No	No
	ROSSI Paleo Barrier Islands	No	No	No	No	No	No	No
	ROSSI Paleo channels	No	No	No	No	No	No	No
	ROSSI Paleo Ebb Deltas	No	No	No	No	No	No	No
	ROSSI Paleo Shoreline Complex	No	No	No	No	No	No	No

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

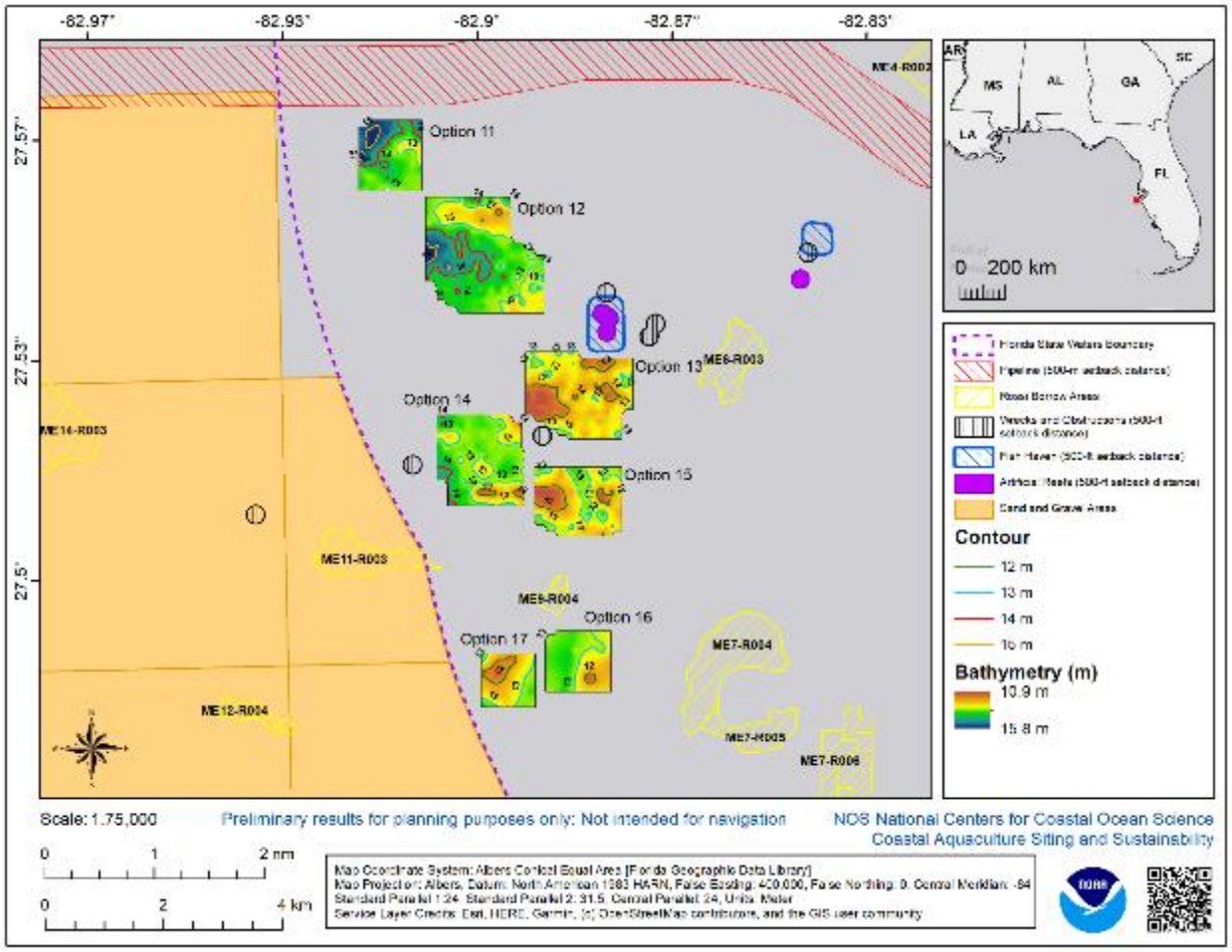

Figure 61. South B/Group 1 POAZs (options 11-17) with nearby considerations and bathymetry. Note the setback for fish havens (blue diagonal bars), pipeline (orange diagonal bars), and wrecks (black bars). The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

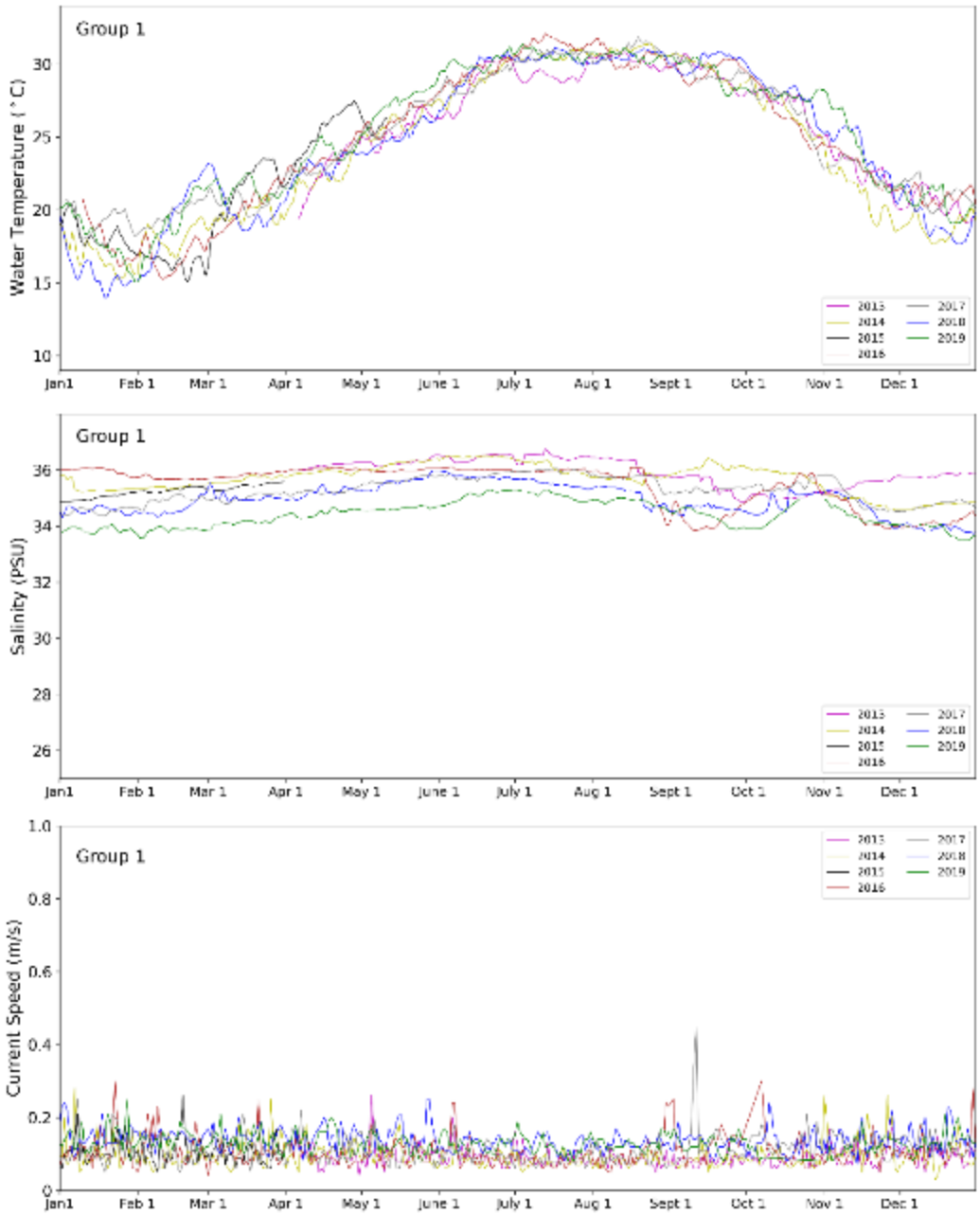

Figure 62. Navy Coastal Ocean Model mean daily water temperature (top panel), salinity (middle panel), and current speed (bottom panel) from all POAZs in South B/Group 1 (options 11-17), 2013-2019.

South B/Group 2 Characterization (Options 18-20)

South B/Group 2 includes POAZs 18-20 (Figure 63). Siting options totaled 7,845 acres (31.7 km^2) in size and ranged in depth from 10.0-15.2 m. The smallest siting option was 213 acres (option 18) and the largest was 7,407 acres (option 19). Option 19 has a shallower ridge in the northern section of the site, and two slightly deeper depressions in the middle and southern sections. Options 18 and 20 are relatively flat. The western boundary of the group is bound by the Florida state water boundary. Option 19 had the closest distance to port at 13 km to Passage Key Inlet.

All siting options in the South B/Group 2 are within the EFH for Atlantic HMS, coastal migratory species, shrimp, reef fish, red drum, spiny lobster, and shallow coral. There are two fish havens located 791 m and 1561 m to the east from option 19 and sand and gravel areas in federal waters located 675 m west from option 18 (Table 17). There is also an oil and gas well permit application from the Coastal Petroleum Company that was denied near option 19.

Total vessel traffic was highest in option 19 (499 transits in 2019) but greatest per area in option 20 (27 transits per 100 acres). Vessel traffic overall was predominantly tug and tow, fishing, pleasure and sailing, and other vessels. Commercial fishing in and around these options includes shrimp trawling and headboat operations for recreational fishing.

Within South B/Group 2 salinity ranged from 33.4 PSU (February 2019) to 36.7 PSU (July 2013). Annually, seawater temperature ranged from 14.1°C in winter (January 2018) to 32.1°C in summer (July 2016). The maximum daily surface current speed between 2013 and 2019 was 0.46 m/s, and the maximum significant wave height was 5.4 m (Figure 64). There was one toxic red tide bloom in option 19 between 2000-2019.

Table 17. Characterization of the South B Planning Area/Group 2 POAZs. Parameters of relevance are listed with the corresponding values. The three planning options totaled 7,845 acres.

Category	Parameters	Option 18	Option 19	Option 20
Geographic	Area (acres)	213	7,407	225
	Bathymetry Range (m)	13.4-14.4	10-15.2	13.2-14.1
	Distance to Passage Key Inlet (km)	16	13	21
	Distance to Longboat Pass (km)	17	14	14
	Distance to New Pass (km)	30	22	20
	Distance to Big Sarasota Pass (km)	34	24	23
	Distance to Venice Inlet (km)	54	42	41
National Security	Unexploded Ordnance FUDs	No	No	No
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes	Yes
	Shrimp EFH	Yes	Yes	Yes
	Reef Fish EFH	Yes	Yes	Yes
	Red Drum EFH	Yes	Yes	Yes
	Spiny Lobster EFH	Yes	Yes	Yes
	Shallow Coral EFH	Yes	Yes	Yes
	Distance to Fish Haven (m)	4,161	791 / 1,561	5,916
Industry and Navigation	Distance to Sand and Gravel Areas (m)	675	2,610	13,301
	Cargo vessel transits 2019	0	0	0
	Tanker vessel transits 2019	0	0	0
	Tug and tow vessel transits 2019	8	51	3
	Fishing vessel transits 2019	11	244	34
	Passenger vessel transits 2019	0	0	0
	Pleasure and sailing vessel transits 2019	13	167	15
	Other vessel transits 2019	9	37	9
	Military vessel transits 2019	0	0	0
	All vessel transits 2019	41	499	61
	All vessel transits per 100 acres	19	7	27

Table 17 (continued)

Category	Parameters	Option 18	Option 19	Option 20
Oceanographic Data for Characterization	Daily temperature min/max (°C) (2013-2019)	14.3/31.9	14.1/32.1	14.1/31.9
	Daily salinity min/max (PSU) (2013-2019)	33.5/36.7	33.4/36.6	33.5/36.6
	Max daily current speed (m/s) (2013-2019)*	0.46	0.46	0.44
	Max significant wave height (m) (1979-2014)**	5.4	5.2	5.1
	K. brevis toxic bloom frequency (2000-2019)	0	1	0
Geologic Data for Characterization	Distance to ROSSI Borrow Areas (m)	2,851	0	2,592
	ROSSI Holocene Sand	No	No	No
	ROSSI Paleo Barrier Islands	No	No	No
	ROSSI Paleo channels	No	No	No
	ROSSI Paleo Ebb Deltas	No	No	No
	ROSSI Paleo Shoreline Complex	No	No	No

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

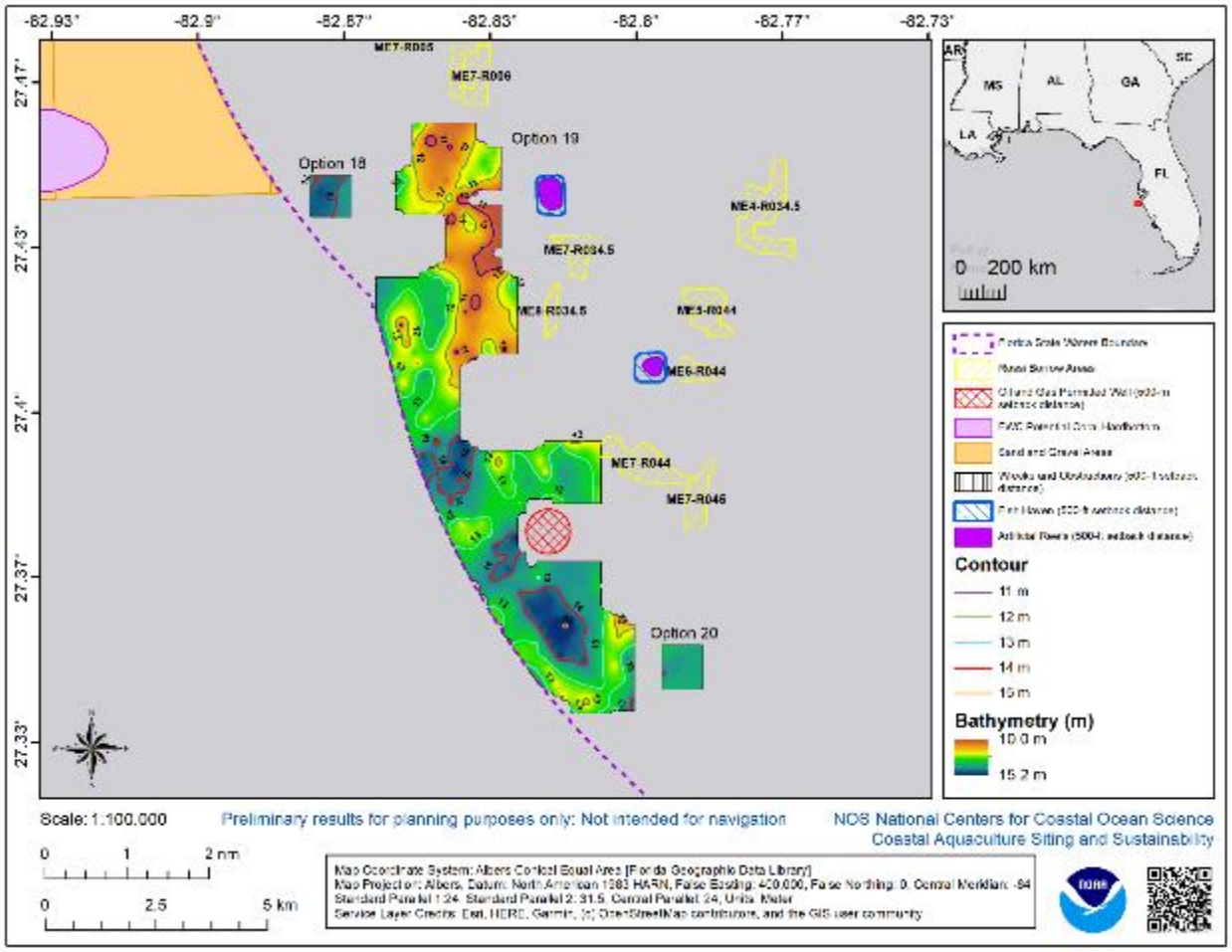

Figure 63. South B/Group 2 POAZs (options 18-20) with nearby considerations and bathymetry. The 500-ft fish haven (blue diagonal bars) setbacks are placed around the feature centroid or boundary. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

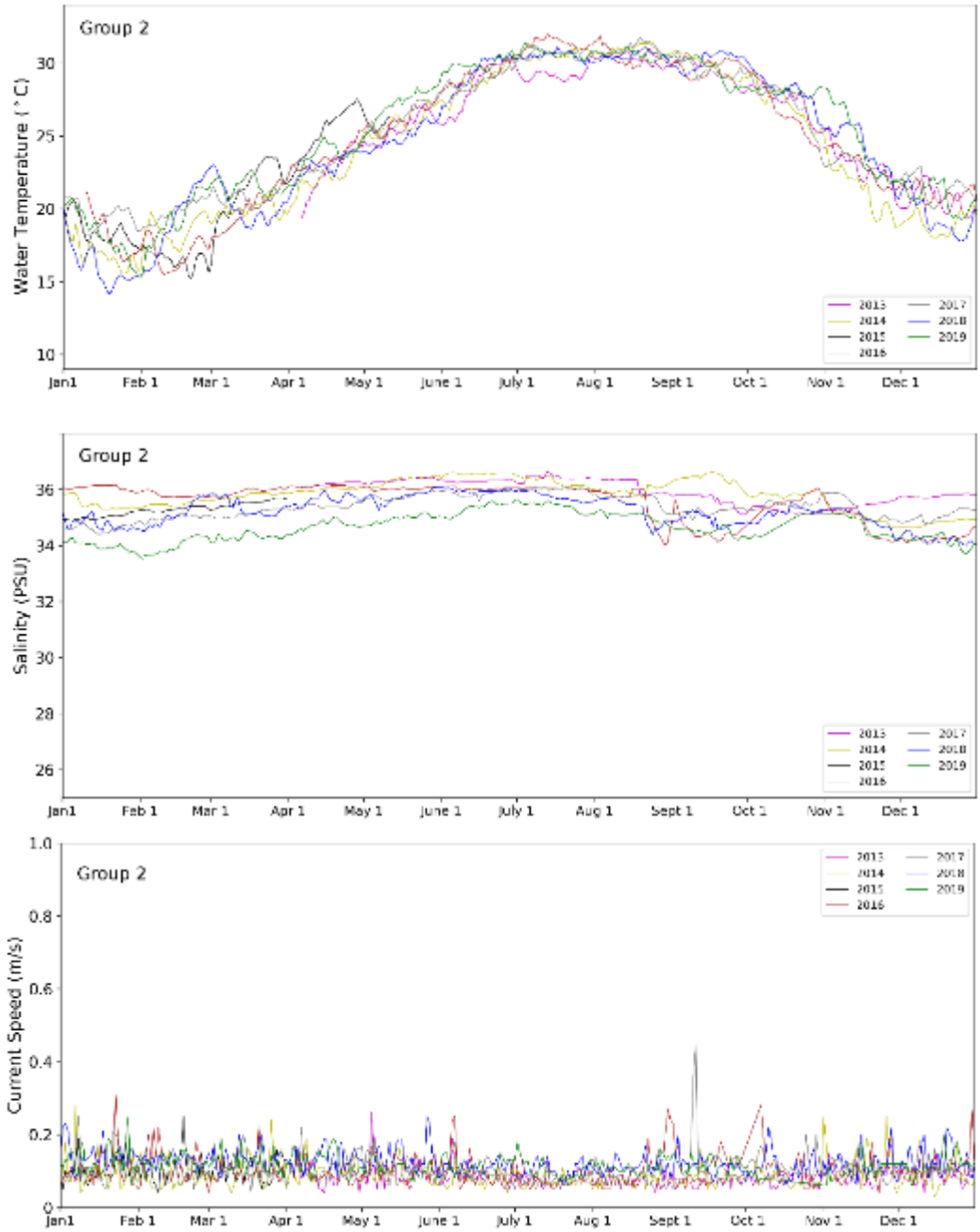

Figure 64. Navy Coastal Ocean Model mean daily water temperature (top panel), salinity (middle panel), and current speed (bottom panel) from all POAZs in South B/Group 2 (options 18-20), 2013-2019.

South B/Group 3 Characterization (Options 21-25)

South B/Group 3 includes POAZs 21-25 (Figure 65). Siting options totaled 2,339 acres (9.5 km^2) in size and ranged in depth from 11.2-15.0 m. The smallest siting option was 228 acres (option 23) and the largest was 658 acres (option 21). Bathymetric contours were relatively flat for all options, except for option 21, which had a ridge in the center. Option 21 had the closest distance to port at 14 km to Longboat Pass.

All siting options in the South B/Group 3 are within the EFH for Atlantic HMS, coastal migratory species, shrimp, reef fish, red drum, spiny lobster, and shallow coral. There are eight artificial reefs to the east in state waters and three to the west in federal waters. There is one fish haven 2 km from option 22, and eight shipwrecks in the eastern part of the area. There is one aid to navigation, the Sarasota County Artificial Reef Buoy M7, in federal waters (Figure 65).

Total vessel traffic was highest in option 21 (168 transits in 2019) but greatest per area in option 23 (36 transits per 100 acres). Vessel traffic overall was predominantly fishing, pleasure and sailing, and other vessels. Commercial fishing in and around these options includes shrimp trawling and headboat operations for recreational fishing.

Within South B/Group 3 salinity ranged from 33.1 PSU (January 2019) to 36.7 PSU (June 2014). Annually, seawater temperature ranged from 14.0°C in winter (January 2018) to 32.3°C in summer (July 2016). The maximum daily surface current speed between 2013 and 2019 was 0.43 m/s, and the maximum significant wave height was 5.2 m (Figure 66). There was one toxic red tide bloom in option 21 and two in option 25 between 2000-2019.

Table 18. Characterization of the South B Planning Area/Group 3 POAZs. Parameters of relevance are listed with the corresponding values. The five planning options totaled 2,339 acres.

		Option #				
Category	**Parameters**	**21**	**22**	**23**	**24**	**25**
Geographic	Area (acres)	658	530	228	269	654
	Bathymetry Range (m)	11.8-14.4	11.2-13.9	12.8-15.0	13.1-14.8	11.6-14.2
	Distance to Passage Key Inlet (km)	23	26	27	28	31
	Distance to Longboat Pass (km)	14	16	18	18	20
	Distance to New Pass (km)	18	15	18	17	16
	Distance to Big Sarasota Pass (km)	20	18	20	19	17
	Distance to Venice Inlet (km)	38	34	35	34	30
National Security	Unexploded Ordnance FUDs	No	No	No	No	No
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes	Yes	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes	Yes	Yes	Yes
	Shrimp EFH	Yes	Yes	Yes	Yes	Yes
	Reef Fish EFH	Yes	Yes	Yes	Yes	Yes
	Red Drum EFH	Yes	Yes	Yes	Yes	Yes
	Spiny Lobster EFH	Yes	Yes	Yes	Yes	Yes
	Shallow Coral EFH	Yes	Yes	Yes	Yes	Yes
	Distance to Artificial Reef (m)	4,520	2,466	3,493	3,384	845
	Distance to Fish Haven (m)	4,607	2,063	4,398	4,146	4,750
	Distance to Shipwrecks (m)	3,949	1,385	3,723	2,826	375
Industry and Navigation	Cargo vessel transits 2019	0	0	0	0	0
	Tanker vessel transits 2019	0	0	0	0	0
	Tug and tow vessel transits 2019	6	12	4	4	9
	Fishing vessel transits 2019	98	61	46	37	42
	Passenger vessel transits 2019	1	0	0	0	1
	Pleasure and sailing vessel transits 2019	40	40	18	20	30
	Other vessel transits 2019	23	25	13	15	29
	Military vessel transits 2019	0	0	0	0	0
	All vessel transits 2019	168	138	81	76	111
	All vessel transits per 100 acres	26	26	36	28	17

Table 18 (continued)

Category	Parameters	Option # 21	22	23	24	25
Oceanographic Data for Characterization	Daily temperature min/max (°C) (2013-2019)	14.0/32.2	14.0/32.3	14.1/32.0	14.1/32.0	14.0/32.1
	Daily salinity min/max (PSU) (2013-2019)	33.2/36.6	33.1/36.7	33.4/36.7	33.4/36.7	33.3/36.7
	Max daily current speed (m/s) (2013-2019)*	0.43	0.42	0.43	0.43	0.43
	Max significant wave height (m) (1979-2014)**	5.1	5.1	5.1	5.1	5.19
	K. brevis toxic bloom frequency (2000-2019)	1	0	0	0	2
Geologic Data for Characterization	Distance to ROSSI Borrow Areas (m)	3,901	1,173	3,421	2,872	2,978
	ROSSI Holocene Sand	No	No	No	No	No
	ROSSI Paleo Barrier Islands	No	No	No	No	No
	ROSSI Paleo channels	No	No	No	No	No
	ROSSI Paleo Ebb Deltas	No	No	No	No	No
	ROSSI Paleo Shoreline Complex	No	No	No	No	No

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

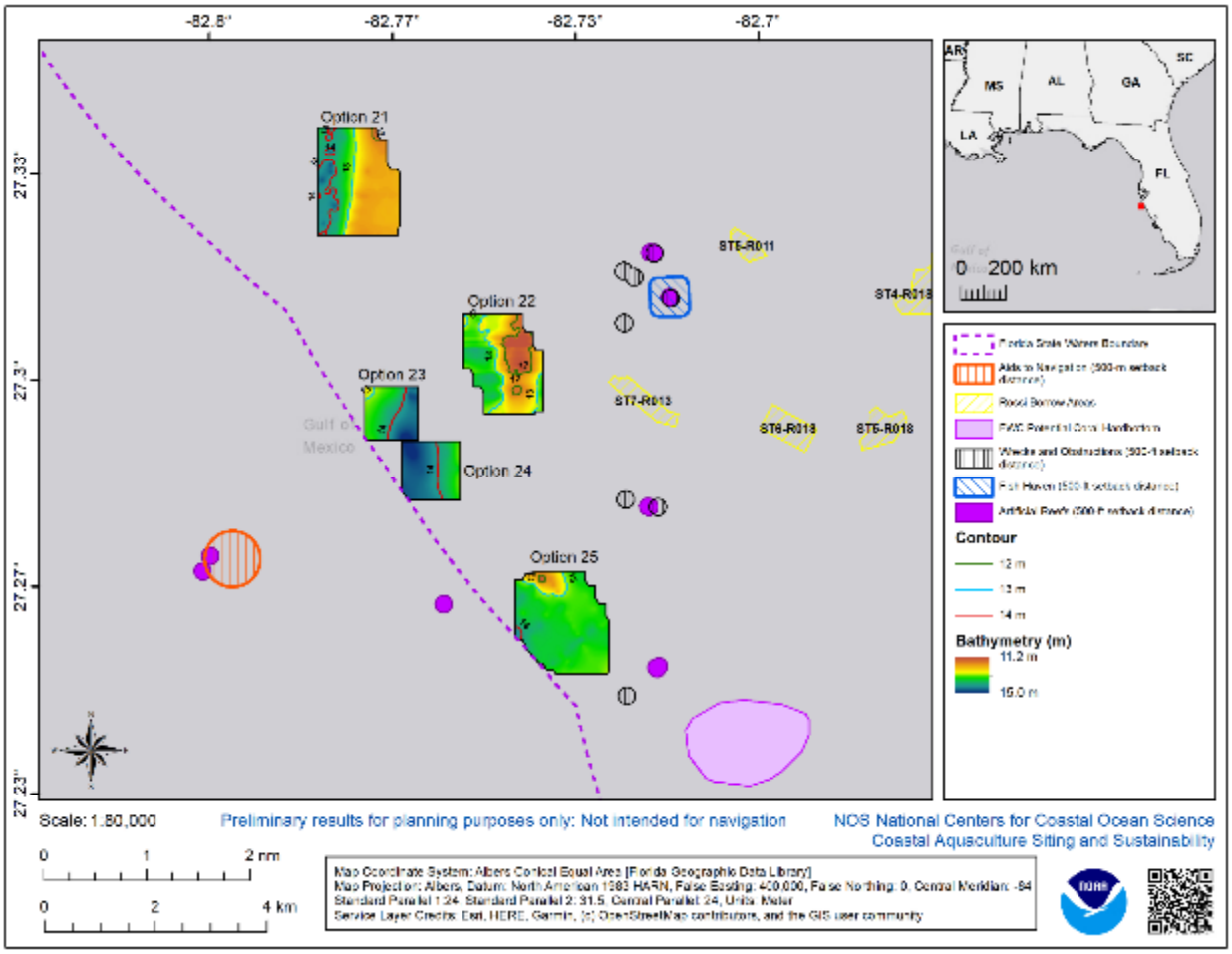

Figure 65. South B/Group 3 POAZs (options 21-25) with nearby considerations and bathymetry. The 500-ft artificial reef (purple), fish haven (blue diagonal bars), and wreck (black bars) setbacks are placed around the feature centroid or boundary. The Florida state water boundary (at 9 nm) is denoted with the dotted pink line.

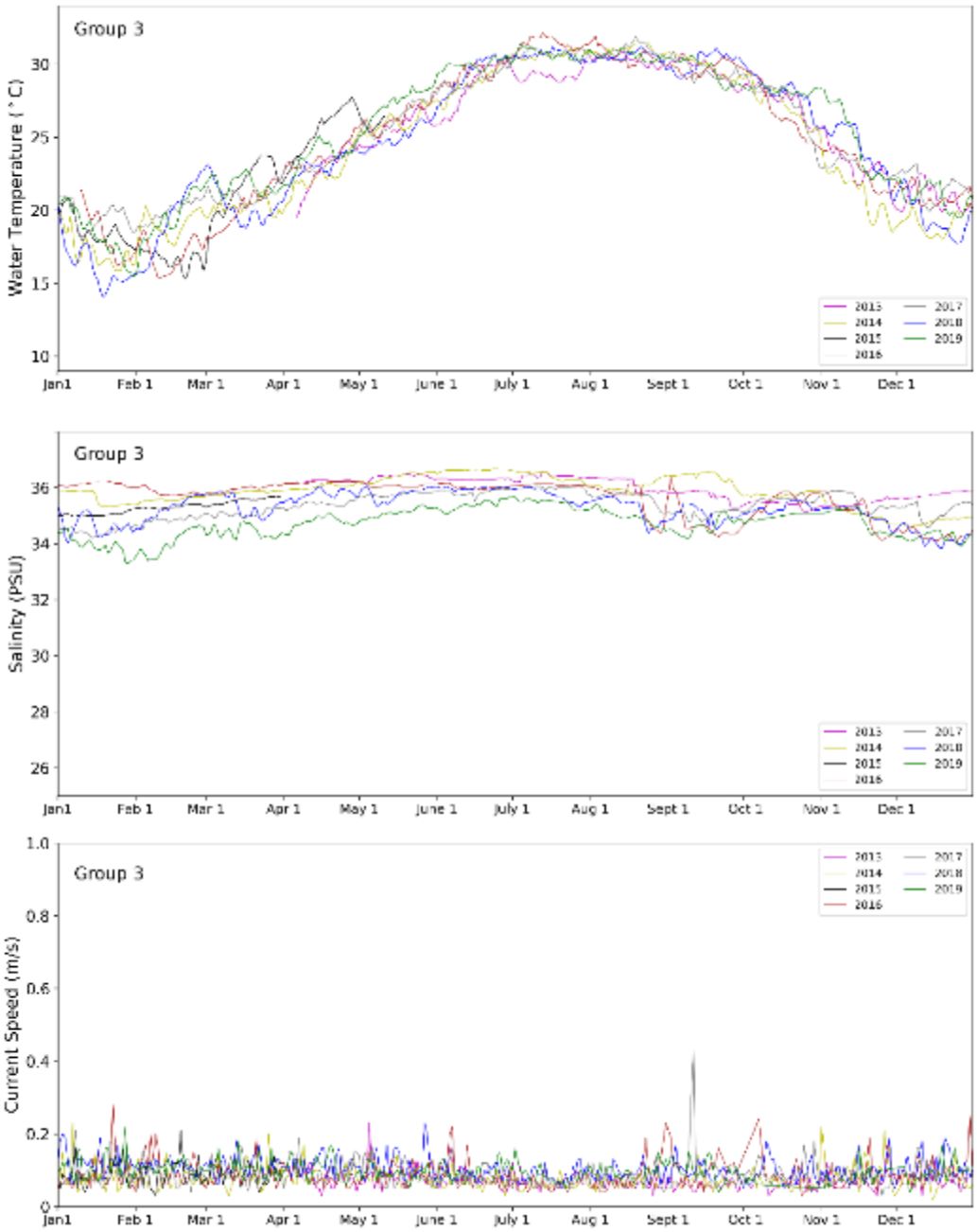

Figure 66. Navy Coastal Ocean Model mean daily water temperature (top panel), salinity (middle panel), and current speed (bottom panel) from all POAZs in South B/Group 3 (options 21-25), 2013-2019.

South B/Group 4 Characterization (Options 26-30)

South B/Group 4 includes POAZs 26-30 (Figure 67). Siting options totaled 5,689 acres (23 km^2) in size and ranged in depth from 10.4-15.6 m. The smallest siting option was 227 acres (option 29) and the largest was 4,174 acres (option 28). Option 28 has a shallower ridge extending from the eastern boundary to the center of the area. The remaining options are relatively flat. The western boundary of the group is bound by the Florida state water boundary. Option 28 had the closest distance to port at 13 km to Big Sarasota Pass (Table 19).

All siting options in the South B/Group 4 are within the EFH for Atlantic HMS, coastal migratory species, shrimp, reef fish, red drum, spiny lobster, and shallow coral. There is potential coral hard bottom to the south and sand and gravel lease areas in federal waters to the west (Figure 67).

Total vessel traffic was highest in option 28 (491 transits in 2019) but greatest per area in option 29 (21 transits per 100 acres). Vessel traffic overall was predominantly fishing and pleasure and sailing vessels with some “other” vessel traffic (Table 19). Commercial fishing in and around these options includes shrimp trawling and headboat operations for recreational fishing.

Within South B/Group 4 salinity ranged from 33.2 PSU (February 2019) to 36.7 PSU (June 2014). Annually, seawater temperature ranged from 14.5°C in winter (January 2018) to 32.1°C in summer (August 2017). The maximum daily surface current speed between 2013 and 2019 was 0.44 m/s, and the maximum significant wave height was 5.2 m (Figure 68). There was one toxic red tide bloom in options 27 and 29 and three in option 28 between 2000-2019.

Table 19. Characterization of the South B Planning Area/Group 4 POAZs. Parameters of relevance are listed with the corresponding values. The five planning options totaled 5,689 acres.

		Option #				
Category	**Parameters**	**26**	**27**	**28**	**29**	**30**
Geographic	Area (acres)	656	352	4,174	227	282
	Bathymetry Range (m)	12.6-15.6	13.1-15.2	10.4-15.0	14.1-15.4	12.2-15.4
	Distance to Longboat Pass (km)	26	28	26	30	31
	Distance to New Pass (km)	17	18	14	19	20
	Distance to Big Sarasota Pass (km)	16	17	13	17	18
	Distance to Venice Inlet (km)	24	22	16	21	19
National Security	Unexploded Ordnance FUDs	No	No	No	No	No
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes	Yes	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes	Yes	Yes	Yes
	Shrimp EFH	Yes	Yes	Yes	Yes	Yes
	Reef Fish EFH	Yes	Yes	Yes	Yes	Yes
	Red Drum EFH	Yes	Yes	Yes	Yes	Yes
	Spiny Lobster EFH	Yes	Yes	Yes	Yes	Yes
	Shallow Coral EFH	Yes	Yes	Yes	Yes	Yes
	Distance to Potential Coral Hard Bottom (m)	2,793	4,664	186	4,386	1,746
Industry and Navigation	Distance to Sand and Gravel Areas (m)	57	854	1,660	241	187
	Cargo vessel transits 2019	0	0	0	0	0
	Tanker vessel transits 2019	0	0	0	0	0
	Tug and tow vessel transits 2019	9	6	58	6	7
	Fishing vessel transits 2019	52	33	216	21	16
	Passenger vessel transits 2019	1	1	13	1	1
	Pleasure and sailing vessel transits 2019	33	24	163	20	23
	Other vessel transits 2019	19	3	41	0	1
	Military vessel transits 2019	0	0	0	0	0
	All vessel transits 2019	114	67	491	48	48
	All vessel transits per 100 acres	17	19	12	21	17

Table 19 (continued)

Category	Parameters	Option # 26	27	28	29	30
Oceanographic Data for Characterization	Daily temperature min/max (°C) (2013-2019)	14.5/31.8	14.7/32.1	14.5/31.8	14.7/31.9	14.7/31.9
	Daily salinity min/max (PSU) (2013-2019)	33.5/36.7	33.5/36.7	33.2/36.7	33.5/36.7	33.5/36.7
	Max daily current speed (m/s) (2013-2019)*	0.44	0.44	0.43	0.44	0.44
	Max significant wave height (m) (1979-2014)**	5.2	4.88	4.98	4.88	4.88
	K. brevis toxic bloom frequency (2000-2019)	0	1	3	1	0
Geologic Data for Characterization	Distance to ROSSI Borrow Areas (m)	0	830	0	837	0
	ROSSI Holocene Sand	No	No	No	No	No
	ROSSI Paleo Barrier Islands	No	No	No	No	No
	ROSSI Paleo channels	No	No	No	No	No
	ROSSI Paleo Ebb Deltas	No	No	No	No	No
	ROSSI Paleo Shoreline Complex	No	No	No	No	No

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

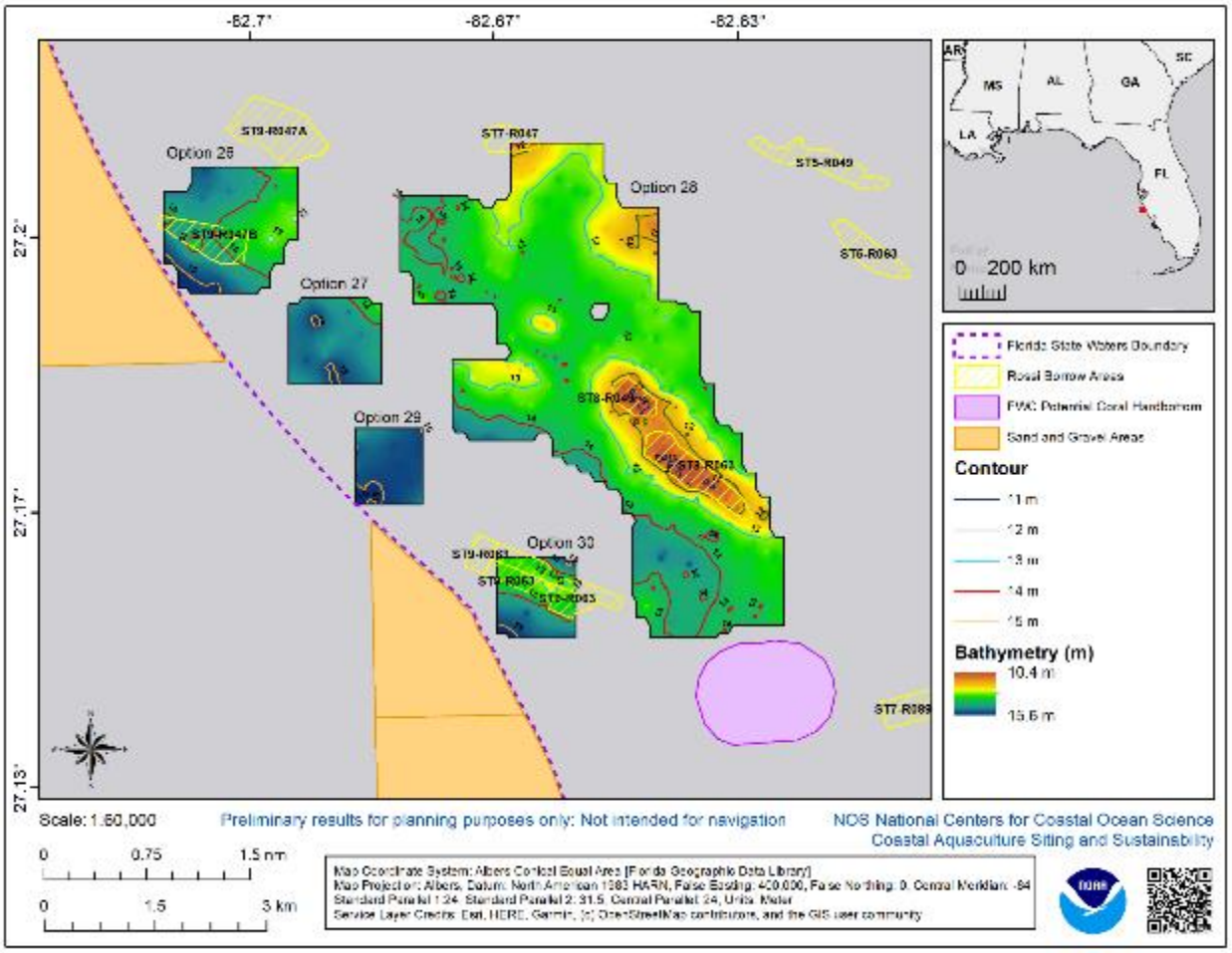

Figure 67. South B/Group 4 POAZs (options 26-30) with nearby considerations and bathymetry. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

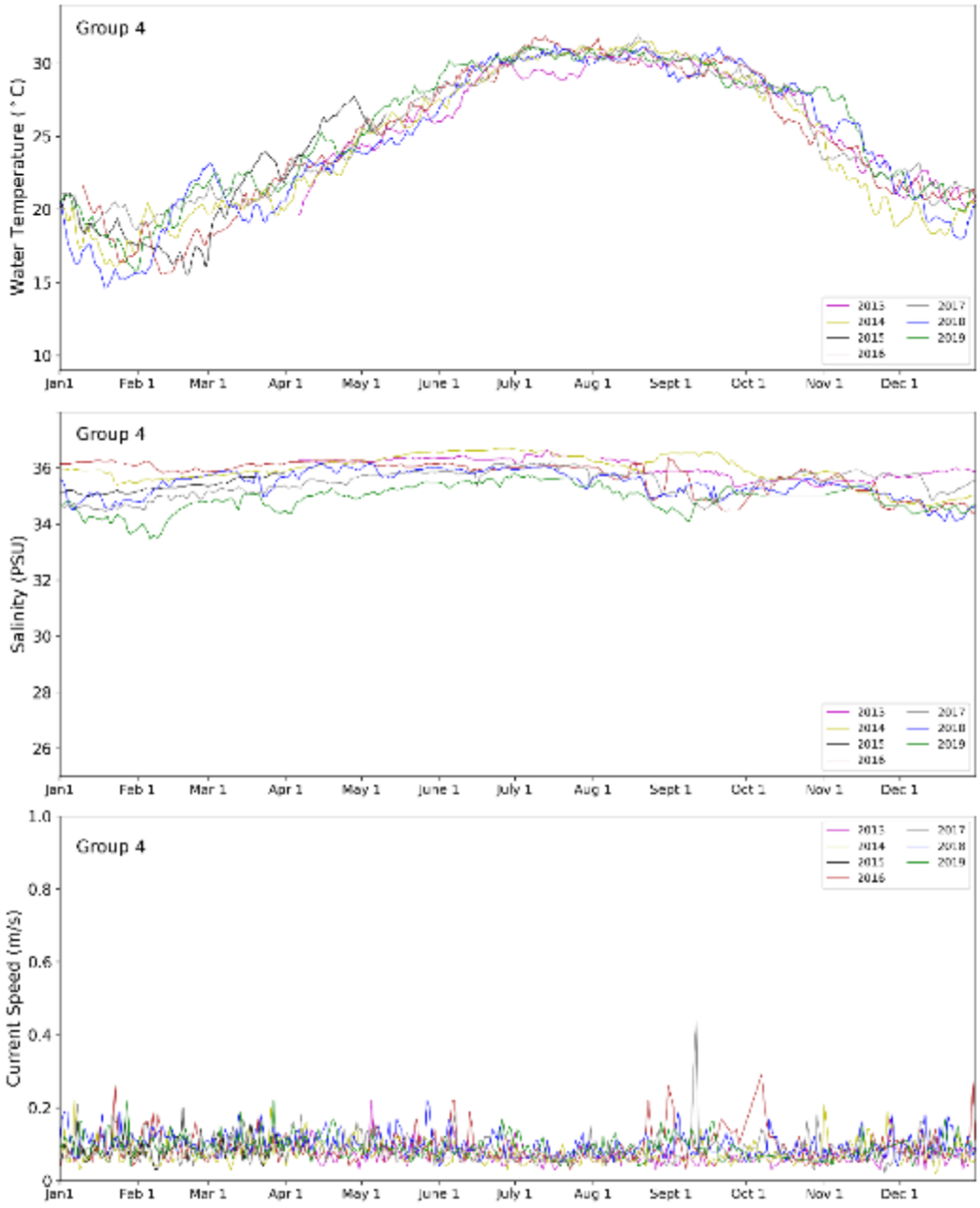

Figure 68. Navy Coastal Ocean Model mean daily water temperature (top panel), salinity (middle panel), and current speed (bottom panel) from all POAZs in South B/Group 4 (options 26-30), 2013-2019.

South B/Group 5 Characterization (Options 31-32)

South B/Group 5 includes POAZs 31-32 (Figure 69). Siting options totaled 2,527 acres (10.2 km^2) in size and ranged in depth from 12.2-15.4 m. The smallest siting option was 267 acres (option 32) and the largest was 2,260 acres (option 31). Option 31 has a series of patchy shallow ridges running through the center as well as in the east and north corners of the area. The western boundary of the group is bound by the Florida state water boundary. Option 31 had the closest distance to port at 12 km to Venice Inlet (Table 20).

All siting options in the South B/Group 5 are within the EFH for Atlantic HMS, coastal migratory species, shrimp, reef fish, red drum, spiny lobster, and shallow coral. There is potential coral hard bottom to the west and north and sand gravel areas in federal waters to the west (Figure 69; Table 20).

Total vessel traffic was highest in option 31 (290 transits in 2019) but greatest per area in option 32 (19 transits per 100 acres). Vessel traffic overall was predominantly fishing, pleasure and sailing, and “other” vessel traffic (Table 20). Commercial fishing in and around these options includes shrimp trawling and headboat operations for recreational fishing.

Within South B/Group 5 salinity ranged from 33.4 PSU (February 2019) to 36.8 PSU (August 2016). Annually, seawater temperature ranged from 15.0°C in winter (January 2018) to 32.0°C in summer (August 2017). The maximum daily surface current speed between 2013 and 2019 was 0.43 m/s, and the maximum significant wave height was 5.4 m (Figure 70). There were 3 toxic red tide blooms in option 31 between 2000-2019.

Table 20. Characterization of the South B Planning Area/Group 5 POAZs. Parameters of relevance are listed with the corresponding values. The two planning options totaled 2,527 acres.

Category	Parameters	Option 31	Option 32
Geographic	Area (acres)	2,260	267
	Bathymetry Range (m)	12.2-15.4	13.4-14.6
	Distance to Longboat Pass (km)	34	38
	Distance to New Pass (km)	22	25
	Distance to Big Sarasota Pass (km)	19	22
	Distance to Venice Inlet (km)	12	14
National Security	Unexploded Ordnance FUDs	No	No
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes
	Shrimp EFH	Yes	Yes
	Reef Fish EFH	Yes	Yes
	Red Drum EFH	Yes	Yes
	Spiny Lobster EFH	Yes	Yes
	Shallow Coral EFH	Yes	Yes
	Distance to FWC Potential coral hard bottom (m)	115	2,106
Industry and Navigation	Distance to Sand and Gravel Areas (m)	1,136	1,943
	Cargo vessel transits 2019	0	0
	Tanker vessel transits 2019	0	0
	Tug and tow vessel transits 2019	28	2
	Fishing vessel transits 2019	145	25
	Passenger vessel transits 2019	5	1
	Pleasure and sailing vessel transits 2019	86	13
	Other vessel transits 2019	26	9
	Military vessel transits 2019	0	0
	All vessel transits 2019	290	50
	All vessel transits per 100 acres	13	19
Oceanographic Data for Characterization	Daily temperature min/max (°C) (2013-2019)	15.0/32.0	15.0/32.0
	Daily salinity min/max (PSU) (2013-2019)	33.4/36.8	33.4/36.8
	Max daily current speed (m/s) (2013-2019)*	0.43	0.41
	Max significant wave height (m) (1979-2014)**	5.22	5.22
	K. brevis toxic bloom frequency (2000-2019)	3	0

Category	Parameters	Option 31	Option 32
Geologic Data for Characterization	Distance to ROSSI Borrow Areas (m)	898	2,641
	ROSSI Holocene Sand	No	No
	ROSSI Paleo Barrier Islands	No	No
	ROSSI Paleo channels	No	No
	ROSSI Paleo Ebb Deltas	No	No
	ROSSI Paleo Shoreline Complex	No	No

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

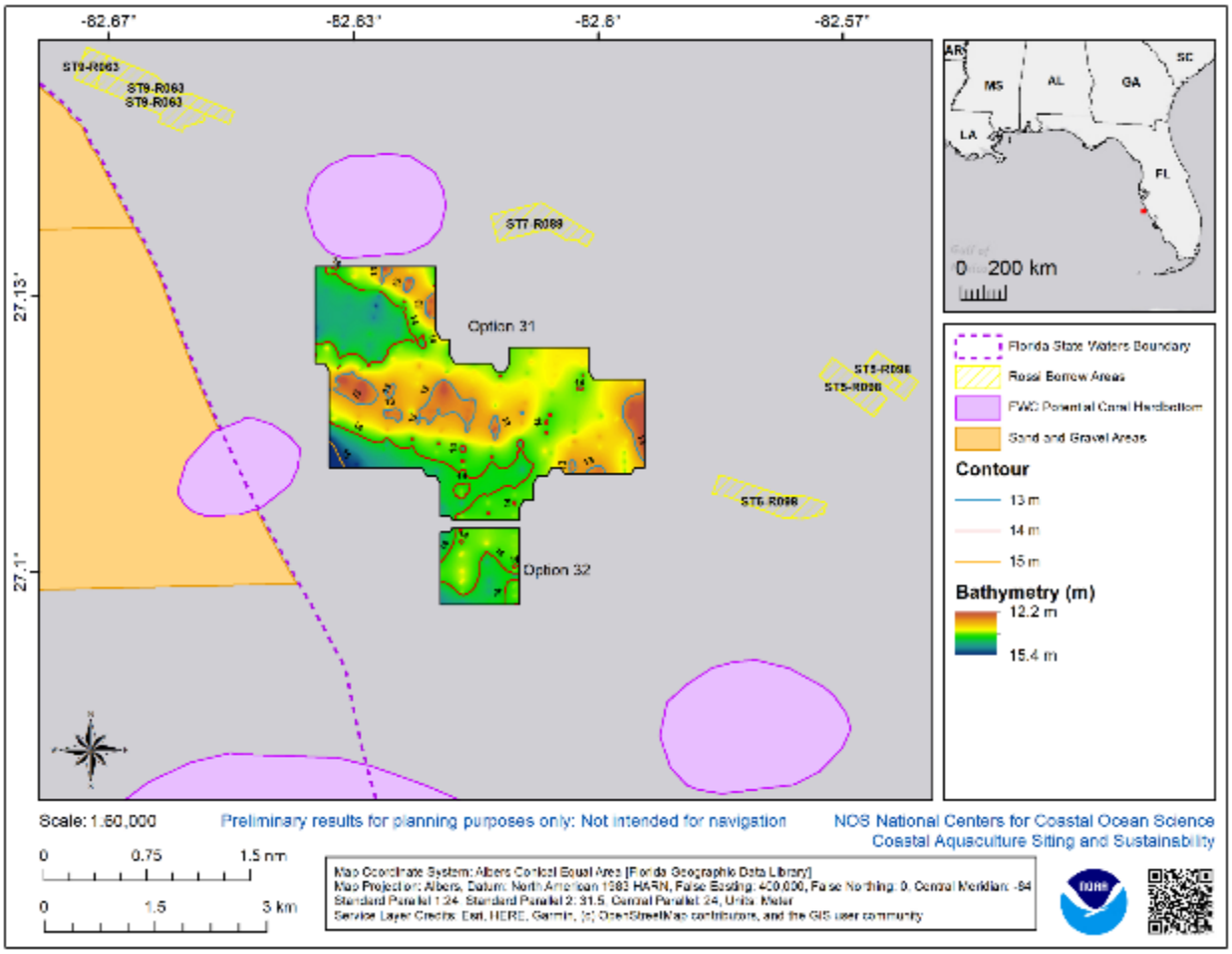

Figure 69. South B/Group 5 POAZs (options 31-32) with nearby considerations and bathymetry. The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

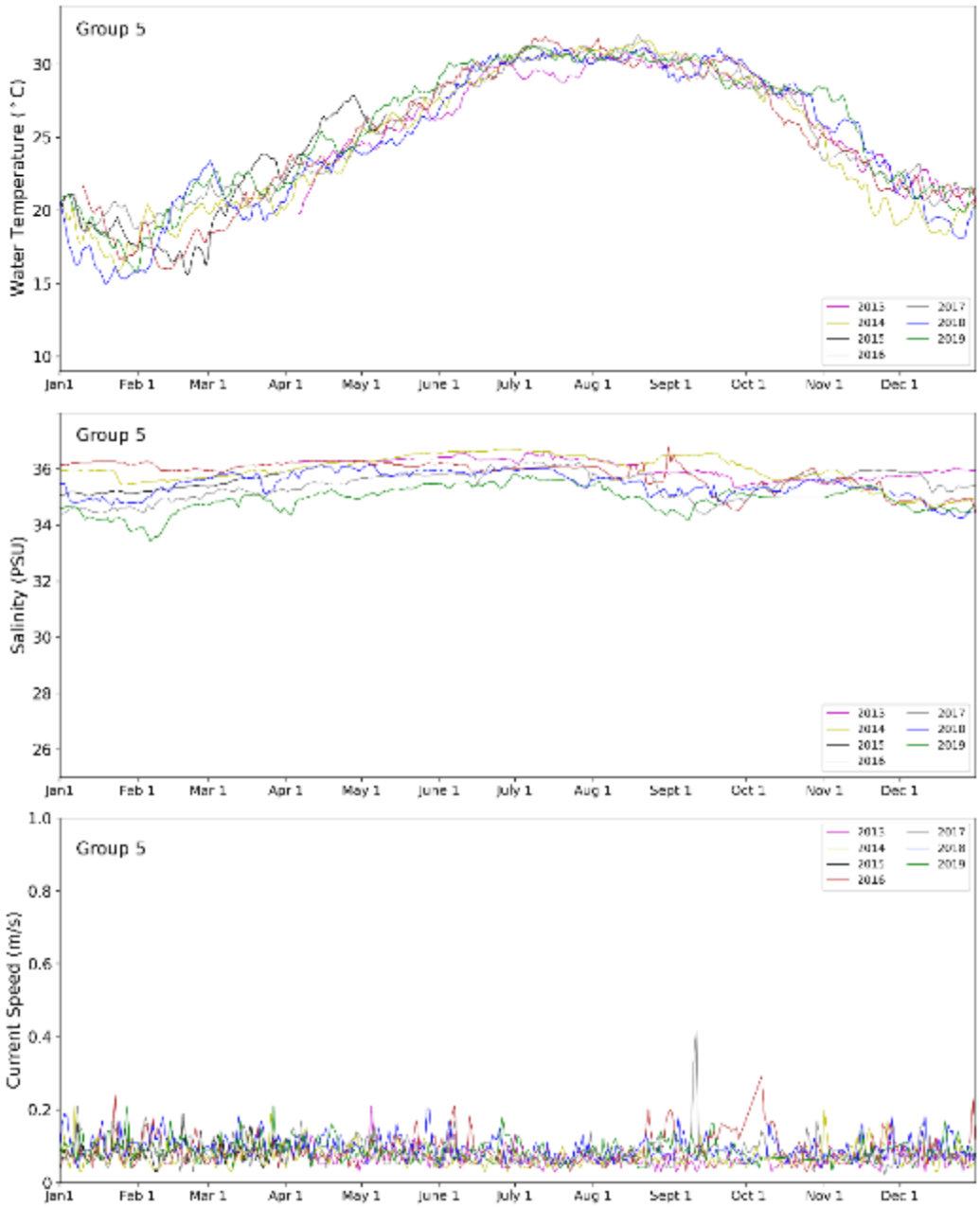

Figure 70. Navy Coastal Ocean Model mean daily water temperature (top panel), salinity (middle panel), and current speed (bottom panel) from all POAZs in South B/Group 5 (options 31-32), 2013-2019.

South B/Group 6 Characterization (Options 33-34)

South B/Group 6 includes POAZs 33-34 (Figure 71). Siting options totaled 5,117 acres (20.7 km^2) in size and ranged in depth from 11.6-17.1 m. The smallest siting option was 383 acres (option 33) and the largest was 4,734 acres (option 34). The bathymetry is characterized by a series of patchy shallow ridges in the northeast of the area, becoming deeper and more uniform moving to the west. The western boundary of the group is bound by the Florida state water boundary. Option 34 had the closest distance to port at 11 km to Venice Inlet (Table 21).

All siting options in the South B/Group 6 are within the EFH for Atlantic HMS, coastal migratory species, shrimp, reef fish, red drum, spiny lobster, and shallow coral. There is potential coral hard bottom 245 m to the southeast of option 34 and 168 m to the northwest of option 33 (Figure 71). Option 34 is also restricted by the presence of a fish haven 63 m to the north and shipwrecks 420 m to the north and 12 m southeast.

Total vessel traffic was much higher in option 34 (440 transits in 2019) but greatest per area in option 33 (23 transits per 100 acres). Vessel traffic overall was predominantly tug and tow, fishing, and pleasure and sailing vessels. Commercial fishing in and around these options includes shrimp trawling and headboat operations for recreational fishing.

Within South B/Group 6 salinity ranged from 33.6 PSU (February 2019) to 36.8 PSU (August 2016). Annually, seawater temperature ranged from 15.2°C in winter (January 2018) to 31.9°C in summer (August 2017). The maximum daily surface current speed between 2013 and 2019 was 0.45 m/s, and the maximum significant wave height was 5.4 m (Figure 72). There were 5 toxic red tide blooms in option 33 between 2000-2019, the most of the Planning Area, and 2 in option 34.

Table 21. Characterization of the South B Planning Area/Group 6 POAZs. Parameters of relevance are listed with the corresponding values. The two planning options totaled 5,117 acres.

Category	Parameters	Option 33	Option 34
Geographic	Area (acres)	383	4,734
	Bathymetry Range (m)	14.3-16.1	11.6-17.1
	Distance to Longboat Pass (km)	43	43
	Distance to New Pass (km)	30	29
	Distance to Big Sarasota Pass (km)	27	25
	Distance to Venice Inlet (km)	15	11
National Security	Unexploded Ordnance FUDs	No	No
Natural and Cultural Resources	Atlantic HMS EFH	Yes	Yes
	Coastal Migratory Species EFH	Yes	Yes
	Shrimp EFH	Yes	Yes
	Reef Fish EFH	Yes	Yes
	Red Drum EFH	Yes	Yes
	Spiny Lobster EFH	Yes	Yes
	Shallow Coral EFH	Yes	Yes
	Distance to Fish Haven (m)	683	63
	Distance to Shipwrecks (m)	1,237	12 / 420
	Distance to FWC Potential coral hard bottom (m)	168	245
Industry and Navigation	Cargo vessel transits 2019	0	0
	Tanker vessel transits 2019	0	0
	Tug and tow vessel transits 2019	9	42
	Fishing vessel transits 2019	39	216
	Passenger vessel transits 2019	1	5
	Pleasure and sailing vessel transits 2019	33	141
	Other vessel transits 2019	5	36
	Military vessel transits 2019	0	0
	All vessel transits 2019	87	440
	All vessel transits per 100 acres	23	9
Oceanographic Data for Characterization	Daily temperature min/max (°C) (2013-2019)	15.2/31.9	15.4/31.8
	Daily salinity min/max (PSU) (2013-2019)	33.6/36.8	33.8/36.8
	Max daily current speed (m/s) (2013-2019)*	0.43	0.45
	Max significant wave height (m) (1979-2014)**	5.42	5.42
	K. brevis toxic bloom frequency (2000-2019)	5	2

Category	Parameters	Option 33	Option 34
Geologic Data for Characterization	Distance to ROSSI Borrow Areas (km)	5.7	4
	ROSSI Holocene Sand	No	No
	ROSSI Paleo Barrier Islands	No	No
	ROSSI Paleo channels	No	No
	ROSSI Paleo Ebb Deltas	No	No
	ROSSI Paleo Shoreline Complex	No	No

*Max daily mean modeled current speed value from 2013-2019

**Max modeled significant wave height from all 3-hr time steps from 1979-2014

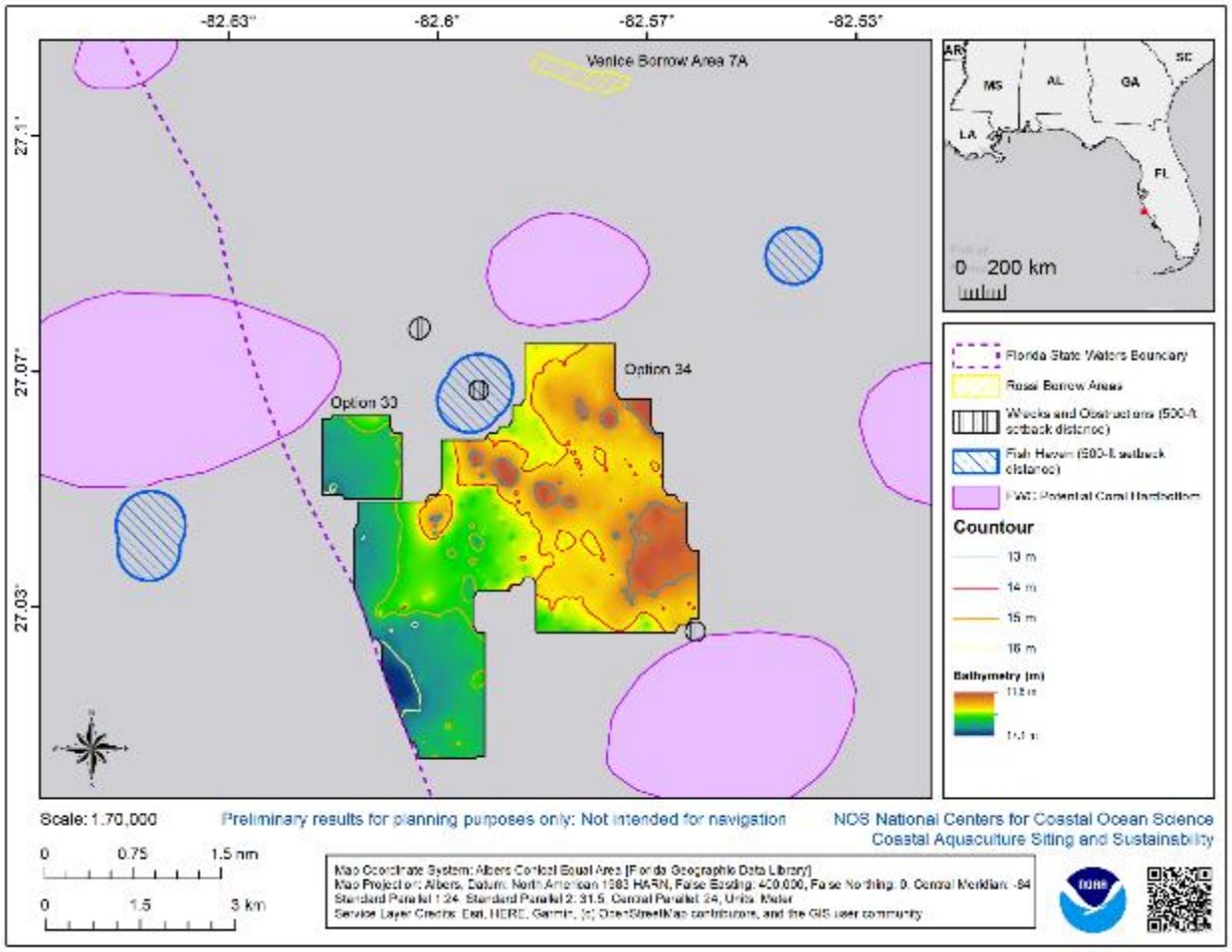

Figure 71. South B/Group 6 POAZs (options 33-34) with nearby considerations and bathymetry. Note the 500-ft setback for fish havens (blue diagonal bars) and wrecks (black bars). The Florida state water boundary (at 9 nm) is denoted with the dotted purple line.

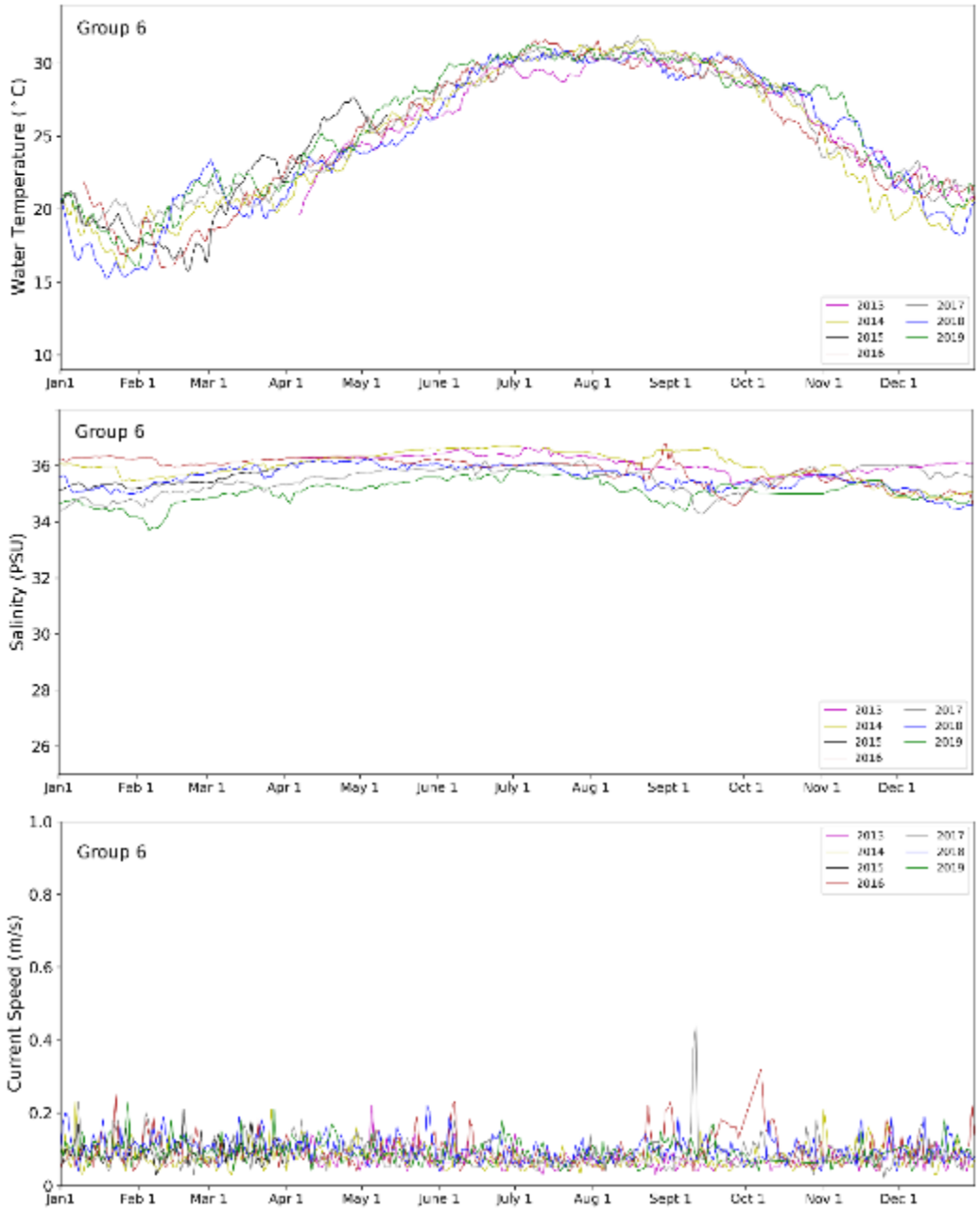

Figure 72. Navy Coastal Ocean Model mean daily water temperature (top panel), salinity (middle panel), and current speed (bottom panel) from all POAZs in South B/Group 6 (options 33-34), 2013-2019.

CONCLUSIONS AND NEXT STEPS

FDACS is proactively planning for the growth of offshore aquaculture in Florida, the Gulf of Mexico, and the United States more broadly. These “first look” siting options will allow FDACS to work collaboratively with other state and federal agencies, the aquaculture industry, and other stakeholders to find the best options for offshore aquaculture in Florida.

Through this site suitability analysis, 34 total POAZ options (totaling 54,904 acres) were identified within Florida state waters of the Gulf of Mexico. A variety of POAZ sizes ranging from 204 to 7,407 acres (0.8 to 30 km^2) were identified through the analysis, as the lower limit for size was 200 acres. Depth remained relatively shallow for the entire AOI, with the deepest option (POAZ option 5) ranging from 23-31 m. For the options identified, known major constraints were utilized in the model, but some will require further vetting and site-by-site analysis (i.e., precision-siting analysis). For instance, some sites near national security assets will require consultation with the military. Discrete variables given a score of 0.5 in the site suitability analysis (for e.g., military assets; see Table 2) may require coordination and consultation with federal and state agencies to fully understand potential compatibility with aquaculture. Most of the POAZs are located within essential fish habitat; this will require additional coordination with state and federal agencies responsible for the management of these resources. All POAZ options presented here should be considered independent at this stage of the scoping and planning process. Caution should be used when comparing sites due to variable sizes and keeping in mind that the scores and statistics were used relative to the four geographically distinct Planning Areas.

Importantly, all models have limitations and assumptions built into them. For instance, the size of siting options, the suitability scores assigned, the grid cell size, and the cluster analysis p-value used are all factors that, if altered, may produce different results than those presented here. Moreover, there are other ways to approach MCDAs, some with more user input in the beginning of the process than others. The approach chosen here offers objective results, with limited subjectivity (i.e., a non-weighted approach with equal value given to each sub-model). In past studies, weighted approaches have shown that aquaculture experts may not be consistent in the assignment of weights or ranking of importance (Aguilar-Manjarrez 1996, Silva et al. 2011). Different backgrounds and experiences bring differing opinions and priorities, resulting in a range of outcomes (Levings et al. 1995, Longdill et al. 2007, Nath et al. 2000). Therefore, to maintain generality and objectivity for the present study, no variable weightings were applied and the unweighted arithmetic mean was used (Longdill et al. 2007).

The ability to site offshore aquaculture in Florida waters of the Gulf of Mexico will require input from and collaboration among various stakeholders, state and federal entities, and interest groups. Further validation of POAZ options and data sets used may occur through outreach initiatives with academia, environmental organizations, industry, and other stakeholders. Next steps will necessarily include engagement and outreach with the aquaculture industry and coastal stakeholders to understand social, economic, and biological compatibility. For example, to determine which types of aquaculture (e.g., finfish, shellfish, macroalgae) might be suitable within the POAZs. FDACS will also seek to understand social perceptions of offshore

aquaculture (i.e., social license) as well as socioeconomic factors (e.g., existing infrastructure, jobs, markets) that could support development of aquaculture in regions where POAZs were identified. During this process, additional biophysical and oceanographic factors may be assessed for the POAZs to further characterize each area and assess potential interactions or impacts. Other variables such as dissolved oxygen, chlorophyll-a, nutrients, light transmissivity, turbidity, mixing layer depth, bottom sediment type and composition, frequency of cyanobacteria and HABs, current speed and direction at gear depth, and temperature and salinity at gear depth, along with other indicators of suitability for aquaculture and associated infrastructure may be considered. Importantly, the siting of aquaculture does not need to be at the expense of other industries such as fishing and can be collaborative and synergistic. As has been shown with other efforts, siting multiple uses of ocean space can be successful when intentional and thoughtful collaboration techniques are employed (see for e.g., offshore wind and fishing as highlighted in the 2020 special issue of *Oceanography*[7]).

These next steps will also be carried out within a framework of social equity. The ability to establish new sectors in the blue economy will depend on cross-scale cooperation, multi-stakeholder collaboration, understanding the drivers and outcomes of resource management, and identifying equitable pathways to establishing new sectors (Cisneros-Montemayor et al. 2021). Local benefits, smaller-scale producers, and a range of stakeholders should be explicitly considered in the planning process to ensure that the full suite of potential benefits from offshore aquaculture are realized and equitably distributed.

DATA AVAILABILITY

All spatial data sets used in this analysis are available upon request. The exception being controlled unclassified information (CUI) that is safeguarded to protect sensitive information not intended for public distribution.

DISCLAIMER

Information within this report is intended for site identification and characterization for planning and informational purposes only. FDACS and NOAA NCCOS make no warranties to the accuracy or completeness of the data presented here, and neither FDACS nor NOAA will be responsible for any adverse result based upon users' reliance on the application or the data presented. This report provides a "first look" at information available within a geographic area of interest, and does not presuppose or confer any permitting authority of the state of Florida, nor represent any regulatory or permitting decision by any state or federal agency. The report should not be interpreted to reflect the views or policies of FDACS or NOAA, nor should any mention of trade names or commercial products constitute an endorsement or recommendation for use. Users are advised to exercise due diligence and independently confirm the accuracy and completeness of the data provided.

[7] *Oceanography* (2020). Special Issue on Understanding the Effects of Offshore Wind Energy Development on Fisheries. https://tos.org/oceanography/issue/volume-33-issue-4.

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Appendix A

Table A-1. Further references for data layers considered for the suitability model in Florida state waters and the U.S. Gulf of Mexico. Any layers included here that are not listed above in the suitability analysis were considered but not included since there was no intersection within the final area of interest (Northern Region or Southern Region). CUI = controlled unclassified information (data not publicly available, must be authorized by holding agency). See the Note at the end of the table for definitions of all abbreviations.

National Security Datasets (n=14)			
Dataset	Source	Source/link	Metadata link
Danger Zones and Restricted Areas in coastal marine waters	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/DangerZonesAndRestrictedAreas.zip	https://www.fisheries.noaa.gov/inport/item/48876
Military Operating Area - Key West	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://www.fisheries.noaa.gov/inport/item/55364
Military Operating Area - Eglin Gulf Test and Training Range (EGTTR)	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://www.fisheries.noaa.gov/inport/item/55364
Military Operating Area - Panama City	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://www.fisheries.noaa.gov/inport/item/55364
Military Operating Area - Pensacola	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://www.fisheries.noaa.gov/inport/item/55364
Special Use Airspace(s) - Warning Areas	Military Aviation & Installation Assurance Siting Clearinghouse	https://www.acq.osd.mil/dodsc/about/maps.html; https://hub.arcgis.com/datasets/dd0d1b726e504137ab3c41b21835d05b_0?geometry=162.853%2C20.649%2C26.359%2C45.970	https://sua.faa.gov/sua/siteFrame.app
Special Use Airspace - Testing and Training	William A. Brown, GISP; Range Operations and Sustainment via DOD Safe	Available with DOD request/approval	Available with DOD request/approval
Unexploded Ordnance point data	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/UnexplodedOrdnance.zip	https://www.fisheries.noaa.gov/inport/item/54408
Unexploded Ordnance polygon data	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/UnexplodedOrdnance.zip	https://www.fisheries.noaa.gov/inport/item/54407
Unexploded Ordnance Formerly Used Defense Sites (FUDS)	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/UnexplodedOrdnance_FUDS.zip	https://www.fisheries.noaa.gov/inport/item/54409
Military Submarine Transit Lanes	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://www.fisheries.noaa.gov/inport/item/51523
Military Surface Grid Area	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://www.fisheries.noaa.gov/inport/item/48899

125 mile (86.68333 W longitude) Military Mission Line[8]	BOEM	https://www.data.boem.gov/Mapping/Files/GOMR_WithdrawAreas.zip; https://www.boem.gov/sites/default/files/oil-and-gas-energy-program/Leasing/GOMESA-Map.pdf	https://metadata.boem.gov/geospatial/GulfRegionWithdrawAreas.xml
Military Installations	DOD	https://catalog.data.gov/dataset/tiger-line-shapefile-2019-nation-u-s-military-installation-national-shapefile	https://catalog.data.gov/harvest/object/5a86c1b8-ba97-429d-aba1-71c9e836caa6/html

Boundary Datasets (n=19)			
Dataset	Source	Source/link	Metadata link
U.S.Exclusive Economic Zone	NOAA OCM	https://coast.noaa.gov/digitalcoast/tools/enow.html	https://coast.noaa.gov/digitalcoast/tools/enow.html
Continental Shelf Boundary	BOEM	https://www.data.boem.gov/Mapping/Files/ContinentalShelfBoundary.gdb.zip	https://www.data.boem.gov/Mapping/Files/csb_meta.html
BOEM Gulf of Mexico District Boundary	BOEM	https://www.data.boem.gov/Mapping/Files/DistrictBoundaries.gdb.zip	https://www.data.boem.gov/Mapping/Files/district_meta.html
BOEM Planning Area Boundaries	BOEM	https://www.data.boem.gov/Mapping/Files/PlanningAreaBoundary.gdb.zip	https://www.data.boem.gov/Mapping/Files/planarea_meta.html
NOAA NMFS Fisheries Regional Boundaries	NMFS Habitat Protection Division	Data available upon Agency request/approval	Data available upon Agency request/approval
Federal/State Boundary	BOEM	https://www.data.boem.gov/Mapping/Files/FedStateBoundary.gdb.zip	https://www.data.boem.gov/Mapping/Files/fedstate_meta.html
U.S.EPA Regions	USEPA	https://www.epa.gov/frs/epa-regional-kml-download	https://www.epa.gov/ceam/metadata-epa-regional-boundaries
U.S.FWS Regions	USFWS	https://data.geospatialhub.org/datasets/85f8c9053d6d4970bd5807eff042a167_0	https://www.arcgis.com/home/item.html?id=85f8c9053d6d4970bd5807eff042a167
COLREGS Demarcation line	NOAA OCM and BOEM (i.e., marinecadastre.gov)	https://www.northeastoceandata.org/data-	https://inport.nmfs.noaa.gov/inport/item/56121

[8] https://www.boem.gov/oil-gas-energy/leasing/areas-under-restriction

		download/?data=Marine%20Transportation	
U.S. Coast Guard Districts	USCG	https://www.northeastoceandata.org/data-download/?data=Administrative%20Boundaries	https://services.northeastoceandata.org/arcgis1/rest/services/Administrative/MapServer/5
USACE Districts	USACE	https://www.northeastoceandata.org/data-download/?data=Administrative%20Boundaries	https://www.arcgis.com/sharing/rest/content/items/70805e1a8fd74e42b0a9585088d6d151/info/metadata/metadata.xml?format=default&output=html
Coastal Counties	NOAA OCM and BOEM (i.e., marinecadastre.gov) and U.S. Census Bureau	http://www2.census.gov/geo/tiger/TIGER2017/COUNTY/tl_2017_us_county.zip	https://inport.nmfs.noaa.gov/inport/item/54371
Federal Consistency Location Descriptions	NOAA NMFS	ftp://ftp.coast.noaa.gov/pub/MSP/GeographicLocationDescriptions.zip	https://inport.nmfs.noaa.gov/inport/item/51544
Coastal States Layer	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/CoastalStates.zip	https://inport.nmfs.noaa.gov/inport/item/54375
Gulf of Mexico Shoreline	GCOOS	https://geo.gcoos.org/data/topography/Shoreline_files/GSHHS_f_GOM.zip	https://geo.gcoos.org/data/topography/Shoreline.html
NOAA National Estuarine Research Reserve System (NERRS)	NOAA	http://cdmo.baruch.sc.edu/data/available-data/	http://cdmo.baruch.sc.edu/get/gis.cfm
National Wildlife Refuge System (NWRS)	U.S. Fish and Wildlife Service (USFWS)	https://www.fws.gov/gis/data/CadastralDB/links_cadastral.html	https://www.fws.gov/gis/data/CadastralDB/links_cadastral.html
Florida State Park Boundaries	FDEP	http://publicfiles.dep.state.fl.us/OTIS/GIS/data/PARKS_AND_REC_AREAS.zip	https://fdacs.maps.arcgis.com/sharing/rest/content/items/bd190cf3d3934fbd9529dfe1c8c8772c/info/metadata/metadata.xml?format=default&output=html

Natural and Cultural Resource Datasets (n=66)			
Dataset	Source	Source/link	Metadata link
NOAA NMFS Gulf of Mexico Bryde's Whale Core Distribution Area	NOAA National Marine Fisheries Service (NMFS)	https://www.fisheries.noaa.gov/resource/map/gulf-mexico-brydes-whale-core-distribution-area-map-gis-data	https://www.fisheries.noaa.gov/webdam/download/96621389

NOAA NMFS Cetacean Biologically Important Areas (BIAs) including reproductive, migratory corridors, feeding areas, and those with small and resident populations	NOAA NMFS	http://cetsound.noaa.gov/Assets/cetsound/data/CetMap_BIA_WGS84.zip	https://inport.nmfs.noaa.gov/inport/item/23643
Manatee Protection Zones	FWC	https://myfwc.com/wildlifehabitats/wildlife/manatee/data-and-maps/	https://myfwc.com/wildlifehabitats/wildlife/manatee/data-and-maps/
Hawksbill sea turtle Critical Habitat	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/hawksbill-turtle-critical-habitat-map-and-gis-data	https://www.fisheries.noaa.gov/webdam/download/92900518
Green sea turtle Critical Habitat	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/green-turtle-critical-habitat-map-and-gis-data	https://www.fisheries.noaa.gov/webdam/download/92900514
Leatherback sea turtle Critical Habitat	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/leatherback-turtle-caribbean-critical-habitat-map-and-gis-data	https://www.fisheries.noaa.gov/webdam/download/92900671
Loggerhead sea turtle Critical Habitat - Sargassum	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map	https://www.fisheries.noaa.gov/webdam/download/67006521
Loggerhead sea turtle Critical Habitat - Breeding	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map	https://www.fisheries.noaa.gov/webdam/download/67006521
Loggerhead sea turtle Critical Habitat – Constricted Migratory	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map	https://www.fisheries.noaa.gov/webdam/download/67006521
Loggerhead sea turtle Critical Habitat – Nearshore Reproductive	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map	https://www.fisheries.noaa.gov/webdam/download/67006521
Loggerhead sea turtle Critical Habitat - Winter	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map	https://www.fisheries.noaa.gov/webdam/download/67006521
FL Sea Turtle Nest Density (2013-2017)	FWC	https://fdacs.maps.arcgis.com/sharing/rest/content/items/a4256b3dfe6e4da5a223c8a0c8dd1b1f/info/meta	https://fdacs.maps.arcgis.com/sharing/rest/content/items/a4256b3dfe6e4da5a223c8a0c8dd1b1f/info/metadata/metadata.xml?format=default&output=html

		data/metadata.xml?format=default&output=html	
Deep-sea Coral Habitat Suitability (soft corals/hard corals) Models	NOAA NOS NCCOS	ftp://ftp.coast.noaa.gov/pub/MSP/DeepSeaCoralHabitatSuitability.zip	https://inport.nmfs.noaa.gov/inport/item/48877
Deep-sea Coral Individual Species Models	NOAA NOS NCCOS	https://gis.ngdc.noaa.gov/arcgis/rest/services/EnvironmentalMonitoring/DSC_Models/MapServer	https://gis.ngdc.noaa.gov/arcgis/rest/services/EnvironmentalMonitoring/DSC_Models/MapServer
Coral (Black Corals, Fire Corals, Hydrocorals, Stony Corals) Essential Fish Habitat (EFH)	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/coral-essential-fish-habitat-efh-map-gis-data	https://www.fisheries.noaa.gov/resource/map/coral-essential-fish-habitat-efh-map-gis-data; https://www.fisheries.noaa.gov/inport/item/23734
Acropora: Elkhorn and Staghorn Coral Critical Habitat	NOAA NMFS SERO	https://www.fisheries.noaa.gov/resource/map/acropora-elkhorn-and-staghorn-coral-critical-habitat-map-and-gis-data	https://www.fisheries.noaa.gov/webdam/download/94271615
Shallow Corals	NOAA NMFS	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/ShallowCorals.zip	https://inport.nmfs.noaa.gov/inport/item/54400
Deep-sea Coral and Sponge Observations (1985 – present)	NOAA Deep-Sea Coral Research and Technology Program	https://deepseacoraldata.noaa.gov/DatasetID_Table/DatasetID_Table.html	https://deepseacoraldata.noaa.gov/library/dscrtp-database-metadata
Coral 9 HAPC	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/reef-banks-essential-fish-habitat-efh-habitat-area-particular-concern-hapc-map-gis	https://www.fisheries.noaa.gov/resource/map/reef-banks-essential-fish-habitat-efh-habitat-area-particular-concern-hapc-map-gis
Coral 9 HAPC (2020 update) with and without regulations proposed	GMFMC	http://portal.gulfcouncil.org/Regulations/HAPCshapefiles.zip	https://portal.gulfcouncil.org/coralhapc.html
Smalltooth Sawfish Critical Habitat	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/smalltooth-sawfish-critical-habitat-map-and-gis-data	https://www.fisheries.noaa.gov/webdam/download/92797163
Gulf Sturgeon Critical Habitat	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/gulf-sturgeon-critical-habitat-map-and-gis-data	https://www.fisheries.noaa.gov/webdam/download/91216902
Red Drum Essential Fish Habitat	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/red-drum-essential-fish-habitat-efh-map-gis-data	https://www.fisheries.noaa.gov/resource/map/red-drum-essential-fish-habitat-efh-map-gis-data
Reef fish (snapper, groupers, tilefishes, jacks, Triggerfish, Hogfish)[9] Essential Fish Habitat	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/reef-fish-essential-fish-habitat-efh-map-gis-data	https://www.fisheries.noaa.gov/resource/map/reef-fish-essential-fish-habitat-efh-map-gis-data

[9] Although Goliath Grouper and Yellowtail Snapper are within the Reef Fish EFH complex, they are currently not mapped (https://www.habitat.noaa.gov/application/efhinventory/index.html)

Highly Migratory Species (Albacore Tuna, Bigeye Tuna, Bluefin Tuna, Skipjack Tuna, Yellowfin Tuna, Swordfish, Blue Marlin, Longbill Spearfish, Sailfish, White Marlin, and numerous species of sharks)[10] Essential Fish Habitat	NOAA NMFS	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/EFH_HighlyMigratorySpecies.zip	https://ezmt.anl.gov/layer/1018/metadata_file; https://www.fisheries.noaa.gov/inport/item/23734
Coastal Migratory Pelagic (Cobia, King Mackerel, Spanish Mackerel) Essential Fish Habitat	NOAA NMFS	https://www.habitat.noaa.gov/application/efhinventory/index.html	http://ocean.floridamarine.org/efh_coral/metadata/Coastal%20Migratory%20Pelagics%20EFH.htm; https://www.fisheries.noaa.gov/inport/item/23734
Spiny Lobster (Spiny Lobster, Slipper Lobster) Essential Fish Habitat	NOAA NMFS	https://www.habitat.noaa.gov/application/efhinventory/data/gulf_of_mexico/gulf_efh.zip	http://ocean.floridamarine.org/efh_coral/metadata/Spiny%20Lobster%20EFH.htm; https://www.fisheries.noaa.gov/inport/item/23734
Shrimp (Brown Shrimp, Pink Shrimp, Rock Shrimp, Royal Red Shrimp, Seabob Shrimp, White Shrimp) Essential Fish Habitat	NOAA NMFS	https://www.habitat.noaa.gov/application/efhinventory/data/gulf_of_mexico/gulf_efh.zip	https://www.fisheries.noaa.gov/resource/map/shrimp-essential-fish-habitat-efh-map-gis-data; https://www.fisheries.noaa.gov/inport/item/23734
FMA Madison-Swanson, The Edges, and Steamboat Lumps	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/tortugas-marine-reserves-hapc-fishery-management-area-map-gis-data	https://www.ecfr.gov/cgi-bin/text-idx?SID=b6b6b1c12d2e95217ebea33eb3fbb333&mc=true&node=pt50.12.622&rgn=div5
FMA Pulley Ridge Essential Fish Habitat, HAPC	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/pulley-ridge-essential-fish-habitat-efh-habitat-area-particular-concern-hapc-map-gis	https://www.ecfr.gov/cgi-bin/text-idx?SID=f3e475e206bdbddfb545dd420753cf9e&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_174
FMA Florida Middle Grounds HAPC	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/florida-middle-grounds-hapc-fishery-management-area-map-gis-data	https://www.ecfr.gov/cgi-bin/text-idx?SID=b6b6b1c12d2e95217ebea33eb3fbb333&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_174
FMA Stetson Bank	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/stetson-bank-habitat-area-particular-concern-hapc-fishery-management-area-map-gis-data	https://www.ecfr.gov/cgi-bin/text-idx?SID=f3e475e206bdbddfb545dd420753cf9e&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_174

[10] Atlantic Angel Shark, Atlantic Sharpnose Shark (Gulf of Mexico Stock), Bigeye Thresher Shark, Blacknose Shark (Gulf of Mexico Stock), Blacktip Shark (Gulf of Mexico Stock), Bonnethead Shark (Gulf of Mexico Stock), Bull Shark, Caribbean Reef Shark, Dusky Shark, Finetooth Shark, Great Hammerhead Shark, Lemon Shark, Longfin Mako Shark, Night Shark, Nurse Shark, Oceanic Whitetip Shark, Sandbar Shark, Scalloped Hammerhead Shark, Shortfin Mako Shark, Silky Shark, Smoothhound Shark Complex (Gulf of Mexico Stock), Spinner Shark, Tiger Shark, Whale Shark

FMA Reef Fish Stressed Area	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/reef-fish-stressed-area-fishery-management-area-map-gis-data	https://www.fisheries.noaa.gov/webdam/download/107260234
FMA Seasonal Prohibitions for Bottom Longline Reef Fish	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/seasonal-prohibitions-bottom-longline-reef-fish-fishery-management-area-map-gis-data	https://www.fisheries.noaa.gov/resource/map/seasonal-prohibitions-bottom-longline-reef-fish-fishery-management-area-map-gis-data
FMA Reef Fish Longline and Buoy Gear Restricted	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/reef-fish-longline-and-buoy-gear-restricted-fishery-management-area-map-gis-data	https://www.fisheries.noaa.gov/webdam/download/107260229
Florida Aquatic Preserves	FDEP	https://geodata.dep.state.fl.us/datasets/81841412d3984e9aac2c00c21e41d32e_0?geometry=-111.510%2C24.229%2C-55.633%2C31.036	https://www.arcgis.com/sharing/rest/content/items/81841412d3984e9aac2c00c21e41d32e/info/metadata/metadata.xml?format=default&output=html
FMA Southwest Florida Seasonal Trawl Closure	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/southwest-florida-seasonal-trawl-closure-fishery-management-area-map-gis-data	https://www.fisheries.noaa.gov/resource/map/southwest-florida-seasonal-trawl-closure-fishery-management-area-map-gis-data
FMA Tortugas Shrimp Sanctuary	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/tortugas-shrimp-sanctuary-fishery-management-areas-map-gis-data	https://www.fisheries.noaa.gov/resource/map/tortugas-shrimp-sanctuary-fishery-management-areas-map-gis-data
FMA King Mackerel Migratory Group Zones	NOAA NMFS	https://www.fisheries.noaa.gov/webdam/download/92442415	https://www.ecfr.gov/cgi-bin/text-idx?SID=f3e475e206bdbddfb545dd420753cf9e&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_1369
FMA Shrimp and Stone Crab Separation Zone	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/shrimp-stone-crab-separation-zones-fishery-management-areas-map-gis-data	https://www.ecfr.gov/cgi-bin/text-idx?SID=b6b6b1c12d2e95217ebea33eb3fbb333&mc=true&node=pt50.12.622&rgn=div5#sp50.12.622.c
FMA Spanish Mackerel Migratory Group Zones	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/spanish-mackerel-migratory-group-zones-fishery-management-areas-map-gis-data	https://www.ecfr.gov/cgi-bin/text-idx?SID=f3e475e206bdbddfb545dd420753cf9e&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_1369
FMA Cobia Migratory Group Zones	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/cobia-migratory-group-zones-fishery-management-areas-map-gis-data	https://www.ecfr.gov/cgi-bin/text-idx?SID=b6b6b1c12d2e95217ebea33eb3fbb333&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_1369
FMA Spiny Lobster Trap Gear	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/spiny-lobster-trap-gear-	https://www.ecfr.gov/cgi-bin/text-idx?SID=b6b6b1c12d2e95217ebea33eb

		fishery-management-areas-map-gis-data	3fbb333&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_1406
FMA McGrail Bank EFH HAPC	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/mcgrail-bank-habitat-area-particular-concern-hapc-fishery-management-area-map-gis-data	https://www.ecfr.gov/cgi-bin/text-idx?SID=f3e475e206bdbddfb545dd420753cf9e&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_174
FMA Tortugas Marine Reserve North/South EFH HAPC	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/tortugas-marine-reserves-hapc-fishery-management-area-map-gis-data	https://www.ecfr.gov/cgi-bin/text-idx?SID=f3e475e206bdbddfb545dd420753cf9e&mc=true&node=pt50.12.622&rgn=div5#se50.12.622_174
Archeological Sensitive Areas	FL National Historic Society	CUI	CUI
Coastal Tribal Lands	NOAA OCM & BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/CoastalTribalLands.zip	https://inport.nmfs.noaa.gov/inport/item/48860
AWOIS and ENC Wrecks and Obstructions	NOAA OCM & BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/WrecksAndObstructions.zip	ftp://ftp.coast.noaa.gov/pub/MSP/WrecksAndObstructions.zip
Remediation of Underwater Legacy Environmental Threats (RULET) Wrecks	USACE	https://sanctuaries.noaa.gov/protect/ppw/wrecks.html	https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/archive/protect/ppw/pdfs/2013_potentiallypollutingwrecks.pdf
U.S.FWS Threatened & Endangered Species Active Critical Habitat	USFWS	https://www.fws.gov/gis/data/national/	https://ecos.fws.gov/ecp/report/table/critical-habitat.html
Oyster Distribution	NCEI	https://www.ncei.noaa.gov/maps/gulf-data-atlas/atlas.htm	Anson K, Arnold W, Banks P, Berrigan M, Pollack J, Randall B, Reed D. Eastern Oyster In Gulf of Mexico Data Atlas [Internet]. Stennis Space Center (MS): National Centers for Environmental Information; 2011. [6 screens]. Available from: https://gulfatlas.noaa.gov/.
Seagrasses of the United States	NOAA OCM & BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/Seagrasses.zip	https://inport.nmfs.noaa.gov/inport/item/56960/
Seagrasses – Florida	Florida Fish and Wildlife Conservation Commission	https://geodata.myfwc.com/datasets/seagrass-habitat-in-florida	https://www.arcgis.com/sharing/rest/content/items/3c899a92589a4f8dba2cdbba734697c5/info/metadata/metadata.xml?format=default&output=html
Seagrasses Florida SIMs	Florida FWRI SIMs	https://atoll.floridamarine.org/Data/Zips/SDE/seagrass_fl_poly.zip	https://atoll.floridamarine.org/Data/Zips/SDE/seagrass_fl_poly.zip
NOAA ENC Artificial Reefs	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ArtificialReefs.zip	https://inport.nmfs.noaa.gov/inport/item/54191
Florida Artificial Reefs	Florida Fish and Wildlife Conservation Commission	https://opendata.arcgis.com/datasets/eb2bfd225149405bba23604f20159f56_1.zip	https://myfwc.com/fishing/saltwater/artificial-reefs/locate/

NOAA ENC Fish Havens	NOAA Office of Coast Survey	https://encdirect.noaa.gov/	https://www.fisheries.noaa.gov/inport/item/39976
U.S.FWS Coastal Barrier Resource System	USFWS	https://www.fws.gov/cbra/maps/boundaries.html	https://www.fws.gov/cbra/Metadata.html
Critical Wildlife Areas (FL)	FWC	https://myfwc.com/conservation/terrestrial/cwa/	https://myfwc.com/conservation/terrestrial/cwa/
Marine Protected Area Inventory	NOAA Marine Protected Areas Center & Anthropocene Institutes ProtectedSeas team	https://www.arcgis.com/apps/webappviewer/index.html?id=7eb7f3112be14713a8540cab37a36af0 ; https://protectedseas.net/mpa-download-data/	https://services9.arcgis.com/lm7wE8a9YA9rKfzy/arcgis/rest/services/usa_10sqkmgrid2/FeatureServer/0
Coastal Wetlands	USGS/USFWS	https://www.fws.gov/wetlands/Data/Data-Download.html	https://www.fws.gov/wetlands/Data/Historic-Wetlands-Data.html
Coral Reef Evaluation and Monitoring Project (CREMP) Stations	FWC	https://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_MarineEco/MapServer/14	https://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_MarineEco/MapServer/14
Manatee Distribution and Observational Survey data	FWC	https://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_Manatees/MapServer	https://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_Manatees/MapServer
Fish Management Areas in Florida	FWC	https://fdacs.maps.arcgis.com/sharing/rest/content/items/bcd7aee1108a4e01b6c9bf32f5cbadbc/info/metadata/metadata.xml?format=default&output=html	https://fdacs.maps.arcgis.com/sharing/rest/content/items/bcd7aee1108a4e01b6c9bf32f5cbadbc/info/metadata/metadata.xml?format=default&output=html
Mangrove Habitats in Florida	FWC	https://fdacs.maps.arcgis.com/sharing/rest/content/items/a78a27e02f9d4a71a3c3357aefc35baf/info/metadata/metadata.xml?format=default&output=html	https://fdacs.maps.arcgis.com/sharing/rest/content/items/a78a27e02f9d4a71a3c3357aefc35baf/info/metadata/metadata.xml?format=default&output=html
Tidal Flats	FWC	https://fdacs.maps.arcgis.com/sharing/rest/content/items/7e8ff70afcfa44a8be502e69f4d668ff/info/metadata/metadata.xml?format=default&output=html	https://fdacs.maps.arcgis.com/sharing/rest/content/items/7e8ff70afcfa44a8be502e69f4d668ff/info/metadata/metadata.xml?format=default&output=html

Industry, Navigation & Transportation Datasets (n=20)			
Dataset	Source	Source/link	Metadata link
Ocean Disposal Sites	U.S. Environmental Protection Agency (EPA)	ftp://ftp.coast.noaa.gov/pub/MSP/OceanDisposalSites.zip	https://inport.nmfs.noaa.gov/inport/item/54193
Submarine Cables	NOAA OCM and BOEM (i.e., marinecadastre.gov)	Confidential; version for public distribution available at ftp://ftp.coast.noaa.gov/pub/MSP/SubmarineCables.zip	Confidential; version for public distribution available at https://inport.nmfs.noaa.gov/inport/item/54403
Submarine Cable Areas	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/SubmarineCableAreas.zip	https://inport.nmfs.noaa.gov/inport/item/54402
Oil and Gas Pipeline Locations	BOEM & Bureau of Safety and Environmental Enforcement (BSEE)	https://www.data.boem.gov/Mapping/Files/ppl_arcs.zip; https://www.data.boem.gov/Main/Pipeline.aspx#ascii; https://www.data.bsee.gov/Main/RawData.aspx	https://www.data.boem.gov/Mapping/Files/ppl_arcs_meta.html
Pilot Boarding Areas	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/PilotBoarding.zip	https://inport.nmfs.noaa.gov/inport/item/54393
Pilot Boarding Stations	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/PilotBoarding.zip	https://inport.nmfs.noaa.gov/inport/item/54394
Coastal Maintained Channels	U.S. Army Corp of Engineers (USACE)	http://encdirect.noaa.gov/theme_layers/data/coastal_maintained_channels/maintainedchannels.zip	https://inport.nmfs.noaa.gov/inport/item/39972
Aids to Navigation	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://csc.noaa.gov/pub/MSP/AidsToNavigation.zip	https://inport.nmfs.noaa.gov/inport/item/56120
Anchorage Areas (used/disused)	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/AnchorageAreas.zip	https://www.fisheries.noaa.gov/inport/item/48849
U.S. Shipping Fairways	NOAA ENC	http://encdirect.noaa.gov/theme_layers/data/shipping_lanes/ShippingLanes.zip	https://inport.nmfs.noaa.gov/inport/item/39986
Navigable Waterway Network (NWN) and Commercial Waterway Network (CWN)	National Waterway GIS Design Committee (NWGISDC)[11]	https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/1472/	https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/1472/

[11] The NWGISDC consists of USACE, USDOT, Volpe National Transportation Systems Center, Maritime Administration, Military Traffic Management Command, Tennessee Valley Authority, USEPA, U.S. Bureau of Census, USCG, and the Federal Railroad Administration. Data were derived from USGS digital line graph files, starting with the USACE Waterway Link Network, along with the NOAA ENC.

U.S. Ferry Routes	National Atlas of the U.S.	https://geo.nyu.edu/catalog/stanford-gd729dg1947	https://geo.nyu.edu/catalog/stanford-gd729dg1947
Automatic Identification System (AIS) Vessel Traffic (2016, 2017, 2018, 2019) for each vessel type (cargo, tanker, passenger, fishing, tug and tow, pleasure and sailing, military, and other)	NOAA OCM and BOEM (i.e., marinecadastre.gov) and USCG	https://marinecadastre.gov/ais/	https://inport.nmfs.noaa.gov/inport/item/53161
Deepwater Ports	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/DeepwaterPorts.zip	https://inport.nmfs.noaa.gov/inport/item/54192
Federal Sand and Gravel Lease Borrow Areas	BOEM Marine Minerals	https://mmis.doi.gov/boemmmis/downloads/layers/LeaseAreas_fgdb.zip	https://mmis.doi.gov/boemmmis/metadata/PlanningAndAdministration/LeaseAreas.xml
Beach Nourishment	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/BeachNourishmentProjects.zip	https://inport.nmfs.noaa.gov/inport/item/59711
Boreholes, Test Wells, and Wells	BSEE	https://www.data.bsee.gov/Main/RawData.aspx; https://www.data.bsee.gov/Mapping/Files/Well.zip	http://metadata.boem.gov/geospatial/OCSwells-GOMR-NAD27.xml
BOEM 2019-2024 Draft Proposed Program Area - Gulf of Mexico Region	BOEM	https://www.data.boem.gov/Mapping/Files/Gom_5yr_2019_2024.zip	https://metadata.boem.gov/geospatial/2019-2024_Draft_Proposed_Program_Area.xml
BOEM 2019-2024 DPP Exclusion Option Areas - Gulf of Mexico Region	BOEM	https://www.data.boem.gov/Mapping/Files/GOM_5yr_2019_2024_excl_opt.zip +	https://metadata.boem.gov/geospatial/2019-2024_DPP_Exclusion_Option_Areas.xml
Gulf of Mexico Current Presidential Withdrawal and Congressional Moratoria Areas	BOEM	https://www.data.boem.gov/Mapping/Files/GOMR_WithdrawAreas.zip	https://metadata.boem.gov/geospatial/GulfRegionWithdrawAreas.xml

Non-Living Datasets (n=27)			
Dataset	Source	Source/link	Metadata link
Shoals and Swales	NOAA NOS NCCOS and BOEM	Data available upon request/approval	File available upon request/approval
Wave Height and Direction (MIKE21) (3-hr time steps for 32-yr climatology)	MIKE21 Model[12]	http://www.iingen.unam.mx/es-mx/Investigacion/Paginas/default.aspx - Christian Mario Appendini Albrechtsen	Limited Distribution data
Sea Surface Height (m)	NASA JPL	https://podaac.jpl.nasa.gov/dataset/SEA_SURFACE_HEIGHT_ALT_GRIDS_L4_2SATS_5DAY_6THDEG_V_JPL1812	https://podaac.jpl.nasa.gov/dataset/SEA_SURFACE_HEIGHT_ALT_GRIDS_L4_2SATS_5DAY_6THDEG_V_JPL1812
pH	GCOOS	https://gisdata.gcoos.org/datasets/d85f86aa33b949a9b3961bbf046d6b31_1; https://gisdata.gcoos.org/datasets/d85f86aa33b949a9b3961bbf046d6b31_0	https://gisdata.gcoos.org/datasets/d85f86aa33b949a9b3961bbf046d6b31_1
Sediment Thickness	NCEI	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018GC008115; http://earthdynamics.org/data/	http://www.earthdynamics.org/page5.html
Mixed Layer Thickness	NCEI	https://polar.ncep.noaa.gov/ofs/download.shtml	https://polar.ncep.noaa.gov/global/nc/?-global-mixed_layer_thickness-000-small-rundate=latest
High Frequency Radar Locations	GCOOS	https://data.gcoos.org/fullView.php	http://gcoos5.geos.tamu.edu:6060/erddap/metadata/iso19115/xml/WS0603_ws0603_01_iso19115.xml
NOAA ERDDAP Walton-Smith CTD data	GCOOS	http://gcoos5.geos.tamu.edu:6060/erddap/info/index.html?page=1&itemsPerPage=1000	http://gcoos5.geos.tamu.edu:6060/erddap/metadata/iso19115/xml/WS0603_ws0603_01_iso19115.xml
GCOOS Glider Data (Wave gliders - USM/MSU)	GCOOS	https://gisdata.gcoos.org/datasets/7fda7eb452674a0e9a797be37bf508a8	https://products.gcoos.org/gliders/
Current Speed (m/s) and direction (U,V)	NCOM (American Seas)	https://www.ncei.noaa.gov/thredds-coastal/catalog/amseas/catalog.html	https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/navoceano-ncom-reg

[12] https://www.mikepoweredbydhi.com/products/mike-21/waves

Seawater Temperature (°C)	NCOM (American Seas)	https://www.ncei.noaa.gov/thredds-coastal/catalog/amseas/catalog.html	https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/navoceano-ncom-reg
Salinity	NCOM (American Seas)	https://www.ncei.noaa.gov/thredds-coastal/catalog/amseas/catalog.html	https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/navoceano-ncom-reg
Bathymetry (Gulf-wide) (2013, 2015)	Coastal Relief Model (2013), GEBCO (2015)	https://www.ngdc.noaa.gov/mgg/coastal/crm.html; https://www.gebco.net/data_and_products/historical_data_sets/	https://inport.nmfs.noaa.gov/inport/item/54365
Bathymetry	Composite - Continuously Updated Digital Elevation Model (CUDEM) at 1/3 arc-second resolution[13] for the area were used along with the CUDEM at 1/9 arc-second resolution.[14] Gaps were filled with other bathymetry sources including the Panama City, Florida 1/3 arc-second MHW Coastal Digital Elevation Model[15], Multibeam data[16], and the U.S. Coastal Relief Model Vol.3 - Florida and East Gulf of Mexico[17]	https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:686/html#; https://www.ngdc.noaa.gov/nos/H12001-H14000/H13154.html; https://www.ngdc.noaa.gov/nos/H12001-H14000/H13155.html; https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:307/html	https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:686/html#; https://www.ngdc.noaa.gov/nos/H12001-H14000/H13154.html; https://www.ngdc.noaa.gov/nos/H12001-H14000/H13155.html; https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:307/html
Surficial Sediment Classification	USGS usSEABED and Sediment Texture databases	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/SurficialSedimentClassification.zip	https://inport.nmfs.noaa.gov/inport/item/54406

[13] Cooperative Institute for Research in Environmental Sciences (2014) Continuously Updated Digital Elevation Model (CUDEM) - 1/3 Arc-Second Resolution Bathymetric-Topographic Tiles. NOAA National Centers for Environmental Information. https://doi.org/10.25921/0mpp-h192 Accessed August 28, 2020.

[14] Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado, Boulder (2014) Continuously Updated Digital Elevation Model (CUDEM) - 1/9 Arc-Second Resolution Bathymetric-Topographic Tiles. NOAA National Centers for Environmental Information. https://doi.org/10.25921/ds9v-ky35 Accessed August 28, 2020.

[15] NOAA National Geophysical Data Center (2010) Panama City, Florida 1/3 arc-second MHW Coastal Digital Elevation Model. NOAA National Centers for Environmental Information. Accessed September 28, 2020. https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:686/html#

[16] https://www.ngdc.noaa.gov/nos/H12001-H14000/H13154.html; https://www.ngdc.noaa.gov/nos/H12001-H14000/H13155.html

[17] NOAA National Geophysical Data Center (2001) U.S. Coastal Relief Model Vol.3 - Florida and East Gulf of Mexico. https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:307/html. Accessed September 28, 2020.

U.S.GS usSEABED Data Series 146 (Gulf of Mexico and Caribbean)[18]	USGS[19]	https://pubs.usgs.gov/ds/2006/146/htmldocs/usseabed.htm; https://pubs.usgs.gov/ds/2006/146/data/gmx_ext.zip	https://pubs.usgs.gov/ds/2006/146/data/gmx_extmeta.htm
Predicted Surficial Sediment mean grain size (also percent gravel, sand, mud)	NOAA NCCOS BIOGEO	Limited distribution	https://www.mdpi.com/2077-1312/8/4/242/pdf
Chlorophyll *a* concentration (Temporal Resolution: 2002 – 2019; Spatial Resolution: 4.6 km)	NASA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/Chlorophyll_a.zip; https://oceandata.sci.gsfc.nasa.gov/MODIS-Aqua/Binned/Monthly/	https://inport.nmfs.noaa.gov/inport/item/54369
Chlorophyll (mg/m^3)	Bio-ORACLE project (Source: Global Ocean Biogeochemistry Non-assimilative Hindcast)	https://bio-oracle.org/downloads-to-email.php	https://bio-oracle.org/release-notes-2-1.php
Sea Surface Temperature (Temporal Resolution: 2002 – 2019; Spatial Resolution: 4.6 km)	NASA	https://podaac.jpl.nasa.gov/SeaSurfaceTemperature; https://oceandata.sci.gsfc.nasa.gov/MODIS-Aqua/Binned/Monthly/	https://podaac.jpl.nasa.gov/AQUA
Aragonite Saturation State	NOAA OCM and BOEM (i.e., marinecadastre.gov)	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/SurfaceAragonite.zip	https://inport.nmfs.noaa.gov/inport/item/54405
Kd(PAR)	NOAA using Visible Infrared Imaging Radiometer (VIIRS) imagery[20]	ftp://ftp.star.nesdis.noaa.gov/pub/socd1/mecb/coastwatch/viirs/science/L3/global/kd/monthly/WW00/	https://inport.nmfs.noaa.gov/inport/item/54386
Kd (490)	NOAA using VIIRs imagery	ftp://ftp.star.nesdis.noaa.gov/pub/socd1/mecb/coastwatch/viirs/science/L3/global/kd/monthly/WW00/	https://inport.nmfs.noaa.gov/inport/item/54385
Nutrients at Depth (Silicate, Phosphate, Nitrate)	Bio-ORACLE	https://bio-oracle.org/downloads-to-email.php	https://bio-oracle.org/release-notes-2-1.php
Total Dissolved Nitrogen Counts and Observation points	GCOOS	https://gisdata.gcoos.org/datasets/d85f86aa33b949a9b3961bbf046d6b31	https://gisdata.gcoos.org/datasets/091c917b6a0e4528947cd9ac2a018628_1
Dissolved Oxygen	Bio-ORACLE	https://bio-oracle.org/downloads-to-email.php	https://bio-oracle.org/release-notes-2-1.php

[18] https://pubs.usgs.gov/ds/2006/146/htmldocs/data_cata.htm

[19] https://pubs.usgs.gov/ds/2006/146/htmldocs/gmx_sources.htm

[20] SeungHyun Son, Menghua Wang., 2015: Diffuse attenuation coefficient of the photosynthetically available radiation Kd (PAR) for global open ocean and coastal waters. *Remote Sensing of Environment*, Volume 159, 15 March 2015, Pages 250-258.

Iron Concentration	Bio-ORACLE	https://bio-oracle.org/downloads-to-email.php	https://bio-oracle.org/release-notes-2-1.php

Commercial and Recreational Fishing & Aquaculture Datasets (n=5)			
Dataset	Source	Source/link	Metadata link
Live Rock Aquaculture	NOAA NMFS SERO	CUI	CUI
Shrimp ELB Summary and Point (2004 - 2019)	NOAA NMFS SEFSC	CUI	CUI
Longline Reef Fish (2007 - 2019)	NOAA NMFS SEFSC	CUI	CUI
Bandit Reef Fish (2007 - 2019)	NOAA NMFS SEFSC	CUI	CUI
Headboat Survey (2014 - 2020)	NOAA Fisheries SE Region Headboat Survey	CUI	CUI

Other Considerations (n=11)			
Dataset	Source	Source/link	Metadata link
Harmful Algal Bloom (*Karenia brevis*) in the Gulf of Mexico	NOAA NCCOS - FWRI, TWFD, Louisiana Hospitals, HABSOS	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/HarmfulAlgalBlooms.zip	https://inport.nmfs.noaa.gov/inport/item/58081
NPDES Permitted Facilities (wastewater input)	USEPA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/WastewaterOutfalls.zip	https://inport.nmfs.noaa.gov/inport/item/54410
Oil Spills (raw incident)	NOAA	https://incidentnews.noaa.gov/raw/incidents.csv	https://incidentnews.noaa.gov/raw/index
Phytoplankton Time Series (Flow Cytobots) for HABs Monitoring	GCOOS	https://geo.gcoos.org/hab/	https://geo.gcoos.org/hab/
ROSSI Borrow Areas	Florida ROSSI	http://rossi.urs-tally.com/Home/Shapefiles	http://rossi.urs-tally.com/Home/Shapefiles
ROSSI Paleo Ebb Deltas	Florida ROSSI	http://rossi.urs-tally.com/Home/Downloads	http://rossi.urs-tally.com/Home/Downloads
ROSSI Shoreline Complex	Florida ROSSI	http://rossi.urs-tally.com/Home/Downloads	http://rossi.urs-tally.com/Home/Downloads
ROSSI Barrier Islands	Florida ROSSI	http://rossi.urs-tally.com/Home/Downloads	http://rossi.urs-tally.com/Home/Downloads
ROSSI Holocene sand	Florida ROSSI	http://rossi.urs-tally.com/Home/Downloads	http://rossi.urs-tally.com/Home/Downloads

ROSSI sediment samples	Florida ROSSI	http://rossi.urs-tally.com/Home/Downloads	http://rossi.urs-tally.com/Home/Downloads
Natural Hydrocarbon Seeps	BOEM	https://www.boem.gov/BOEM-Seafloor-Anomalies-Layer-Package/	https://www.boem.gov/oil-gas-energy/mapping-and-data/map-gallery/seismic-water-bottom-anomalies-map-gallery

List of Acronyms:

AWOIS = Automated Wreck and Obstruction Information System
BOEM = Bureau of Ocean Energy Management
BSEE = Bureau of Safety and Environmental Enforcement
CUI = controlled unclassified information; Not publicly available data, must be authorized by holding agency
DOD = U.S. Department of Defense
ENC = Electronic Navigation Chart
FDEP = Florida Department of Environmental Protection
FMA = Federally Managed Area
FWC = Florida Fish and Wildlife Conservation Commission
FWRI = Florida Wildlife Research Institute
GCOOS = Gulf of Mexico Coastal Ocean Observing System
HABSOS = Harmful Algal BloomS Observing System
HAPC = Habitat Area of Particular Concern
NCCOS = National Centers for Coastal Ocean Science
NCOM = Navy Coastal Ocean Model
NCEI = NOAA National Centers for Environmental Information
NMFS = National Marine Fisheries Service
NOAA = National Oceanic and Atmospheric Administration
NOS = National Ocean Service
OCM = Office of Coastal Management
ROSSI = Regional Offshore Sand Source Inventory
SEFSC = Southeast Fisheries Science Center
SERO = Southeast Regional Office
TWFD = Texas Parks and Wildlife Department
USACE = U.S. Army Corps of Engineers
USEPA = U.S. Environmental Protection Agency
USFWS = U.S. Fish and Wildlife Service
USGS = U.S. Geological Survey

Appendix B: Data Processing Notes

Numerical Datasets

Bathymetry

The Continuously Updated Digital Elevation Model (CUDEM) at 1/3 arc-second resolution for the area was used along with the CUDEM at 1/9 arc-second resolution. All data were resampled to 1/3 arc-second (~10 x 10 m pixels). Gaps in the AOI were filled with other bathymetry sources including the Panama City, Florida 1/3 arc-second MHW Coastal Digital Elevation Model,[21] Multibeam data,[22] and the U.S. Coastal Relief Model Vol.3 - Florida and East Gulf of Mexico.[23]

Vessel Traffic

Automatic Identification System (AIS) vessel traffic data are information collected by the U.S. Coast Guard to monitor real-time vessel information to improve navigation safety. Data such as ship name, purpose, course, and speed are acquired 24 hours per day. Vessel traffic data from 2019 was downloaded and processed for the AOI.[24] Vessel traffic from 2019 was categorized by vessel type (Cargo, Tanker, Tug and tow, Fishing, Passenger, Pleasure and sailing, Other, and Military), and the sum of vessel transits per grid cell was calculated.[25] More recent vessel traffic data from 2020 was available, but not used due to artifacts in the data from a global pandemic, which impacted cruise ships and other shipping.

Commercial and Recreational Fishing

Fisheries data were received as point data of track lines or as annual gridded summaries from NMFS Southeast Fisheries Science Center (SEFSC) for this planning exercise. These data are confidential and considered Controlled Unclassified Information (CUI).[26] Data shown in maps within this technical report reflect the resolution at which data can be displayed to the public, to ensure confidential data components are maintained (i.e., data are displayed at a coarser resolution so only generalized fishing patterns are visible), and follow the “rule of three” (at least three records are included in aggregations for visualization purposes).[27] However, data were used at the resolution received from the data provider within the suitability model. Data processing steps are detailed below for each fishery data set received for this analysis.

Recreational headboat: Southeast Regional Headboat Survey (2014–2020). The NMFS SEFSC provided gridded headboat survey data representing recreational fishing effort within the Gulf of Mexico. Headboats are defined as carrying 15 or more passengers, each charged by the head, and primarily targets recreational harvest of reef fish. The NMFS provided gridded point data with degrees and minutes (no seconds) of positional data, representing when fishing was occurring on a vessel. The sum of the vessels fishing at a location (1’ x 1’ grid cells) was calculated for each year and the sum of all years (2014 to 2020) was calculated.

[21] https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:686/html#

[22] https://www.ngdc.noaa.gov/nos/H12001-H14000/H13154.html; https://www.ngdc.noaa.gov/nos/H12001-H14000/H13155.html

[23] https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:307/html

[24] https://marinecadastre.gov/ais/

[25] https://coast.noaa.gov/data/marinecadastre/ais/VesselTypeCodes2018.pdf

[26] https://www.archives.gov/cui/about

[27] https://www.gsmfc.org/fin-dms-conf-data-faq.php

Commercial Shrimp Trawling Vessel Monitoring System (VMS) (2004-2019). The NMFS SEFSC provided commercial shrimp trawling (white shrimp, pink shrimp, and brown shrimp) vessel data from the Vessel Monitoring System records from 2004 to 2019. These data are considered confidential and therefore limited descriptions are provided to maintain the confidentiality of the data. The VMS transits or records a signal at 10-minute intervals that records a vessel's location and speed over ground. For trawl fisheries, data were categorized into an assumed activity, where 2 to 3.8 knots was the speed over ground when trawling is assumed to occur. All vessel transmissions where trawling was assumed to be occurring were extracted from the full dataset. Track lines were then created from only the extracted data. The count of vessel tracks per 100 x 100 m grid cell were calculated for each year, and the total sum of all years was calculated.

Commercial Reef Fish: Bandit Gear (2007-2019). The NMFS SEFSC provided point data with probable fishing locations for reef fish bandit fishing efforts from 2007 to 2019 within the Gulf of Mexico from Vessel Monitoring System (VMS) data. The sum of values for each of the points were aggregated to a new grid (1 km x 1 km) for modeling purposes.

Commercial Reef Fish: Longline (2007-2019). The NMFS SEFSC provided point data with probable fishing locations for longline reef fish efforts from 2007 to 2019 within the Gulf of Mexico from Vessel Monitoring System (VMS) data. The sum of values for each point was aggregated to a new grid (1 km x 1 km) for modeling purposes.

Oceanographic Conditions

The American Seas Navy Coastal Ocean Model (NCOM) was used to characterize current speed and direction, temperature, and salinity.[28] Output from the MIKE21 model[29] provided statistics for significant wave height (H_s), period, and direction and wind speed and direction over a 32-year period with three-hour time steps.

Harmful Algal Blooms (HABs): *Karenia brevis* (2000-2019)

This compilation of harmful algal bloom (*Karenia brevis*) observational point data for the Gulf of Mexico and eastern coast of Florida represents both presence and absence of *K. brevis*. Consistent sampling occurred from 2000 to 2019, and therefore, this data period was used to determine areas of consistent annual bloom levels above cellar concentrations lethal to fish (100,000 cells per liter). Frequency of blooms (number of years with lethal fish blooms) was visualized to indicate areas of potential concern for current and future impacts to fish species occupying these areas. Importantly, areas with no bloom occurrence in these data should not be interpreted to mean no bloom occurrence has occurred in the past or will not occur in the future. Data were opportunistically sampled and binned to show patterns over time. Areas with no hexagons represent areas where samples were not collected, whereas bins with samples with no *K. brevis* detected are hollow hexagons.

[28] https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/navoceano-ncom-reg

[29] https://www.mikepoweredbydhi.com/products/mike-21

Categorical Datasets

Fish Havens (2020)

Fish havens are artificial shelters, also known as artificial reefs, made up of rocks, rubble, subway cars, ships, airplanes, specially designed concrete structures, and other objects placed on the ocean floor to enhance fish habitat (NOAA 2016). Fish haven data were extracted from NOAA's electronic navigational chart (ENC) using the ENC Direct to GIS tool. The extracted features were quality assured by overlaying the features onto the ENC within ArcGIS Pro and performed manual checks to ensure polygons lined up with those on the chart.

Deep-sea Coral Observational Data (1985-present)

Deep sea coral observations for the U.S. Gulf of Mexico were obtained from DOC/NOAA/NESDIS/NCEI and NOAA DSCTRP directly.[30] Recommendations from dataset experts were to use the post 1985-DSCRTP presence data on a select group of corals (gorgonians, stony branching, black, and lace corals, and *Hexactenillida* sponges), as this subset represent the most important benthic epifauna, and have the most reliable navigation (with exception). The most conservative positional offset within these records is 300 m, and therefore a 500-m setback was applied to each data point.

[30] https://deepseacoraldata.noaa.gov/metadata-records/iso-dscrtp-national-db