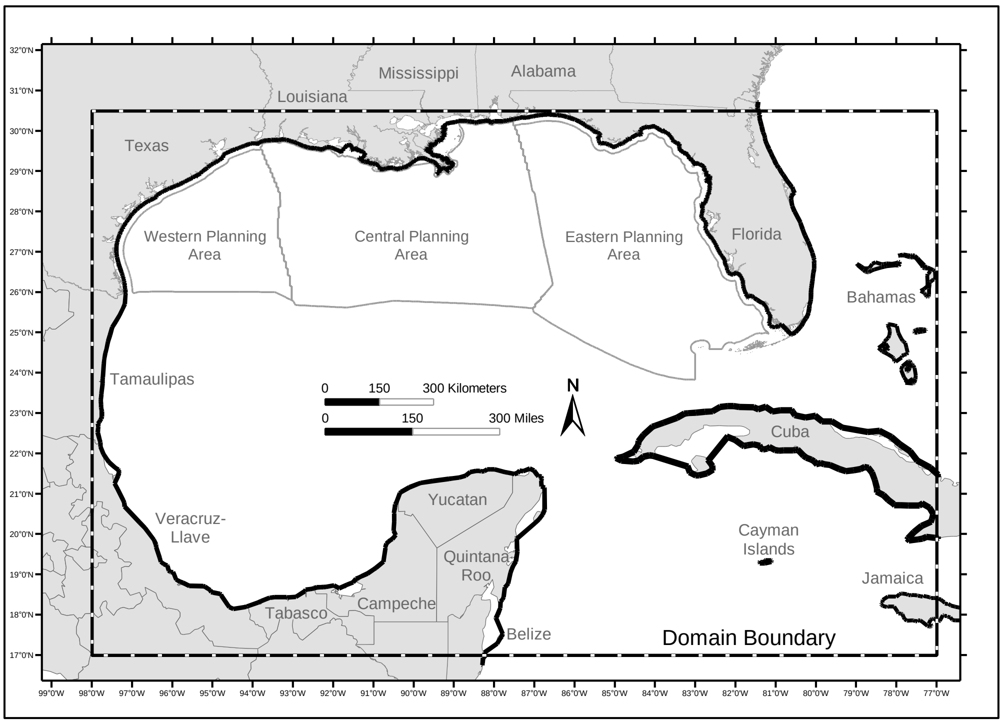
OCS Study
BOEM 2023-026

Oil Spill Risk Analysis

Gulf of Mexico Outer Continental Shelf (OCS) Lease Sales in the Eastern Planning Area, Central Planning Area, and Western Planning Area and Gulf-wide OCS Program



November 2023

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Contents

List of Tables

List of Figures

Abbreviations and Acronyms

bbl	barrel (42 U.S. gallons)
Bbbl	billion barrels = 10^9 barrels
BOEM	Bureau of Ocean Energy Management
CPA	Central Planning Area
EPA	Eastern Planning Area
GOM	Gulf of Mexico
NEPA	National Environmental Policy Act
OCS	Outer Continental Shelf
OSRA	Oil Spill Risk Analysis
POM	Princeton Ocean Model
WPA	Western Planning Area

1 Introduction

The national Outer Continental Shelf (OCS) oil and gas leasing program (OCS Program) is mandated by Section 18 of the OCS Lands Act (OCSLA) (43 U.S.C. §§ 1331 et seq.). The OCS Lands Act, as amended, provides the authority for the U.S. Department of the Interior to implement an OCS oil and gas leasing program.

Oil spills are accidental and unauthorized events that may occur from activities associated with offshore oil exploration, development, production, transportation, and decommissioning. The Bureau of Ocean Energy Management (BOEM) conducts oil spill risk analysis (OSRA) to support environmental analyses, including National Environmental Policy Act (NEPA) analyses. These analyses are prepared prior to authorizing OCS oil and gas activities, including proposed lease sales.

OSRA estimates the risks of contact of an oil spill (potentially resulting from OCS oil development, production, and transportation activities) with sensitive offshore and onshore environmental (biological, physical, and socioeconomic) resources. **OSRA focuses on two key issues: 1) the probability of an oil spill from oil development and 2) the probability of hypothetically spilled oil contacting environmental resources.**

In this analysis, the OSRA study domain is the proposed Gulf of Mexico (GOM) "region-wide" oil and gas lease sale, called Program Area 1 (Figure B-1b), as defined in the *2023–2028 National Outer Continental Shelf Oil and Gas Leasing Proposed Program* (BOEM 2022). Program Area 1 comprises the Western Planning Area (WPA), the Central Planning Area (CPA), and a small portion of the Eastern Planning Area (EPA) not withdrawn from leasing.

OSRA models the combined probability of 1) an oil spill occurring and 2) that oil spill contacting an identified resource of interest, such as a sensitive habitat or a shoreline. This modeling process treats oil spills as probabilistic events with likelihoods that can be quantified, but it cannot predict when or how they may occur. The risk calculations are based on inputs that are themselves estimations for a given lease sale, including the ranges for future oil production volumes (see Section 2.2, *Estimated Volume of Oil Resources*) and the likelihood or sizes of spills that could occur during activities stemming from a lease sale (see Section 3.1, *Probability of Oil Spills Occurring*). Likewise, the winds and ocean currents that transport oil after a spill cannot be known for certain but can be used reliably as inputs for OSRA (see Section 3.2, *Oil Spill Trajectory Simulations*).

BOEM conducted this OSRA in three parts to calculate the following:

1. **Probability of oil spill occurrence**, based on estimated volumes of oil produced and transported and on spill rates derived from historical data
2. **Trajectories of oil spills** from hypothetical spill locations to locations of various environmental resources simulated (Ji et al. 2003; Smith et al. 1982)
3. **Combination of above results to estimate the overall oil spill risk**

This report is available on the BOEM website (www.boem.gov/environment/environmental-assessment/oil-spill-risk-analysis-reports).

2 Framework of the Analysis

OSRA considers multiple factors when estimating oil spill risk. These factors are described below and include the proposed action, estimated volume of oil resources in the area proposed for leasing, study domain, and environmental resources in or near the proposed leasing area.

2.1 Proposed Action

The proposed action addressed in this report is the proposed lease sale schedule in Program Area 1 (Figure B-1b) put forth in the *2023–2028 National Outer Continental Shelf Oil and Gas Leasing Proposed Program* (BOEM 2022). The purpose of the proposed action is to offer for lease those areas that may contain economically recoverable oil and natural gas. The development scenario assumes that the oil produced in the lease areas will be transported to shore predominantly by pipelines, with a small quantity transported by vessels including barges, shuttle tankers, and floating production.

2.2 Estimated Volume of Oil Resources

The estimated volume of oil resources is an important factor for calculating risk, because benefits and risks are functions of and mutually dependent on the volume of oil produced. For example, greater volumes of produced oil are associated with greater economic benefits from the production and use of oil itself, as well as greater risks. If the benefits are evaluated by assuming production of a specific amount of oil, then the corresponding risks should be stated conditionally, such as "if the volume is *x*, then the risks would be *y*." Any statements about the likelihood of a particular volume of oil being produced also apply to the likelihood of the corresponding benefits and risks.

This analysis presents two resource estimate scenarios:

- **Proposed Action**: the range of oil resources estimated to be leased, discovered, and produced over a 40-year time period as a result of a GOM region-wide lease sale (i.e., Program Area 1). Program Area 1 is described in the *2023–2028 National Outer Continental Shelf Oil and Gas Leasing Proposed Program* (BOEM 2022).
- **Cumulative OCS Program**: the range of oil resources estimated to be leased, discovered, and produced as a result of prior lease sales, the proposed action, and reasonably foreseeable future lease sales that may occur during the life of the proposed action, which in this case is 70 years (2023–2092) (BOEM 2021)

Resource estimates for the proposed action are based on two factors:

- Conditional estimates of undiscovered, unleased, conventionally recoverable oil resources in the proposed lease sale areas
- Estimates of the portion or percentage of these resources assumed to be leased, discovered, developed, and produced as a result of the proposed action

The estimates of undiscovered, unleased, conventionally recoverable oil resources are based on a comprehensive appraisal of the conventionally recoverable petroleum resources of the U.S. There are inherent uncertainties in these estimates, which the OSRA model is designed to account for when modeling probabilities based on oil production volume inputs.

The estimates of the portion of the resources assumed to be leased, discovered, developed, and produced as a result of the proposed action are based upon logical sequences of events that incorporate past experience, current conditions, and foreseeable development strategies. BOEM used a wealth of historical data and information derived from more than 50 years of oil and gas exploration, development, and production activities.

The projected life of all exploration, development, production, and decommissioning activities that result from a proposed lease sale is 40 years. This assumption is based on the average length of time required for these activities to occur over the life of a typical lease in the GOM.

The resource estimates described above were used to calculate the projected oil production in billion barrels (Bbbl) for a single proposed lease sale and the cumulative OCS Program (Table 1). The undiscovered, unleased, conventionally recoverable oil resource estimates for the proposed action are expressed as ranges from low to high. For example, Table 1 indicates that for the proposed action in the WPA, the amount of oil estimated to be produced is in the range between 0.003 Bbbl (low) and 0.044 Bbbl (high).

Table 1. Projected oil production in the GOM for a single lease sale and the cumulative OCS Program

Scope	Planning Area	Estimated Production (Bbbl)[1]	Analysis Period
Single Lease Sale	Region-wide	0.056–0.745	40 years
Single Lease Sale	CPA and EPA[2]	0.053–0.701	40 years
Single Lease Sale	WPA	0.003–0.044	40 years
Cumulative OCS Program	Region-wide	0.559–7.616	70 years
Cumulative OCS Program	CPA and EPA[2]	0.526–7.162	70 years
Cumulative OCS Program	WPA	0.033–0.454	70 years

[1] Bbbl = billion (10^9) barrels; 1 barrel = 42 U.S. Gallons
[2] This analysis considers only a small portion of the EPA (Figure B-1b).

2.3 Study Domain

This OSRA study domain (Figure B-1a) includes the entire GOM and surrounding areas, which is an area larger than the extent of the proposed action (Figure B-1b). The OSRA study domain is larger than the proposed action area to account for movement by surface currents of spilled oil outside of the proposed area; the analysis does not include consideration of oil production outside of the proposed action area. Figure B-1a shows the geographic boundaries encompassing the environmental resources considered at risk from a hypothetical oil spill due to OCS operations in the proposed lease areas. Although few hypothetical oil spills are likely to extend beyond the borders of this domain within 30 days after release (the maximum elapsed time considered), we have tracked and tabulated some spills that could travel beyond the open-ocean boundaries.

2.4 Environmental Resources

BOEM selected the environmental resources considered in this analysis with supplementary input from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service. BOEM used information from its Environmental Studies Program research, literature reviews, and professional exchanges with other scientists. As part of the analysis, BOEM mapped the biological, physical, and socioeconomic resources that could be vulnerable to oil spill contact. These maps (Figures B-2 through B-11) depict locations that were analyzed by the OSRA model and represent either the locations of onshore environmental resources or the surface waters overlying or surrounding offshore environmental resources.

All the onshore or coastal resource locations were represented by one or more partitions of the coastline (herein called “land”). The study area coastline was partitioned into 210 equidistant land segments approximately 10 miles (16 kilometers) in length. The partitions were formed by creating straight lines between two points projected onto the coast; therefore, the actual miles of shoreline represented by each land segment vary, depending upon the complexity of the coastal area.

In addition, State offshore waters were included as environmental resources. The limits of State waters are defined by the states and range from 3 to 9 nautical miles from shore. Texas and Florida States offshore waters extend 3 marine leagues (just over 9 nautical miles) seaward from the baseline from which the breadth of the territorial sea is measured (1 marine league = 1,8228.3 feet). Louisiana State offshore waters extend 3 imperial nautical miles seaward of the baseline from which the breadth of the territorial sea is measured (1 imperial nautical mile = 6,080 feet). Mississippi and Alabama State offshore waters extend 3 nautical miles seaward of the baseline from which the breadth of the territorial sea is measured (1 nautical mile = 6,076 feet).

The offshore and onshore environmental resources that are examined in this OSRA report are listed in Tables A-3 through A-8. Periods of habitat or beach use are identified in parentheses. These tables also indicate which figures illustrate the areas associated with each resource. Appendix B provides the maps of the locations of each potentially affected resource (Figures B-2 through B-11).

3 Conducting OSRA

BOEM conducted this OSRA in three parts and calculated the following:

1. Probability of oil spill occurrence (Section 3.1)
2. Trajectories of oil spills from hypothetical spill locations to environmental resources (Section 3.2)
3. Combined calculation of the first two parts to estimate the overall oil spill risk of both spill occurrence and spill contact if there is oil development (Section 3.3).

Risk analyses may be characterized as “hazard-based” or “risk-based” (Smith et al. 1982). Hazard-based analysis examines possible events regardless of their likelihood. For example, a potential impact would not lose significance because the risk has been reduced due to an increase in the level of control, such as engineering standards. Risk-based analysis, on the other hand, does consider the likelihood of the event occurring or the measures that can be taken to mitigate its potential impacts.

This OSRA uses risk-based analysis. Therefore, the likelihood of oil spills (in this case, greater than or equal to [≥] 1,000 barrels [bbl] in size) occurring on the OCS plays an integral role in the analysis. In addition to the estimated chance of spills occurring, the analysis utilizes an extensive oil spill trajectory model. Results from the trajectory analysis provide input to the final product by estimating where spills might travel on the ocean surface and what environmental resources could be contacted. Therefore, results from the OSRA are combined probabilities, first of the probability of an oil spill occurring, and second the probability of an oil spill contacting identified resource locations.

Note that OSRA is a conservative model that estimates only oil spill contact probability and *not* the impacts of those contacts; BOEM assess impacts through NEPA analyses. Therefore, additional variables such as the natural weathering of oil spills and the effects of cleanup activities are not factored into this analysis.

3.1 Probability of Oil Spills Occurring

The probability of oil spills occurring assumes that spills occur independently of each other as a Poisson process. The Poisson process is a statistical distribution that is commonly used to model random events. The probability of oil spills occurring is based on spill rates derived from the historical OCS platform and OCS pipeline spill records, and the historical tanker spill record in U.S. waters; the rates depend on the volume of oil produced and transported. All types of accidental oil spills ≥ 1,000 bbl are considered in this analysis, including spills from well blowouts and other accidents, platforms, and transportation of oil to shore. These potential spills were classified as platform, pipeline, or tanker spills. This classification allows the analyst to compare the risks from each spill source due to a proposed action, relative to the risks of spill occurrence and contact due to the alternatives being considered.

ABS Consulting Inc (2016) examined oil spill occurrence rates applicable to the OCS. Their results are adjusted for recent experience and based upon more complete databases than were available for earlier analyses (Anderson and LaBelle 2000; Anderson and LaBelle 1990; Anderson and LaBelle 1994; Anderson et al. 2012; Lanfear and Amstutz 1983). This report uses the updated spill occurrence rates from ABS Consulting Inc (2016).

Spill rates are expressed as number of spills per billion barrels (spills/Bbbl) of oil produced or transported. A billion barrels (Bbbl) is defined as 10^9 bbl of oil. Spills of different sizes are analyzed when calculating the rates of spills per Bbbl of oil produced. Spills ≥ 1,000 bbl persist in the environment long enough to be modeled and are addressed in OSRA reports (Smith et al. 1982). Additionally, larger spills are likely to be identified and reported; therefore, records of larger spills are more comprehensive than those of smaller spills (Anderson and LaBelle 1990). Conversely, spills less than (<) 1,000 bbls are addressed in NEPA analysis for each proposed action without the use of trajectory modeling because smaller spills may not persist in the environment long enough to be simulated by trajectory modeling and are less likely to be accurately reported.

For potential catastrophic oil spills for an oil volume greater than 1 million bbl, Ji et al. (2014) used the extreme value theory to analyze the probability of catastrophic oil spill occurrences. A catastrophic oil spill is a low probability event and is not a part of this analysis. For information pertaining to a catastrophic spill event, see Ji et al. (2014).

In selecting the risk exposure variable, two basic criteria pointed to using the volume of oil handled as the risk exposure variable: 1) the exposure variable needed to be simple to define, and 2) the variable needed to be a quantity that could be estimated. Historical volumes of oil produced and transported are well documented, and future volumes of oil production and transportation are routinely estimated (Anderson and LaBelle 1990). The estimated oil spill occurrence rate can be easily calculated as the ratio of the number of historical spills to the volume of oil produced or transported. This analysis estimates the volume of oil to be produced for a proposed action and for the cumulative OCS Program in the GOM from an assessment of oil resources by using comprehensive geological and geophysical databases and related models.

ABS Consulting Inc (2016) analyzed platform and pipeline spills that occurred in Federal waters from OCS oil and gas development from 1964 through 2015 and crude oil tanker spills that occurred in U.S. waters from 1974 through 2014. In these analyses, every spill record was examined and verified. Each spill was classified for size, product spilled, and spill source. Table 2 shows the OCS oil spill rates (in spills per Bbbl of oil produced or transported) for platforms, pipelines, and tankers.

Table 2. Oil spill rates from OCS spill sources based on a 15-year period

Spill Source	> 1,000 bbl (spills/Bbbl)	> 10,000 bbl (spills/Bbbl)
Platforms	0.25	0.13
Pipelines	0.38	0.07
Tankers	0.12	0.02

Note: These spill rates are based on a 15-year period (2000–2015) for OCS platforms and pipelines and a 15-year period (1999–2014) for tankers (ABS Consulting Inc 2016).

Using Bayesian techniques, Devanney III et al. (1974) showed that the probability of *n* oil spill contacts can be described by a negative binomial distribution. Smith et al. (1982), however, noted that when actual exposure is much less than historical exposure, as is the case here, the negative binomial distribution can be approximated by a Poisson distribution. The Poisson distribution has a significant advantage in calculations because it is defined by only one parameter, the assumed number of spills. If $p(n,i)$ is the probability of exactly *n* contacts to a resource *i*, then:

$$p(n,i) = \frac{{\lambda_i}^n \cdot e^{-\lambda i}}{n!}$$

where *n* is the specific number of spills (0, 1, 2, ..., *n*), *e* is the base of the natural logarithm, and λ is the parameter of the Poisson distribution. For oil spills, the Poisson parameter (λ) is equal to the spill rate multiplied by the volume of oil to be produced or transported. The spill rate has dimensions of number of spills/Bbbl, and the volume is expressed in Bbbl. Therefore, λ denotes the mean number of spills estimated to occur as a result of production or transportation of a specific volume of oil.

BOEM calculated oil spill occurrence estimates for spills ≥ 1,000 bbl for production and transportation of oil during the 40-year analysis period associated with the proposed action (2023–2062). These probabilities are based on the volume of oil estimated to be found, produced, and transported over the life of a typical lease sale and on the rates that have been calculated for oil spills from OCS platforms, pipelines, and tankers by ABS Consulting Inc (2016). Table A-2 provides the probabilities of one or more oil spills ≥ 1,000 bbl occurring as a result of OCS exploration, development, and production and transportation resulting from a typical lease sale or resulting from the cumulative OCS Program. Table A-2 also show the probabilities for spills ≥ 10,000 bbl.

3.2 Oil Spill Trajectory Simulations

OSRA estimates where an oil spill might begin (Section 3.2.1), where it is likely to move (Section 3.2.2 and 3.2.3), and the probability of an oil spill contacting a given surface area (Section 3.2.4). Section 3.2.5 lists factors that are not included in OSRA modeling and discusses how the exclusion of those factors affects the model's results.

3.2.1 Hypothetical Spill Locations and Timing

To model where a spill might go, the source and timing of its occurrence need to be specified. To provide a location from which a hypothetical spill begins, the OSRA model uses hypothetical spill locations called launch points. The OSRA model does not use the locations of platforms or wells to determine the launch points. Instead, using a more general approach, the OSRA model initiates hypothetical oil spills uniformly in space and time from within the domain (Figure B-1a).

At distance intervals of one-tenth of a degree (1/10°) of latitude (about 11 kilometers) and intervals of 1/10° of longitude (about 10 kilometers), we identified 6,045 launch points to cover the entire study area (Figure B-1a). The spatial resolution of the spill simulations (1/10° north–south and 1/10° east–west) was selected to reflect the spatial resolution of the input data. With such a high spatial resolution, these 6,045 launch points are sufficient for OSRA trajectory simulations.

The OSRA model estimates and tracks one spill per launch point per day for the 15 years of the available wind and current data. Trajectories of hypothetical spills were initiated every day (at a 1-day interval) from each of the launch points over the simulation period (January 1, 1993–December 31, 2007), which is the modeling period of the ocean currents by Princeton University (Oey 2008; Oey 2005).

The OSRA model integrates the spill velocities (a linear superposition of surface ocean currents and empirical wind drift) by integrating velocity in time to produce the spill trajectories. The time step selected was 1 hour to fully utilize the spatial resolution of the ocean current field and to achieve a stable set of trajectories. The velocity field was bi-linearly interpolated from the 3-hourly or 1-hourly grid to get velocities at 1-hour intervals. Time steps smaller than 1 hour were analyzed previously (Price et al. 2004) and did not produce significant differences in the simulated trajectories after 30 model days, so the 1-hour time step was chosen for this analysis.

The chosen number of trajectories was small enough to be computationally practical and large enough to reduce the random sampling error to an insignificant level (Price et al. 2004). Also, the weather-scale changes in the winds are at least minimally sampled with simulated spills started daily. The interval of time between releases (1 day) was sufficiently short to sample weather-scale changes in the input winds (Price et al. 2004). Sensitivity tests on the OSRA model (Price et al. 2004) indicated that, statistically, the above-mentioned spatial resolution (1/10° by 1/10°) and time resolution (1-day) are sufficient to represent the spatial and time variations of the oil spill trajectories in the area.

In summary, this analysis calculated one spill per day for each of the 6,045 launch points for 15 years (1993–2007). In total, we tracked over 33 million oil spill trajectories.

3.2.2 Ocean Current Data and Wind Simulations

This section describes two major inputs for the OSRA model: surface ocean currents and surface wind velocities. Ocean currents and winds move spilled oil across the ocean surface. Complex surface ocean currents exert a shear force on the spilled oil from below while prevailing winds exert additional shear forces on the spill from above. The combination of these two forces causes the movement of spilled oil away from its initial spill location.

OSRA Model: The OSRA model can estimate the potential paths of oil spills and track those movements before they happen. The model, which was originally developed by Smith et al. (1982) and enhanced by BOEM over the years (Ji et al. 2014; Ji et al. 2011; Ji et al. 2004; Ji et al. 2002; LaBelle and Anderson 1985), simulates oil spill transport using realistic data fields of winds and ocean currents. The model calculates the movement of hypothetical spills by successively integrating time sequences of two spatially gridded input fields: surface ocean currents and the sea-level winds. In this fashion, the OSRA model generates time sequences of hypothetical oil spill locations—essentially, oil spill trajectories.

Conducting OSRA requires detailed information on ocean currents and wind fields (Ji 2004). For this analysis, ocean currents inputs are numerically computed from a GOM ocean circulation model driven by meteorological forces (near-surface winds and total heat fluxes) and observed river inflow into the GOM (Oey 2008; Oey 2005).

Modified Princeton Ocean Model (POM): The model used to provide ocean current data for OSRA is a version of POM (Oey 2008; Oey 2005), an enhanced version of the Mellor-Blumberg model. POM is a three-dimensional, time-dependent, primitive-equation model using orthogonal curvilinear coordinates in the horizontal dimension and a topographically conformal coordinate in the vertical dimension. Thus, the model can represent realistic coastlines and bottom topography, including a sloping shelf. This analysis used the surface currents calculated from the modified POM.

The prognostic variables of the modified POM are velocity, temperature, salinity, turbulence kinetic energy, and turbulence macroscale. The momentum equations are nonlinear and incorporate a variable Coriolis parameter, which changes with latitude and accounts for the Earth's rotation. Prognostic equations governing the thermodynamic quantities (temperature and salinity) account for water mass variations brought about by highly time-dependent coastal upwelling processes. The processes responsible for eddy production, movement, and eventual dissipation also are included in the model physics. Other computed variables used in the modified POM include density, vertical eddy viscosity, and vertical eddy diffusivity. POM also uses the Mellor-Yamada turbulence closure model to incorporate into the calculations the vertical mixing process through the water column.

Princeton University performed the modified POM calculation (Oey 2008; Oey 2005). This simulation covered a 15-year period (1993–2007), and the results were saved at 3-hour intervals. The simulation period covers the data available for this study. These modified POM runs include the assimilation of sea surface altimeter observations to improve the ocean model results.

Modified POM simulations were extensively assessed using observations from the GOM (Oey 2008; Oey 2005). Extensive sets of observations and other current measurements from moored current meters rigorously verified the modified POM's ability to reproduce ocean transport, as well as prominent features of the Gulf such as the Loop Current and strong mesoscale eddies, which are easily observed from satellite-borne instrumentation. The modified POM reproduces the characteristics of the GOM surface currents both on and off the continental shelf. The surface current field manifests all the dominant structures in time and space of the observed currents.

Surface Wind Data: For surface wind data, the OSRA model incorporates concurrent wind fields, which are the 6-hourly surface wind speeds and directions, as analyzed by the European Center for Medium Range Weather Forecasting (Oey 2008; Oey 2005). The OSRA model used the same wind field to calculate the empirical wind drift of the simulated spills.

3.2.3 Trajectory Simulations

The OSRA model simulates hypothetical oil spill trajectories by numerically integrating a temporally and spatially varying ocean current field and then superimposing an empirical wind-induced drift (Samuels et al. 1982). Collectively, the trajectories represent a statistical ensemble of simulated oil spill displacements produced by a field of winds. The historical data on winds and currents in the GOM are assumed to be statistically similar to those that would occur in the Gulf during future offshore activities. In other words, this analysis assumes that the frequency of strong wind events in the wind field is the same as what would occur during future offshore activities. By inference, the frequencies of contact by the simulated oil spills are the same as what could occur from actual oil spills during future offshore activities.

This OSRA used a cluster analysis (Everitt 1993) to divide the planning areas into hypothetical spill subareas. Cluster analysis is a multivariate technique that groups entities based on similar characteristics. In the case of the CPA and WPA, BOEM used the probability of contact to shoreline segments to identify offshore areas that showed similar risk, based on similarity in patterns of trajectories. The EPA has a small portion that is not subject to Presidential withdrawal (Figure B-1b), which is incorporated into the CPA cluster. Each cluster has the projected oil production volumes for a single lease sale and for the cumulative OCS Program.

To account for the risk of spills occurring from the transportation of oil to shore via pipeline, we identified generalized pipeline corridors originating within the offshore cluster area(s) (Figure B-1c) and terminating at existing major oil pipeline shore bases. These pipeline corridors represent the complex matrix of pipeline systems existing offshore that are likely to be used in support of each proposed action. The oil volume estimated to be produced within the cluster area was proportioned among likely pipeline corridor routes to represent the transportation of the oil from within the cluster area and to State/Federal boundaries near known pipeline shore bases.

3.2.4 Spill-Resource Contact Probabilities

To identify the locations of potential environmental resources that could be contacted by an oil spill, the model uses the geographical boundaries of a variety of identified environmental features. At each successive time step, we compared the location of the hypothetical spills against the geographic boundaries of shoreline and designated offshore environmental resources. The OSRA model then counts the number of "contacts," which is consists of the number of oil spill contacts to segments of shoreline (counties/parishes) plus the occurrences of oil spill contact to offshore environmental resources during the time periods that the habitat is known to be used by the resource. As soon as a simulated oil spill trajectory contacts the land, the trajectory simulation stops. Re-washing is not considered in this model. A contact to an offshore resource that is not a shoreline (such as a wildlife refuge area in the middle of the ocean) does not stop the trajectory calculation.

After specified periods of time, the OSRA model will divide the total number of contacts by the total number of simulated oil spills from a given geographic location. The number of simulated spills for this OSRA is one hypothetical spill per day multiplied by 15 years multiplied by 360 days. The ratios between the total number of contacts and total simulated spills are the estimated probabilities of oil spill contact from offshore activities at that geographic location, **assuming spill occurrence**.

Finally, the frequencies of oil spill contact are computed for designated oil spill travel times (e.g., 3, 10, or 30 days). This is calculated by dividing the total number of oil spill contacts by the total number of hypothetical spills initiated in the model from a given hypothetical spill location. The frequencies of oil spill contact are the model-estimated probabilities of oil spill contact. The OSRA model output provides the estimated probabilities of contact to all identified offshore environmental resources and segments of shoreline from locations chosen to represent hypothetical oil spills from oil production and transportation facilities. The OSRA model combines the statistics of the trajectories contacting the shoreline contacts to calculate the average probabilities of shoreline contact.

3.2.5 Factors Not Considered

There are factors not explicitly considered by the OSRA model that can affect the transport of spilled oil and the contacting of environmental resources. These include possible cleanup operations and other oil spill response activities, chemical composition of the spilled oil, weathering of the spilled oil, and spreading and splitting of oil spills. For this analysis, BOEM takes a conservative approach by presuming that no oil spill response activities occur and by assuming complete persistence of spilled oil over the selected time duration of the trajectories. **Furthermore, if a trajectory passes over a resource, even if the resource would be below the surface, OSRA still considers a contact to have been made.** These assumptions make the OSRA model's calculated probabilities conservative. Finally, the potential impacts of climate change on current and wind are beyond the scope of this report and are not discussed here.

3.3 Conditional Probabilities of Contact

Assuming a spill occurs, the probability that an oil spill will contact a specific resource within a given time of travel from a certain location or spill point is termed a "conditional probability." Each trajectory was allowed to continue for as long as 30 days. However, if the hypothetical spill contacted shoreline sooner than 30 days after the start of the spill, the spill trajectory was terminated, and the contact was recorded.

The trajectories simulated by the model represent only hypothetical pathways of oil slicks; they do not involve any direct consideration of cleanup, dispersion, or weathering processes that could alter the quantity or properties of oil that might eventually contact the resource locations. BOEM performed an analysis of the likely weathering of a typical offshore oil spill ≥ 1,000 bbl occurring under the proposed action scenarios (Price et al. 2004). The analysis of the slick's fate showed that a typical GOM oil slick

≥ 1,000 bbl, when exposed to typical winds and currents, would not persist on the water surface beyond 30 days. Therefore, OSRA model trajectories were analyzed only up to 30 days. Spill contacts occurring on or before the 30-day period are reported in the probability tables. For input into the final risk calculations, this analysis calculated conditional probabilities of contact with resource locations and land segments within 10, 20 and 30 days of travel time for each of the hypothetical spill sites by the model.

3.4 Combined Probabilities of Contact

A critical difference exists between the calculated conditional probabilities and combined probabilities. *Conditional probabilities* depend only on the winds and currents in the study area. *Combined probabilities,* on the other hand, depend not only on the winds and currents, but also on the chance of spill occurrence, estimated volume of oil to be produced or transported, and oil transportation scenario. The combined probabilities for this analysis of the proposed action are presented in Tables A-3 through A-8.

In calculating the combined probabilities of both oil spill contact and oil spill occurrence, the following steps are performed:

1. To address the probability of spill contact for a set of n_t environmental resources and n_l launch points, conditional probabilities can be represented in matrix form. Let [C] be an $n_t \times n_l$ matrix, where each element $c_{i,j}$ is the probability that an oil spill will contact resource *i*, given that a spill occurs at launch point *j*. Note that launch points can represent potential starting points of spills from production areas or from transportation routes.
2. Oil spill occurrence can be represented by another matrix [S]. With n_l launch points and n_s production sites, the dimensions of [S] are $n_l \times n_s$. Each element $s_{j,k}$ is the estimated mean number of spills occurring at launch point *j* owing to production of a unit volume (1 Bbbl) of oil at site *k*. These spills can result from either production or transportation. The $s_{j,k}$ can be determined as a function of the volume of oil (spills/Bbbl). Each column of [S] corresponds to one production site and one transportation route. If alternative and mutually exclusive transportation routes are considered for the same production site, they can be represented by additional columns of [S], thus increasing n_s.
3. The unit risk matrix [U] is defined as:

   $$[U] = [C] \times [S]$$

   [U] has dimensions $n_t \times n_s$. Each element $u_{i,k}$ corresponds to the estimated mean number of spills occurring and contacting resource *i*, owing to the production of a unit volume (1 Bbbl) of oil at site *k*.

4. To convert this number into a number that reflects the expected oil production volume, a value for volume must be included. With [U], the mean contacts to each resource are estimated, given a set of oil volumes at each site. Let [V] be a vector of dimension n_s where each element v_k corresponds to the volume of oil expected to be found at production site *k*. Then, if [L] is a vector of dimension n_t, where each element λ_i corresponds to the mean number of contacts to resource *i*, the formula is:

   $$[L] = [U] \times [V]$$

   Thus, estimates of the mean number of oil spills that are likely to occur and contact environmental resources (or land segments) can be calculated. (Note that, as a statistical parameter, the mean number can assume a fractional value, even though fractions of oil spills have no physical meaning.)

4 Discussion

Tables A-3 through A-8 give the combined probabilities. The results fit expectations, and resource locations closest to the spill sites have the greatest risk of contact. As the model run duration increases, more of the identified environmental resources and shoreline segments could have meaningful probabilities of contact (≥ 0.5%). The longer transit times (up to 30 days) enable more hypothetical spills to reach the environmental resources and shoreline from distant spill locations. With increased travel time, the complex patterns of wind and ocean currents produce eddy-like motions of the oil spills and multiple opportunities for a spill to contact any given resource or shoreline segment.

For instance, Table A-3 provides the probabilities (expressed as percent chance) of one or more offshore spills ≥ 1,000 bbl, and the number of spills (mean) that could occur and could contact a certain offshore resource within 10 days and 30 days, given the estimated volume of oil produced from a proposed action for the WPA and CPA (Table A-1). Table A-3 shows that Texas State waters (Figure B-2) has a 4% probability of being contacted by spilled oil within 10 days, if there is an oil spill from a proposed action (with the proposed action having an estimated oil production volume of 0.7449 Bbbl (Table A-1), which is the high estimate for a "region-wide" sale). The probability of being contacted by the spilled oil increases to 11% within 30 days. Probabilities less than 0.5% are all set to n.

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Appendix A. OSRA Tables

Table A-1. Oil spill occurrence probability estimates for offshore spills ≥ 1,000 bbl resulting from the single lease sale and the cumulative OCS Program

Area and High or Low Resource Estimate >	Region-wide Low	Region-wide High	CPA/EPA Low	CPA/EPA High	WPA Low	WPA High
Single Lease Sale	-	-	-	-	-	-
Forecasted Oil Production (Bbbl)	0.0559	0.7449	0.0526	0.7005	0.0033	0.0444
Mean Number of Spills Estimated to Occur						
Platforms	0.01	0.19	0.01	0.18	0.00	0.01
Pipelines	0.02	0.28	0.02	0.27	0.00	0.02
Tankers	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.04	0.47	0.03	0.44	0.00	0.03
Estimates of Probability (% chance) of One or More Spills						
Platforms	1	17	1	15	0	1
Pipelines	2	25	2	23	0	2
Tankers	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total	3	37	3	36	0	3
Cumulative OCS Program	-	-	-	-	-	-
Forecasted Oil Production (Bbbl)	0.5590	7.6158	0.5257	7.1621	0.0333	0.4537
Mean Number of Spills Estimated to Occur						
Platforms	0.14	1.90	0.13	1.79	0.01	0.11
Pipelines	0.21	2.89	0.20	2.72	0.01	0.17
Tankers	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.35	4.80	0.33	4.51	0.02	0.29
Estimates of Probability (% chance) of One or More Spills						
Platforms	13	85	12	83	1	11
Pipelines	19	94	18	93	1	16
Tankers	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total	30	99	28	99	2	25

Notes: "Platforms" refers to facilities used in exploration, development, or production.
[1]Low = low resource estimate; High = high resource estimate

Table A-2. Oil spill occurrence probability estimates for offshore spills ≥ 10,000 bbl resulting from the single lease sale and the cumulative OCS Program

Area and High or Low Resource Estimate >	Region-wide Low	Region-wide High	CPA/EPA Low	CPA/EPA High	WPA Low	WPA High
Single Lease Sale	-	-	-	-	-	-
Forecasted Oil Production (Bbbl)	0.0559	0.7449	0.0526	0.7005	0.0033	0.0444
Mean Number of Spills Estimated to Occur						
Platforms	0.01	0.10	0.01	0.09	0.00	0.01
Pipelines	0.00	0.05	0.00	0.05	0.00	0.00
Tankers	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.01	0.15	0.01	0.14	0.00	0.01
Estimates of Probability (% chance) of One or More Spills						
Platforms	1	9	1	9	<0.5	1
Pipelines	<0.5	5	<0.5	5	<0.5	<0.5
Tankers	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total	1	14	1	13	<0.5	1
Cumulative OCS Program	-	-	-	-	-	-
Forecasted Oil Production (Bbbl)	0.5590	7.6158	0.5257	7.1621	0.0333	0.4537
Mean Number of Spills Estimated to Occur						
Platforms	0.07	0.99	0.07	0.93	0.00	0.06
Pipelines	0.04	0.53	0.04	0.50	0.00	0.03
Tankers	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.11	1.52	0.11	1.43	0.01	0.09
Estimates of Probability (% chance) of One or More Spills						
Platforms	7	63	7	61	<0.5	6
Pipelines	4	41	4	39	<0.5	3
Tankers	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total	11	78	10	76	1	9

Notes: "Platforms" refers to facilities used in exploration, development, or production.
[1]Low = low resource estimate; High = high resource estimate

Table A-3. Probabilities (expressed as percent chance) of one or more offshore spills ≥1,000 bbl occurring and contacting certain offshore resource locations within 10 and 30 days for low and high oil production estimates for the single lease sale in the Western and Central Planning Areas

Notes: Low = Low Estimates, High = High Estimates, Prob = Probability; * = seasonal (April-November); ** = Greater than 99.5%; n = less than 0.5%

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
1	Cayman Islands	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
2	Northwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
3	Northeast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
4	Midwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
5	Mideast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
6	South Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
7	Jamaica	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
8	TX State Waters	B-2	n	1	0.00	0.01	4	11	0.04	0.12
9	West LA State Waters	B-2	1	1	0.01	0.01	10	14	0.10	0.15
10	East LA State Waters	B-2	n	n	0.00	0.00	2	3	0.02	0.03
11	MS State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
12	AL State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
13	FL Panhandle State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
14	West FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
15	Tortugas State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
16	Southeast FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
17	Northeast State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
18	Mexican State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
31	Shoreline - 20 m (1)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
32	Shoreline - 20 m (2)	B-6	n	n	0.00	0.00	n	3	0.00	0.03
33	Shoreline - 20 m (3)	B-6	n	1	0.00	0.01	5	11	0.05	0.11
34	Shoreline - 20 m (4)	B-6	1	1	0.01	0.01	9	12	0.10	0.13
35	Shoreline - 20 m (5)	B-6	1	1	0.01	0.01	12	13	0.12	0.14
36	Shoreline - 20 m (6)	B-6	n	n	0.00	0.00	2	3	0.02	0.03
37	Shoreline - 20 m (7)	B-6	n	n	0.00	0.00	2	2	0.02	0.02
38	Shoreline - 20 m (8)	B-6	n	n	0.00	0.00	1	1	0.01	0.01
39	Shoreline - 20 m (9)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
40	Shoreline - 20 m (10)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
41	Shoreline - 20 m (11)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
42	Shoreline - 20 m (12)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
43	Shoreline - 20 m (13)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
44	Shoreline - 20 m (14)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
45	Shoreline - 20 m (15)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
46	20 m - 300 m (1)	B-6	n	n	0.00	0.00	1	4	0.01	0.04
47	20 m - 300 m (2)	B-6	1	1	0.01	0.01	8	14	0.08	0.15
48	20 m - 300 m (3)	B-6	1	2	0.01	0.02	17	20	0.19	0.22
49	20 m - 300 m (4)	B-6	1	1	0.01	0.01	15	17	0.17	0.18
50	20 m - 300 m (5)	B-6	n	n	0.00	0.00	2	3	0.02	0.03
51	20 m - 300 m (6)	B-6	n	n	0.00	0.00	3	4	0.03	0.04
52	20 m - 300 m (7)	B-6	n	n	0.00	0.00	2	3	0.03	0.03
53	20 m - 300 m (8)	B-6	n	n	0.00	0.00	1	1	0.01	0.01
54	20 m - 300 m (9)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
55	20 m - 300 m (10)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
56	20 m - 300 m (11)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
57	20 m - 300 m (12)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
58	20 m - 300 m (13)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
59	20 m - 300 m (14)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
60	300 m - outer jurisdiction (1)	B-6	n	n	0.00	0.00	1	4	0.01	0.04
61	300 m - outer jurisdiction (2)	B-6	n	n	0.00	0.00	1	4	0.01	0.04

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
62	300 m - outer jurisdiction (3)	B-6	n	1	0.00	0.01	3	7	0.03	0.07
63	300 m - outer jurisdiction (4)	B-6	n	n	0.00	0.00	2	6	0.02	0.06
64	300 m - outer jurisdiction (5)	B-6	n	n	0.00	0.00	1	3	0.01	0.03
65	300 m - outer jurisdiction (6)	B-6	n	1	0.00	0.01	6	9	0.06	0.10
66	300 m - outer jurisdiction (7)	B-6	n	1	0.00	0.01	4	7	0.04	0.07
67	300 m - outer jurisdiction (8)	B-6	n	n	0.00	0.00	2	5	0.02	0.05
68	300 m - outer jurisdiction (9)	B-6	1	1	0.01	0.01	8	10	0.09	0.11
69	300 m - outer jurisdiction (10)	B-6	1	1	0.01	0.01	7	9	0.08	0.10
70	300 m - outer jurisdiction (11)	B-6	n	n	0.00	0.00	3	5	0.03	0.06
71	300 m - outer jurisdiction (12)	B-6	1	1	0.01	0.01	9	10	0.09	0.11
72	300 m - outer jurisdiction (13)	B-6	1	1	0.01	0.01	8	9	0.08	0.09
73	300 m - outer jurisdiction (14)	B-6	n	n	0.00	0.00	4	5	0.04	0.05
74	300 m - outer jurisdiction (15)	B-6	n	n	0.00	0.00	4	5	0.04	0.05
75	300 m - outer jurisdiction (16)	B-6	n	n	0.00	0.00	5	6	0.05	0.06
76	300 m - outer jurisdiction (17)	B-6	n	n	0.00	0.00	3	5	0.03	0.05
77	300 m - outer jurisdiction (18)	B-6	n	n	0.00	0.00	2	3	0.02	0.03
78	300 m - outer jurisdiction (19)	B-6	n	n	0.00	0.00	1	2	0.01	0.02
79	300 m - outer jurisdiction (20)	B-6	n	n	0.00	0.00	1	2	0.01	0.02
80	300 m - outer jurisdiction (21)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
81	300 m - outer jurisdiction (22)	B-6	n	n	0.00	0.00	1	2	0.01	0.02
82	300 m - outer jurisdiction (23)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
83	300 m - outer jurisdiction (24)	B-6	n	n	0.00	0.00	1	2	0.01	0.02
84	300 m - outer jurisdiction (25)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
85	300 m - outer jurisdiction (26)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
86	300 m - outer jurisdiction (27)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
87	300 m - outer jurisdiction (28)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
88	300 m - outer jurisdiction (28)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
89	300 m - outer jurisdiction (30)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
100	Mysterious Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
101	Blackfish Ridge Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
102	Dream Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
103	Southern Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
104	Hospital Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
105	North Hospital Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
106	Aransas Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
107	South Baker Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
108	Baker Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
109	Big Dunn Bar Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
110	Small Dunn Bar Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
111	32 Fathom	B-7	n	n	0.00	0.00	n	n	0.00	0.00
112	Stetson Bank	B-8	n	n	0.00	0.00	n	n	0.00	0.00
113	Claypile Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
114	Applebaum Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
115	Coffee Lump Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
116	East Flower Garden Bank	B-8	n	n	0.00	0.00	n	1	0.00	0.01
117	West Flower Garden Bank	B-8	n	n	0.00	0.00	n	1	0.00	0.01
118	MacNeil Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
119	29 Fathom Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
120	Rankin-1 Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
121	Rankin-2 Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
122	Bright Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
123	Geyer Bank	B-7	n	n	0.00	0.00	1	1	0.01	0.01
124	Elvers Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
125	McGrail Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
126	Sonnier Bank	B-8	n	n	0.00	0.00	n	1	0.00	0.01

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
127	Bouma Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
128	Rezak Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
129	Sidner Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
130	Parker Bank	B-7	n	n	0.00	0.00	1	1	0.01	0.01
131	Alderdice Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
132	Fishnet Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
133	Sweet Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
134	Jakkula Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
135	Ewing-1 Bank	B-7	n	n	0.00	0.00	1	1	0.01	0.01
136	Ewing-2 Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
137	Diaphus Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
138	Sackett Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
139	Pinnacle Trend	B-8	n	n	0.00	0.00	2	3	0.02	0.03
140	Chandeleur Islands	B-8	n	n	0.00	0.00	1	2	0.01	0.02
141	Florida Middle Ground	B-8	n	n	0.00	0.00	n	n	0.00	0.00
142	Pulley Ridge	B-8	n	n	0.00	0.00	n	n	0.00	0.00
143	Madison Swanson	B-8	n	n	0.00	0.00	n	n	0.00	0.00
144	Steamboat Lumps	B-8	n	n	0.00	0.00	n	n	0.00	0.00
145	Dry Tortugas	B-8	n	n	0.00	0.00	n	n	0.00	0.00
146	Tortugas Ecological Reserve North	B-8	n	n	0.00	0.00	n	n	0.00	0.00
147	Tortugas Ecological Reserve South	B-8	n	n	0.00	0.00	n	n	0.00	0.00
148	Florida Keys National Marine Sanctuary	B-8	n	n	0.00	0.00	n	n	0.00	0.00
150	Key Biscayne National Park	B-8	n	n	0.00	0.00	n	n	0.00	0.00
151	Texas Clipper and South Texas Platform*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
152	Port Lavaca/Liberty Ship Reef*	B-9	n	n	0.00	0.00	1	4	0.01	0.04
153	High Island*	B-9	n	n	0.00	0.00	2	3	0.02	0.03
154	West Cameron*	B-9	n	n	0.00	0.00	3	5	0.03	0.05
155	Galveston Area (GA 393)*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
156	Cognac Platform (MC 194)*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
157	Horseshoe Rigs (MP 306)*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
158	Vermilion Area*	B-9	n	1	0.00	0.01	5	7	0.05	0.07
159	Vermilion Area, South Addition*	B-9	n	n	0.00	0.00	4	5	0.04	0.05
160	Bay Marchand*	B-9	n	n	0.00	0.00	n	1	0.00	0.01
161	South Timbalier*	B-9	n	n	0.00	0.00	5	6	0.05	0.06
162	South Timbalier Area, South Addition*	B-9	n	n	0.00	0.00	4	4	0.04	0.04
163	Panhandle FL*	B-10	n	n	0.00	0.00	n	1	0.00	0.01
164	Tampa*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
165	SE FL*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
166	Daytona Beach*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
167	Jacksonville*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
185	Edges	B-11	n	n	0.00	0.00	n	n	0.00	0.00
186	West Florida Wall	B-11	n	n	0.00	0.00	n	n	0.00	0.00
187	Flower Garden National Marine Sanctuary	B-11	n	1	0.00	0.01	4	7	0.04	0.08
188	Topographic Features without FGNMS	B-11	n	n	0.00	0.00	3	5	0.03	0.05

Table A-4. Probabilities (expressed as percent chance) of one or more offshore spills ≥ 1,000 bbl occurring and contacting certain onshore environmental resources within 10 and 30 days for low and high oil production estimates for the single lease sale in the Western and Central Planning Areas

Notes: Low = Low Estimates, High = High Estimates, Prob = Probability; ** = Greater than 99.5%; n = less than 0.5%

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
1	Cameron, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
2	Willacy, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
3	Kenedy, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
4	Kleberg, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
5	Nueces, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
6	Aransas, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
7	Calhoun, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
8	Matagorda, TX	B-4	n	n	0.00	0.00	1	2	0.01	0.02
9	Brazoria, TX	B-3	n	n	0.00	0.00	1	2	0.01	0.02
10	Galveston, TX	B-4	n	n	0.00	0.00	1	3	0.01	0.03
11	Chambers, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
12	Jefferson, TX	B-4	n	n	0.00	0.00	1	1	0.01	0.01
13	Cameron, LA	B-3	n	n	0.00	0.00	1	3	0.01	0.03
14	Vermilion, LA	B-4	n	n	0.00	0.00	1	2	0.01	0.02
15	Iberia, LA	B-3	n	n	0.00	0.00	1	1	0.01	0.01
16	St. Mary, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
17	Terrebonne, LA	B-3	n	n	0.00	0.00	3	4	0.03	0.04
18	Lafourche, LA	B-4	n	n	0.00	0.00	1	1	0.01	0.01
19	Jefferson, LA	B-3	n	n	0.00	0.00	1	1	0.01	0.01
20	Plaquemines, LA	B-4	n	n	0.00	0.00	2	3	0.02	0.03
21	St. Bernard, LA	B-3	n	n	0.00	0.00	n	1	0.00	0.01
22	Hancock, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
23	Harrison, MS	B-3	n	n	0.00	0.00	n	n	0.00	0.00
24	Jackson, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
25	Mobile, ALA	B-3	n	n	0.00	0.00	n	n	0.00	0.00
26	Baldwin, ALA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
27	Escambia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
28	Santa Rosa, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
29	Okaloosa, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
30	Walton, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
31	Bay, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
32	Gulf, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
33	Franklin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
34	Wakulla, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
35	Jefferson, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
36	Taylor, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
37	Dixie, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
38	Levy, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
39	Citrus, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
40	Hernando, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
41	Pasco, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
42	Pinellas, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
43	Hillsborough, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
44	Manatee, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
45	Sarasota, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
46	Charlotte, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
47	Lee, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
48	Collier, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
49	Monroe, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
50	Dade, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
51	Broward, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
52	Palm Beach, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
53	Martin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
54	St. Lucie, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
55	Indian River, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
56	Brevard, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
57	Volusia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
58	Flagler, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
59	St. Johns, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
60	Duval, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
61	Nassau, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
62	TX	B-1a	n	1	0.00	0.01	3	10	0.03	0.11
63	LA	B-1a	1	1	0.01	0.01	9	14	0.10	0.15
64	MS	B-1a	n	n	0.00	0.00	n	1	0.00	0.01
65	AL	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
66	FL	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
67	Tamaulipas, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
68	Veracruz-Llave, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
69	Tabasco, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
70	Campeche, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
71	Yucatan, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
72	Quintana Roo, Mexcio	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
73	Belize (country)	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
74	Cuba	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
101	TX Coastal Bend Beach Area	B-5	n	n	0.00	0.00	n	2	0.00	0.02
102	TX Matagorda Beach Area	B-5	n	n	0.00	0.00	1	3	0.01	0.03
103	TX Galveston Beach Area	B-5	n	n	0.00	0.00	2	5	0.02	0.05
104	TX Sea Rim State Park	B-5	n	n	0.00	0.00	1	1	0.01	0.01
105	LA Beach Areas	B-5	n	n	0.00	0.00	3	5	0.03	0.05
106	AL/MS Gulf Islands	B-5	n	n	0.00	0.00	n	1	0.00	0.01
107	AL Gulf Shores	B-5	n	n	0.00	0.00	n	n	0.00	0.00
108	FL Panhandle Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
109	FL Big Bend Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
110	FL Southwest Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
111	FL Ten Thousand Islands Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
112	FL Southeast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
113	FL Centraleast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
114	FL Northeast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00

Table A-5. Probabilities (expressed as percent chance) of one or more offshore spills ≥ 1,000 bbl occurring and contacting certain offshore environmental resources within 10 and 30 days for low and high oil production estimates for the single lease sale in the Western Planning Area

Notes: Low = Low Estimates, High = High Estimates, Prob = Probability; * = seasonal (April-November); ** = Greater than 99.5%; n = less than 0.5%

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
1	Cayman Islands	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
2	Northwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
3	Northeast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
4	Midwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
5	Mideast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
6	South Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
7	Jamaica	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
8	TX State Waters	B-2	n	n	0.00	0.00	1	2	0.01	0.02
9	West LA State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
10	East LA State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
11	MS State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
12	AL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
13	FL Panhandle State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
14	West FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
15	Tortugas State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
16	Southeast FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
17	Northeast State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
18	Mexican State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
31	Shoreline - 20 m (1)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
32	Shoreline - 20 m (2)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
33	Shoreline - 20 m (3)	B-6	n	n	0.00	0.00	2	2	0.02	0.02
34	Shoreline - 20 m (4)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
35	Shoreline - 20 m (5)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
36	Shoreline - 20 m (6)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
37	Shoreline - 20 m (7)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
38	Shoreline - 20 m (8)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
39	Shoreline - 20 m (9)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
40	Shoreline - 20 m (10)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
41	Shoreline - 20 m (11)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
42	Shoreline - 20 m (12)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
43	Shoreline - 20 m (13)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
44	Shoreline - 20 m (14)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
45	Shoreline - 20 m (15)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
46	20 m - 300 m (1)	B-6	n	n	0.00	0.00	n	1	0.01	0.01
47	20 m - 300 m (2)	B-6	n	n	0.00	0.00	2	2	0.02	0.02
48	20 m - 300 m (3)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
49	20 m - 300 m (4)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
50	20 m - 300 m (5)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
51	20 m - 300 m (6)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
52	20 m - 300 m (7)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
53	20 m - 300 m (8)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
54	20 m - 300 m (9)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
55	20 m - 300 m (10)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
56	20 m - 300 m (11)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
57	20 m - 300 m (12)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
58	20 m - 300 m (13)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
59	20 m - 300 m (14)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
60	300 m - outer jurisdiction (1)	B-6	n	n	0.00	0.00	1	1	0.01	0.01
61	300 m - outer jurisdiction (2)	B-6	n	n	0.00	0.00	n	1	0.00	0.01

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
62	300 m - outer jurisdiction (3)	B-6	n	n	0.00	0.00	1	1	0.01	0.01
63	300 m - outer jurisdiction (4)	B-6	n	n	0.00	0.00	1	1	0.01	0.01
64	300 m - outer jurisdiction (5)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
65	300 m - outer jurisdiction (6)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
66	300 m - outer jurisdiction (7)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
67	300 m - outer jurisdiction (8)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
68	300 m - outer jurisdiction (9)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
69	300 m - outer jurisdiction (10)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
70	300 m - outer jurisdiction (11)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
71	300 m - outer jurisdiction (12)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
72	300 m - outer jurisdiction (13)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
73	300 m - outer jurisdiction (14)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
74	300 m - outer jurisdiction (15)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
75	300 m - outer jurisdiction (16)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
76	300 m - outer jurisdiction (17)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
77	300 m - outer jurisdiction (18)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
78	300 m - outer jurisdiction (19)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
79	300 m - outer jurisdiction (20)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
80	300 m - outer jurisdiction (21)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
81	300 m - outer jurisdiction (22)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
82	300 m - outer jurisdiction (23)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
83	300 m - outer jurisdiction (24)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
84	300 m - outer jurisdiction (25)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
85	300 m - outer jurisdiction (26)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
86	300 m - outer jurisdiction (27)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
87	300 m - outer jurisdiction (28)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
88	300 m - outer jurisdiction (28)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
89	300 m - outer jurisdiction (30)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
100	Mysterious Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
101	Blackfish Ridge Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
102	Dream Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
103	Southern Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
104	Hospital Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
105	North Hospital Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
106	Aransas Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
107	South Baker Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
108	Baker Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
109	Big Dunn Bar Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
110	Small Dunn Bar Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
111	32 Fathom	B-7	n	n	0.00	0.00	n	n	0.00	0.00
112	Stetson Bank	B-8	n	n	0.00	0.00	n	n	0.00	0.00
113	Claypile Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
114	Applebaum Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
115	Coffee Lump Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
116	East Flower Garden Bank	B-8	n	n	0.00	0.00	n	n	0.00	0.00
117	West Flower Garden Bank	B-8	n	n	0.00	0.00	n	n	0.00	0.00
118	MacNeil Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
119	29 Fathom Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
120	Rankin-1 Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
121	Rankin-2 Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
122	Bright Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
123	Geyer Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
124	Elvers Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
125	McGrail Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
126	Sonnier Bank	B-8	n	n	0.00	0.00	n	n	0.00	0.00

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
127	Bouma Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
128	Rezak Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
129	Sidner Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
130	Parker Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
131	Alderdice Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
132	Fishnet Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
133	Sweet Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
134	Jakkula Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
135	Ewing-1 Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
136	Ewing-2 Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
137	Diaphus Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
138	Sackett Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
139	Pinnacle Trend	B-8	n	n	0.00	0.00	n	n	0.00	0.00
140	Chandeleur Islands	B-8	n	n	0.00	0.00	n	n	0.00	0.00
141	Florida Middle Ground	B-8	n	n	0.00	0.00	n	n	0.00	0.00
142	Pulley Ridge	B-8	n	n	0.00	0.00	n	n	0.00	0.00
143	Madison Swanson	B-8	n	n	0.00	0.00	n	n	0.00	0.00
144	Steamboat Lumps	B-8	n	n	0.00	0.00	n	n	0.00	0.00
145	Dry Tortugas	B-8	n	n	0.00	0.00	n	n	0.00	0.00
146	Tortugas Ecological Reserve North	B-8	n	n	0.00	0.00	n	n	0.00	0.00
147	Tortugas Ecological Reserve South	B-8	n	n	0.00	0.00	n	n	0.00	0.00
148	Florida Keys National Marine Sanctuary	B-8	n	n	0.00	0.00	n	n	0.00	0.00
150	Key Biscayne National Park	B-8	n	n	0.00	0.00	n	n	0.00	0.00
151	Texas Clipper and South Texas Platform*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
152	Port Lavaca/Liberty Ship Reef*	B-9	n	n	0.00	0.00	n	1	0.00	0.01
153	High Island*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
154	West Cameron*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
155	Galveston Area (GA 393)*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
156	Cognac Platform (MC 194)*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
157	Horseshoe Rigs (MP 306)*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
158	Vermilion Area*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
159	Vermilion Area, South Addition*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
160	Bay Marchand*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
161	South Timbalier*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
162	South Timbalier Area, South Addition*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
163	Panhandle FL*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
164	Tampa*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
165	SE FL*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
166	Daytona Beach*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
167	Jacksonville*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
185	Edges	B-11	n	n	0.00	0.00	n	n	0.00	0.00
186	West Florida Wall	B-11	n	n	0.00	0.00	n	n	0.00	0.00
187	Flower Garden National Marine Sanctuary	B-11	n	n	0.00	0.00	n	n	0.00	0.00
188	Topographic Features without FGNMS	B-11	n	n	0.00	0.00	n	n	0.00	0.00

Table A-6. Probabilities (expressed as percent chance) of one or more offshore spills ≥ 1,000 bbl occurring and contacting certain onshore environmental resources within 10 and 30 days for low and high oil production estimates for the single lease sale in the Western Planning Area

Notes: Low = Low Estimates, High = High Estimates, Prob = Probability; ** = Greater than 99.5%; n = less than 0.5%

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
1	Cameron, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
2	Willacy, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
3	Kenedy, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
4	Kleberg, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
5	Nueces, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
6	Aransas, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
7	Calhoun, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
8	Matagorda, TX	B-4	n	n	0.00	0.00	n	1	0.00	0.01
9	Brazoria, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
10	Galveston, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
11	Chambers, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
12	Jefferson, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
13	Cameron, LA	B-3	n	n	0.00	0.00	n	n	0.00	0.00
14	Vermilion, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
15	Iberia, LA	B-3	n	n	0.00	0.00	n	n	0.00	0.00
16	St. Mary, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
17	Terrebonne, LA	B-3	n	n	0.00	0.00	n	n	0.00	0.00
18	Lafourche, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
19	Jefferson, LA	B-3	n	n	0.00	0.00	n	n	0.00	0.00
20	Plaquemines, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
21	St. Bernard, LA	B-3	n	n	0.00	0.00	n	n	0.00	0.00
22	Hancock, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
23	Harrison, MS	B-3	n	n	0.00	0.00	n	n	0.00	0.00
24	Jackson, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
25	Mobile, ALA	B-3	n	n	0.00	0.00	n	n	0.00	0.00
26	Baldwin, ALA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
27	Escambia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
28	Santa Rosa, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
29	Okaloosa, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
30	Walton, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
31	Bay, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
32	Gulf, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
33	Franklin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
34	Wakulla, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
35	Jefferson, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
36	Taylor, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
37	Dixie, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
38	Levy, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
39	Citrus, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
40	Hernando, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
41	Pasco, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
42	Pinellas, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
43	Hillsborough, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
44	Manatee, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
45	Sarasota, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
46	Charlotte, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
47	Lee, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
48	Collier, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
49	Monroe, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
50	Dade, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
51	Broward, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
52	Palm Beach, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
53	Martin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
54	St. Lucie, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
55	Indian River, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
56	Brevard, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
57	Volusia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
58	Flagler, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
59	St. Johns, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
60	Duval, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
61	Nassau, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
62	TX	B-1a	n	n	0.00	0.00	1	2	0.01	0.02
63	LA	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
64	MS	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
65	AL	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
66	FL	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
67	Tamaulipas, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
68	Veracruz-Llave, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
69	Tabasco, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
70	Campeche, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
71	Yucatan, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
72	Quintana Roo, Mexcio	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
73	Belize (country)	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
74	Cuba	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
101	TX Coastal Bend Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
102	TX Matagorda Beach Area	B-5	n	n	0.00	0.00	n	1	0.00	0.01
103	TX Galveston Beach Area	B-5	n	n	0.00	0.00	1	1	0.01	0.01
104	TX Sea Rim State Park	B-5	n	n	0.00	0.00	n	n	0.00	0.00
105	LA Beach Areas	B-5	n	n	0.00	0.00	n	n	0.00	0.00
106	AL/MS Gulf Islands	B-5	n	n	0.00	0.00	n	n	0.00	0.00
107	AL Gulf Shores	B-5	n	n	0.00	0.00	n	n	0.00	0.00
108	FL Panhandle Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
109	FL Big Bend Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
110	FL Southwest Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
111	FL Ten Thousand Islands Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
112	FL Southeast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
113	FL Centraleast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
114	FL Northeast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00

Table A-7. Probabilities (expressed as percent chance) of one or more offshore spills ≥ 1,000 bbl occurring and contacting certain offshore resource locations within 10 and 30 days for low and high oil production estimates for the single lease sale in the Central Planning Area

Notes: Low = Low Estimates, High = High Estimates, Prob = Probability; * = seasonal (April-November); ** = Greater than 99.5%; n = less than 0.5%

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
1	Cayman Islands	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
2	Northwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
3	Northeast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
4	Midwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
5	Mideast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
6	South Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
7	Jamaica	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
8	TX State Waters	B-2	n	1	0.00	0.01	2	9	0.02	0.10
9	West LA State Waters	B-2	1	1	0.01	0.01	10	14	0.10	0.15
10	East LA State Waters	B-2	n	n	0.00	0.00	2	3	0.02	0.03
11	MS State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
12	AL State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
13	FL Panhandle State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
14	West FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
15	Tortugas State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
16	Southeast FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
17	Northeast State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
18	Mexican State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
31	Shoreline - 20 m (1)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
32	Shoreline - 20 m (2)	B-6	n	n	0.00	0.00	n	2	0.00	0.03
33	Shoreline - 20 m (3)	B-6	n	1	0.00	0.01	4	9	0.04	0.09
34	Shoreline - 20 m (4)	B-6	1	1	0.01	0.01	9	12	0.09	0.13
35	Shoreline - 20 m (5)	B-6	1	1	0.01	0.01	12	13	0.12	0.14
36	Shoreline - 20 m (6)	B-6	n	n	0.00	0.00	2	3	0.02	0.03
37	Shoreline - 20 m (7)	B-6	n	n	0.00	0.00	2	2	0.02	0.02
38	Shoreline - 20 m (8)	B-6	n	n	0.00	0.00	1	1	0.01	0.01
39	Shoreline - 20 m (9)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
40	Shoreline - 20 m (10)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
41	Shoreline - 20 m (11)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
42	Shoreline - 20 m (12)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
43	Shoreline - 20 m (13)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
44	Shoreline - 20 m (14)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
45	Shoreline - 20 m (15)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
46	20 m - 300 m (1)	B-6	n	n	0.00	0.00	n	4	0.00	0.04
47	20 m - 300 m (2)	B-6	n	1	0.00	0.01	6	12	0.06	0.13
48	20 m - 300 m (3)	B-6	1	2	0.01	0.02	17	19	0.18	0.21
49	20 m - 300 m (4)	B-6	1	1	0.01	0.01	15	17	0.17	0.18
50	20 m - 300 m (5)	B-6	n	n	0.00	0.00	2	3	0.02	0.03
51	20 m - 300 m (6)	B-6	n	n	0.00	0.00	3	4	0.03	0.04
52	20 m - 300 m (7)	B-6	n	n	0.00	0.00	2	3	0.03	0.03
53	20 m - 300 m (8)	B-6	n	n	0.00	0.00	1	1	0.01	0.01
54	20 m - 300 m (9)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
55	20 m - 300 m (10)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
56	20 m - 300 m (11)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
57	20 m - 300 m (12)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
58	20 m - 300 m (13)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
59	20 m - 300 m (14)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
60	300 m - outer jurisdiction (1)	B-6	n	n	0.00	0.00	n	3	0.00	0.04
61	300 m - outer jurisdiction (2)	B-6	n	n	0.00	0.00	n	3	0.00	0.03

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
62	300 m - outer jurisdiction (3)	B-6	n	n	0.00	0.00	2	6	0.02	0.06
63	300 m - outer jurisdiction (4)	B-6	n	n	0.00	0.00	1	5	0.01	0.06
64	300 m - outer jurisdiction (5)	B-6	n	n	0.00	0.00	n	3	0.00	0.03
65	300 m - outer jurisdiction (6)	B-6	n	1	0.00	0.01	6	9	0.06	0.09
66	300 m - outer jurisdiction (7)	B-6	n	1	0.00	0.01	4	7	0.04	0.07
67	300 m - outer jurisdiction (8)	B-6	n	n	0.00	0.00	2	4	0.02	0.04
68	300 m - outer jurisdiction (9)	B-6	1	1	0.01	0.01	8	10	0.09	0.11
69	300 m - outer jurisdiction (10)	B-6	1	1	0.01	0.01	7	9	0.08	0.10
70	300 m - outer jurisdiction (11)	B-6	n	n	0.00	0.00	3	5	0.03	0.06
71	300 m - outer jurisdiction (12)	B-6	1	1	0.01	0.01	9	10	0.09	0.11
72	300 m - outer jurisdiction (13)	B-6	1	1	0.01	0.01	8	9	0.08	0.09
73	300 m - outer jurisdiction (14)	B-6	n	n	0.00	0.00	4	5	0.04	0.05
74	300 m - outer jurisdiction (15)	B-6	n	n	0.00	0.00	4	5	0.04	0.05
75	300 m - outer jurisdiction (16)	B-6	n	n	0.00	0.00	5	6	0.05	0.06
76	300 m - outer jurisdiction (17)	B-6	n	n	0.00	0.00	3	5	0.03	0.05
77	300 m - outer jurisdiction (18)	B-6	n	n	0.00	0.00	2	3	0.02	0.03
78	300 m - outer jurisdiction (19)	B-6	n	n	0.00	0.00	1	2	0.01	0.02
79	300 m - outer jurisdiction (20)	B-6	n	n	0.00	0.00	1	2	0.01	0.02
80	300 m - outer jurisdiction (21)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
81	300 m - outer jurisdiction (22)	B-6	n	n	0.00	0.00	1	2	0.01	0.02
82	300 m - outer jurisdiction (23)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
83	300 m - outer jurisdiction (24)	B-6	n	n	0.00	0.00	1	2	0.01	0.02
84	300 m - outer jurisdiction (25)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
85	300 m - outer jurisdiction (26)	B-6	n	n	0.00	0.00	n	1	0.00	0.01
86	300 m - outer jurisdiction (27)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
87	300 m - outer jurisdiction (28)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
88	300 m - outer jurisdiction (28)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
89	300 m - outer jurisdiction (30)	B-6	n	n	0.00	0.00	n	n	0.00	0.00
100	Mysterious Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
101	Blackfish Ridge Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
102	Dream Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
103	Southern Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
104	Hospital Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
105	North Hospital Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
106	Aransas Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
107	South Baker Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
108	Baker Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
109	Big Dunn Bar Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
110	Small Dunn Bar Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
111	32 Fathom	B-7	n	n	0.00	0.00	n	n	0.00	0.00
112	Stetson Bank	B-8	n	n	0.00	0.00	n	n	0.00	0.00
113	Claypile Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
114	Applebaum Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
115	Coffee Lump Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
116	East Flower Garden Bank	B-8	n	n	0.00	0.00	n	1	0.00	0.01
117	West Flower Garden Bank	B-8	n	n	0.00	0.00	n	1	0.00	0.01
118	MacNeil Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
119	29 Fathom Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
120	Rankin-1 Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
121	Rankin-2 Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
122	Bright Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
123	Geyer Bank	B-7	n	n	0.00	0.00	1	1	0.01	0.01
124	Elvers Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
125	McGrail Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
126	Sonnier Bank	B-8	n	n	0.00	0.00	n	1	0.00	0.01

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
127	Bouma Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
128	Rezak Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
129	Sidner Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
130	Parker Bank	B-7	n	n	0.00	0.00	1	1	0.01	0.01
131	Alderdice Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
132	Fishnet Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
133	Sweet Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
134	Jakkula Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
135	Ewing-1 Bank	B-7	n	n	0.00	0.00	1	1	0.01	0.01
136	Ewing-2 Bank	B-7	n	n	0.00	0.00	n	1	0.00	0.01
137	Diaphus Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
138	Sackett Bank	B-7	n	n	0.00	0.00	n	n	0.00	0.00
139	Pinnacle Trend	B-8	n	n	0.00	0.00	2	3	0.02	0.03
140	Chandeleur Islands	B-8	n	n	0.00	0.00	1	2	0.01	0.02
141	Florida Middle Ground	B-8	n	n	0.00	0.00	n	n	0.00	0.00
142	Pulley Ridge	B-8	n	n	0.00	0.00	n	n	0.00	0.00
143	Madison Swanson	B-8	n	n	0.00	0.00	n	n	0.00	0.00
144	Steamboat Lumps	B-8	n	n	0.00	0.00	n	n	0.00	0.00
145	Dry Tortugas	B-8	n	n	0.00	0.00	n	n	0.00	0.00
146	Tortugas Ecological Reserve North	B-8	n	n	0.00	0.00	n	n	0.00	0.00
147	Tortugas Ecological Reserve South	B-8	n	n	0.00	0.00	n	n	0.00	0.00
148	Florida Keys National Marine Sanctuary	B-8	n	n	0.00	0.00	n	n	0.00	0.00
150	Key Biscayne National Park	B-8	n	n	0.00	0.00	n	n	0.00	0.00
151	Texas Clipper and South Texas Platform*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
152	Port Lavaca/Liberty Ship Reef*	B-9	n	n	0.00	0.00	1	3	0.01	0.03
153	High Island*	B-9	n	n	0.00	0.00	1	3	0.01	0.03
154	West Cameron*	B-9	n	n	0.00	0.00	3	5	0.03	0.05
155	Galveston Area (GA 393)*	B-9	n	n	0.00	0.00	n	n	0.00	0.00
156	Cognac Platform (MC 194)*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
157	Horseshoe Rigs (MP 306)*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
158	Vermilion Area*	B-9	n	1	0.00	0.01	5	7	0.05	0.07
159	Vermilion Area, South Addition*	B-9	n	n	0.00	0.00	4	5	0.04	0.05
160	Bay Marchand*	B-9	n	n	0.00	0.00	n	1	0.00	0.01
161	South Timbalier*	B-9	n	n	0.00	0.00	5	6	0.05	0.06
162	South Timbalier Area, South Addition*	B-9	n	n	0.00	0.00	4	4	0.04	0.04
163	Panhandle FL*	B-10	n	n	0.00	0.00	n	1	0.00	0.01
164	Tampa*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
165	SE FL*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
166	Daytona Beach*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
167	Jacksonville*	B-10	n	n	0.00	0.00	n	n	0.00	0.00
185	Edges	B-11	n	n	0.00	0.00	n	n	0.00	0.00
186	West Florida Wall	B-11	n	n	0.00	0.00	n	n	0.00	0.00
187	Flower Garden National Marine Sanctuary	B-11	n	1	0.00	0.01	4	7	0.04	0.07
188	Topographic Features without FGNMS	B-11	n	n	0.00	0.00	3	5	0.03	0.05

Table A-8. Probabilities (expressed as percent chance) of one or more offshore spills ≥ 1,000 bbl occurring and contacting certain onshore resource locations within 10 and 30 days for low and high oil production estimates for the single lease sale in the Central Planning Area

Notes: Low = Low Estimates, High = High Estimates, Prob = Probability; ** = Greater than 99.5%; n = less than 0.5%

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
1	Cameron, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
2	Willacy, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
3	Kenedy, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
4	Kleberg, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
5	Nueces, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
6	Aransas, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
7	Calhoun, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
8	Matagorda, TX	B-4	n	n	0.00	0.00	n	2	0.00	0.02
9	Brazoria, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
10	Galveston, TX	B-4	n	n	0.00	0.00	1	2	0.01	0.02
11	Chambers, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
12	Jefferson, TX	B-4	n	n	0.00	0.00	n	1	0.00	0.01
13	Cameron, LA	B-3	n	n	0.00	0.00	1	3	0.01	0.03
14	Vermilion, LA	B-4	n	n	0.00	0.00	1	1	0.01	0.02
15	Iberia, LA	B-3	n	n	0.00	0.00	1	1	0.01	0.01
16	St. Mary, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
17	Terrebonne, LA	B-3	n	n	0.00	0.00	3	4	0.03	0.04
18	Lafourche, LA	B-4	n	n	0.00	0.00	1	1	0.01	0.01
19	Jefferson, LA	B-3	n	n	0.00	0.00	1	1	0.01	0.01
20	Plaquemines, LA	B-4	n	n	0.00	0.00	2	3	0.02	0.03
21	St. Bernard, LA	B-3	n	n	0.00	0.00	n	1	0.00	0.01
22	Hancock, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
23	Harrison, MS	B-3	n	n	0.00	0.00	n	n	0.00	0.00
24	Jackson, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
25	Mobile, ALA	B-3	n	n	0.00	0.00	n	n	0.00	0.00
26	Baldwin, ALA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
27	Escambia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
28	Santa Rosa, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
29	Okaloosa, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
30	Walton, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
31	Bay, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
32	Gulf, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
33	Franklin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
34	Wakulla, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
35	Jefferson, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
36	Taylor, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
37	Dixie, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
38	Levy, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
39	Citrus, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
40	Hernando, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
41	Pasco, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
42	Pinellas, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
43	Hillsborough, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
44	Manatee, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
45	Sarasota, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
46	Charlotte, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
47	Lee, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
48	Collier, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
49	Monroe, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
50	Dade, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00

ID	Onshore Resource Locations	Figure Showing Resource Location	Low Prob 10 days	Low Prob 30 days	Low Mean 10 days	Low Mean 30 days	High Prob 10 days	High Prob 30 days	High Mean 10 days	High Mean 30 days
51	Broward, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
52	Palm Beach, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
53	Martin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
54	St. Lucie, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
55	Indian River, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
56	Brevard, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
57	Volusia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
58	Flagler, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
59	St. Johns, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
60	Duval, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
61	Nassau, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
62	TX	B-1a	n	1	0.00	0.01	2	8	0.02	0.09
63	LA	B-1a	1	1	0.01	0.01	9	14	0.10	0.15
64	MS	B-1a	n	n	0.00	0.00	n	1	0.00	0.01
65	AL	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
66	FL	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
67	Tamaulipas, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
68	Veracruz-Llave, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
69	Tabasco, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
70	Campeche, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
71	Yucatan, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
72	Quintana Roo, Mexcio	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
73	Belize (country)	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
74	Cuba	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
101	TX Coastal Bend Beach Area	B-5	n	n	0.00	0.00	n	1	0.00	0.01
102	TX Matagorda Beach Area	B-5	n	n	0.00	0.00	n	2	0.00	0.02
103	TX Galveston Beach Area	B-5	n	n	0.00	0.00	1	4	0.01	0.04
104	TX Sea Rim State Park	B-5	n	n	0.00	0.00	n	1	0.00	0.01
105	LA Beach Areas	B-5	n	n	0.00	0.00	3	5	0.03	0.05
106	AL/MS Gulf Islands	B-5	n	n	0.00	0.00	n	1	0.00	0.01
107	AL Gulf Shores	B-5	n	n	0.00	0.00	n	n	0.00	0.00
108	FL Panhandle Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
109	FL Big Bend Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
110	FL Southwest Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
111	FL Ten Thousand Islands Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
112	FL Southeast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
113	FL Centraleast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00
114	FL Northeast Beach Area	B-5	n	n	0.00	0.00	n	n	0.00	0.00

Appendix B. OSRA Figures

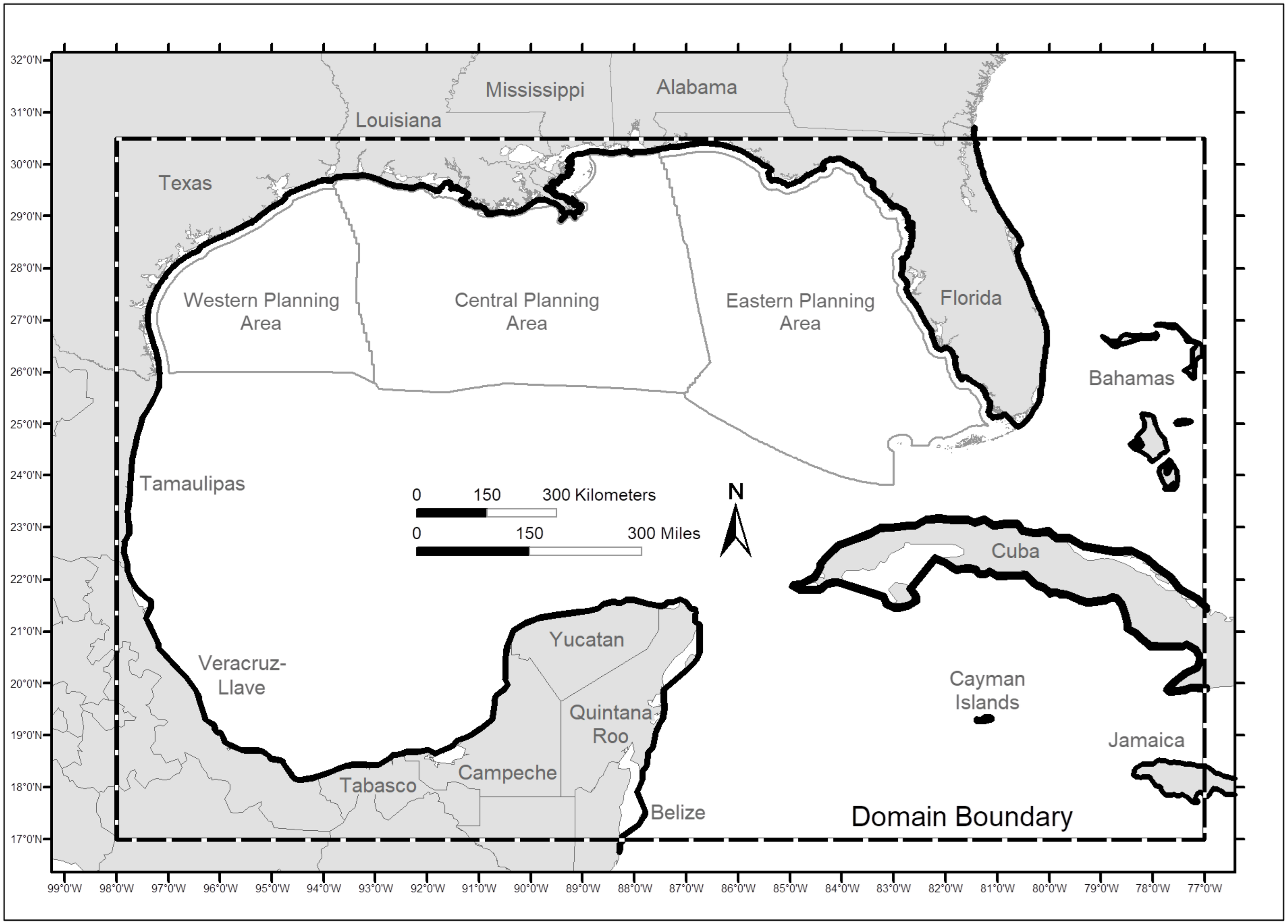

Figure B-1a. **Gulf of Mexico planning areas and the study domain**

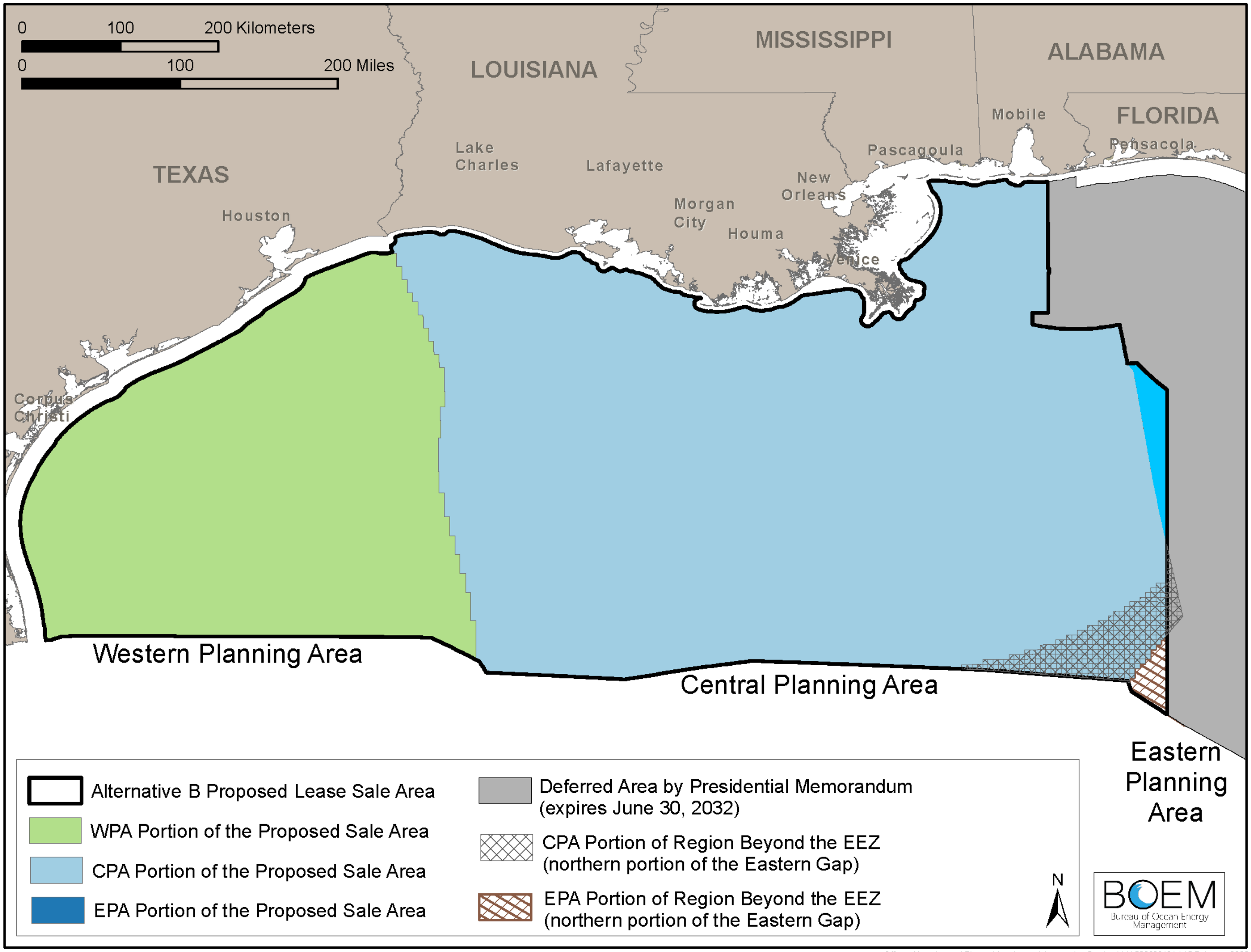

Figure B-1b. Proposed lease sale area

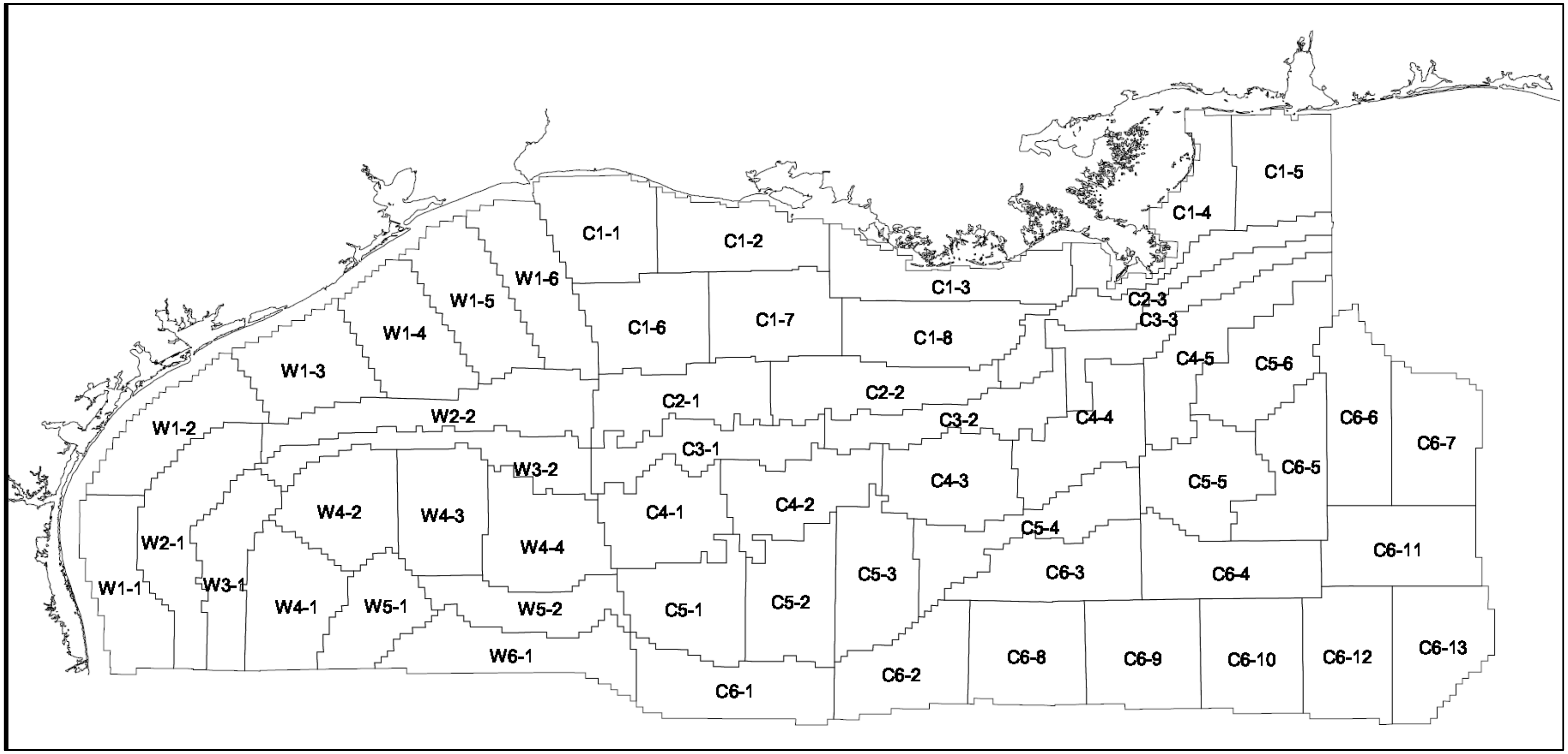

Figure B-1c. Locations of cluster subareas for launching hypothetical spills

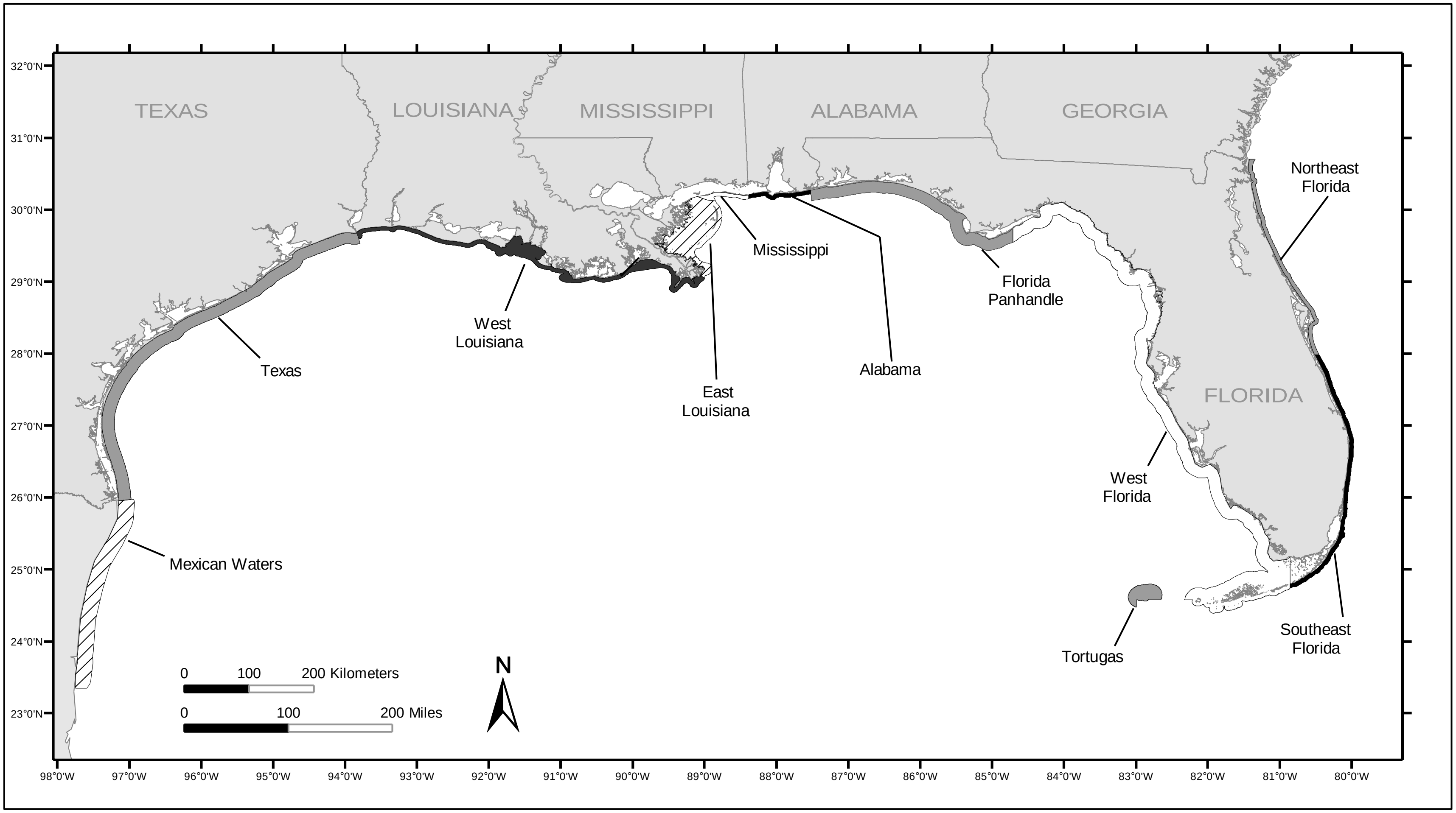

Figure B-2. Locations of state offshore waters for Mexico, Texas, Louisiana, Mississippi, Alabama, and Florida

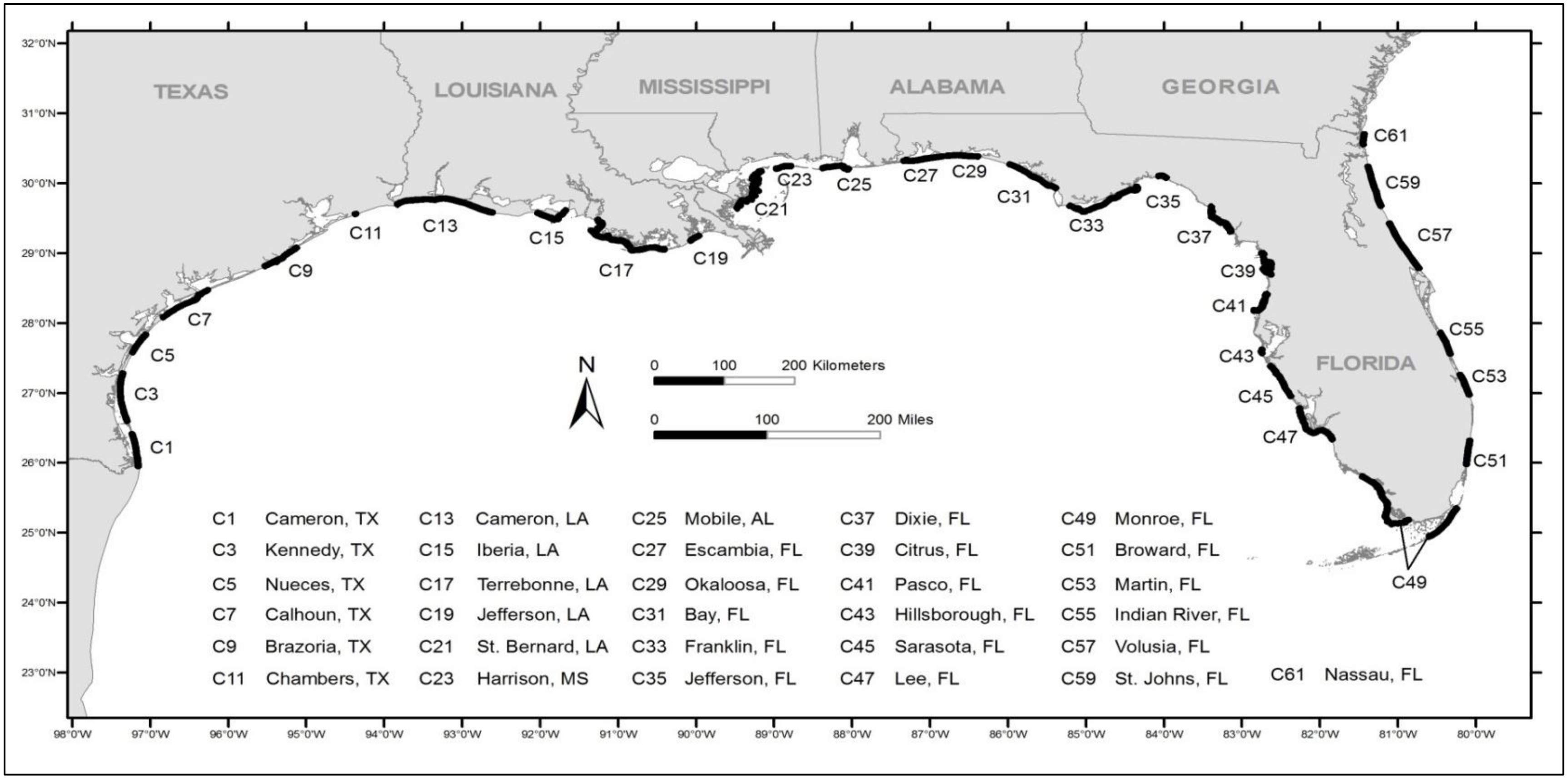

Figure B-3. Locations of Gulf of Mexico counties and parishes (set 1)

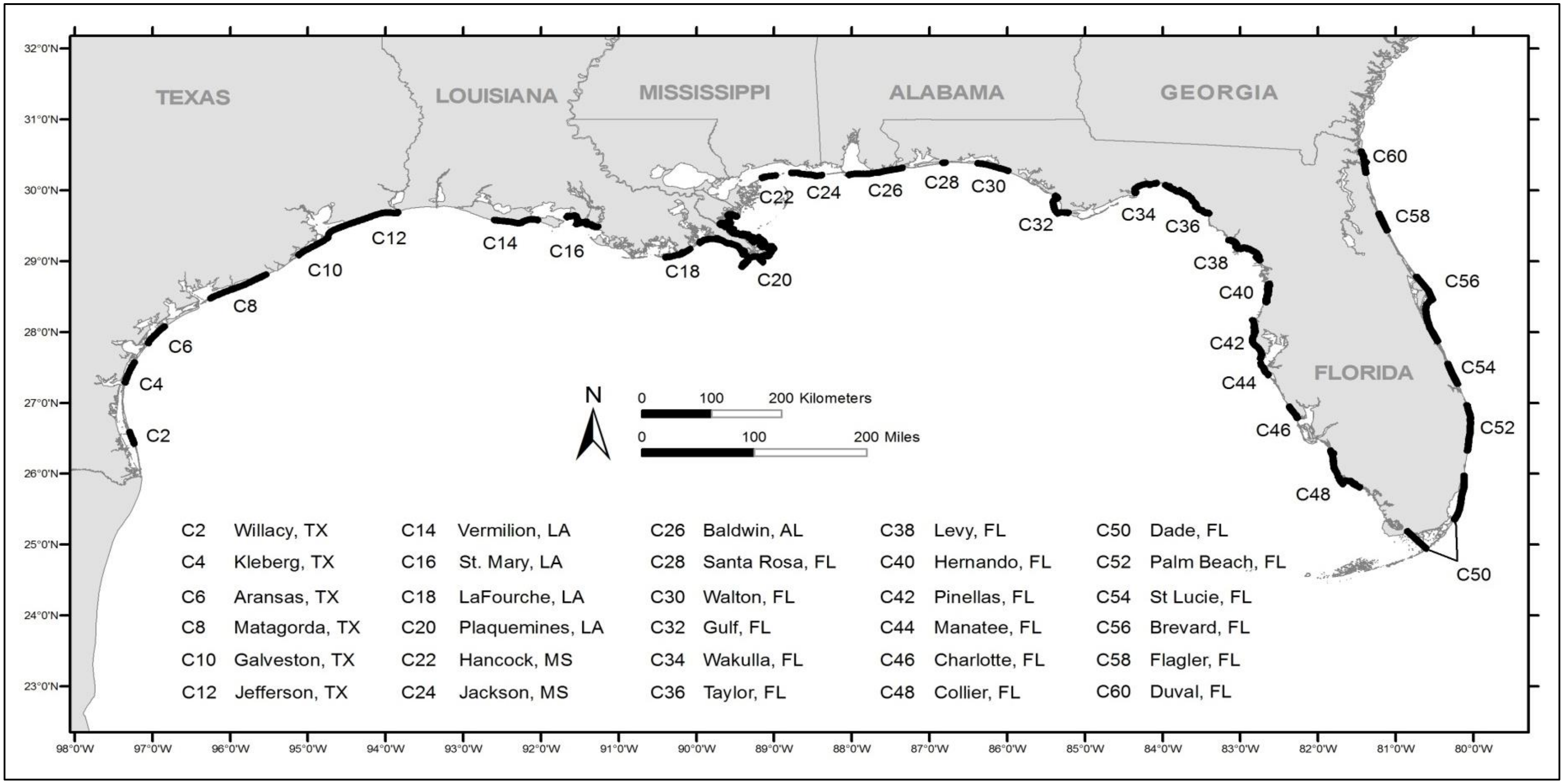

Figure B-4. **Locations of Gulf of Mexico counties and parishes (set 2)**

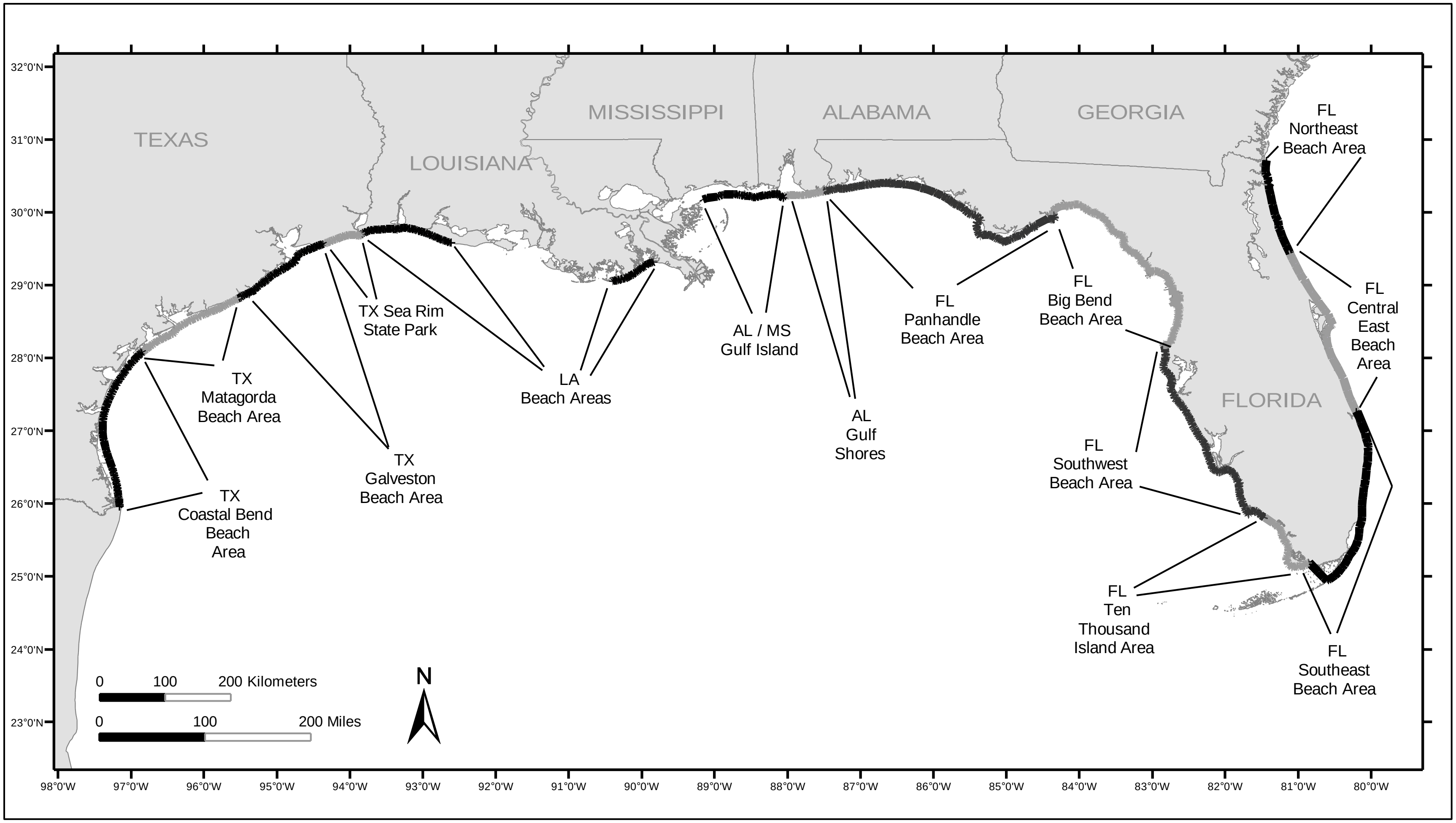

Figure B-5. Locations of recreational beaches

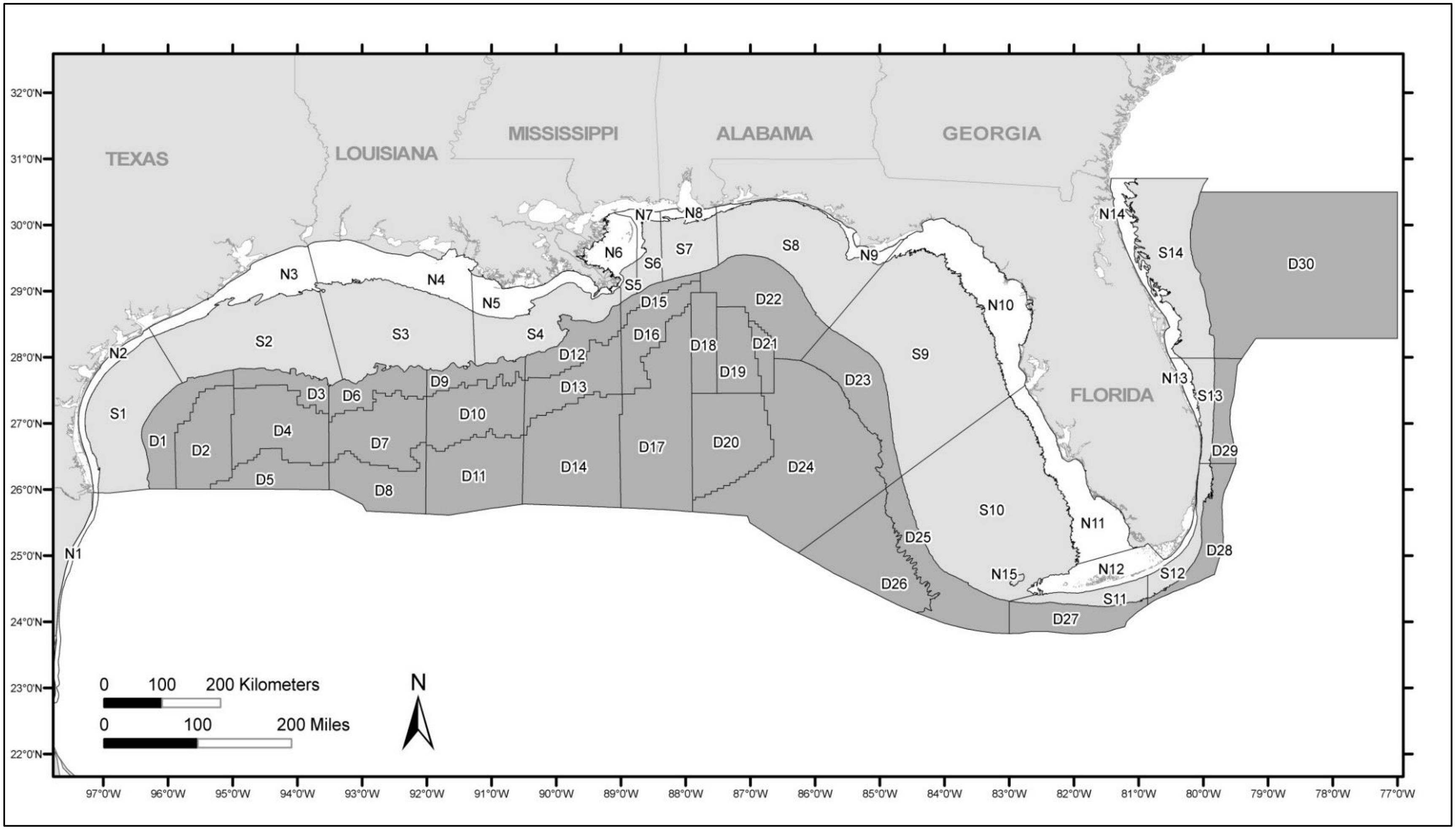

Figure B-6. Locations of nearshore (“N”, 0–20 m), shelf (“S”, 20–300 m), and deepwater (“D”, 300 m to outer jurisdiction) seafloor polygons

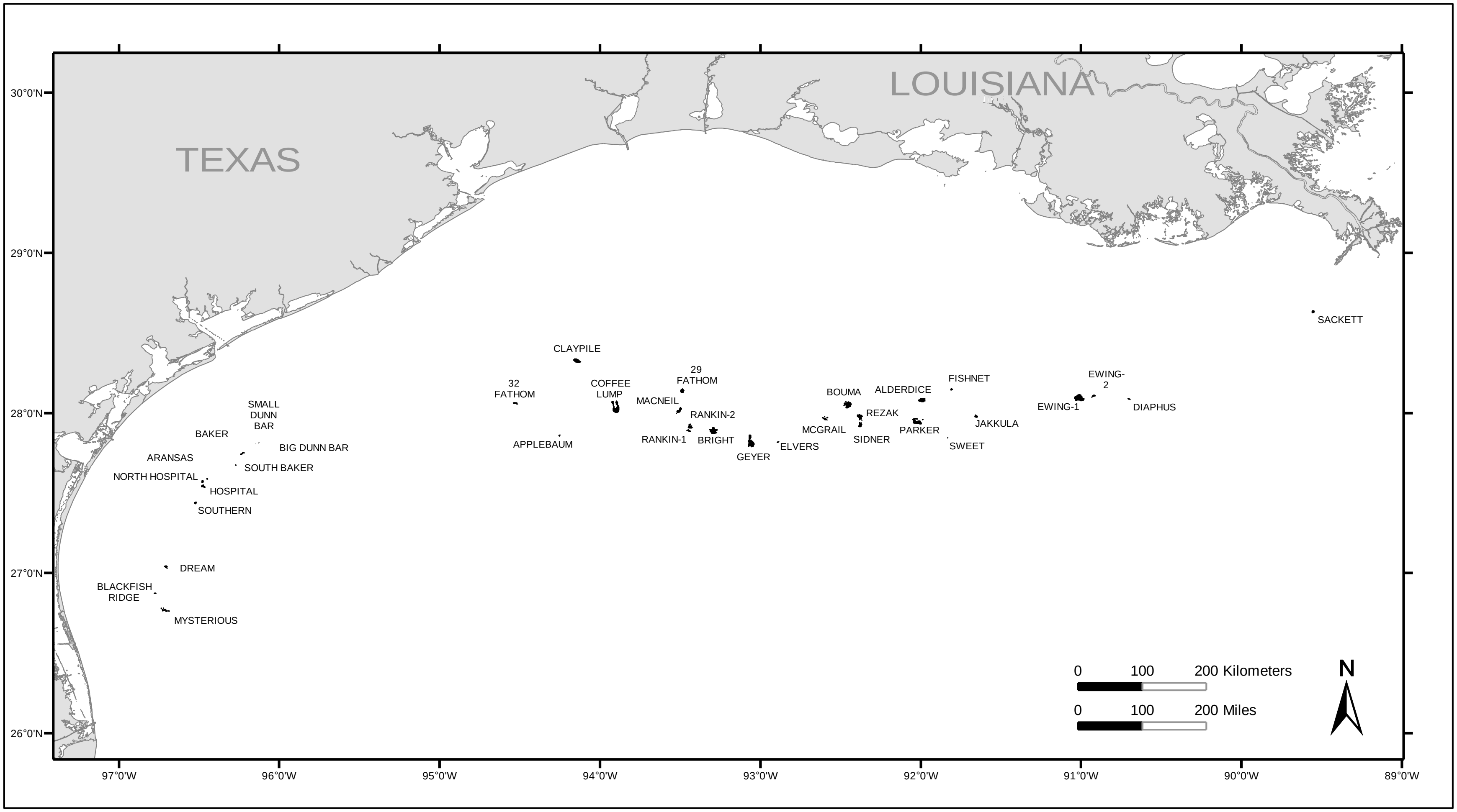

Figure B-7. Locations of topographic features

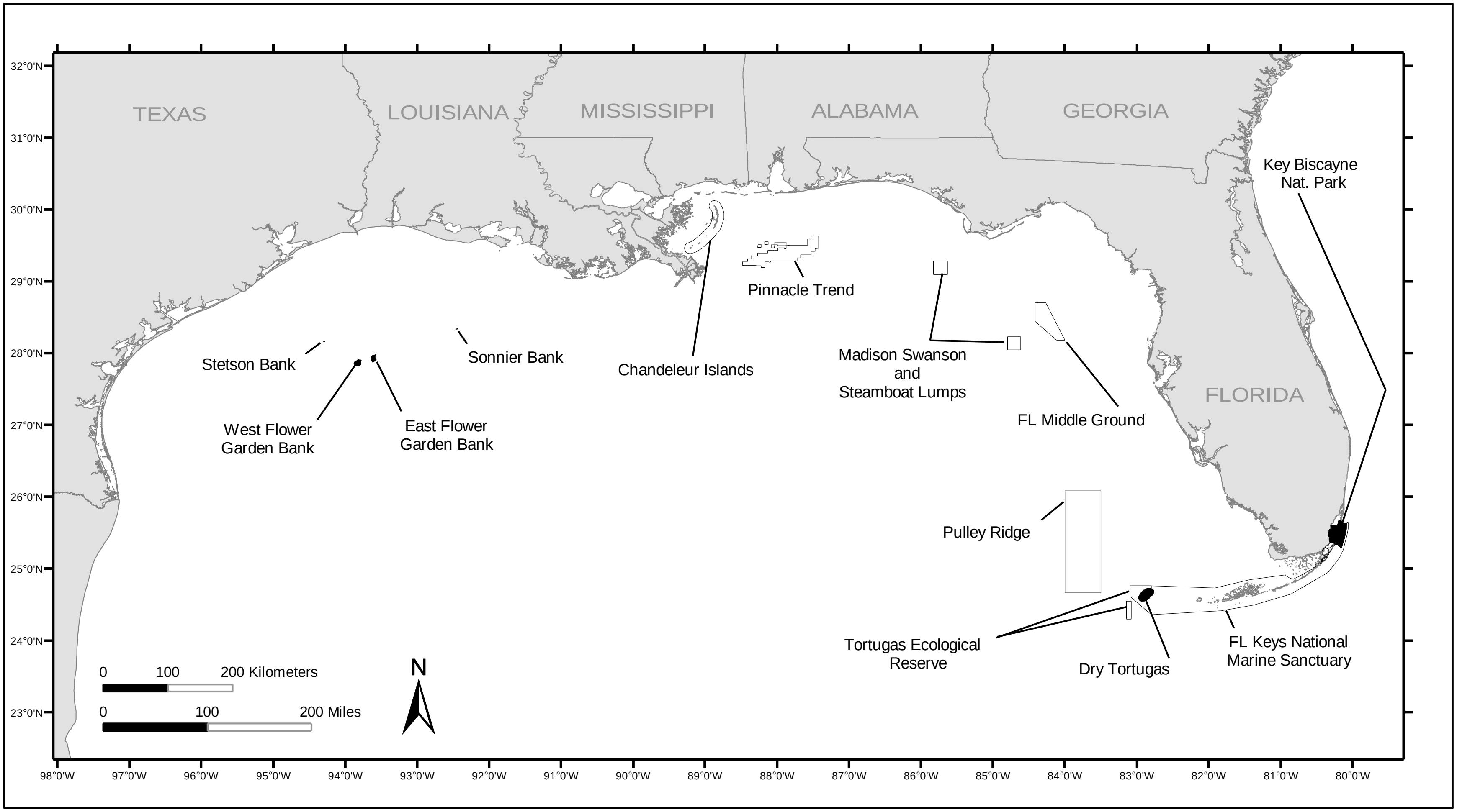

Figure B-8. Locations of Habitat Areas of Particular Concern

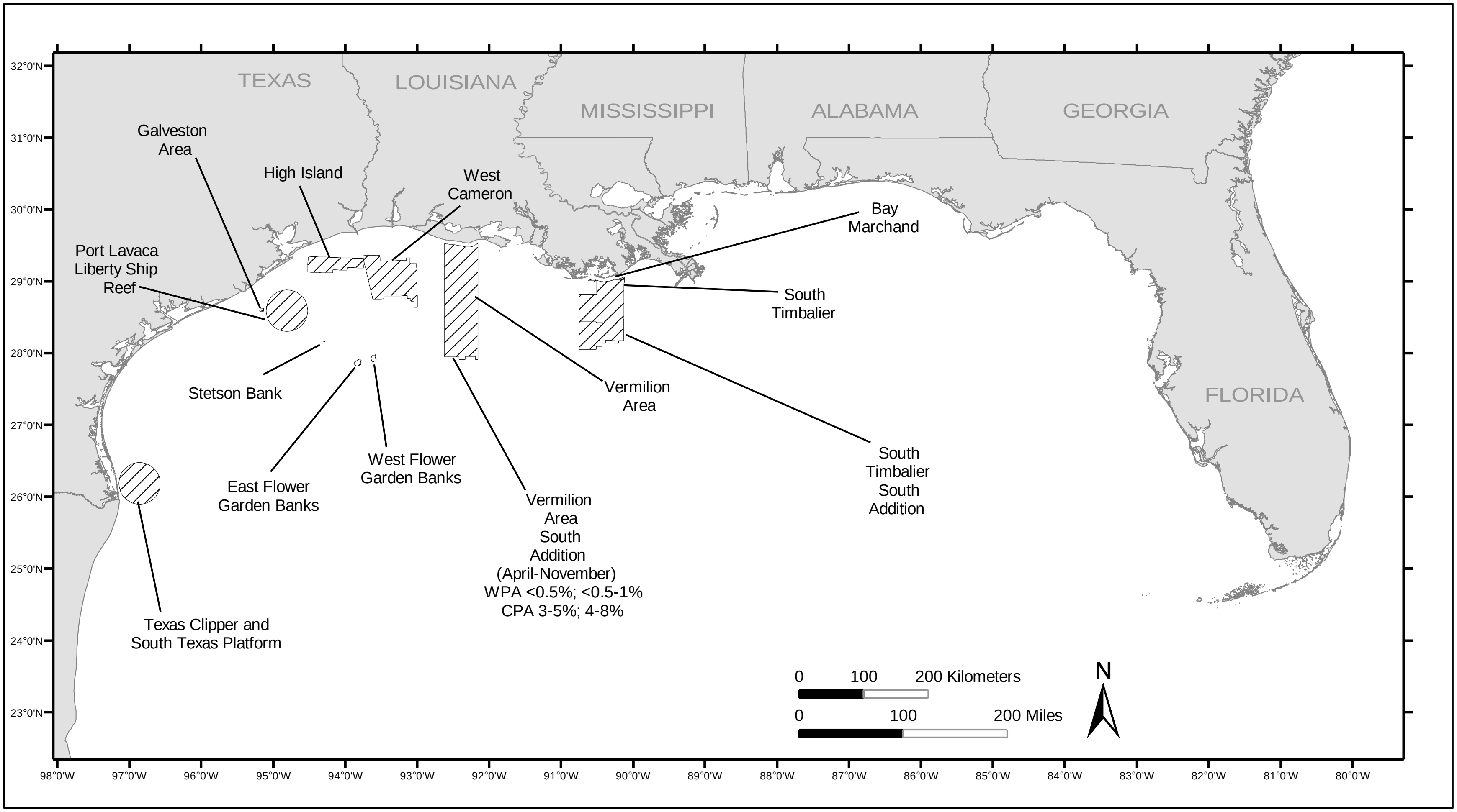

Figure B-9. **Locations of recreational dive areas in the western Gulf of Mexico**

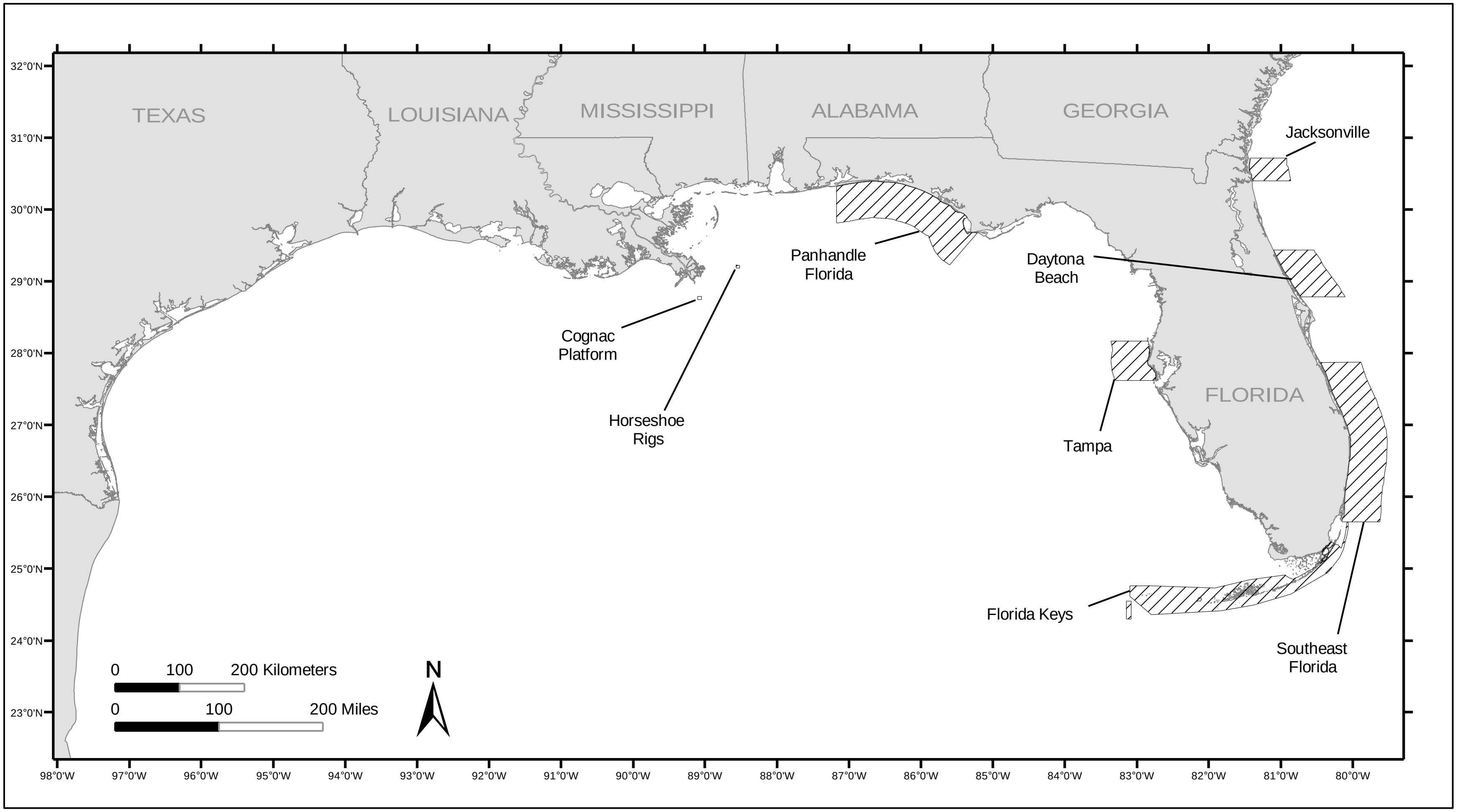

Figure B-10. Locations of recreational dive areas in the eastern Gulf of Mexico

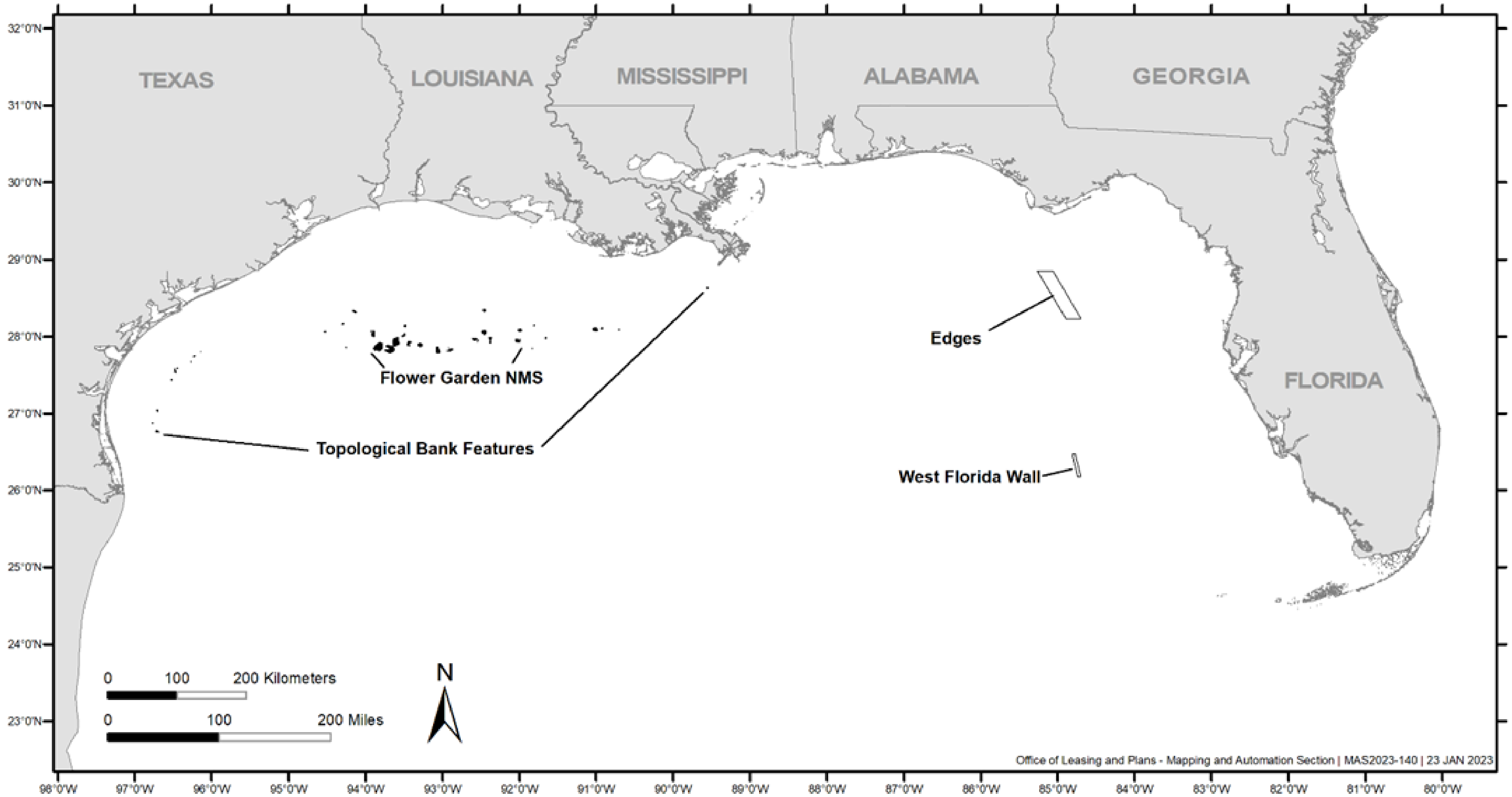

Figure B-11. Locations of Edges, West Florida Wall, Flower Garden National Marine Sanctuary (FGNMS), and Topographic Bank Features outside of FGNMS

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BOEM's mission is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.