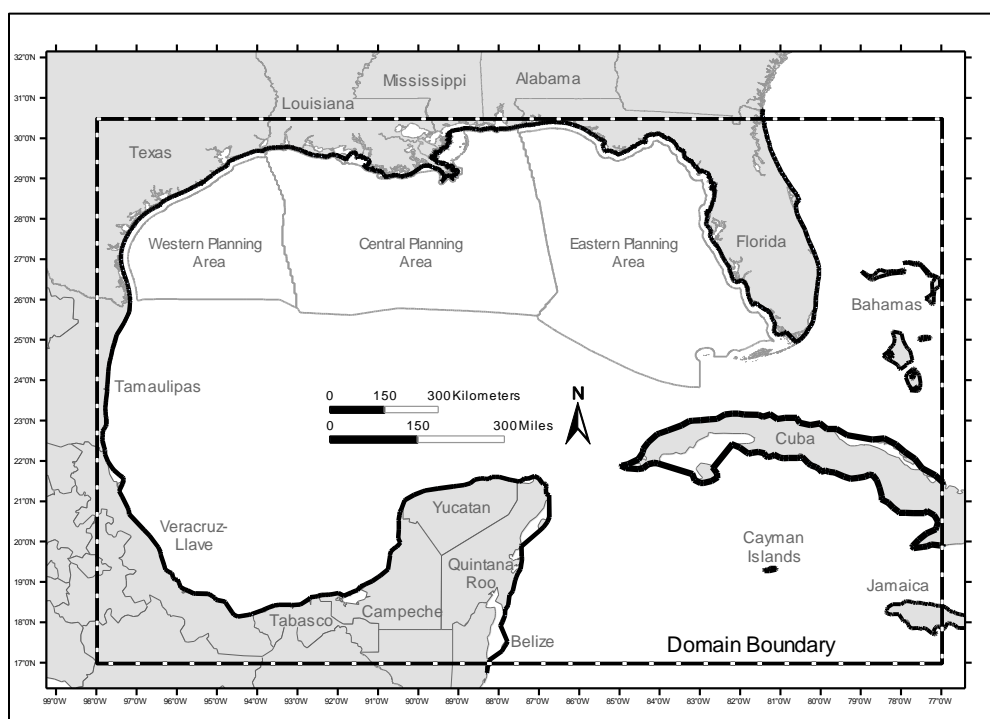# Oil-Spill Risk Analysis

Gulf of Mexico Outer Continental Shelf (OCS) Lease Sales, Eastern Planning Area, Central Planning Area, and Western Planning Area, 2017–2022, and Gulf-wide OCS Program, 2017–2086

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BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

Oil-Spill Risk Analysis

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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
EIS	Environmental Impact Statement
EPA	Eastern Planning Area
FPSO	Floating Production, Storage and Offloading
GOM	Gulf of Mexico
HAPC	Habitat Areas of Particular Concern
MMS	Minerals Management Service
OCS	Outer Continental Shelf
OSRA	Oil Spill Risk Analysis
POM	Princeton Ocean Model
WPA	Western Planning Area
USDOI	United States Department of the Interior

1.0   Introduction

The Federal Government plans to offer, for oil and gas leasing, the U.S. Outer Continental Shelf (OCS) lands in the Eastern Planning Area (EPA), Central Planning Area (CPA), and Western Planning Area (WPA) of the Gulf of Mexico (GOM), as shown on the front cover. Because oil spills may occur from activities associated with offshore oil exploration, development, production, transportation, and decommissioning that result from these lease sales, the U.S. Department of the Interior (USDOI), Bureau of Ocean Energy Management (BOEM) conducts a formal oil-spill risk analysis (OSRA) to support environmental impact statements (EISs) that are completed before conducting the proposed leasing of these areas. This report summarizes results of that analysis, the objective of which was to estimate the risk of oil-spill contact to sensitive offshore and onshore environmental resources and socioeconomic features, referred to in this report as resources, from oil spills accidentally occurring from OCS activities.

The occurrence of oil spills is fundamentally a matter of probability. There is no certainty regarding the amount of oil that would be produced, or the size or likelihood of a spill that could occur during the estimated life of a given lease sale. Neither can the winds and ocean currents that transport oil spills be known for certain. A probabilistic event, such as an oil-spill occurrence or oil-spill contact to an environmentally sensitive area, cannot be predicted, but an estimate of its likelihood (its probability) can be quantified.

The OSRA was conducted in three parts, corresponding to different aspects of the overall problem.

1. The probability of oil-spill occurrence, which is based on estimated volumes of oil produced and transported and on spill rates derived from historical data.
2. Calculated trajectories of oil spills from hypothetical spill locations to locations of various resources, which are simulated using the OSRA model (Smith et al. 1982; Ji et al. 2003).
3. The combination of results of the first two parts to estimate the overall oil-spill risk if there is oil development.

This report is available from the BOEM website (http://www.boem.gov).

2.0   Framework of the Analysis

Many factors are considered when conducting an OSRA. These include the proposed action, the estimated volume of oil resources in the area proposed for leasing, the location of the proposed action, the location and method of transportation of oil resources, and identifying the resources in or near the area proposed for leasing.

2.1   The Proposed Actions and the OCS Program

The proposed Federal actions addressed in this report are region-wide oil and gas lease sales within the EPA, CPA, and WPA of the Gulf of Mexico OCS (Figure B-1). Under the "Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022 (Five-Year Program)" (USDOI-BOEM, 2016b), ten region-wide lease sales are scheduled: one sale in 2017 and 2022, and two sales in 2018, 2019, 2020, and 2021. The purpose of the proposed Federal actions is to offer for lease those areas that may contain economically recoverable oil and natural gas resources. 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, storage and offloading (FPSO) units.

The proposed action analyzed in this report is one "typical" region-wide lease sale. A set of ranges for resource estimates and projected exploration and development activities developed for each planning area over a 50-year analysis period (2017–2066) was used to analyze the region-wide spill risk. The analyses of oil-spill risk for the "typical" proposed action are expected to be "typical" of any of the other proposed region-wide lease sales scheduled in the Five-Year Program. In other words, each of the proposed region-wide lease sales in the Five-Year Program is expected to be within the combined ranges of resource estimates for each planning area used for the analyzed "typical" proposed action.

In addition, an analysis of the Cumulative OCS Oil and Gas Program is performed based on estimates representative of all anticipated production over a 70-year analysis period (2017–2086) from proposed, existing, and future leases.

2.2   Estimated Volume of Oil Resources

For this analysis, both benefits and risks are functions of the volume of oil produced and are mutually dependent. For example, greater volumes of produced oil are associated with greater economic benefits, 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 "the risks are…, given that the volume is…" Any statements about the likelihood of a particular volume of oil being developed also apply to the likelihood of the corresponding benefits and risks.

The resource estimates are presented for the following scenarios:

Proposed Action: the range of oil resources estimated to be leased, discovered, and produced over a 50-year time period as a result of a typical lease sale, as found in the proposed Five-Year Program for 2017-2022 (USDOI-BOEM 2016b)

OCS Program: the range of oil resources estimated to be leased, discovered, and produced as a result of prior lease sales, the proposed actions, and future lease sales that will occur during the life of a proposed action, which in this case is 70 years (USDOI-BOEM 2016b).

The range in oil resource projections used to develop the proposed actions and OCS Program scenarios are based on resource and reserves estimates as presented in "2016 Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental

Shelf" (USDOI-BOEM 2016a). The resource estimates for the proposed actions are based on two factors:

(1) the conditional estimates of undiscovered, unleased, conventionally recoverable oil and gas resources in the proposed lease sale areas; and

(2) estimates of the portion or percentage of these resources assumed to be leased, discovered, developed, and produced as a result of the proposed actions.

The estimates of undiscovered, unleased, conventionally recoverable oil and gas resources are based on a comprehensive appraisal of the conventionally recoverable petroleum resources of the US. Due to the inherent uncertainties associated with an assessment of undiscovered resources, probabilistic techniques were employed, and the results were reported as a range of values corresponding to different probabilities of occurrence. A thorough discussion of the methodologies used and the results obtained in the assessment are presented. The estimates of the portion of the resources assumed to be leased, discovered, developed, and produced as a result of the proposed actions are based upon logical sequences of events that incorporate past experience, current conditions, and foreseeable development strategies. A wealth of historical data and information derived from more than 50 years of oil and gas exploration, development, and production activities were used extensively by BOEM (formerly the Minerals Management Service [MMS]). The undiscovered, unleased, conventionally recoverable resource estimates for the proposed actions are expressed as ranges, from low to high. The range reflects a range of projected economic valuations of the produced oil and gas.

The projected life of all exploration, development, production, and decommissioning activities that result from a typical proposed lease sale is assumed to be 50 years. This is based on the average length of time required for these activities to occur over the life of a typical Gulf of Mexico (GOM) lease.

Based on the resource estimates described above, an estimate of amount of oil to be produced from a given area is estimated, and the estimate is presented in billion barrels (Bbbl). The projected oil production in Bbbl for a typical proposed lease sale and the OCS Program are shown in Table 1 below.

Table 1.   Projected Oil Production for the OCS Program and for a Typical Proposed Lease Sale

Planning Area	Estimated Production (Bbbl)[1]	Analysis Period
Proposed Action		
Regionwide	0.210–1.118	50 years
CPA/EPA	0.185–0.970	50 years
WPA	0.026–0.148	50 years
Cumulative OCS Program		
Regionwide	15.482–25.806	70 years
CPA/EPA	13.590–22.381	70 years
WPA	1.892–3.425	70 years
[1]Bbbl = billion (10^9) barrels; 1 barrel = 42 U.S. Gallons		

2.3   Location of the Proposed Action (Compared with Domain and Study Areas)

The proposed action involves leasing scenarios based on three alternatives described in "Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022 Gulf of Mexico Lease Sales 249,250,251,252,253,254,256,257,259, and 261 Draft Environmental Impact Statement" (USDOI-BOEM 2016c), and the study area includes the entire GOM and surrounding area (Figure B-1a).

The geographic boundaries that encompass the resources at risk from a hypothetical oil spill from OCS operations in the lease areas are shown in Figure B-1a. This area is called the domain. Although few hypothetical oil spills were likely to extend beyond the borders of the domain within 30 days after release (the maximum elapsed time considered), we have tracked and tabulated some spills that would travel beyond the open-ocean boundaries. These spills could contact land or other resources outside the domain.

2.4   Resources Considered in the Analysis

The resources considered in this analysis were selected by BOEM analysts in the Gulf of Mexico OCS Region with supplementary input from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service. BOEM analysts also used information from its Environmental Studies Program results, literature reviews, and professional exchanges with other scientists to define resources. The analysts used geographic digital information on the biological, physical, and socioeconomic resources that could be exposed to contact from OCS oil spills to create maps of resource locations vulnerable to oil-spill impact. These maps (Figures B-2 through B-17) depict locations that were analyzed by the OSRA Model, representing either the locations of onshore resources or the surface waters overlying or surrounding offshore resources. Each map may represent the location of a resource or resource habitat, but may be used to assess risk to multiple resources, even though the map is not labeled with the names of those resources. Discussions of risks to all considered resources can be found in the multisale environmental impact statement (EIS) (USDOI-BOEM 2016c) or the forthcoming EISs that are prepared for each individual lease sale (proposed action).

All of the onshore, 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 of approximately 10-mile (16-kilometer) 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, the state offshore waters were included as resources. The limits of State waters are defined by the States and range from 3 to 9 nautical miles. Texas and Florida state 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 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 contains the figures, which show the locations of each potentially affected resource (Figures B-2 through B-17).

3.0   Oil-Spill Risk Analysis

The OSRA was conducted in three parts, corresponding to different aspects of the overall problem:

1. The probability of oil-spill occurrence (discussed in Section 3.1),
2. The trajectories of oil spills from hypothetical spill locations to various resources (described in Section 3.2), and
3. A combination of the first two analyses to estimate the overall oil-spill risk of both spill occurrence and spill contact if there is oil development (presented in Section 3.3).

Risk analyses may be characterized as "hazard-based" or "risk-based." A hazard-based analysis examines possible events regardless of their low (or high) 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. A risk-based analysis, on the other hand, does take into account the likelihood of the event occurring or the measures that can be taken to mitigate its potential impacts.

This OSRA is designed for use as a risk-based assessment. Therefore, the likelihood of oil spills (≥ 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 entails 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's surface and what resources could be contacted.

Results from the OSRA are, therefore, expressed as the combined probability of spills both occurring and contacting modeled offshore and coastal resource locations.

Note that the analysis estimates spill contacts, not spill impacts. Further measures that should be evaluated to determine impacts, such as the natural weathering of oil spills and the effects of cleanup activities, are not directly factored into the analysis but should be added to the interpretation of its results.

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 record and the historical tanker spill record in U.S. waters, and it depends on the volume of oil produced and transported. All types of accidental spills greater than or equal to 1,000 bbl were considered in this analysis. These spills include those from well blowouts, other accidents that occur on platforms, and during transportation of oil to shore. These 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.

Anderson et al. (2012) 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, 1990, 1994, 2000; Lanfear and Amstutz, 1983); their results indicated that some significant changes had occurred in the spill rates for platforms, pipelines, and tankers. This report uses the updated spill occurrence rates from Anderson et al (2012).

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 less than 1,000 bbls are addressed in the EIS 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. Spills greater than or equal to 1,000 bbl persist in the environment long enough to be modeled and are addressed in OSRA reports. Larger spills are likely to be identified and reported; therefore, these records are more comprehensive than those of smaller spills. For potential catastrophic oil spills for a volume greater than 1 million bbl, Ji et al. (2014) used the extreme value theory to analyze the probability of catastrophic spills. A catastrophic spill is not considered as part of the proposed actions in the proposed program and is therefore not part of this analysis. For information pertaining to a catastrophic spill event please refer to Ji et al. (2014).

Two basic criteria were used in selecting the volume of oil handled as the risk exposure variable:
(1) the exposure variable should be simple to define, and
(2) it should be a quantity that can be estimated.

The volume of oil produced or transported was the chosen exposure variable primarily for the following reasons: historical volumes of oil produced and transported are well documented; using these volumes makes the calculation of the estimated oil-spill occurrence rate simple—the ratio of the number of historical spills to the volume of oil produced or transported; and future volumes of oil production and transportation are routinely estimated. The volume of oil and gas to be produced for a proposed action and for the Gulf-wide OCS Program is estimated from an assessment of oil resources by using comprehensive geological and geophysical databases and related models. In addition, the BOEM analysts estimate other exposure variables, such as

number of platforms and tanker trips, as a function of the volume of oil estimated to be produced or transported.

Anderson et al. (2012) analyzed platform and pipeline spills in Federal waters that occurred from OCS oil and gas development from 1964 through 2010 and crude oil tanker spills that occurred in U.S. waters from 1974 through 2008. In these analyses, every spill record was examined and verified to the furthest extent possible. Each spill was classified for size, product spilled, and spill source according to its applicability to the analysis. Spill rates (in spills per Bbbl of oil produced at platforms on the OCS or transported by pipelines on the OCS or tankers traversing the OCS) were estimated for platforms, pipelines and tankers on the OCS, as shown in Table 2.

Table 2. Oil Spill Rates

Spill Source	Number of Spills	
	>1,000 bbl[1] (spills/Bbbl)[2]	>10,000 bbl[1] (spills/Bbbl)[2]
OCS Platforms	0.25	0.13
OCS Pipelines	0.88	0.18
OCS Tankers	0.34	0.11
[1]bbl = barrels = 42 U.S. gallons		
[2]Bbbl = Billion barrels = 10^9 barrels		
Source: Anderson et al. 2012		

The spill rates in Table 2, which are based on a 15-year period (1996-2010) for OCS platforms and pipelines and a 20-year period (1989–2008) for tankers, as found in Anderson et al. (2012) were used in this OSRA study as best representing current technology.

Using Bayesian techniques, Devanney and Stewart (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.

Oil-spill occurrence estimates for spills greater than or equal to 1,000 bbl were calculated for

production and transportation of oil during the 50-year analysis period associated with the proposed action in the OCS Program (2017–2066). 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 Anderson et al. (2012). The probabilities of one or more oil spills greater than or equal to 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 OCS Program are found in Table A-2. The probabilities for spills greater than or equal to 10,000 bbl are also shown in Table A-2.

3.2 Oil-Spill Trajectory Simulations

The goal of an oil-spill risk analysis is to answer the question: What is the probability of oil and gas development from a platform in a given area to cause oil, if it is spilled, to contact specific shorelines or sensitive resources? To achieve this goal, the OSRA model must estimate where an oil spill might begin, where it is likely to move, and where the shorelines and resources are, relative to that potential movement. From these analyses, the probability of contact to a given area is calculated.

Locations of hypothetical spill sites are addressed in Section 3.2.1. Ocean current and wind inputs used in the OSRA model are described in Section 3.2.2, and the trajectories of hypothetical spills are addressed in Section 3.2.3. The outputs from the OSRA model are a series of probabilities of contact between a hypothetical spill in a specific area and a resource or a specific segment of the shoreline. These are introduced in Section 3.2.4. Finally, 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, one needs to know where and when it began. To provide a location from which a hypothetical spill begins, the OSRA model uses hypothetical spill locations called launch points. The OSRA model initiates hypothetical oil spills uniformly in space and time from within the study area, as shown in Figure B-1a.

At distance intervals of one-tenth of a degree ($1/10^o$) of latitude (about 11 kilometers) and intervals of $1/10^o$ of longitude (about 10 kilometers), 6045 launch points for hypothetical spills were identified in the study area. The spatial resolution of the spill simulations ($1/10^o$ north-south and $1/10^o$ east-west) was selected to reflect the spatial resolution of the input data.

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 (a 1-day interval) from each of the launch points in space over the simulation period from January 1, 1993 to December 31, 2007. A total of one spill per day for each of the 6045 launch points for 15 years was calculated.

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. 2002) and were found to 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. 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. 2002).

Sensitivity tests on the OSRA model (Price et al. 2002) indicated that, statistically, the above-mentioned spatial resolution ($1/10^o$ by $1/10^o$) and time resolution (1-day) are sufficient to represent the spatial and time variations of the oil-spill trajectories in the area. At this resolution, over 33 million oil-spill trajectories were tracked from the launch points in the study area, based on the wind and current data during the period from 1993 to 2007.

3.2.2   Ocean Current Data and Wind Simulations as Inputs to OSRA

This section describes two major inputs for the OSRA model: the model that is used to provide ocean currents, and the data that are used for wind speeds and wind directions.

Ocean currents and winds move spilled oil on the ocean surface. Complex surface ocean currents exert a shear force on the spilled oil from below. In addition, prevailing winds exert an 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.

The OSRA model: The OSRA model was designed to track the movements of potential oil spills before they happen. The model, which was originally developed by Smith et al. (1982) and enhanced by BOEM over the years (LaBelle and Anderson 1985; Ji et al. 2002, 2004, 2011, 2014), simulates oil-spill transport using realistic data fields of winds and ocean currents in the GOM. The model calculates the movement of hypothetical spills by successively integrating time sequences of two spatially gridded input fields: the 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 an oil-spill risk analysis requires detailed information on ocean currents and wind fields (Ji 2004). The ocean currents inputs are numerically computed from an ocean circulation model of the GOM that is driven by meteorological forces (the near-surface winds and the total heat fluxes) that have been analyzed and by observed river inflow into the GOM (Oey 2005; 2008).

The Modified Princeton Ocean Model: The model used to provide ocean current data for the OSRA model is a version of the Princeton Ocean Model (POM), which is an enhanced version of the earlier-constructed Mellor-Blumberg Model. It 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. The use of these coordinates allows for a realistic coastline and bottom topography, including a sloping shelf, to be represented in the model simulation. The model incorporates the Mellor-Yamada turbulence closure model to provide a parameterization of the vertical mixing process through the water column.

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. 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 are also included in the model physics. Other computed variables used in the modified POM include density, vertical eddy viscosity, and vertical eddy diffusivity.

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

The modified POM simulations were extensively skill-assessed with many observations from the GOM (Oey 2005; 2008). These extensive sets of observations afford a rigorous test of 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. With these observations and with other current measurements from moored current meters, a good determination of the model's veracity was made. The modified POM reproduced 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 as the observed currents and is, therefore, applicable in the statistical estimation of future spill risk that the OSRA model makes. The surface currents from the modified POM calculation were used for input into the OSRA Model.

Wind Data Used as OSRA model Input: 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. The OSRA model used the same wind field to calculate the empirical wind drift of the simulated spills.

3.2.3 Trajectory Simulations

In the trajectory simulation portion of the OSRA Model, many hypothetical oil-spill trajectories are produced by numerically integrating a temporally- and spatially-varying ocean current field, and superimposed on that an empirical wind-induced drift of the hypothetical oil spills (Samuels et al. 1982). Collectively, the trajectories represent a statistical ensemble of simulated oil-spill displacements produced by a field of winds derived from observations and numerically derived ocean currents. The historical data on winds and currents in the GOM are assumed to be

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statistically similar to those that will occur in the Gulf during future offshore activities. In other words, the oil-spill risk analysts assume that the frequency of strong wind events in the wind field is the same as what will 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.

A cluster analysis (Everitt 1993) is used to further 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 the WPA of the GOM, BOEM used the probability of contact to shoreline segments to identify offshore areas that showed similar risk, based on similarity in patterns of trajectories. In the case of the EPA, a single cluster was assumed for the entire planning area because the portion of the EPA being considered for leasing is very small in comparison to the size of the CPA and WPA.

To account for the risk of spills occurring from the transportation of oil to shore via pipeline, generalized pipeline corridors originating within the offshore cluster area(s) and terminating at existing major oil pipeline shore bases were identified. 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, representing the transportation of the oil beginning within the cluster area and terminating at State/Federal boundaries proximate to known pipeline shore bases.

3.2.4 Spill-Resource Contact Probabilities

In addition to the ocean current, and the surface wind data, and the hypothetical spill locations, another portion of the OSRA model tabulates the simulated oil spill contacts to specific locations or resources.

To locate resources, the model contains the geographical boundaries of a variety of identified environmental features. At each successive time step, the OSRA model compares the location of the hypothetical spills against the geographic boundaries of shoreline and designated offshore resources. The OSRA model then counts the number of "contacts," which is comprised of the number of oil-spill contacts to segments of shoreline (counties/parishes) plus the occurrences of oil-spill contact to offshore resources during the time periods that the habitat is known to be used by the resource. A contact to a shoreline will stop the trajectory of an oil spill; no re-washing is assumed in this model. A contact to an offshore resource that is not a shoreline (a wildlife refuge area in the middle of the ocean, for example) will not stop the calculation of the trajectory in OSRA.

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. Recall that the number of simulated spills for this OSRA report 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 resources and segments of shoreline from locations chosen to represent hypothetical oil spills from oil production and transportation facilities, at several selected oil-spill travel times. The OSRA model combines the statistics for shoreline contacts by the trajectories to calculate the average probabilities of shoreline contact.

3.2.5 Factors Not Considered in the OSRA Model

There are factors not explicitly considered by the OSRA model that can affect the transport of spilled oil as well as the dimensions, volume, and nature of the oil spills contacting resources or the shoreline. These include possible cleanup operations, chemical composition of the spilled oil, weathering of oil spills, or the spreading and splitting of oil spills. The OSRA analysts have chosen to take a more 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. These assumptions make the OSRA model's calculated probabilities conservative.

3.3 Conditional Probabilities of Contact

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," the condition being that a spill is assumed to have occurred. 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. However, an implicit analysis of weathering and decay can be considered by choosing a travel time for the simulated oil spills when they contact resource locations that represent the likely persistence of the oil slick on the water surface. BOEM performed an analysis of the likely weathering of a typical offshore oil spill of 1,000 bbl or greater occurring under the proposed action scenarios (USDOI, BOEM 2016). The analysis of the slick's fate showed that a typical GOM oil slick of 1,000 bbl or greater, 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. Any spill contacts occurring on or before the 30-day period are reported in the probability tables. Conditional probabilities of contact with resource locations and land segments within 10, 20 and 30 days of travel time were calculated for each of the hypothetical spill sites by the model to serve as input into the final calculation of risk.

3.4 Combined Probabilities of Contact

A critical difference exists between the conditional probabilities and the combined probabilities calculated. 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, the estimated volume of oil to be produced or transported, and the oil transportation scenario. The combined probabilities for this analysis of the proposed action activities 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 resources and n_l launch points, the conditional probabilities can be represented in a 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 $n_l \times n_s$. Let each element $s_{j,k}$ be 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 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.)

4.0   Discussion

Tables A-3 through A-8 give the combined probabilities of three alternative leasing scenarios (USDOI, BOEM 2016c). As one might expect, resource locations closest to the spill sites have the greatest risk of contact. As the model run duration increases, more of the identified resources and shoreline segments could have meaningful probabilities of contact ($\geq$0.5%). The longer transit times (up to 30 days) allowed by the model enable more hypothetical spills to reach the resources and the shoreline from more 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 make contact with any given resource or shoreline segment.

For instance, Table A-3 provides the probabilities (expressed as percent chance) of one or more offshore spills greater than or equal to 1,000 bbl, and the number of spills (mean) that could occur and could contact a certain offshore resource within 10 days and within 30 days, given the estimated volume of oil produced from a proposed action for the Alternative A leasing scenario. This table shows that Texas State Waters, which is illustrated on Figure B-2, has a probability of 2 percent of being contacted by spilled oil within 10 days, if there is an oil spill from a proposed action with an estimated oil production volume of 0.210 Bbbl (Table 1). Its probability increases to 5 percent of being contacted by the spilled oil within 30 days.

5.0   References

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Appendix A.   Oil-Spill Risk Analysis Tables

Table A-1.   Oil-spill occurrence probability estimates for offshore spills ≥1,000 barrels resulting from each alternative (2017–2066) and the cumulative OCS oil and gas program (2017–2086).

	Forecasted Oil Production (Bbbl)[1]	Mean Number of Spills Estimated to Occur				Estimates of Probability (% chance) of One or More Spills			
		Platforms	Pipelines	Tankers	Total	Platforms	Pipelines	Tankers	Total
Single Lease Sale Alternatives									
Alternative A[2]	0.210	0.05	0.19	0	0.24	5	17	<0.5	21
	1.118	0.28	0.98	0.01	1.27	24	63	<0.5	72
Alternative B[3]	0.185	0.05	0.16	0	0.21	5	15	<0.5	19
	0.970	0.24	0.85	0	1.10	22	57	<0.5	67
Alternative C[4]	0.026	0.01	0.02	0	0.03	1	2	<0.5	3
	0.148	0.04	0.13	0	0.17	4	12	<0.5	15
Cumulative OCS Oil and Gas Program									
Regionwide	15.482	3.87	13.62	0.08	17.57	98	>99.5	7	>99.5
	25.806	6.45	22.71	0.13	29.29	>99.5	>99.5	12	>99.5
CPA/EPA	13.590	3.40	11.96	0.07	15.42	97	>99.5	7	>99.5
	22.381	5.60	19.70	0.11	25.40	>99.5	>99.5	11	>99.5
WPA	1.892	0.47	1.66	0	2.14	38	81	<0.5	88
	3.425	0.86	3.01	0	3.87	58	95	<0.5	98

Notes: Bbbl = billion barrels.

"Platforms" refers to facilities used in exploration, development, or production.

[1]Values represent the low and high resource estimates.
[2]Regionwide proposed lease sale.
[3]Regionwide proposed lease sale excluding blocks in the WPA.
[4]Regionwide proposed lease sale excluding blocks in the CPA/EPA.

Table A-2. Oil-spill occurrence probability estimates for offshore spills ≥10,000 barrels resulting from each alternative (2017–2066) and the cumulative OCS oil and gas program (2017–2086).

	Forecasted Oil Production (Bbbl)[1]	Mean Number of Spills Estimated to Occur				Estimates of Probability (% chance) of One or More Spills			
		Platforms	Pipelines	Tankers	Total	Platforms	Pipelines	Tankers	Total
Single Sale Alternatives									
Alternative A[2]	0.210	0.03	0.04	0	0.07	3	4	<0.5	6
	1.118	0.15	0.20	0	0.35	14	18	<0.5	29
Alternative B[3]	0.185	0.02	0.03	0	0.06	2	3	<0.5	6
	0.970	0.13	0.17	0	0.30	12	13	<0.5	26
Alternative C[4]	0.026	0	0	0	0.01	<0.5	<0.5	<0.5	1
	0.148	0.02	0.03	0	0.05	2	3	<0.5	4
Cumulative OCS Oil and Gas Program									
Regionwide	15.482	2.01	2.79	0.02	4.82	87	94	2	99
	25.806	3.35	4.65	0.04	8.04	97	99	4	>99.5
CPA/EPA	13.590	1.77	2.45	0.02	4.23	83	91	2	99
	22.381	2.91	4.03	0.04	6.97	95	98	4	>99.5
WPA	1.892	0.25	0.34	0	0.59	22	29	<0.5	44
	3.425	0.45	0.62	0	1.06	36	46	<0.5	65

Notes: Bbbl = billion barrels.

  "Platforms" refers to facilities used in exploration, development, or production.

[1]Values represent the low and high resource estimates.
[2]Regionwide proposed lease sale.
[3]Regionwide proposed lease sale excluding blocks in the WPA.
[4]Regionwide proposed lease sale excluding blocks in the CPA/EPA.

Table A-3. Probabilities (expressed as percent chance) of one or more offshore spills ≥1,000 barrels occurring and contacting certain offshore resources within 10 and 30 days for low and high oil production estimates for Alternative A.

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Cayman Islands	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Northwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Northeast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Midwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Mideast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
South Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Jamaica	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
TX State Waters	B-2	2	5	0.02	0.05	10	26	0.11	0.30
West LA State Waters	B-2	3	5	0.03	0.05	17	26	0.19	0.30
East LA State Waters	B-2	1	1	0.01	0.01	6	8	0.06	0.08
MS State Waters	B-2	n	n	0.00	0.00	1	2	0.01	0.02
AL State Waters	B-2	n	n	0.00	0.00	1	2	0.01	0.02
FL Panhandle State Waters	B-2	n	n	0.00	0.00	1	2	0.01	0.02
West FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Southeast FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Northeast State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Mexican State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
Shoreline - 20 m (1)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
Shoreline - 20 m (2)	B-11	n	2	0.00	0.02	3	10	0.03	0.11
Shoreline - 20 m (3)	B-11	2	4	0.02	0.04	11	22	0.12	0.25
Shoreline - 20 m (4)	B-11	2	4	0.02	0.04	14	21	0.15	0.23
Shoreline - 20 m (5)	B-11	4	5	0.04	0.05	20	25	0.22	0.28
Shoreline - 20 m (6)	B-11	1	2	0.01	0.02	6	8	0.07	0.08
Shoreline - 20 m (7)	B-11	1	1	0.01	0.01	4	6	0.04	0.06
Shoreline - 20 m (8)	B-11	n	n	0.00	0.00	1	2	0.01	0.02
Shoreline - 20 m (9)	B-11	n	n	0.00	0.00	n	2	0.00	0.02
Shoreline - 20 m (10)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (11)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (12)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
Shoreline - 20 m (13)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (14)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (15)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (1)	B-11	1	3	0.01	0.03	5	14	0.05	0.15
20 m - 300 m (2)	B-11	3	6	0.04	0.07	19	31	0.22	0.37
20 m - 300 m (3)	B-11	5	7	0.05	0.08	27	35	0.32	0.42

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
20 m - 300 m (4)	B-11	6	7	0.06	0.08	28	33	0.33	0.40
20 m - 300 m (5)	B-11	1	2	0.01	0.02	7	9	0.08	0.10
20 m - 300 m (6)	B-11	2	2	0.02	0.02	9	11	0.10	0.12
20 m - 300 m (7)	B-11	1	2	0.01	0.02	7	9	0.08	0.10
20 m - 300 m (8)	B-11	n	1	0.00	0.01	2	5	0.02	0.05
20 m - 300 m (9)	B-11	n	n	0.00	0.00	n	2	0.00	0.02
20 m - 300 m (10)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
20 m - 300 m (11)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
20 m - 300 m (12)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (13)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (14)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (1)	B-11	1	3	0.01	0.03	6	14	0.06	0.15
300 m - outer jurisdiction (2)	B-11	1	3	0.01	0.03	6	13	0.06	0.14
300 m - outer jurisdiction (3)	B-11	2	4	0.02	0.04	9	18	0.10	0.20
300 m - outer jurisdiction (4)	B-11	2	4	0.02	0.04	10	19	0.10	0.21
300 m - outer jurisdiction (5)	B-11	1	2	0.01	0.03	5	12	0.05	0.12
300 m - outer jurisdiction (6)	B-11	3	5	0.03	0.05	14	21	0.15	0.24
300 m - outer jurisdiction (7)	B-11	3	5	0.03	0.05	13	20	0.14	0.23
300 m - outer jurisdiction (8)	B-11	2	4	0.02	0.04	9	16	0.09	0.17
300 m - outer jurisdiction (9)	B-11	3	5	0.03	0.05	15	21	0.17	0.24
300 m - outer jurisdiction (10)	B-11	4	5	0.04	0.06	17	23	0.19	0.26
300 m - outer jurisdiction (11)	B-11	3	4	0.03	0.04	11	18	0.12	0.20
300 m - outer jurisdiction (12)	B-11	4	6	0.04	0.06	20	25	0.23	0.29
300 m - outer jurisdiction (13)	B-11	4	5	0.04	0.05	18	23	0.20	0.26
300 m - outer jurisdiction (14)	B-11	3	4	0.03	0.04	12	17	0.13	0.19
300 m - outer jurisdiction (15)	B-11	3	3	0.03	0.04	13	16	0.14	0.18
300 m - outer	B-11	4	5	0.05	0.05	19	23	0.22	0.26

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
jurisdiction (16)									
300 m - outer jurisdiction (17)	B-11	4	5	0.04	0.05	18	22	0.20	0.25
300 m - outer jurisdiction (18)	B-11	2	3	0.03	0.03	11	14	0.12	0.16
300 m - outer jurisdiction (19)	B-11	2	2	0.02	0.02	7	11	0.08	0.11
300 m - outer jurisdiction (20)	B-11	1	2	0.01	0.02	7	10	0.07	0.11
300 m - outer jurisdiction (21)	B-11	1	1	0.01	0.01	3	6	0.03	0.06
300 m - outer jurisdiction (22)	B-11	1	2	0.01	0.02	5	9	0.06	0.09
300 m - outer jurisdiction (23)	B-11	n	1	0.00	0.01	1	3	0.01	0.04
300 m - outer jurisdiction (24)	B-11	1	2	0.01	0.02	5	10	0.05	0.10
300 m - outer jurisdiction (25)	B-11	n	n	0.00	0.00	n	2	0.00	0.02
300 m - outer jurisdiction (26)	B-11	n	1	0.00	0.01	1	4	0.01	0.04
300 m - outer jurisdiction (27)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
300 m - outer jurisdiction (28)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (28)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (30)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Mysterious Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Blackfish Ridge Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Dream Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Southern Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Hospital Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
North Hospital Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Aransas Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
South Baker Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Baker Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Big Dunn Bar Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Small Dunn Bar Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
32 Fathom	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Stetson Bank	B-15	n	n	0.00	0.00	n	n	0.00	0.00

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Claypile Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Applebaum Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Coffee Lump Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
East Flower Garden Bank	B-15	n	1	0.00	0.01	1	3	0.01	0.03
West Flower Garden Bank	B-15	n	n	0.00	0.00	1	3	0.01	0.03
MacNeil Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
29 Fathom Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Rankin-1 Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Rankin-2 Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Bright Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Geyer Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Elvers Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
McGrail Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Sonnier Bank	B-15	n	n	0.00	0.00	1	1	0.01	0.01
Bouma Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Rezak Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.02
Sidner Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Parker Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Alderdice Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Fishnet Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Sweet Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Jakkula Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Ewing-1 Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Ewing-2 Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Diaphus Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Sackett Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Pinnacle Trend	B-15	1	2	0.01	0.02	6	8	0.07	0.09
Chandeleur Islands	B-15	1	1	0.01	0.01	4	5	0.04	0.05
Florida Middle Ground	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Pulley Ridge	B-15	n	n	0.00	0.00	n	1	0.00	0.01
Madison Swanson	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Steamboat Lumps	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Dry Tortugas	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas Ecological Reserve North	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas Ecological Reserve South	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Florida Keys National Marine Sanctuary	B-15	n	n	0.00	0.00	n	1	0.00	0.01
Key Biscayne National	B-15	n	n	0.00	0.00	n	n	0.00	0.00

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Park									
Texas Clipper and South Texas Platform*	B-16	n	n	0.00	0.00	n	1	0.00	0.01
Port Lavaca/Liberty Ship Reef*	B-16	1	1	0.01	0.01	3	8	0.04	0.08
High Island*	B-16	n	1	0.00	0.01	3	6	0.03	0.06
West Cameron*	B-16	1	2	0.01	0.02	5	10	0.05	0.10
Galveston Area (GA 393)*	B-16	n	n	0.00	0.00	n	1	0.00	0.01
Cognac Platform (MC 194)*	B-17	n	n	0.00	0.00	1	1	0.01	0.01
Horseshoe Rigs (MP 306)*	B-17	n	n	0.00	0.00	1	1	0.01	0.01
Vermilion Area*	B-16	1	2	0.01	0.02	7	12	0.07	0.13
Vermilion Area, South Addition*	B-16	1	2	0.01	0.02	6	10	0.07	0.10
Bay Marchand*	B-16	n	n	0.00	0.00	1	1	0.01	0.01
South Timbalier*	B-16	2	2	0.02	0.02	9	12	0.10	0.12
South Timbalier Area, South Addition*	B-16	1	2	0.01	0.02	7	9	0.07	0.09
Panhandle FL*	B-17	n	n	0.00	0.00	1	2	0.01	0.02
Tampa*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
SE FL*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Daytona Beach*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Jacksonville*	B-17	n	n	0.00	0.00	n	n	0.00	0.00

Notes: * = seasonal (April-November); ** = Greater than 99.5%; n = less than 0.5%

Table A-4.   Probabilities (expressed as percent chance) of one or more offshore spills ≥1,000 barrels occurring and contacting certain onshore resources within 10 and 30 days for low and high oil production estimates for Alternative A.

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Cameron, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Willacy, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Kenedy, TX	B-3	n	n	0.00	0.00	n	2	0.00	0.02
Kleberg, TX	B-4	n	n	0.00	0.00	n	1	0.00	0.01
Nueces, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Aransas, TX	B-4	n	n	0.00	0.00	n	1	0.00	0.01
Calhoun, TX	B-3	n	n	0.00	0.00	1	3	0.01	0.03
Matagorda, TX	B-4	n	1	0.00	0.01	2	6	0.02	0.06
Brazoria, TX	B-3	n	1	0.00	0.01	1	4	0.01	0.04
Galveston, TX	B-4	n	1	0.00	0.01	2	6	0.02	0.06
Chambers, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Jefferson, TX	B-4	n	n	0.00	0.00	1	3	0.01	0.03
Cameron, LA	B-3	n	1	0.00	0.01	2	5	0.02	0.05
Vermilion, LA	B-4	n	n	0.00	0.00	1	3	0.01	0.03
Iberia, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
St. Mary, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Terrebonne, LA	B-3	1	1	0.01	0.01	4	6	0.04	0.06
Lafourche, LA	B-4	n	1	0.00	0.01	2	3	0.02	0.03
Jefferson, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
Plaquemines, LA	B-4	1	2	0.01	0.02	6	8	0.06	0.09
St. Bernard, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
Hancock, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Harrison, MS	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Jackson, MS	B-4	n	n	0.00	0.00	1	1	0.01	0.01
Mobile, ALA	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Baldwin, ALA	B-4	n	n	0.00	0.00	n	1	0.00	0.01
Escambia, FL	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Santa Rosa, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Okaloosa, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Walton, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Bay, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Gulf, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Franklin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Wakulla, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Jefferson, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Taylor, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Dixie, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Levy, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Citrus, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Hernando, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Pasco, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Pinellas, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Hillsborough, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Manatee, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Sarasota, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Charlotte, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Lee, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Collier, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Monroe, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Dade, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Broward, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Palm Beach, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Martin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
St. Lucie, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Indian River, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Brevard, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Volusia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Flagler, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
St. Johns, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Duval, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Nassau, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
TX	B-1a	1	5	0.01	0.05	8	24	0.09	0.27
LA	B-1a	3	5	0.03	0.06	17	27	0.19	0.31
MS	B-1a	n	n	0.00	0.00	1	2	0.01	0.02
AL	B-1a	n	n	0.00	0.00	1	1	0.01	0.01
FL	B-1a	n	n	0.00	0.00	n	2	0.00	0.02
Tamaulipas, Mexico	B-1a	n	n	0.00	0.00	n	1	0.00	0.01
Veracruz-Llave, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Tabasco, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Campeche, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Yucatan, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Quintana Roo, Mexcio	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Belize (country)	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Cuba	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
TX Coastal Bend Beach Area	B-10	n	1	0.00	0.01	1	6	0.01	0.06
TX Matagorda Beach Area	B-10	n	2	0.01	0.02	3	9	0.03	0.09
TX Galveston Beach Area	B-10	1	2	0.01	0.02	4	9	0.04	0.10
TX Sea Rim State Park	B-10	n	n	0.00	0.00	1	3	0.01	0.03

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
LA Beach Areas	B-10	1	2	0.01	0.02	5	9	0.05	0.10
AL/MS Gulf Islands	B-10	n	n	0.00	0.00	1	2	0.01	0.02
AL Gulf Shores	B-10	n	n	0.00	0.00	n	1	0.00	0.01
FL Panhandle Beach Area	B-10	n	n	0.00	0.00	n	1	0.00	0.01
FL Big Bend Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Southwest Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Ten Thousand Islands Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Southeast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Centraleast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Northeast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00

Notes: ** = Greater than 99.5%; n = less than 0.5%

Table A-5.   Probabilities (expressed as percent chance) of one or more offshore spills ≥1,000 barrels occurring and contacting certain offshore resource locations within 10 and 30 days for low and high oil production estimates for Alternative B.

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Cayman Islands	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Northwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Northeast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Midwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Mideast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
South Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Jamaica	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
TX State Waters	B-2	1	3	0.01	0.03	4	17	0.05	0.19
West LA State Waters	B-2	3	5	0.03	0.05	17	26	0.19	0.29
East LA State Waters	B-2	1	1	0.01	0.01	6	8	0.06	0.08
MS State Waters	B-2	n	n	0.00	0.00	1	2	0.01	0.02
AL State Waters	B-2	n	n	0.00	0.00	1	2	0.01	0.02
FL Panhandle State Waters	B-2	n	n	0.00	0.00	1	2	0.01	0.02
West FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Southeast FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Northeast State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Mexican State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (1)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (2)	B-11	n	1	0.00	0.01	n	5	0.00	0.05
Shoreline - 20 m (3)	B-11	1	3	0.01	0.03	7	16	0.07	0.18
Shoreline - 20 m (4)	B-11	2	4	0.02	0.04	14	20	0.15	0.22
Shoreline - 20 m (5)	B-11	4	5	0.04	0.05	20	25	0.22	0.28
Shoreline - 20 m (6)	B-11	1	2	0.01	0.02	6	8	0.07	0.08
Shoreline - 20 m (7)	B-11	1	1	0.01	0.01	4	5	0.04	0.06
Shoreline - 20 m (8)	B-11	n	n	0.00	0.00	1	2	0.01	0.02
Shoreline - 20 m (9)	B-11	n	n	0.00	0.00	n	2	0.00	0.02
Shoreline - 20 m (10)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (11)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (12)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
Shoreline - 20 m (13)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (14)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (15)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (1)	B-11	n	1	0.00	0.01	1	7	0.01	0.08
20 m - 300 m (2)	B-11	2	4	0.02	0.05	11	23	0.12	0.26
20 m - 300 m (3)	B-11	5	7	0.05	0.07	26	33	0.31	0.40

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
20 m - 300 m (4)	B-11	6	7	0.06	0.07	28	33	0.33	0.40
20 m - 300 m (5)	B-11	1	2	0.01	0.02	7	9	0.08	0.10
20 m - 300 m (6)	B-11	2	2	0.02	0.02	9	11	0.10	0.12
20 m - 300 m (7)	B-11	1	2	0.01	0.02	7	9	0.08	0.10
20 m - 300 m (8)	B-11	n	1	0.00	0.01	2	5	0.02	0.05
20 m - 300 m (9)	B-11	n	n	0.00	0.00	n	2	0.00	0.02
20 m - 300 m (10)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
20 m - 300 m (11)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
20 m - 300 m (12)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (13)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (14)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (1)	B-11	n	1	0.00	0.02	1	8	0.01	0.08
300 m - outer jurisdiction (2)	B-11	n	2	0.00	0.02	1	8	0.01	0.08
300 m - outer jurisdiction (3)	B-11	1	3	0.01	0.03	4	13	0.04	0.14
300 m - outer jurisdiction (4)	B-11	1	3	0.01	0.03	4	13	0.04	0.14
300 m - outer jurisdiction (5)	B-11	n	2	0.00	0.02	2	8	0.02	0.09
300 m - outer jurisdiction (6)	B-11	3	4	0.03	0.04	12	20	0.13	0.22
300 m - outer jurisdiction (7)	B-11	3	4	0.03	0.04	12	19	0.12	0.21
300 m - outer jurisdiction (8)	B-11	2	3	0.02	0.03	8	14	0.08	0.15
300 m - outer jurisdiction (9)	B-11	3	4	0.03	0.05	15	21	0.17	0.23
300 m - outer jurisdiction (10)	B-11	4	5	0.04	0.05	17	23	0.18	0.26
300 m - outer jurisdiction (11)	B-11	3	4	0.03	0.04	11	17	0.12	0.19
300 m - outer jurisdiction (12)	B-11	4	5	0.04	0.06	20	25	0.23	0.29
300 m - outer jurisdiction (13)	B-11	4	5	0.04	0.05	18	23	0.20	0.26
300 m - outer jurisdiction (14)	B-11	3	4	0.03	0.04	12	17	0.12	0.19
300 m - outer jurisdiction (15)	B-11	3	3	0.03	0.04	13	16	0.14	0.18

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
300 m - outer jurisdiction (16)	B-11	4	5	0.05	0.05	19	23	0.22	0.26
300 m - outer jurisdiction (17)	B-11	4	5	0.04	0.05	18	22	0.20	0.25
300 m - outer jurisdiction (18)	B-11	2	3	0.03	0.03	11	14	0.12	0.16
300 m - outer jurisdiction (19)	B-11	2	2	0.02	0.02	7	11	0.08	0.11
300 m - outer jurisdiction (20)	B-11	1	2	0.01	0.02	7	10	0.07	0.11
300 m - outer jurisdiction (21)	B-11	1	1	0.01	0.01	3	6	0.03	0.06
300 m - outer jurisdiction (22)	B-11	1	2	0.01	0.02	5	9	0.06	0.09
300 m - outer jurisdiction (23)	B-11	n	1	0.00	0.01	1	3	0.01	0.04
300 m - outer jurisdiction (24)	B-11	1	2	0.01	0.02	5	10	0.05	0.10
300 m - outer jurisdiction (25)	B-11	n	n	0.00	0.00	n	2	0.00	0.02
300 m - outer jurisdiction (26)	B-11	n	1	0.00	0.01	1	4	0.01	0.04
300 m - outer jurisdiction (27)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
300 m - outer jurisdiction (28)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (28)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (30)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Mysterious Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Blackfish Ridge Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Dream Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Southern Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Hospital Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
North Hospital Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Aransas Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
South Baker Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Baker Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Big Dunn Bar Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Small Dunn Bar Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
32 Fathom	B-14	n	n	0.00	0.00	n	1	0.00	0.01

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Stetson Bank	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Claypile Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Applebaum Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Coffee Lump Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
East Flower Garden Bank	B-15	n	n	0.00	0.00	1	2	0.01	0.02
West Flower Garden Bank	B-15	n	n	0.00	0.00	1	2	0.01	0.02
MacNeil Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
29 Fathom Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Rankin-1 Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Rankin-2 Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Bright Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.02
Geyer Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Elvers Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
McGrail Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Sonnier Bank	B-15	n	n	0.00	0.00	1	1	0.01	0.01
Bouma Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Rezak Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Sidner Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Parker Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Alderdice Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Fishnet Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Sweet Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Jakkula Bank	B-14	n	n	0.00	0.00	n	1	0.00	0.01
Ewing-1 Bank	B-14	n	n	0.00	0.00	1	2	0.01	0.02
Ewing-2 Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Diaphus Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Sackett Bank	B-14	n	n	0.00	0.00	1	1	0.01	0.01
Pinnacle Trend	B-15	1	2	0.01	0.02	6	8	0.07	0.09
Chandeleur Islands	B-15	1	1	0.01	0.01	4	5	0.04	0.05
Florida Middle Ground	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Pulley Ridge	B-15	n	n	0.00	0.00	n	1	0.00	0.01
Madison Swanson	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Steamboat Lumps	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Dry Tortugas	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas Ecological Reserve North	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas Ecological Reserve South	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Florida Keys National Marine Sanctuary	B-15	n	n	0.00	0.00	n	1	0.00	0.01

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Key Biscayne National Park	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Texas Clipper and South Texas Platform*	B-16	n	n	0.00	0.00	n	1	0.00	0.01
Port Lavaca/Liberty Ship Reef*	B-16	n	1	0.00	0.01	2	6	0.02	0.06
High Island*	B-16	n	1	0.00	0.01	2	5	0.02	0.05
West Cameron*	B-16	1	2	0.01	0.02	5	9	0.05	0.09
Galveston Area (GA 393)*	B-16	n	n	0.00	0.00	n	1	0.00	0.01
Cognac Platform (MC 194)*	B-17	n	n	0.00	0.00	1	1	0.01	0.01
Horseshoe Rigs (MP 306)*	B-17	n	n	0.00	0.00	1	1	0.01	0.01
Vermilion Area*	B-16	1	2	0.01	0.02	7	12	0.07	0.12
Vermilion Area, South Addition*	B-16	1	2	0.01	0.02	6	10	0.06	0.10
Bay Marchand*	B-16	n	n	0.00	0.00	1	1	0.01	0.01
South Timbalier*	B-16	2	2	0.02	0.02	9	12	0.10	0.12
South Timbalier Area, South Addition*	B-16	1	2	0.01	0.02	7	9	0.07	0.09
Panhandle FL*	B-17	n	n	0.00	0.00	1	2	0.01	0.02
Tampa*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
SE FL*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Daytona Beach*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Jacksonville*	B-17	n	n	0.00	0.00	n	n	0.00	0.00

Notes: * = seasonal (April-November); ** = Greater than 99.5%; n = less than 0.5%

Table A-6. Probabilities (expressed as percent chance) of one or more offshore spills ≥1,000 barrels occurring and contacting certain onshore resource locations within 10 and 30 days for low and high oil production estimates for Alternative B.

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Cameron, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Willacy, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Kenedy, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Kleberg, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Nueces, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Aransas, TX	B-4	n	n	0.00	0.00	n	1	0.00	0.01
Calhoun, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Matagorda, TX	B-4	n	1	0.00	0.01	n	3	0.00	0.03
Brazoria, TX	B-3	n	n	0.00	0.00	1	2	0.01	0.02
Galveston, TX	B-4	n	1	0.00	0.01	1	5	0.02	0.05
Chambers, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Jefferson, TX	B-4	n	n	0.00	0.00	1	2	0.01	0.02
Cameron, LA	B-3	n	1	0.00	0.01	2	5	0.02	0.05
Vermilion, LA	B-4	n	n	0.00	0.00	1	3	0.01	0.03
Iberia, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
St. Mary, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Terrebonne, LA	B-3	1	1	0.01	0.01	4	6	0.04	0.06
Lafourche, LA	B-4	n	1	0.00	0.01	2	3	0.02	0.03
Jefferson, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
Plaquemines, LA	B-4	1	2	0.01	0.02	6	8	0.06	0.08
St. Bernard, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
Hancock, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Harrison, MS	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Jackson, MS	B-4	n	n	0.00	0.00	1	1	0.01	0.01
Mobile, ALA	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Baldwin, ALA	B-4	n	n	0.00	0.00	n	1	0.00	0.01
Escambia, FL	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Santa Rosa, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Okaloosa, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Walton, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Bay, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Gulf, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Franklin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Wakulla, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Jefferson, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Taylor, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Dixie, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Levy, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Citrus, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Hernando, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Pasco, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Pinellas, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Hillsborough, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Manatee, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Sarasota, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Charlotte, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Lee, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Collier, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Monroe, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Dade, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Broward, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Palm Beach, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Martin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
St. Lucie, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Indian River, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Brevard, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Volusia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Flagler, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
St. Johns, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Duval, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Nassau, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
TX	B-1a	1	3	0.01	0.03	4	16	0.04	0.17
LA	B-1a	3	5	0.03	0.05	17	26	0.19	0.30
MS	B-1a	n	n	0.00	0.00	1	2	0.01	0.02
AL	B-1a	n	n	0.00	0.00	1	1	0.01	0.01
FL	B-1a	n	n	0.00	0.00	n	2	0.00	0.02
Tamaulipas, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Veracruz-Llave, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Tabasco, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Campeche, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Yucatan, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Quintana Roo, Mexcio	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Belize (country)	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Cuba	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
TX Coastal Bend Beach Area	B-10	n	n	0.00	0.00	n	3	0.00	0.03
TX Matagorda Beach Area	B-10	n	1	0.00	0.01	1	5	0.01	0.05

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
TX Galveston Beach Area	B-10	n	1	0.00	0.01	2	7	0.02	0.07
TX Sea Rim State Park	B-10	n	n	0.00	0.00	1	2	0.01	0.02
LA Beach Areas	B-10	1	2	0.01	0.02	5	9	0.05	0.09
AL/MS Gulf Islands	B-10	n	n	0.00	0.00	1	2	0.01	0.02
AL Gulf Shores	B-10	n	n	0.00	0.00	n	1	0.00	0.01
FL Panhandle Beach Area	B-10	n	n	0.00	0.00	n	1	0.00	0.01
FL Big Bend Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Southwest Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Ten Thousand Islands Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Southeast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Centraleast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Northeast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00

Notes: ** = Greater than 99.5%; n = less than 0.5%

Table A-7. Probabilities (expressed as percent chance) of one or more offshore spills ≥1,000 barrels occurring and contacting certain offshore resource locations within 10 and 30 days for low and high oil production estimates for Alternative C.

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Cayman Islands	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Northwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Northeast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Midwest Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Mideast Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
South Bahamas	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Jamaica	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
TX State Waters	B-2	1	2	0.01	0.02	6	11	0.06	0.11
West LA State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
East LA State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
MS State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
AL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
FL Panhandle State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
West FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Southeast FL State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Northeast State Waters	B-2	n	n	0.00	0.00	n	n	0.00	0.00
Mexican State Waters	B-2	n	n	0.00	0.00	n	1	0.00	0.01
Shoreline - 20 m (1)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (2)	B-11	n	1	0.00	0.01	2	5	0.03	0.05
Shoreline - 20 m (3)	B-11	1	1	0.01	0.01	5	7	0.05	0.07
Shoreline - 20 m (4)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
Shoreline - 20 m (5)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (6)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (7)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (8)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (9)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (10)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (11)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (12)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (13)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (14)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Shoreline - 20 m (15)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (1)	B-11	1	1	0.01	0.01	4	7	0.05	0.07
20 m - 300 m (2)	B-11	2	2	0.02	0.02	10	11	0.10	0.11
20 m - 300 m (3)	B-11	n	n	0.00	0.00	1	2	0.01	0.02

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
20 m - 300 m (4)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (5)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (6)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (7)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (8)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (9)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (10)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (11)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (12)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (13)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
20 m - 300 m (14)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (1)	B-11	1	1	0.01	0.01	5	7	0.05	0.07
300 m - outer jurisdiction (2)	B-11	1	1	0.01	0.01	5	6	0.05	0.06
300 m - outer jurisdiction (3)	B-11	1	1	0.01	0.01	5	6	0.05	0.06
300 m - outer jurisdiction (4)	B-11	1	1	0.01	0.01	6	7	0.06	0.07
300 m - outer jurisdiction (5)	B-11	1	1	0.01	0.01	3	4	0.03	0.04
300 m - outer jurisdiction (6)	B-11	n	n	0.00	0.00	2	2	0.02	0.02
300 m - outer jurisdiction (7)	B-11	n	n	0.00	0.00	1	2	0.01	0.02
300 m - outer jurisdiction (8)	B-11	n	n	0.00	0.00	1	1	0.01	0.02
300 m - outer jurisdiction (9)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (10)	B-11	n	n	0.00	0.00	n	1	0.00	0.01
300 m - outer jurisdiction (11)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (12)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (13)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (14)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (15)	B-11	n	n	0.00	0.00	n	n	0.00	0.00

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
300 m - outer jurisdiction (16)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (17)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (18)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (19)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (20)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (21)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (22)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (23)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (24)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (25)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (26)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (27)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (28)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (28)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
300 m - outer jurisdiction (30)	B-11	n	n	0.00	0.00	n	n	0.00	0.00
Mysterious Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Blackfish Ridge Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Dream Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Southern Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Hospital Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
North Hospital Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Aransas Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
South Baker Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Baker Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Big Dunn Bar Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Small Dunn Bar Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
32 Fathom	B-14	n	n	0.00	0.00	n	n	0.00	0.00

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Stetson Bank	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Claypile Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Applebaum Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Coffee Lump Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
East Flower Garden Bank	B-15	n	n	0.00	0.00	n	1	0.00	0.01
West Flower Garden Bank	B-15	n	n	0.00	0.00	n	n	0.00	0.00
MacNeil Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
29 Fathom Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Rankin-1 Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Rankin-2 Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Bright Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Geyer Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Elvers Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
McGrail Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Sonnier Bank	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Bouma Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Rezak Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Sidner Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Parker Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Alderdice Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Fishnet Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Sweet Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Jakkula Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Ewing-1 Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Ewing-2 Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Diaphus Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Sackett Bank	B-14	n	n	0.00	0.00	n	n	0.00	0.00
Pinnacle Trend	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Chandeleur Islands	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Florida Middle Ground	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Pulley Ridge	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Madison Swanson	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Steamboat Lumps	B-15	n	n	0.00	0.00	n	1	0.00	0.00
Dry Tortugas	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas Ecological Reserve North	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Tortugas Ecological Reserve South	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Florida Keys National Marine Sanctuary	B-15	n	n	0.00	0.00	n	n	0.00	0.00

Offshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Key Biscayne National Park	B-15	n	n	0.00	0.00	n	n	0.00	0.00
Texas Clipper and South Texas Platform*	B-16	n	n	0.00	0.00	n	n	0.00	0.00
Port Lavaca/Liberty Ship Reef*	B-16	n	n	0.00	0.00	2	2	0.02	0.02
High Island*	B-16	n	n	0.00	0.00	n	1	0.00	0.01
West Cameron*	B-16	n	n	0.00	0.00	n	1	0.00	0.01
Galveston Area (GA 393)*	B-16	n	n	0.00	0.00	n	n	0.00	0.00
Cognac Platform (MC 194)*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Horseshoe Rigs (MP 306)*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Vermilion Area*	B-16	n	n	0.00	0.00	n	n	0.00	0.00
Vermilion Area, South Addition*	B-16	n	n	0.00	0.00	n	n	0.00	0.00
Bay Marchand*	B-16	n	n	0.00	0.00	n	n	0.00	0.00
South Timbalier*	B-16	n	n	0.00	0.00	n	n	0.00	0.00
South Timbalier Area, South Addition*	B-16	n	n	0.00	0.00	n	n	0.00	0.00
Panhandle FL*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Tampa*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
SE FL*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Daytona Beach*	B-17	n	n	0.00	0.00	n	n	0.00	0.00
Jacksonville*	B-17	n	n	0.00	0.00	n	n	0.00	0.00

Notes: * = seasonal (April-November); ** = Greater than 99.5%; n = less than 0.5%

Table A-8. Probabilities (expressed as percent chance) of one or more offshore spills ≥1,000 barrels occurring and contacting certain onshore resources within 10 and 30 days for low and high oil production estimates for Alternative C.

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Cameron, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Willacy, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Kenedy, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Kleberg, TX	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Nueces, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Aransas, TX	B-4	n	n	0.00	0.00	n	1	0.00	0.01
Calhoun, TX	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Matagorda, TX	B-4	n	1	0.00	0.01	n	3	0.00	0.03
Brazoria, TX	B-3	n	n	0.00	0.00	1	2	0.01	0.02
Galveston, TX	B-4	n	1	0.00	0.01	1	5	0.02	0.05
Chambers, TX	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Jefferson, TX	B-4	n	n	0.00	0.00	1	2	0.01	0.02
Cameron, LA	B-3	n	1	0.00	0.01	2	5	0.02	0.05
Vermilion, LA	B-4	n	n	0.00	0.00	1	3	0.01	0.03
Iberia, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
St. Mary, LA	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Terrebonne, LA	B-3	1	1	0.01	0.01	4	6	0.04	0.06
Lafourche, LA	B-4	n	1	0.00	0.01	2	3	0.02	0.03
Jefferson, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
Plaquemines, LA	B-4	1	2	0.01	0.02	6	8	0.06	0.08
St. Bernard, LA	B-3	n	n	0.00	0.00	1	2	0.01	0.02
Hancock, MS	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Harrison, MS	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Jackson, MS	B-4	n	n	0.00	0.00	1	1	0.01	0.01
Mobile, ALA	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Baldwin, ALA	B-4	n	n	0.00	0.00	n	1	0.00	0.01
Escambia, FL	B-3	n	n	0.00	0.00	n	1	0.00	0.01
Santa Rosa, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Okaloosa, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Walton, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Bay, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Gulf, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Franklin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Wakulla, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Jefferson, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Taylor, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Dixie, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Levy, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
Citrus, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Hernando, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Pasco, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Pinellas, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Hillsborough, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Manatee, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Sarasota, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Charlotte, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Lee, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Collier, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Monroe, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Dade, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Broward, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Palm Beach, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Martin, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
St. Lucie, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Indian River, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Brevard, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Volusia, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Flagler, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
St. Johns, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
Duval, FL	B-4	n	n	0.00	0.00	n	n	0.00	0.00
Nassau, FL	B-3	n	n	0.00	0.00	n	n	0.00	0.00
TX	B-1a	1	3	0.01	0.03	4	16	0.04	0.17
LA	B-1a	3	5	0.03	0.05	17	26	0.19	0.30
MS	B-1a	n	n	0.00	0.00	1	2	0.01	0.02
AL	B-1a	n	n	0.00	0.00	1	1	0.01	0.01
FL	B-1a	n	n	0.00	0.00	n	2	0.00	0.02
Tamaulipas, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Veracruz-Llave, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Tabasco, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Campeche, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Yucatan, Mexico	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Quintana Roo, Mexcio	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Belize (country)	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
Cuba	B-1a	n	n	0.00	0.00	n	n	0.00	0.00
TX Coastal Bend Beach Area	B-10	n	n	0.00	0.00	n	3	0.00	0.03
TX Matagorda Beach Area	B-10	n	1	0.00	0.01	1	5	0.01	0.05

Onshore Resource Locations	Figure Showing Resource Location	Low Estimates				High Estimates			
		Probability		Mean		Probability		Mean	
		10 days	30 days	10 days	30 days	10 days	30 days	10 days	30 days
TX Galveston Beach Area	B-10	n	1	0.00	0.01	2	7	0.02	0.07
TX Sea Rim State Park	B-10	n	n	0.00	0.00	1	2	0.01	0.02
LA Beach Areas	B-10	1	2	0.01	0.02	5	9	0.05	0.09
AL/MS Gulf Islands	B-10	n	n	0.00	0.00	1	2	0.01	0.02
AL Gulf Shores	B-10	n	n	0.00	0.00	n	1	0.00	0.01
FL Panhandle Beach Area	B-10	n	n	0.00	0.00	n	1	0.00	0.01
FL Big Bend Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Southwest Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Ten Thousand Islands Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Southeast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Centraleast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00
FL Northeast Beach Area	B-10	n	n	0.00	0.00	n	n	0.00	0.00

Notes: ** = Greater than 99.5%; n = less than 0.5%

Appendix B.   Oil-Spill Risk Analysis Figures
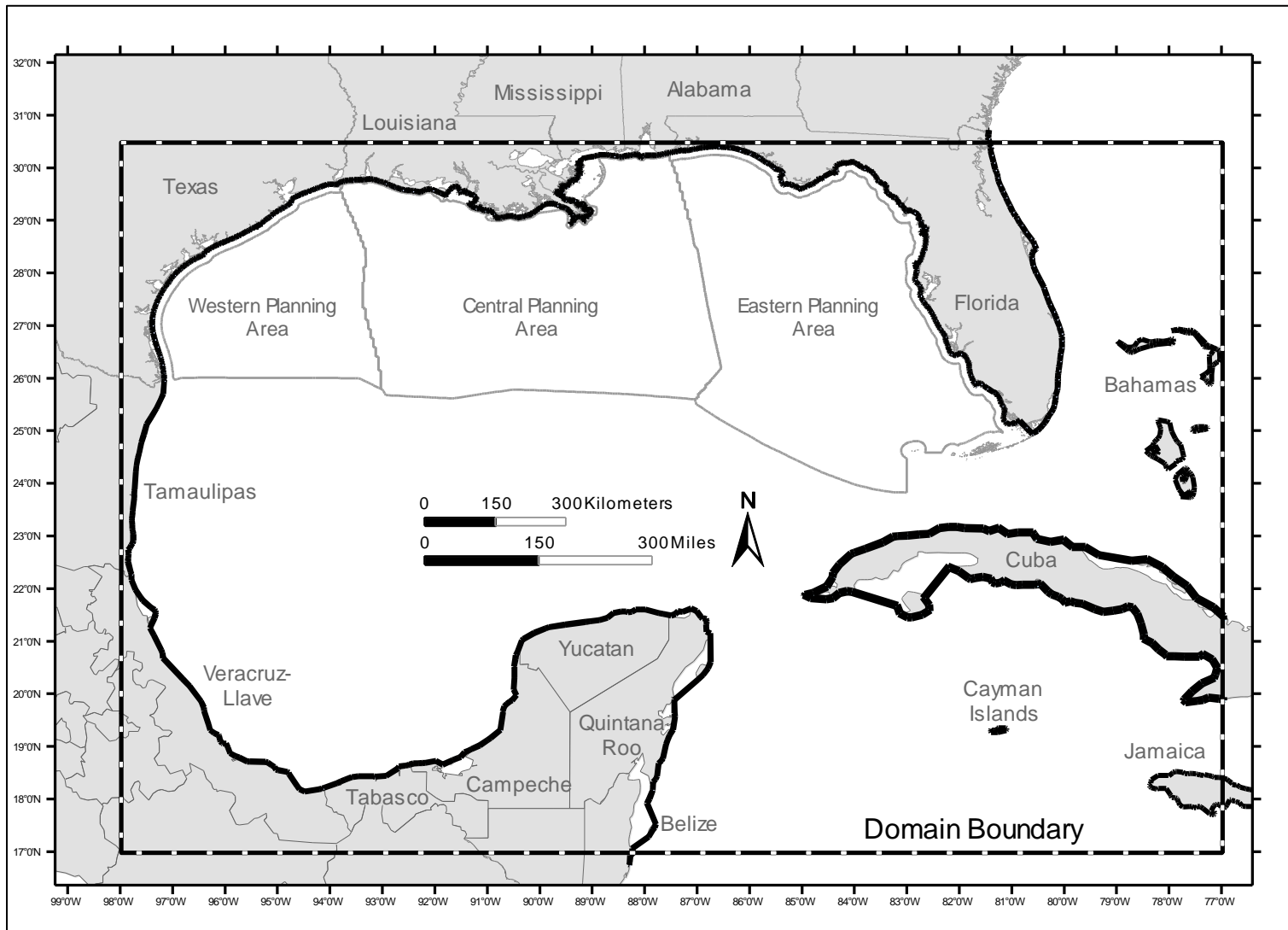
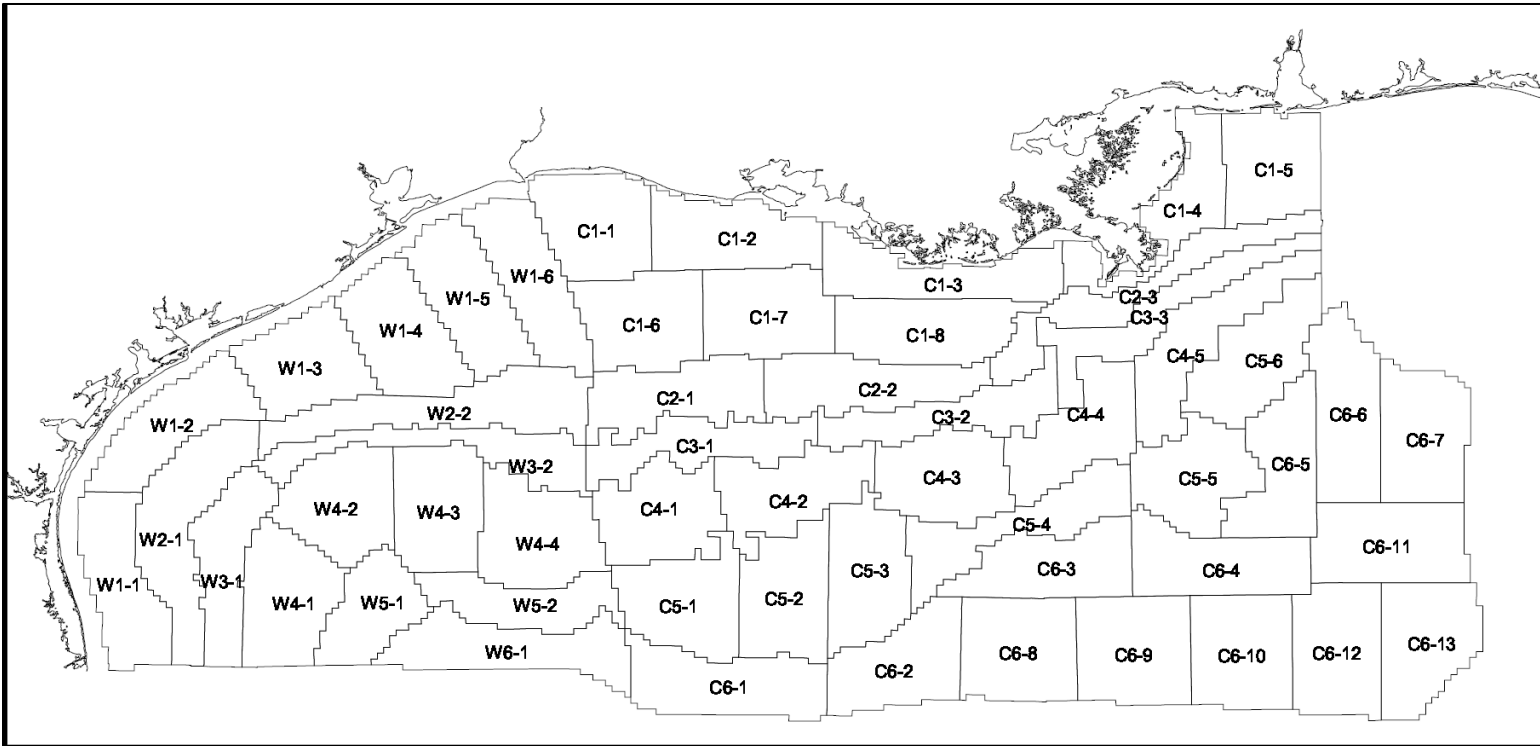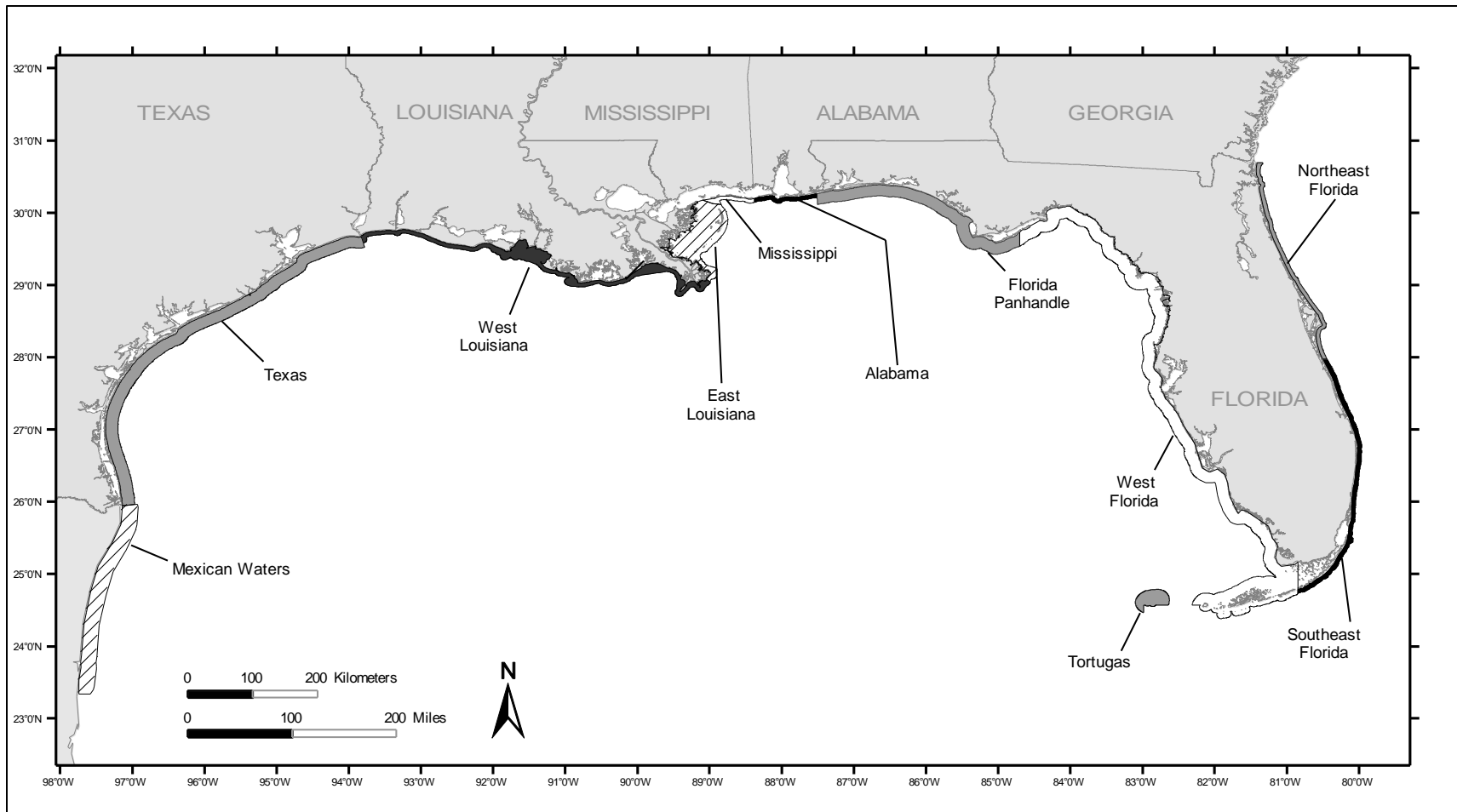**Figure B-1a.   Domain, planning areas, and locations of countries and U.S. and Mexican states.**

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

Figure B-2.   Locations of state offshore waters for Mexico, Texas, Louisiana, Mississippi, Alabama, and Florida.
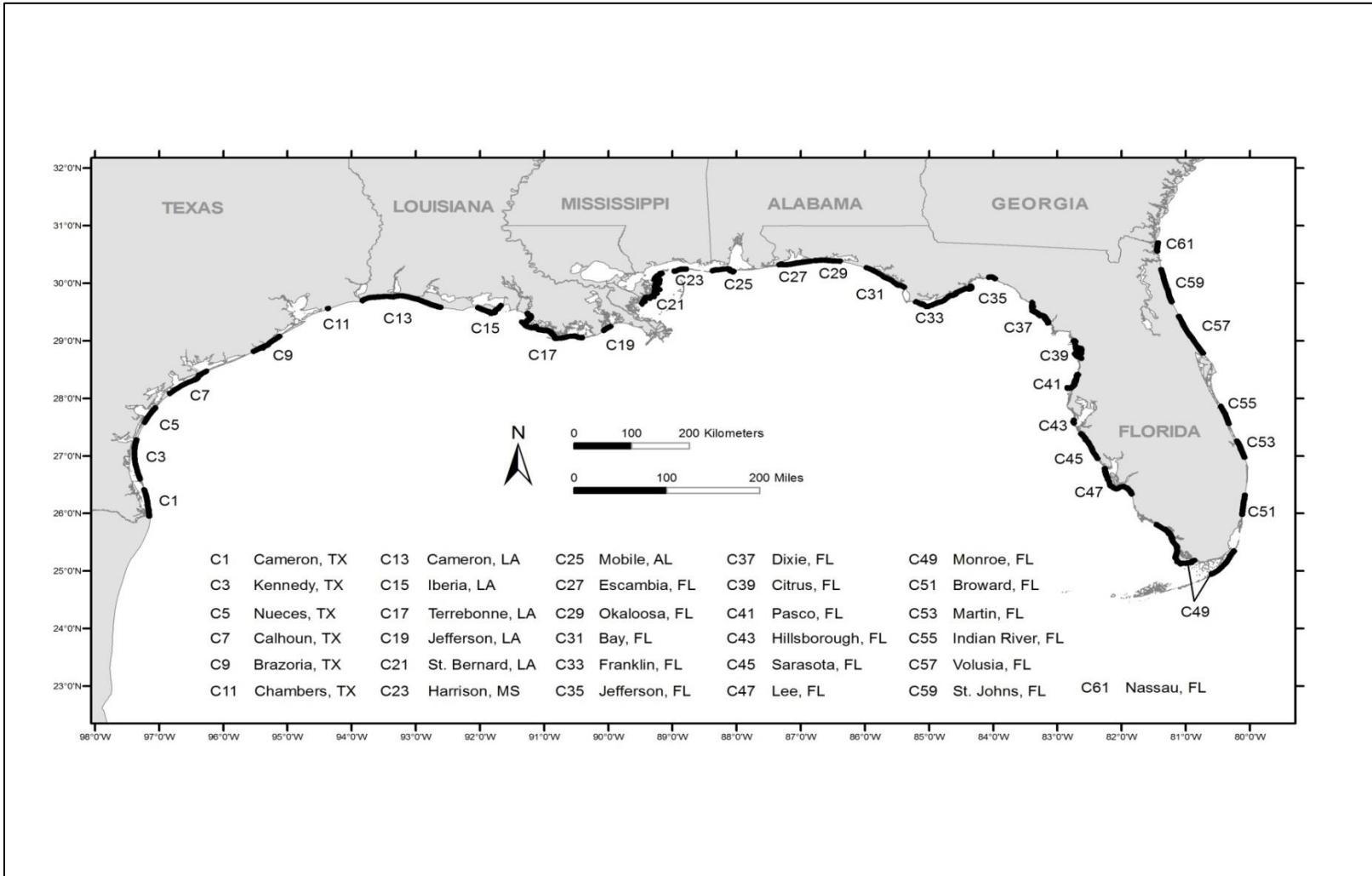
TEXAS LOUISIANA MISSISSIPPI ALABAMA GEORGIA

FLORIDA

C61
C59
C57
C55
C53
C51
C49
C47
C45
C43
C41
C39
C37
C35
C33
C31
C29
C27
C25
C23
C21
C19
C17
C15
C13
C11
C9
C7
C5
C3
C1

N

0	100	200 Kilometers				
0	100	200 Miles				

C1	Cameron, TX	C13	Cameron, LA	C25	Mobile, AL	C37	Dixie, FL	C49	Monroe, FL
C3	Kennedy, TX	C15	Iberia, LA	C27	Escambia, FL	C39	Citrus, FL	C51	Broward, FL
C5	Nueces, TX	C17	Terrebonne, LA	C29	Okaloosa, FL	C41	Pasco, FL	C53	Martin, FL
C7	Calhoun, TX	C19	Jefferson, LA	C31	Bay, FL	C43	Hillsborough, FL	C55	Indian River, FL
C9	Brazoria, TX	C21	St. Bernard, LA	C33	Franklin, FL	C45	Sarasota, FL	C57	Volusia, FL
C11	Chambers, TX	C23	Harrison, MS	C35	Jefferson, FL	C47	Lee, FL	C59	St. Johns, FL
								C61	Nassau, FL

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

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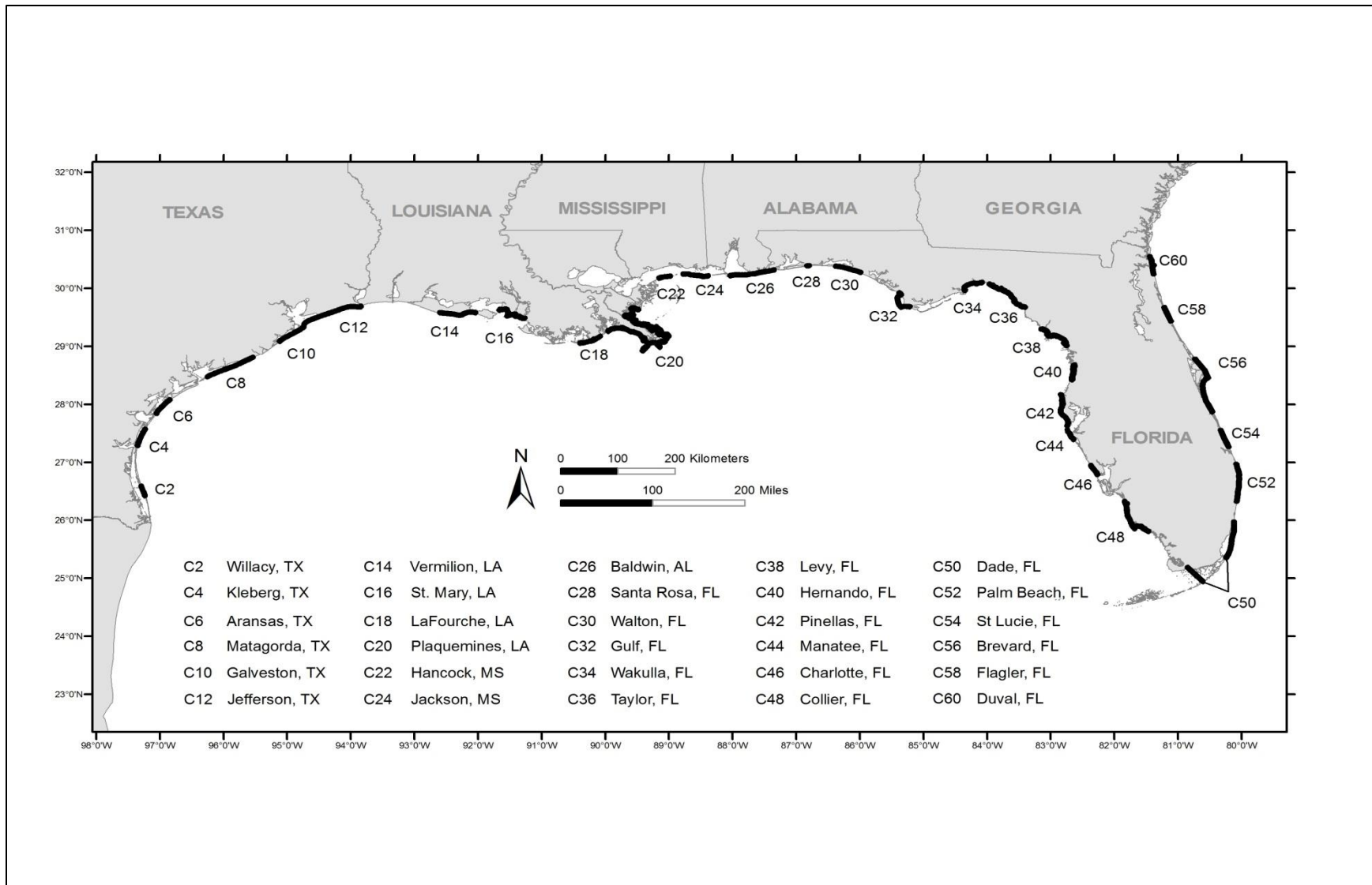
Figure B-4. Locations of Gulf of Mexico counties and parishes (set 2).
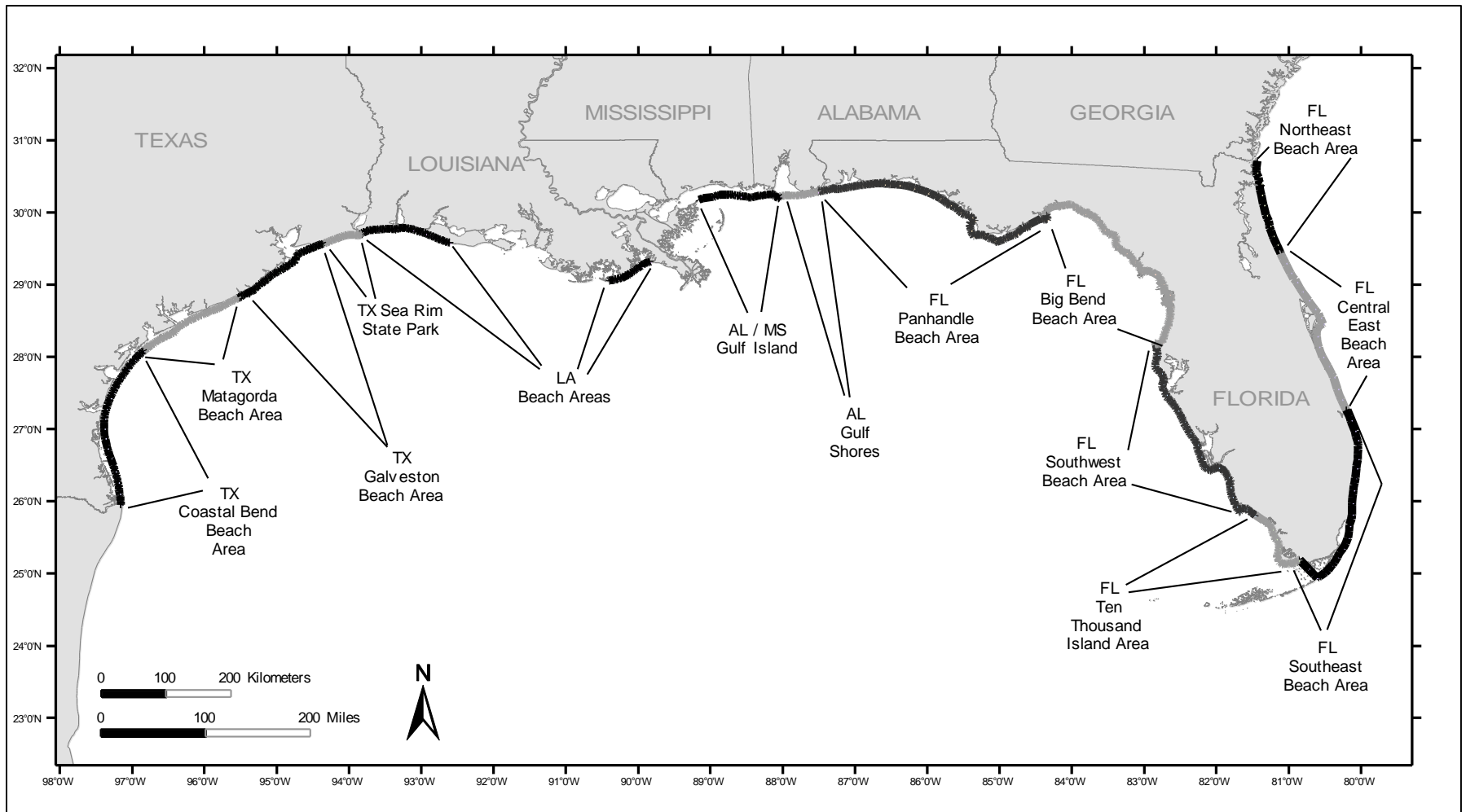
Figure B-10.   Locations of recreational beaches.

51
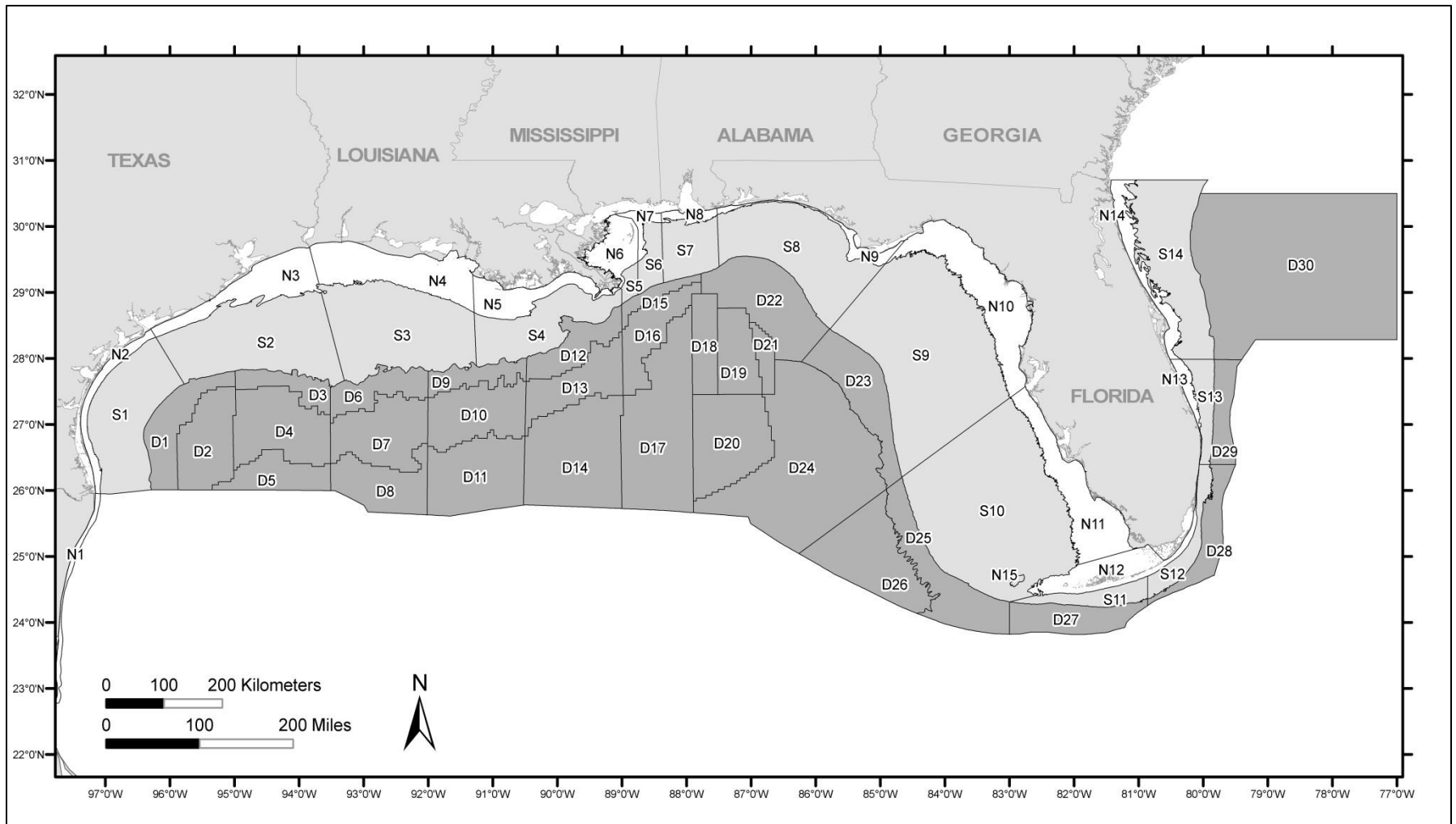
Figure B-11. Locations of nearshore ("N", 0–20 m), shelf ("S", 20–300 m), and deepwater ("D", 300 m to outer jurisdiction) seafloor polygons.
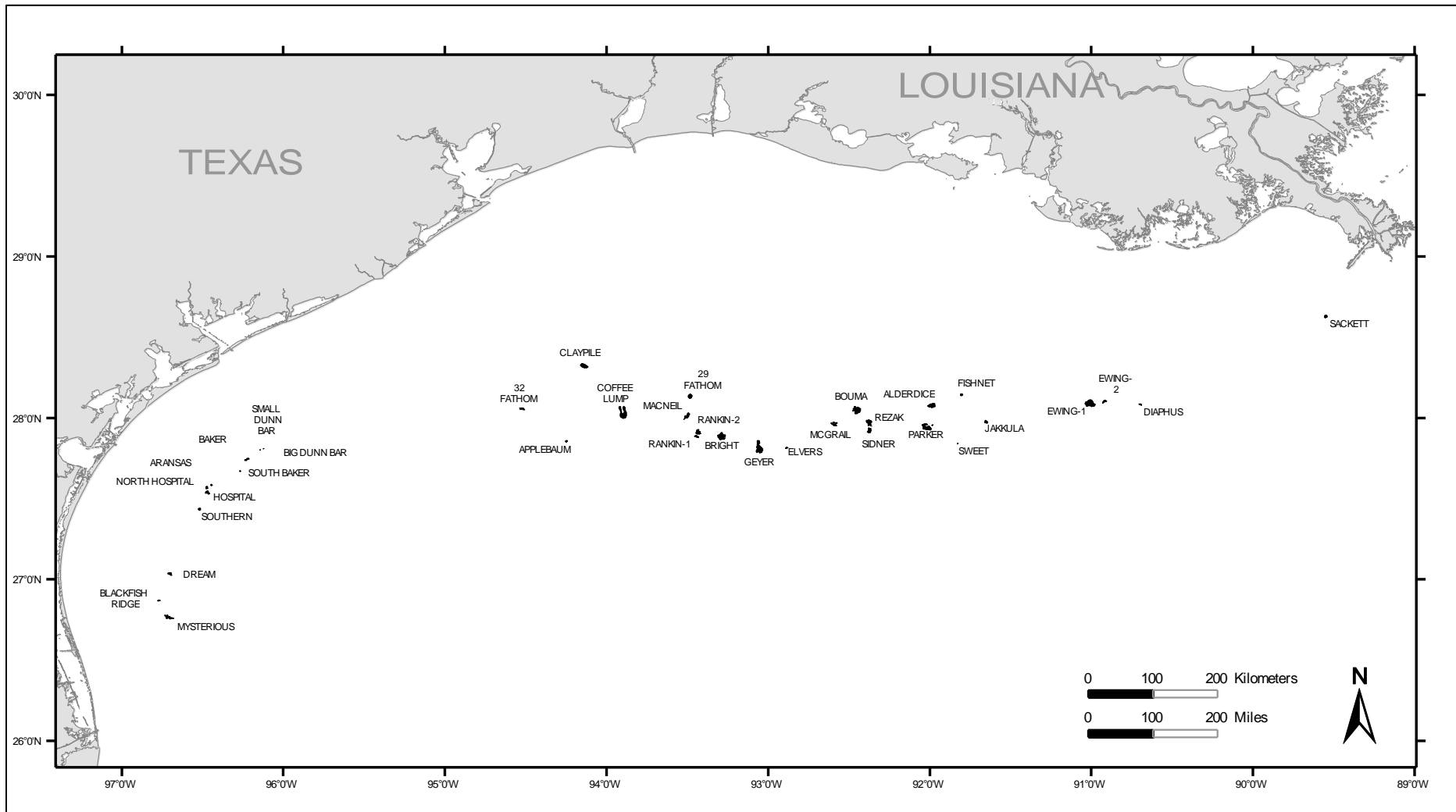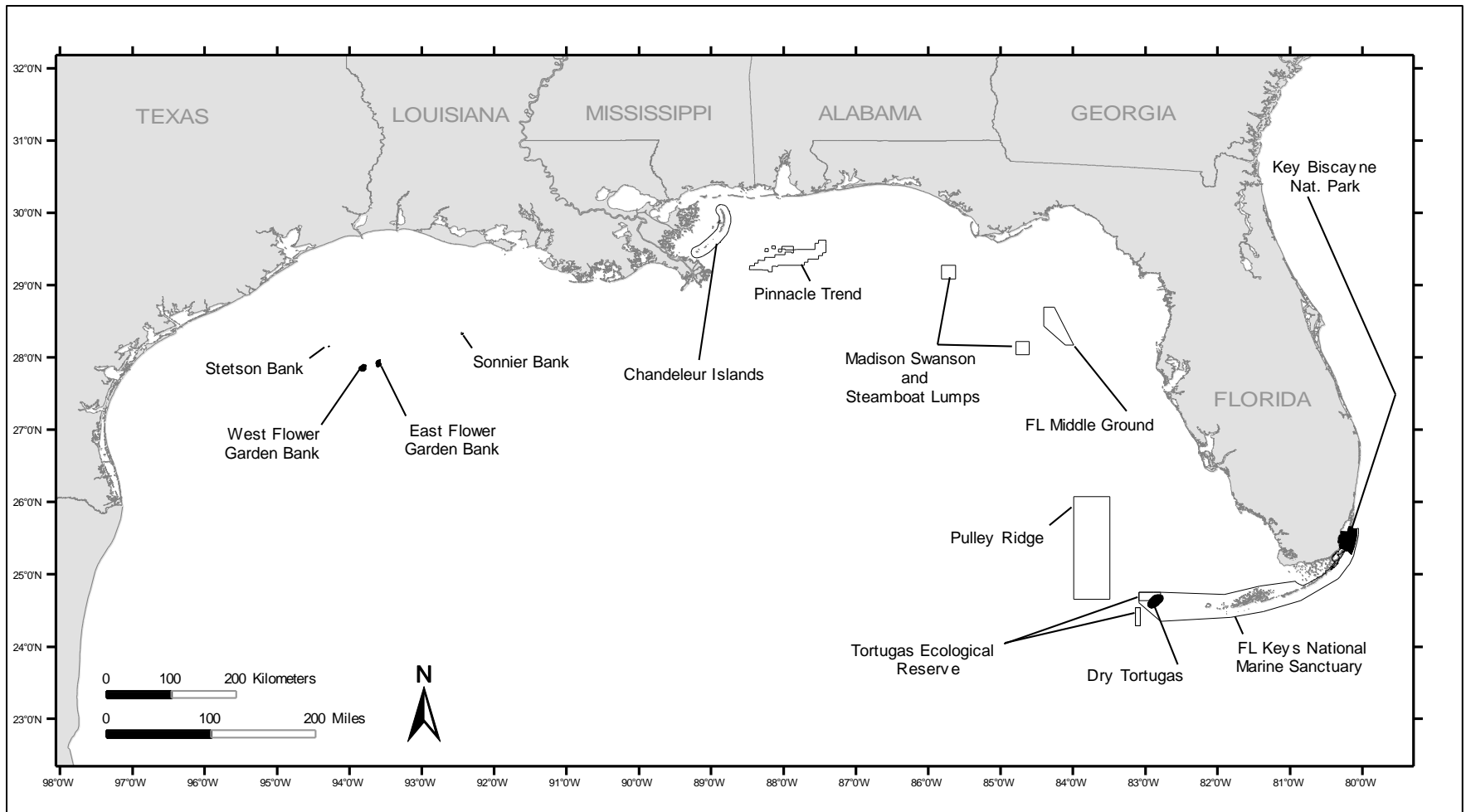
Figure B-14.   Locations of topographic features.

Figure B-15.   Locations of Habitat Areas of Particular Concern (HAPC).
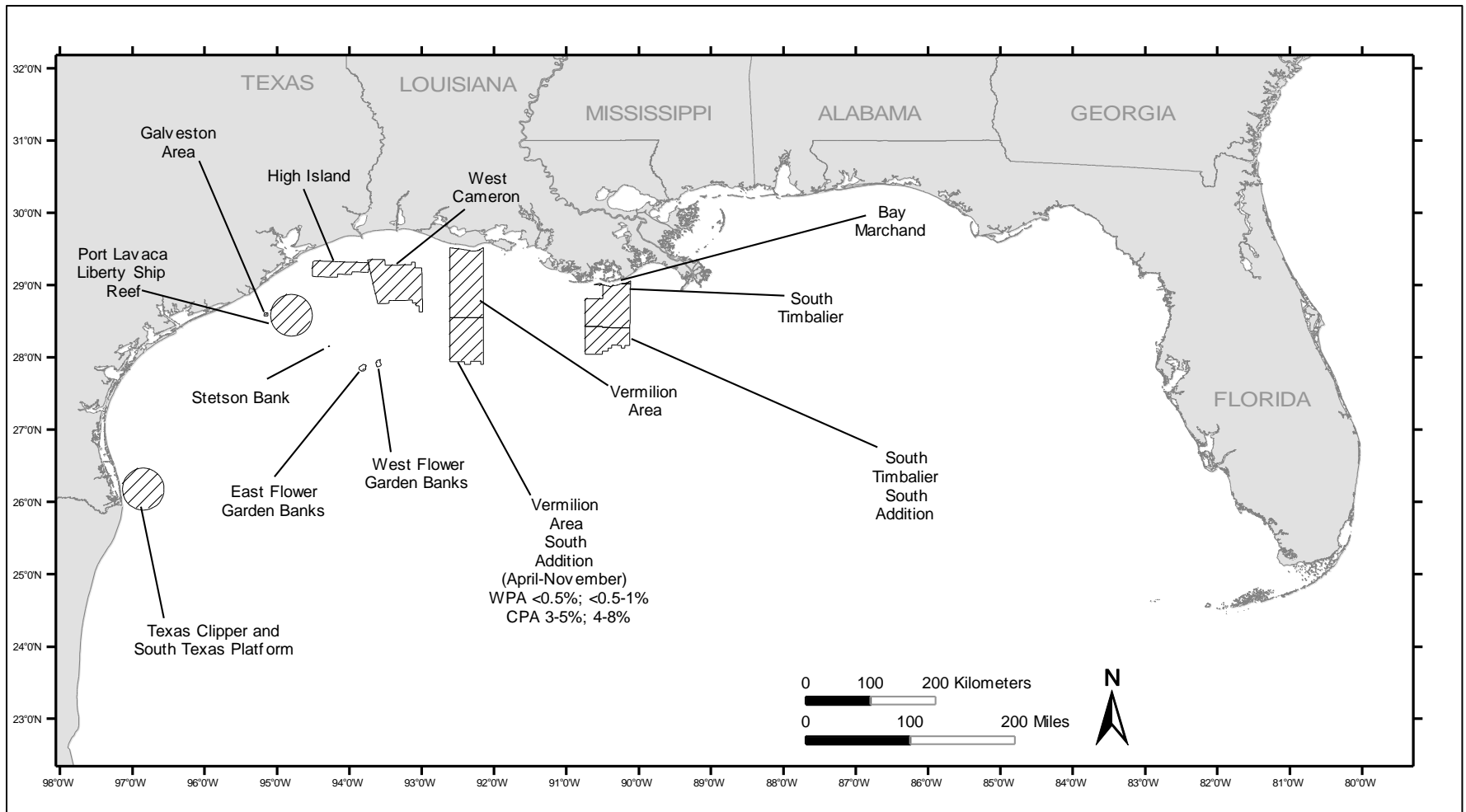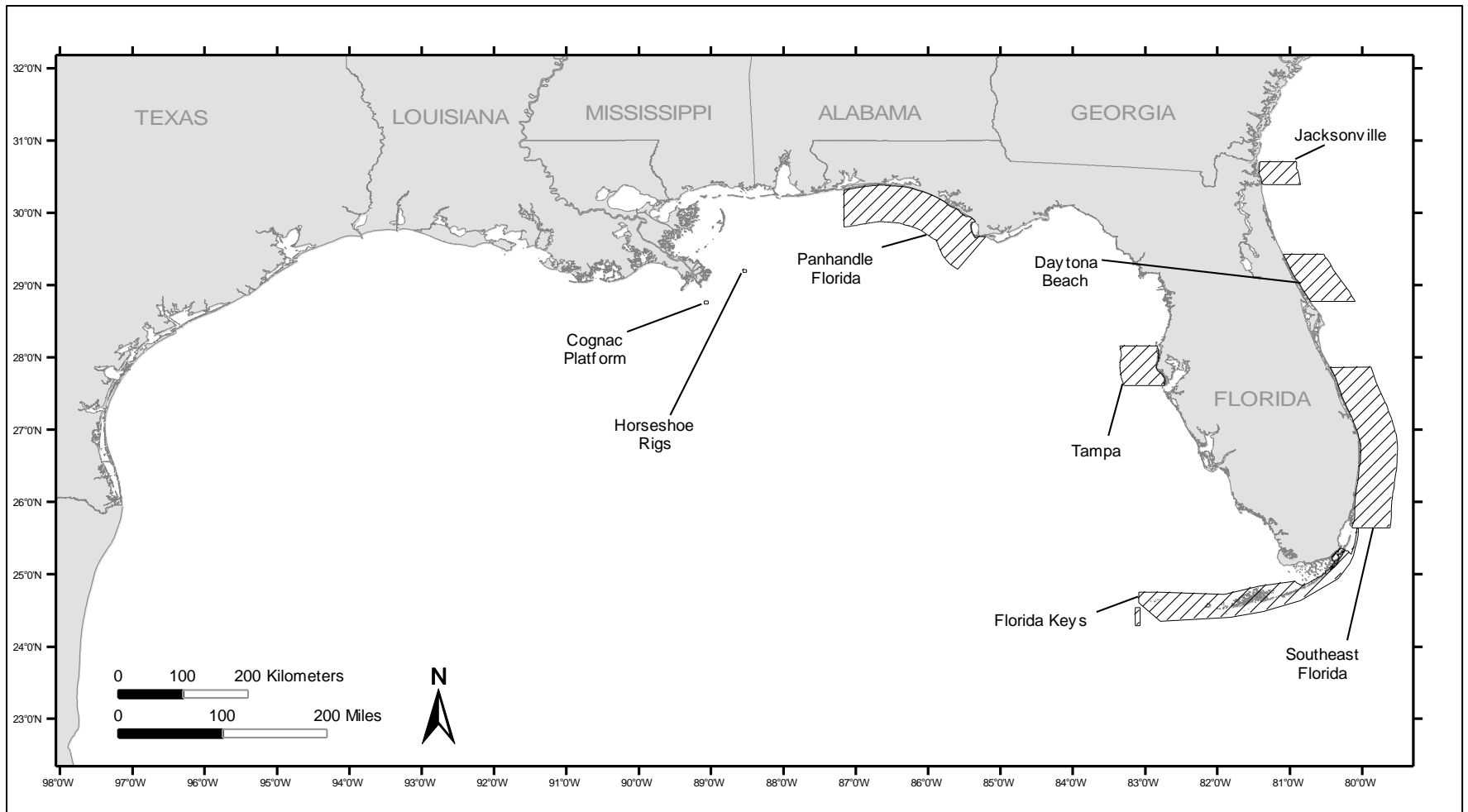
Figure B-16.   Locations of recreational dive areas in the western Gulf of Mexico.

Figure B-17. Locations of recreational dive areas in the eastern Gulf of Mexico.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources, protecting our fish, wildlife and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island communities.

The Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management (BOEM) works to manage the exploration and development of the nation's offshore resources in a way that appropriately balances economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.