

UNITED STATES DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE

AN OILSPILL RISK ANALYSIS FOR THE
CENTRAL GULF (APRIL 1984) AND WESTERN
GULF OF MEXICO (JULY 1984) LEASE OFFERINGS

by Robert P. LaBelle

Minerals Management Service
Environmental Modeling Group

U.S. GEOLOGICAL SURVEY
Open-File Report 83-119

February 1983

Contents

Introduction -----	1
Summary of the proposed action -----	1
Environmental resources -----	2
Estimated quantity of oil resources -----	4
Probability of oilspills occurring -----	5
Oilspill trajectory simulations -----	7
Combined analysis of oilspill occurrence and oilspill trajectory simulations -----	8
Conclusions -----	10
References cited -----	11
List of Illustrations -----	12
List of Tables -----	22
Appendix A -----	38
Appendix B -----	50
Appendix C -----	57

Introduction

The Federal Government has proposed to offer Outer Continental Shelf (OCS) lands off the Gulf of Mexico coast for oil and gas leasing. This report examines what could happen if oil is found, and attempts to compare relative risks of future leasing with risks of existing leases and transportation of imported oil in the study area.

Oilspills are a major concern associated with offshore oil production. An important fact that stands out when one attempts to evaluate the significance of accidental oilspills is that the problem is fundamentally probabilistic. Uncertainty exists about the amount of oil that will be produced from the leases and the number and size of spills that might occur during the life of production, as well as the wind and current conditions that would exist at the time of a spill occurrence and give movement and direction to the oil slick. Although some of the uncertainty reflects incomplete and imperfect data, considerable uncertainty is simply inherent in the problem of describing future events over which complete control cannot be exercised. Since it can not be predicted with certainty that a probabilistic event such as an oilspill will occur, only the likelihood of occurrence can be quantified. The range of possible effects that may accompany a decision on oil and gas production must be considered. In attempting to maintain perspective on the problem, each potential effect must be associated with a quantitative estimate of its probability of occurrence.

This report summarizes results of an oilspill risk analysis conducted for the proposed OCS lease offerings in the Central (April 1984) and Western (July 1984) Gulf of Mexico. The study had the objective of determining relative risks associated with oil and gas production in these areas. This study was undertaken for consideration in the draft environmental impact statement (EIS), which is prepared for the area by the Minerals Management Service, (formerly the Bureau of Land Management); and to aid in the final selection of tracts to be offered for sale. A description of the oilspill trajectory analysis model used in this analysis can be found in previous papers (Lanfear and others, 1979; Smith and others, 1982; Lanfear and Samuels, 1981). The analysis was conducted in three parts corresponding to different aspects of the overall problem. The first part dealt with the probability of oilspill occurrence and the second with the trajectories of oilspills from potential launch areas to various targets. Results of the first two parts of the analysis were then combined to give estimates of the overall oilspill risk associated with oil and gas production in the lease areas.

Summary of the Proposed Action

The proposed action is to offer for lease a large number of tracts on the Outer Continental Shelf off the U.S. coast in the Central and Western Gulf of Mexico. The study area for this analysis includes all of these tracts and extends from latitude 23° N to 30° 30' N, and from longitude 81° W to 97° 30' W. Also included in the study area are tracts from sales already held and sales to be held in the area.

For purposes of this analysis, in order to characterize as much of the Gulf as possible, the OCS lease sale study area was divided into the 77 subareas shown in figure 1. These subareas were then combined into two planning areas, Western and Central (figure 2). Areas representing the locations of natural petroleum reservoirs for existing leases are shown in figure 3.

If oil is discovered and produced, it is assumed that the oil will be transported to shore via potential and existing pipelines and tanker routes shown in figures 4 and 5, respectively. Only major pipeline routes are being considered in this analysis, and in the western Gulf such lines mainly carry gas and condensate. These pipelines may terminate in refineries or connect to major land-based lines. For existing leases, all oil is assumed to be piped ashore via the nearest pipeline route. Crude oil imported to the Gulf area is assumed to be transported via tankers and barges. Cities that receive major volumes of such imports include: Port Arthur, Galveston, Freeport, Corpus Christi, and Brownsville, Texas; New Orleans and Lake Charles, Louisiana; Pascagoula, Mississippi; Mobile, Alabama; and Pensacola and Port St. Joe, Florida.

Environmental Resources

The locations of 27 categories of environmental resources (or targets, as they are designated in this paper) were digitized in the same coordinate system, or base map, as that used in trajectory simulations. Targets were selected by MMS analysts in the Gulf of Mexico Regional OCS Office, who are preparing the EIS. Maps showing the digitized targets are shown in appendix A, figures A-1 to A-11. The monthly sensitivities of these targets were also recorded so that, for example, a target such as migrating birds could be contacted by simulated oilspills only when the birds would be in the area. All targets are considered to be vulnerable year-round unless otherwise indicated. The targets are listed below:

- Coastal inlet areas
- Sea grass beds
- East and West Flower Garden Banks
- Designated environmental preservation areas
- Major Texas beaches
- Major Louisiana beaches
- Major Mississippi beaches
- Major Alabama beaches
- Major Florida beaches
- Major Gulf beaches
- Historic and prehistoric sites
- Brown pelican rookeries
- Mississippi sandhill crane area
- Whooping crane area (vulnerable September through April)
- Sea turtle nesting beaches (vulnerable April through September)
- Manatee habitats
- Dry Tortugas
- Straits of Florida
- Atchafalaya River Basin
- Everglades National Park
- Gulf segment 1

Gulf segment 2
 Gulf segment 3
 Gulf segment 4
 Gulf segment 5
 Gulf segment 6

The target "major Gulf beaches" represents the total of all the individual State beaches. The six Gulf segments were used to help determine which directions would predominate in spills moving out of the study area.

Because the trajectory model simulates an oilspill as a point, most targets have been given an areal extent slightly greater than they actually occupy. For example, some shoreline targets extend a short distance offshore; this allows the model to simulate a spill that approaches land, makes partial contact, withdraws, and continues on its way.

To provide a more detailed analysis for land or land-based targets, the model includes a feature that allows subdividing the coastline into land segments. Figure 6 shows the coastline divided into 43 segments selected by MMS analysts to represent county or parish boundaries. Listed below are the county (parish) names and their corresponding segment numbers:

<u>County/Parish Name</u>	<u>Land Segment Number</u>
Cameron, Tex.	1
Willacy, Tex.	2
Kenedy, Tex.	3
Kleberg, Tex.	4
Nueces, Tex.	5
San Patricio, Tex.	5
Aransas, Tex.	6
Calhoun, Tex.	7
Matagorda, Tex.	8
Brazoria, Tex.	9
Galveston, Tex.	10
Chambers, Tex.	10
Jefferson, Tex.	11
Cameron, La.	12
Vermilion, La.	13
New Iberia, La.	14
St. Mary, La.	15
Terrebonne, La.	16
Lafourche, La.	17
Jefferson, La.	18
Plaquemines, La.	19
St. Bernard, La.	20
Orleans, La.	20
St. Charles, La.	20
St. John the Baptist, La.	20
Livingston, La.	20
Tangipahoa, La.	20
St. Tammany, La.	20
Hancock, Miss.	21
Harrison, Miss.	21
Jackson, Miss.	21

Mobile, Ala.	22
Baldwin, Ala.	23
Escambia, Fla.	24
Santa Rosa, Fla.	24
Okaloosa, Fla.	25
Walton, Fla.	26
Bay, Fla.	27
Gulf, Fla.	28
Franklin, Fla.	29
Wakulla, Fla.	30
Jefferson, Fla.	30
Taylor, Fla.	31
Dixie, Fla.	32
Levy, Fla.	33
Citrus, Fla.	34
Hernando, Fla.	35
Pasco, Fla.	36
Pinellas, Fla.	37
Hillsborough, Fla.	37
Manatee, Fla.	38
Sarasota, Fla.	39
Charlotte, Fla.	40
Lee, Fla.	41
Collier, Fla.	42
Dade, Fla.	43
Monroe, Fla.	43

Estimated Quantity of Oil Resources

Benefits and risks (as well as many environmental impacts), are functions of the volume of oil, and are not independent of each other. Greater risks are associated with greater volumes of oil and greater economic benefits. If benefits are evaluated by assuming production of a specific amount of oil, then the corresponding risks should be stated in a conditional form such as, "the risks are ..., given that the volume is ..". If benefits are evaluated for a number of discrete volumes, then risks should likewise be calculated for the same volumes. Any statements about the likelihood of the presence of a particular volume of oil apply equally well to the likelihood of the corresponding benefits and risks.

The estimated oil resources used for oilspill risk calculations in this report correspond to those used by MMS in preparing the EIS for the region. These estimates are based on those derived by the Resource Appraisal Group, Geologic Division, USGS, for the Bureau of Land Management (Memorandum from R. Martin, USGS, October 26, 1981). The conditional mean estimates of remaining (as of the proposed offerings) undiscovered recoverable oil in each planning area are as follows:

<u>Planning Area</u>	<u>Volume (billion bbls)</u>
Central Gulf	3.01
Western Gulf	1.40

The "total find" volume scenario refers to the total development/production

of the above volumes over an assumed production life of 40 years. The "most likely find" volume scenario refers to the estimated most likely volume of oil to be produced from the proposed lease offerings. The production life of this scenario is assumed to be 18 years. The estimated volumes for both scenarios are as follows:

<u>Planning Area</u>	<u>Volume (billion bbls)</u>	
	<u>Total Find Scenario</u>	<u>Most Likely Find Scenario</u>
Central Gulf	3.01	0.065
Western Gulf	1.40	0.029

We cannot overemphasize that these estimates are conditional, that is, they are based on the assumption that oil is present; if it is not present, then, obviously, no oilspill risks exist. The remainder of this analysis is designed to answer the question, "What are the risks if oil is found?"

The assumed volume of oil for existing leases is 3.3 billion barrels. In addition to the oil estimated to be produced over the 40-year expected life of future leases, MMS estimates that 47.9 billion barrels of crude oil will be imported into the region by tanker from outside sources over the same period. The estimate of imports over the first 18 years is 21.5 billion barrels.

Probability of Oilspills Occurring

The probability of oilspills occurring (given that oil is present) is based on the assumption that spills occur independently of each other as a Poisson process, with a rate derived from past OCS experience and dependent upon the volume of oil produced and transported. All types of accidental oil spills of 1,000 barrels, or larger, were considered in this analysis, including not only well blowouts, but also other accidents on platforms, during transportation of oil to shore, and in some cases, further transportation from an intermediate terminus to refineries. These types of accidents were classified as either platform, pipeline, or tanker spills. By including all of these risks, the risks of the proposed OCS leasing can be compared to those of other alternatives. Intentional discharges of oil are not considered in this analysis.

Lanfear and Amstutz (1982) examined oilspill occurrence rates applicable to the U.S. OCS. Basing their results upon new, more recent, and more complete data bases than were available for earlier OSTA models, they recommended updated spill rates for platforms and tankers. This analysis uses the new spill rates for all accident categories.

Spill rates for OCS platforms are based on the record for the U.S. OCS (Gulf of Mexico, and California) from 1964 through 1980, in which 5 spills of 10,000 barrels, or larger, are noted, along with 7 spills of 1,000 to 10,000 barrels in size. Nakassis (1982) conducted a statistical analysis of this record (1964-1979) and concluded that the platform spill rate did not remain constant since 1964, but had decreased significantly. Using this trend analysis, and updating for the 1980 data, the spill rate for platform spills of 1,000 barrels, or larger, is 1.0 spills per billion

barrels produced; and the spill rate for platform spills of 10,000 barrels, or larger, is 0.44 spills per billion barrels.

Like platform spills, the spill rate for pipelines is based on the record for the U.S. OCS from 1964 through 1980. Two spills of 10,000 barrels, or larger, are in the data base, along with 6 spills of 1,000 to 10,000 barrels in size. No trend in the pipeline spill rate is evident. The spill rate for pipeline spills of 1,000 barrels, or larger, is 1.60 spills per billion barrels transported; and the rate for spills of 10,000 barrels, or larger, is 0.67 spills per billion barrels.

For tanker spill rates, previous OSTA models for the Gulf of Mexico (LaBelle and Lanfear, 1980; LaBelle, 1982) used data for years prior to 1973. Using a new data base (The Futures Group, and World Information systems, 1982) covering the years 1974 through 1980, Lanfear and Amstutz (1982) concluded that the tanker spill rate (expressed as spills per billion barrels transported) since 1974 was only about a third of that found prior to 1973. Thus, this oilspill analysis uses a significantly lower tanker spill rate than the earlier models. From 1974 through 1980, the data base contains records of 57 tanker spills of crude oil of 10,000 barrels, or larger, and another 57 spills of 1,000 to 10,000 barrels in size; during this period, approximately 88 billion barrels of oil were transported. The spill rate for tanker spills of 1,000 barrels, or larger, is 1.3 spills per billion barrels transported, and the rate for spills of 10,000 barrels, or larger, is 0.65 spills per billion barrels.

In summary, the spill rates, expressed as number of spills per billion barrels produced or transported, used in this report are:

	<u>>1,000 bbl</u>	<u>>10,000 bbl</u>
Platforms	1.0	0.44
Pipelines	1.6	0.67
Tankers	1.3	0.65

Oilspill occurrence estimates for spills greater than 1,000 barrels were calculated for production and transportation of oil during the expected production life of the proposed leases, using both volume scenarios for the Central and Western planning areas, alone and combined. Similar estimates were also calculated for existing leases, and for transportation of oil imported from other areas by tanker. The assumption was made that only one-half of the spills from tanker transportation of imported oil would occur within the study area and the other half of the spills would occur outside the study area. Table 1 shows the "expected number" (or mean number) of spills estimated to occur over the entire production life of the lease area. Table 1a presents similar information, but for spills greater than 10,000 barrels only.

Oilspill Trajectory Simulations

The trajectory simulation portion of the model consists of a large number of hypothetical oilspill trajectories that collectively represent both the general trend and the variability of winds and currents, and which can be described in statistical terms. Representations of seasonal surface-water velocity fields were kindly provided by Dymalysis of Princeton (Princeton, New Jersey) (Blumberg and Mellor, 1981). The currents are geostrophically derived assuming a level of no motion at the bottom of the water column and are calculated using all available hydrographic data.

Short-term patterns in wind variability were characterized by seasonal probability matrices for successive 3-hour velocity transitions. A first-order Markov process with 41 wind velocity states (eight compass directions by five wind speed classes, and a calm condition) was assumed. The elements of this matrix are the probabilities, expressed as percent chance, that a particular wind velocity will be succeeded by another wind velocity in the next time step in a given season. If the present state of the wind is given, then the next wind state is derived by random sampling according to the percentages given in the appropriate row of the matrix. Seasonal wind transition matrices were calculated from the U.S. Weather Service records from Key West, Florida (station number 12836); environmental buoy number 42001 (located at latitude 26.0° N., longitude 90.0° W.); and environmental buoy number 42002 (located at latitude 26.0° N., longitude 93.5° W.). The study area was divided into zones so that a simulated oilspill would, depending upon its location, be directed according to the matrix of the appropriate wind station.

Five hundred hypothetical oilspill trajectories were simulated in Monte-Carlo fashion for each of the four seasons from each of the 77 subareas shown in figure 2, representing proposed lease areas. The same number per season were also simulated from each of the existing resource areas (X1 - X100, figure 3); from each pipeline transportation route segment (P1-P106, figure 4); and from each tankering transportation route segment (T1-T89, figure 5). Each potential spill source was represented as either a single point; a straight line with the potential spills uniformly distributed along the line (for example, a transportation route); or as an area (for example, the potential spills uniformly distributed within the area). Surface transport of the oil slick for each spill was simulated as a series of straight-line displacements of a point under the joint influence of winds and currents for a 3-hour period. The assumptions used are as follows: (1) the effects of wind and currents act independently; (2) only a fraction of the velocity of the wind, as a result of surface shear stress, is imparted to the body of oil; and (3) the direction of oilspill motion induced by the wind is at some angle to the direction of the wind (a result of the combined effects of Ekman, Langmuir, and Stokes drifts). The seasonal wind transition probability matrix was sampled each 3-hour period for a new wind speed and direction, and current velocity was updated as the spill changed location or the simulated month changed. The wind drift factor was taken to be 0.035 with a variable drift angle ranging from 0 to 25° clockwise. The drift angle was computed as a function of wind speed according to the formula in Samuels and others (1982); (the drift angle is inversely related to wind speed). As the simulated oilspill was moved, any contacts with targets were recorded. Spill movement

continued until the spill hit land, moved off the map, or aged more than 30 days.

The trajectories simulated by the model represent only hypothetical pathways of oil slicks and do not involve any direct consideration of cleanup, dispersion, or weathering processes which could determine the quantity or quality of oil that might eventually come in contact with targets. An implicit analysis of weathering and decay can be considered by noting the age of simulated oilspills when they contact targets. For this analysis, three time periods were selected: 3, 10, and 30 days, to represent implicit measures of oil weathering, as well as matters relating to containment and cleanup.

When calculating probabilities from Monte Carlo trials it is desirable to estimate the error associated with this technique. The standard deviation $\underline{s}$ for a particular binominal probability $\underline{p}$ is calculated as follows:

$$\underline{s} = \text{SQRT}(\underline{p}(1-\underline{p})/\underline{N}),$$

where $\underline{N}$ = number of trials. The shape of this distribution approximates the normal curve. For practical purposes, the Monte Carlo error is insignificant when $\underline{N} = 2,000$, as in this analysis.

The probability that, if an oilspill occurs at a certain location, or launch area, it will contact a specific target within a given time-of-travel (under the circumstances described above) is termed a conditional probability, because it is conditioned on oilspill occurrence. Conditional probabilities were calculated for each of the proposed and existing launch areas, and for each transportation route segment. These probabilities of contacts to targets and land segments within 3, 10, and 30 days are reported in the oilspill risk analysis report for the Gulf of Mexico Regional Environmental Impact Statement (LaBelle, 1982).

Combined Analysis of Oilspill Occurrence and Oilspill Trajectory Simulations

In calculating the combined or "overall" probabilities of both spill occurrence and contact, the following steps are taken:

(1) For a set of n_t targets and n_l launch points, the conditional probabilities (described above) 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 oilspill will hit target i , given that a spill occurs at launch point j . Note that launch points can represent potential spill starting points from production areas or transportation routes.

(2) 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 expected number of spills occurring at launch point j due to production of a unit volume of oil at site k . These spills can result from either production or transportation. The $s(j,k)$ can be expressed as functions of the volume of oil (spills per billion barrels). 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], effectively increasing ns.

(3) Define matrix [U] as:

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

Matrix [U] which has dimensions nt x ns, is termed the unit risk matrix because each element u(i,k) corresponds to the expected number of spills occurring and contacting target i due to the production of a unit volume of oil at site k.

(4) With [U], it is a relatively simple matter to find the expected contacts to each target, given a set of oil volumes at each site. Let [V] be a vector of dimension ns, 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 nt, where each element l(i) corresponds to the expected number of contacts to target i:

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

Thus, estimates of the expected number of oilspills that will both occur and contact targets or land segments can be calculated. (Note that as a statistical parameter, expected number can assume a fractional value, even though fractions of oilspills have no physical meaning.)

Using Bayesian techniques, Devanney and Stewart (1974) showed that the probability of n oilspill contacts can be described by a negative binomial distribution. Smith and others (1982), however, noted that when actual exposure is much less than historical exposure, as is the case for most oilspill risk analyses, 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 expected number of spills. The matrix [L] thus contains all the information needed to use the Poisson distribution: if P(n,i) is the probability of exactly n contacts to target i,

$$P(n,i) = \frac{[l(i)]^n \exp(-l(i))}{n!}$$

A critical difference exists between conditional probabilities and the overall probabilities calculated in this section. Conditional probabilities depend only on the winds and currents in the study area -- elements over which the decisionmaker has no control. Overall probabilities, on the other hand, will depend not only on the physical conditions, but also on the course of action chosen by the decisionmaker; that is, choosing to sell or not to sell the lease tracts. The overall probabilities for this analysis are presented in tables 2 through 13, as follows.

Tables 2 and 3 compare the probabilities of one or more oilspills (greater than 1,000 barrels) and the expected numbers (means) of such oilspills occurring and contacting targets and land segments within periods of 3, 10, and 30 days, over the expected production life of the lease area, based on the Western Gulf most likely find volume scenario. For each time period the tables present a cumulative analysis of the proposed action;

proposed action and existing leases; and proposed action plus existing leases and imported tankering of oil into the study area over the assumed production life (in this case 18 years). It is useful to compare the probabilities of spills occurring and contacting targets over the expected production life of the proposed lease area with the risks from existing leases and tanker transportation of imported oil. In this way the relative effect of adding proposed tracts to the study area may be examined.

The overall probabilities are presented in a similar fashion for the Central Gulf most likely find volume scenario in tables 4 and 5. Likewise, tables 6 and 7 show results based on this scenario, but for both the Western and Central planning areas combined. Tables 8 through 13 are arranged the same way, but are based on the total find volume scenario (with an assumed production life of 40 years).

The total find scenario was also used in calculating overall probabilities of one or more oilspills of 10,000 barrels or greater. Appendix B presents tables for Western, Central, and the combined planning areas, which show the expected numbers (means) of such large spills over a 40-year production life.

For further analysis, the 43 land segments representing county/parish boundaries (figure 6) were grouped into "coastal subareas," as follows:

<u>Land Segment Numbers</u>	<u>Coastal Subareas</u>
1-7	W1
8-11	W2
12-14	C1
15-17	C2
18-20	C3
21-23	C4
24-27	E1
28-33	E2
34-42	E3
43	E4X

Overall probabilities for these coastal subareas are presented in Appendix C. The tables show probabilities based on spills of 1,000 barrels or more, for both planning areas, and for both the most likely find and the total find volume scenarios.

Conclusions

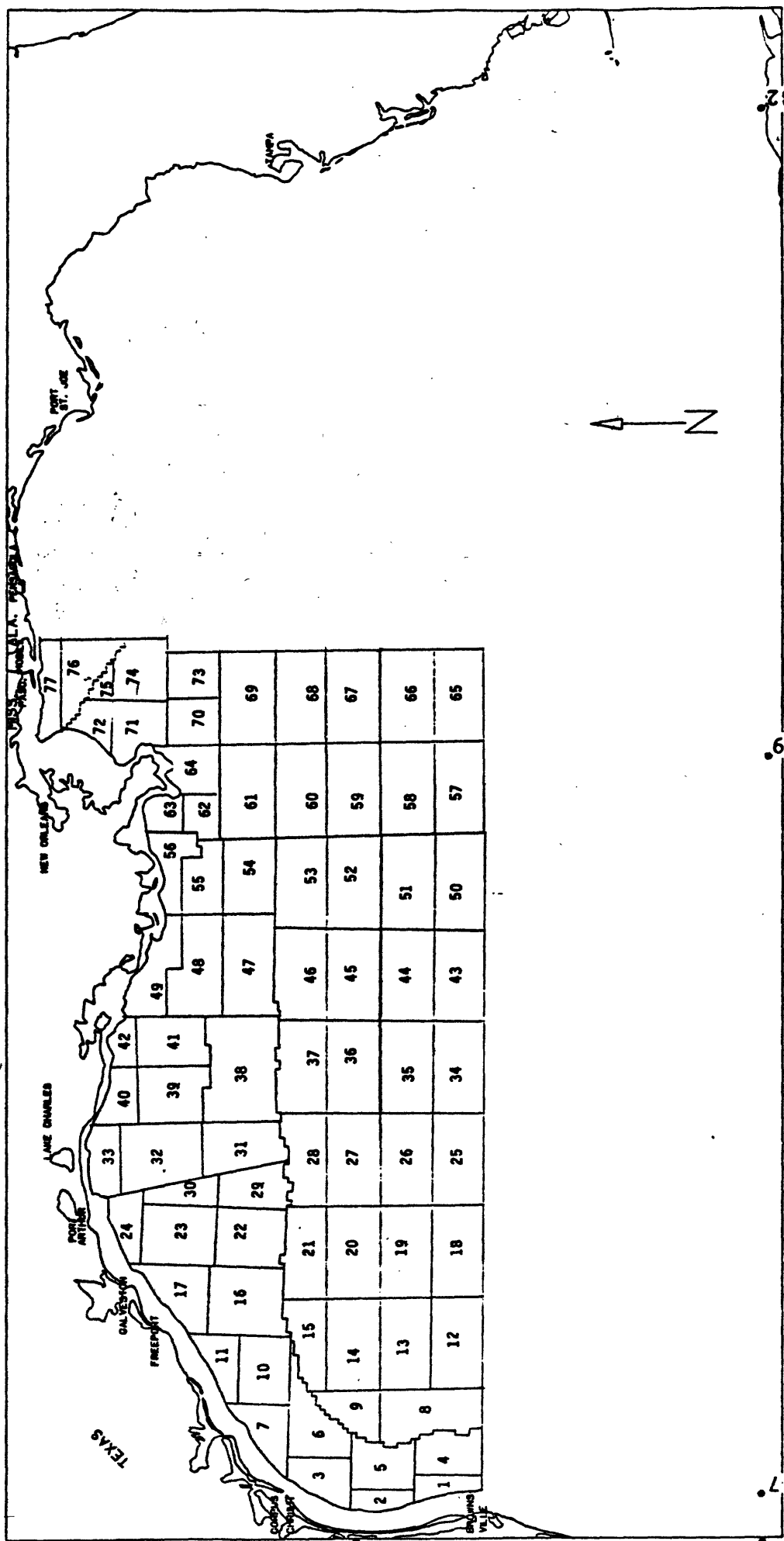
This analysis characterizes the risks involved in the leasing of OCS areas in the Western and Central Gulf of Mexico. Assuming a most likely find scenario in which 94 million barrels of oil are estimated to be present and produced over an 18-year production life, the estimated probability that one or more oilspills of 1,000 barrels or larger will occur and contact land within 30 days travel time is 21 percent. This probability is increased to greater than 99.5 percent for the total find scenario, in which 4.41 billion barrels are estimated to be produced over a 40-year assumed production life. However, the estimated mean number of spills contacting land from existing leases and existing tanker transportation of imported crude oil is almost twice that of the total find scenario.

References Cited

- Blumberg, A., and Mellor, G.L., 1981, A numerical calculation of the circulation in the Gulf of Mexico: Dymalysis, Inc., Princeton, N.J., Report 66, 159 p.
- Devanney, M.W., III, and Stewart, R.J., 1974, Analysis of oilspill statistics, April 1974: Massachusetts Institute of Technology (Cambridge) report no. MITSG-74-20 prepared for the Council on Environmental Quality, 126 p.
- LaBelle, R.P., and Lanfear, K.J., 1980, An oilspill risk analysis for the Gulf of Mexico (Proposed Sales 67 and 69) Outer Continental Shelf Lease Area: U.S. Geological Survey Open-File Report 81-306, 118 p.
- LaBelle, R.P., 1982, An oilspill risk analysis for the Gulf of Mexico Outer Continental Shelf Lease Area Regional Environmental Impact Statement: U.S. Geological Survey Open-File Report 82-238, 210 p.
- Lanfear, K.J., Smith, R.A., and Slack, J.R., 1979, An introduction to the oilspill risk analysis model: Proceedings of the Offshore Technology Conference, 11th, Houston, Tex., 1979, OTC 3607, p. 2173-2175.
- Lanfear, K.J., and Samuels, W.B., 1981, Documentation and user's guide to the U.S. Geological Survey oilspill risk analysis model: oilspill trajectories and the calculation of conditional probabilities: U.S. Geological Survey Open-File Report 81-316, 95 p.
- Lanfear, K.J. and Amstutz, D.E., 1982, A reexamination of occurrence rates for accidental oilspills on the U.S. Outer Continental Shelf: to be presented at the Eighth Conference on the Prevention, Behavior, Control, and Cleanup of Oil Spills, San Antonio, Texas, February 28-March 3, 1983.
- Nakassis, A., 1982, Has offshore oil production become safer?: U.S. Geological Survey Open-File Report 82-232, 27 p.
- Samuels, W.B., Huang, N.E., and Amstutz, D.E., 1982, An oilspill trajectory analysis model with a variable wind deflection angle: Ocean Engineering, v.9. p. 347-360.
- Smith, R.A., Slack, J.R., Wyant, T., and Lanfear, K.J., 1982, The oilspill risk analysis model of the U.S. Geological Survey: U.S. Geological Survey Professional Paper 1227, 40 p.
- The Futures Group, and World Information Systems, 1982, "Final technical report, Outer Continental Shelf Oil Spill Probability Assessment, Volume I: Data collection report", Prepared for the U.S. Department of the Interior, Bureau of Land Management, under contract number AA851-CTO-69, The Futures Group, Glastonbury, Conn., 69 p.

List of Illustrations

<u>Figure</u>	<u>Page</u>
1. Map showing the Gulf of Mexico OCS lease offerings study area divided into 77 subareas. -----	13
2. Map showing the subdivisions of the Gulf of Mexico into Western and Central planning areas. -----	14
3. Map showing the resource areas for existing Gulf of Mexico OCS leases. -----	15
4. Map showing the pipeline transportation route segments (P1 - P106). -----	17
5. Map showing the tankering and transportation route segments (T1 - T89) and other possible spill sites (S1 - S3). -----	19
6. Map showing the division of the Gulf of Mexico coastline into 43 segments (representing county boundaries) selected by MMS. -----	21



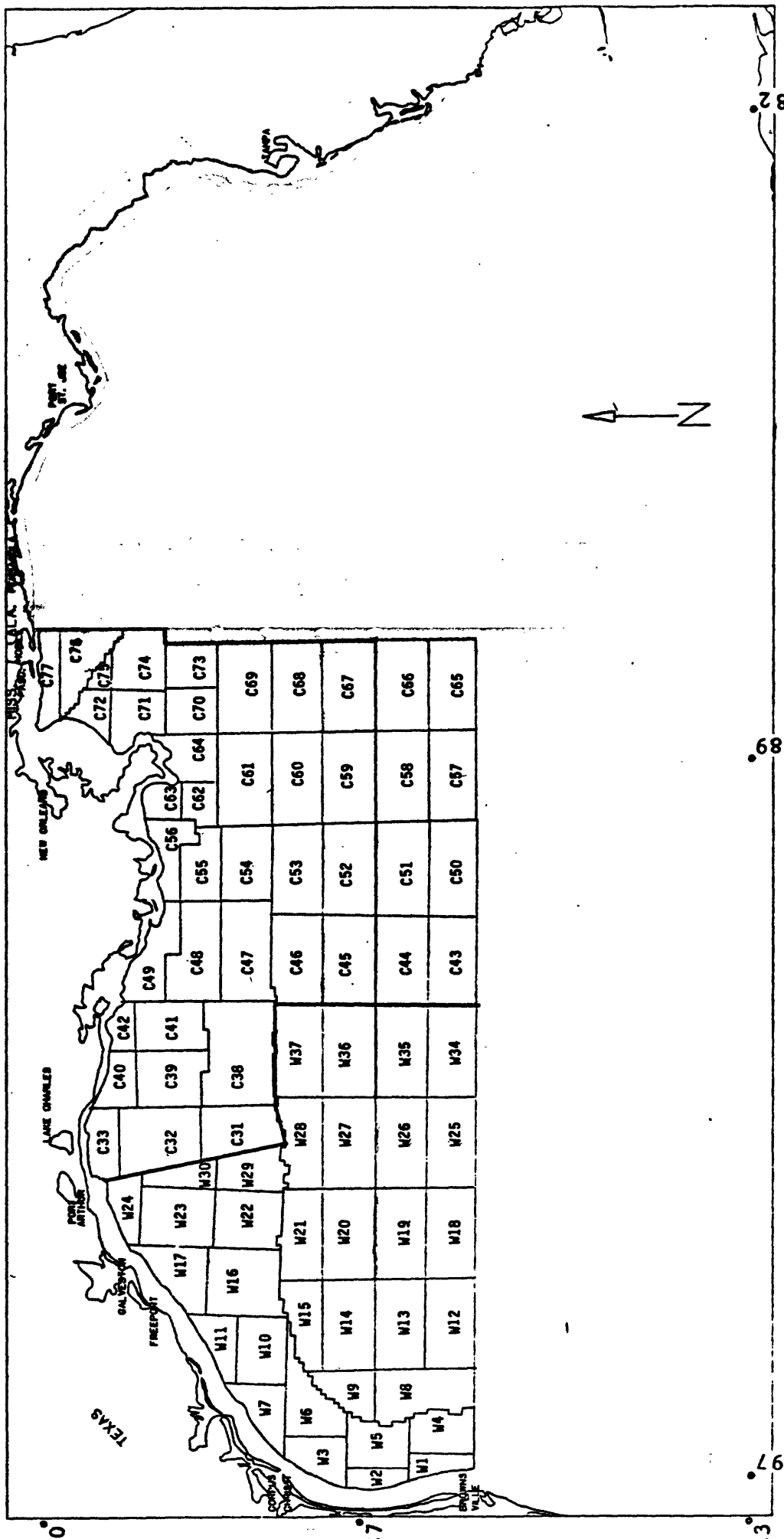


Figure 2.--Map showing the subdivisions of the Gulf of Mexico into Western and Central planning areas.

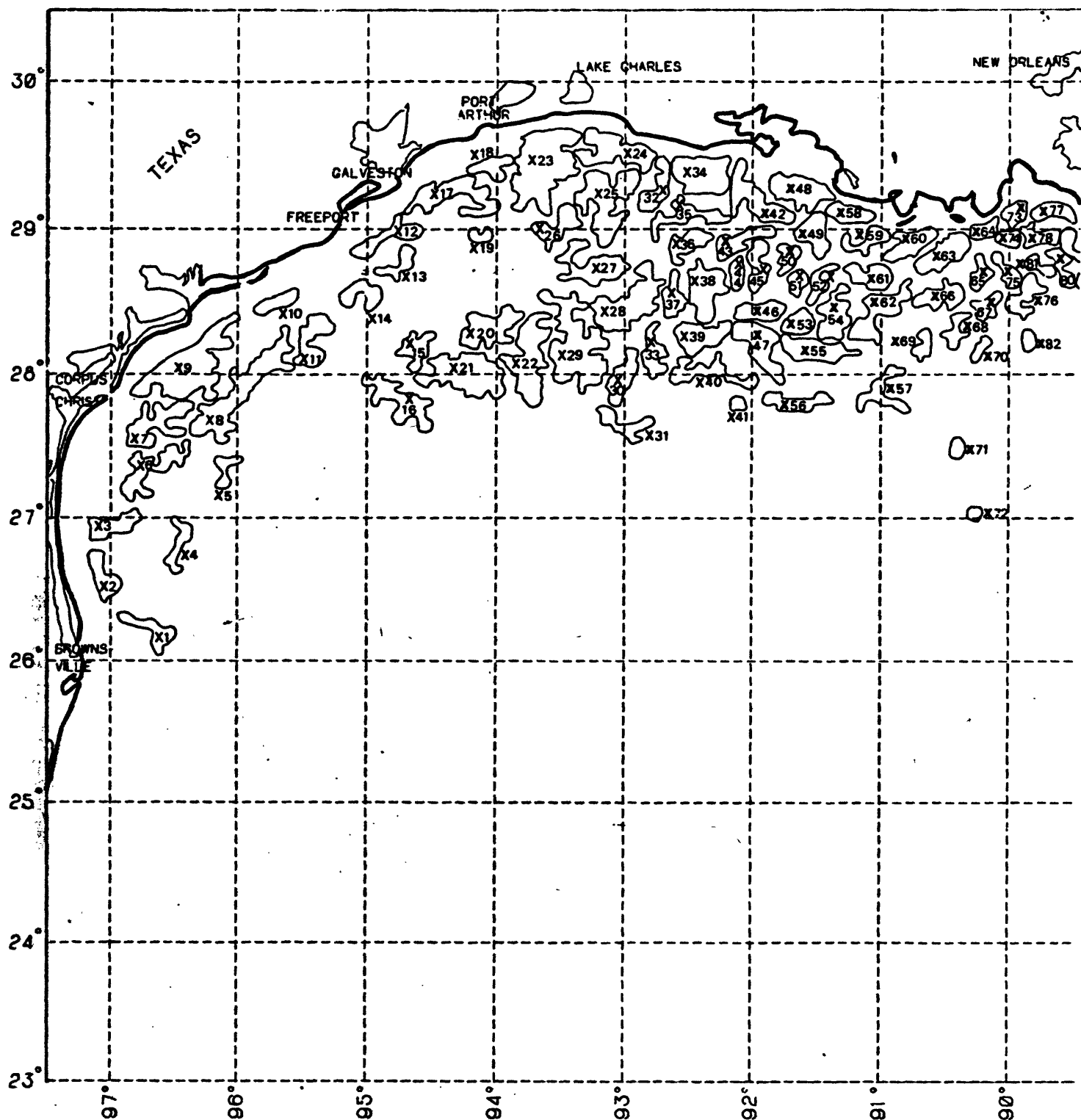


Figure 3.--Map showing the resource areas for existing Gulf of Mexico OCS leases.

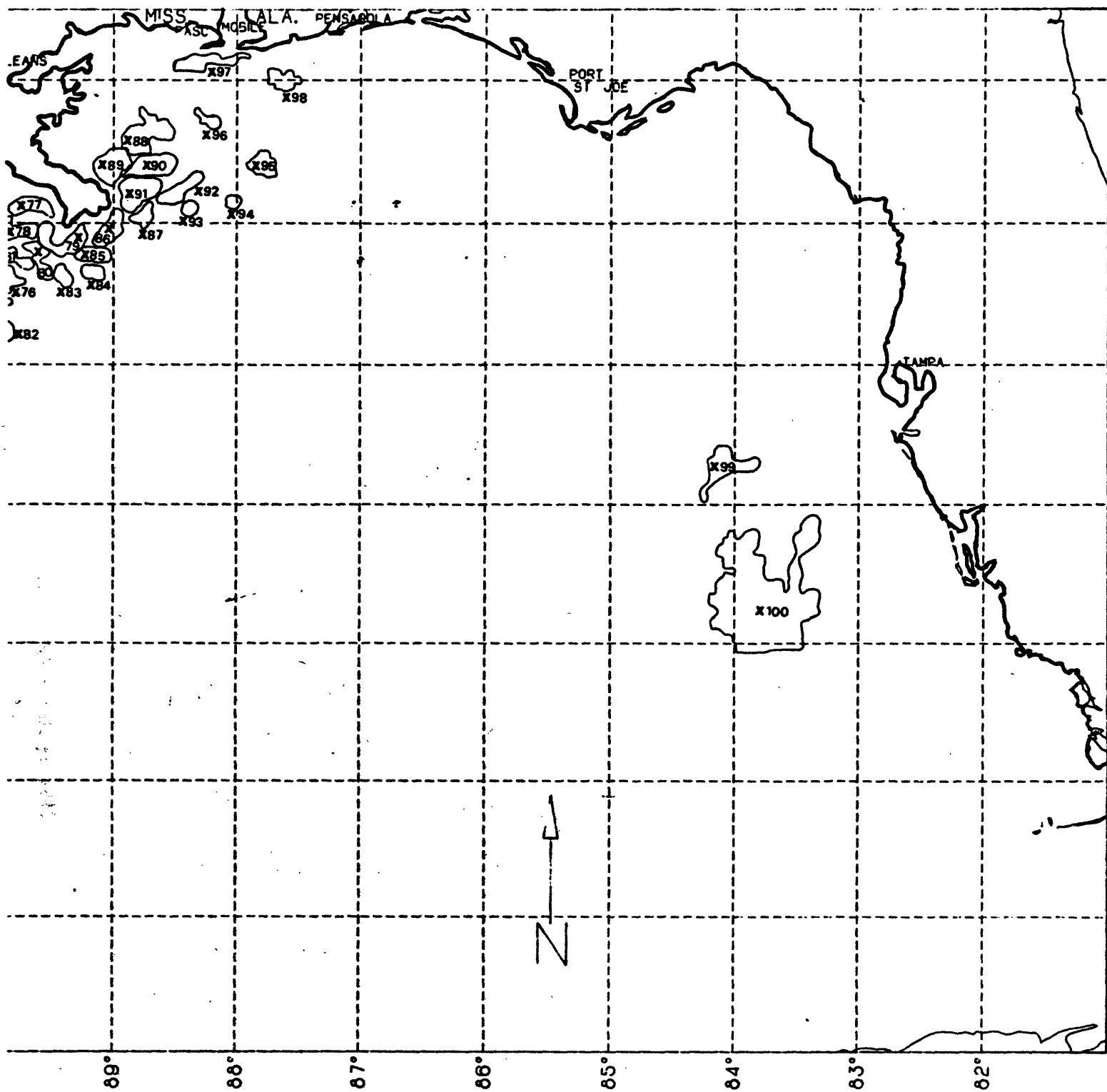


Figure 3.-- (continued)

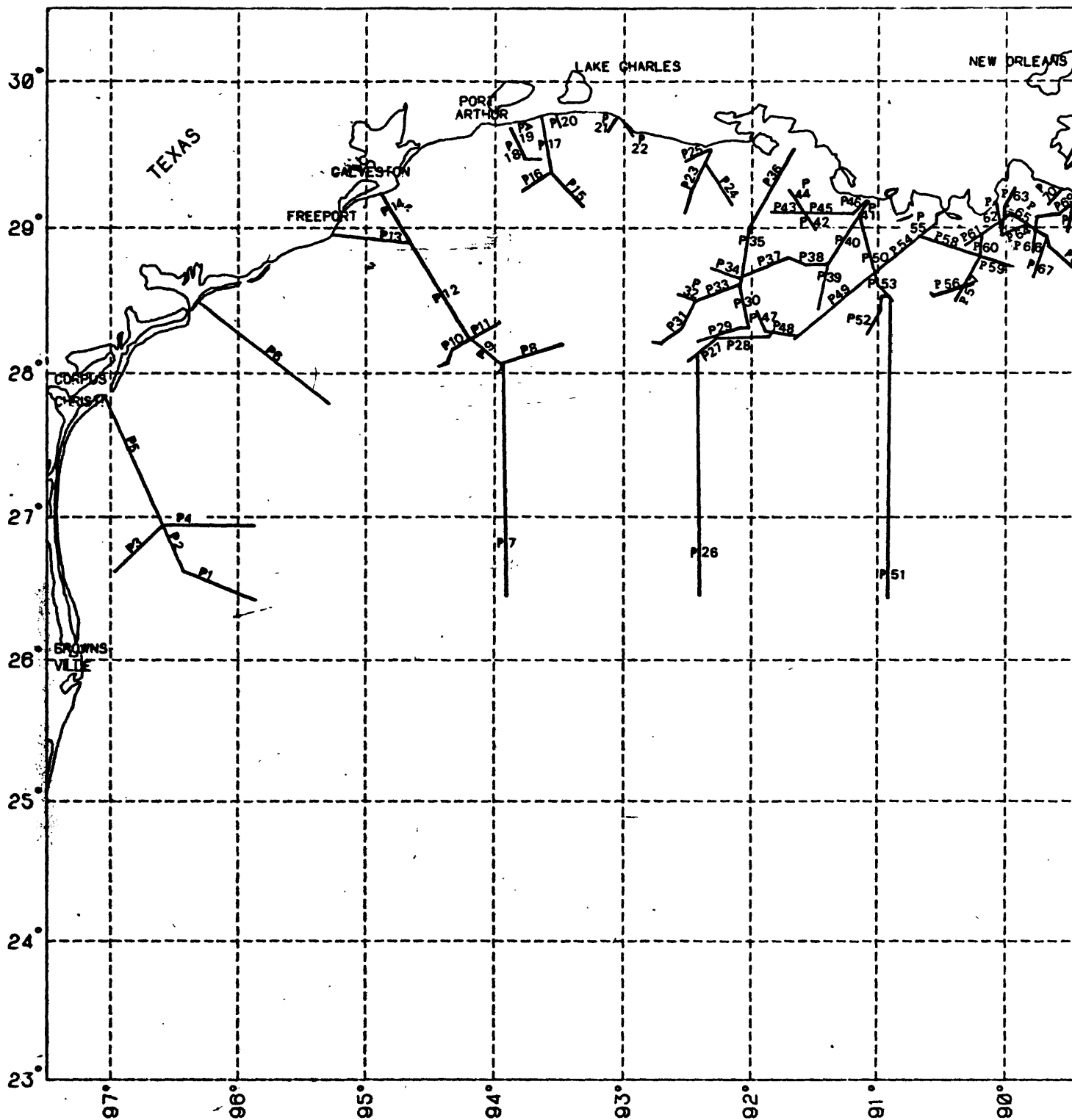


Figure 4.--Map showing the pipeline transportation route segments (P1 -P106).

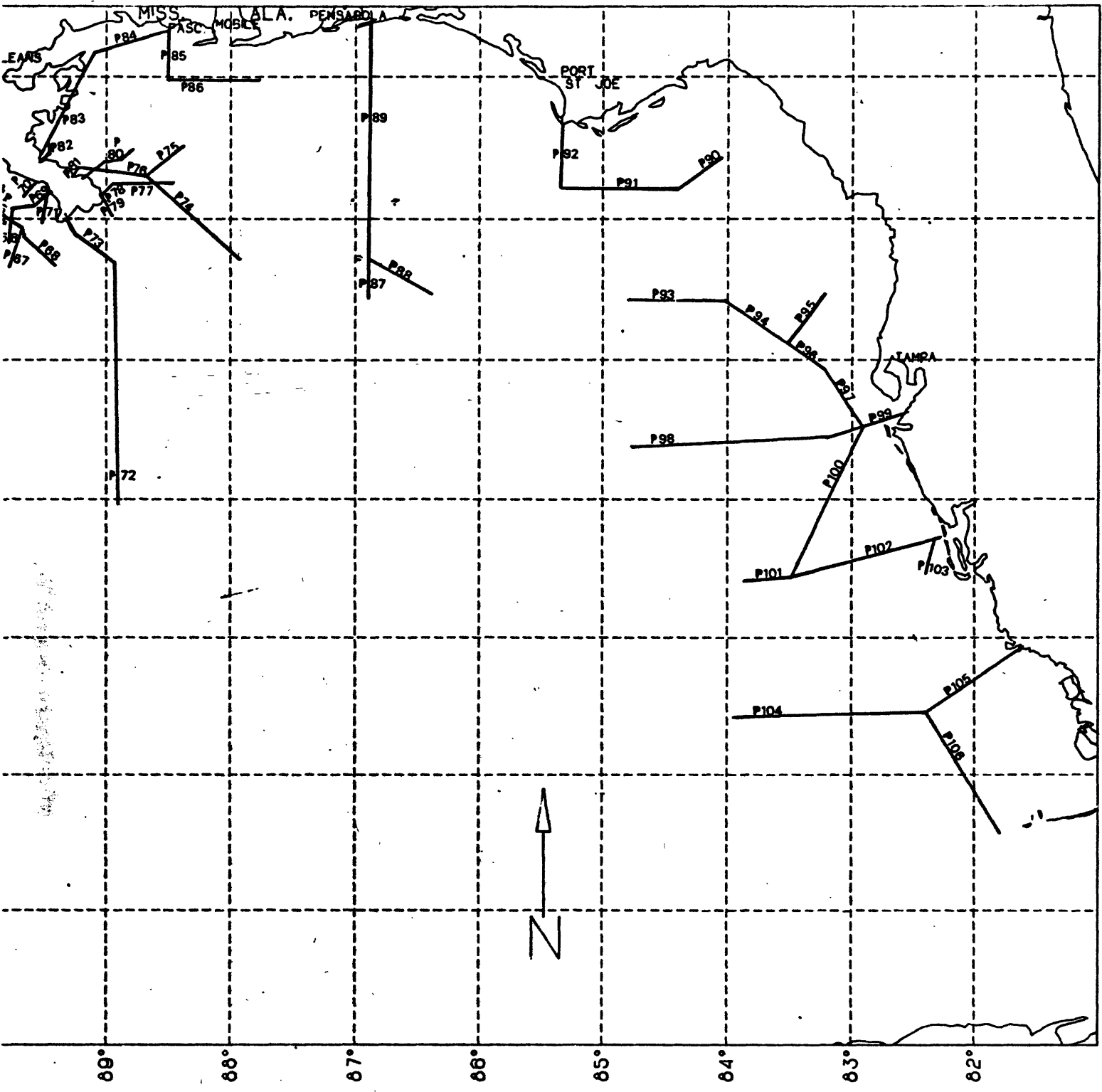


Figure 4.--(continued)

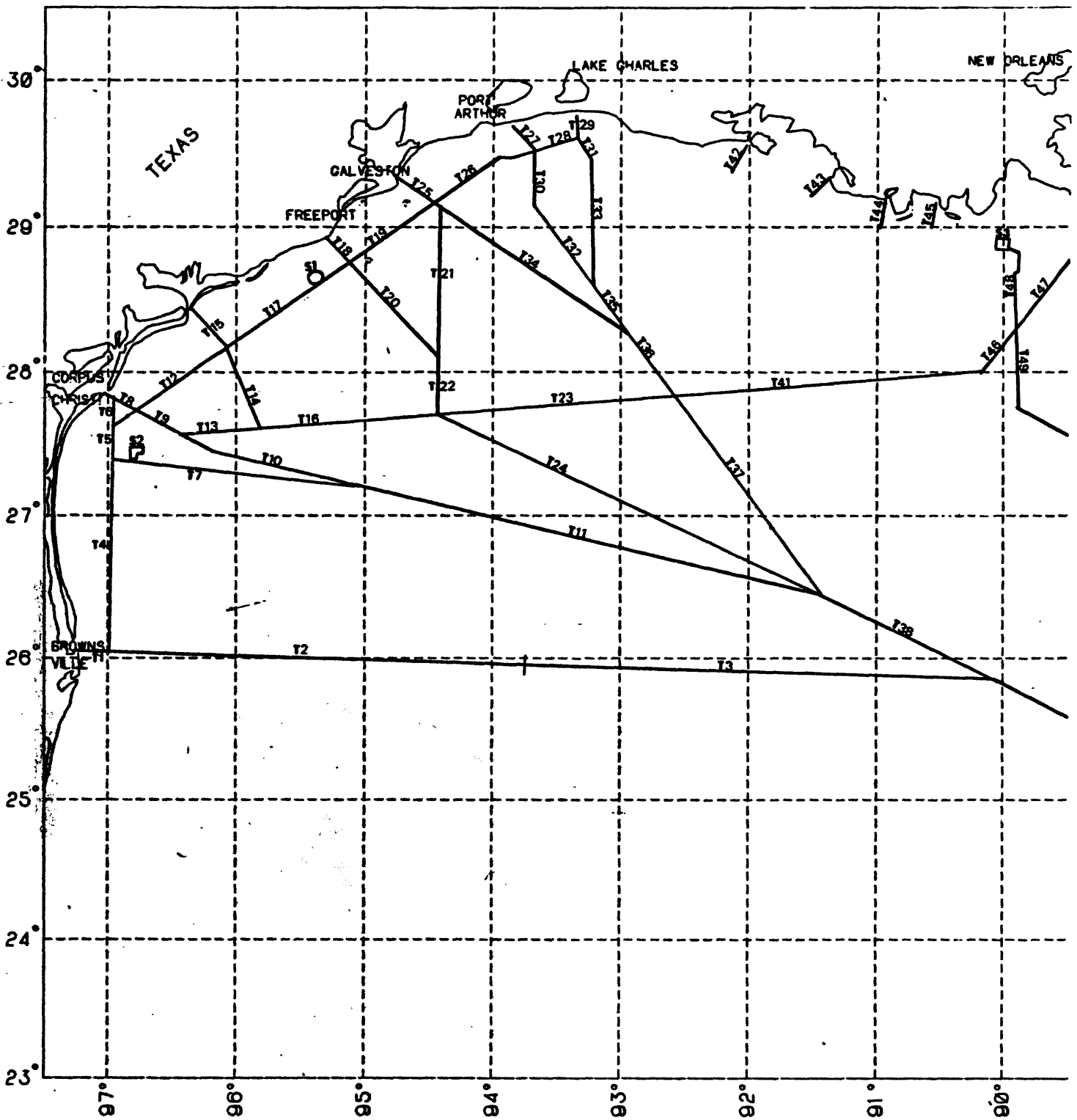


Figure 5.--Map showing the tankering transportation route segments (T1-T89) and other possible spill sites (S1-S3).

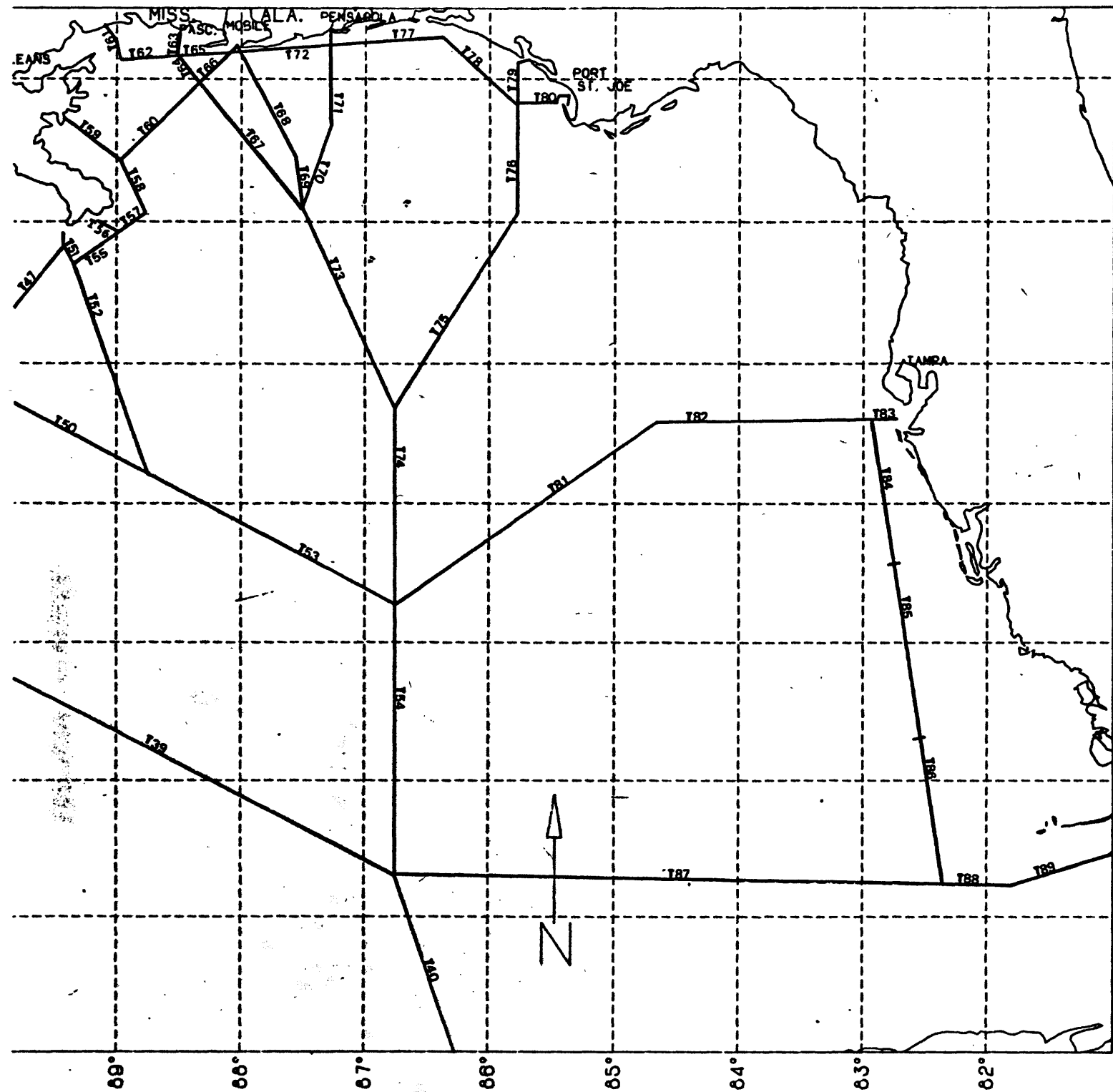


Figure 5.--(continued)

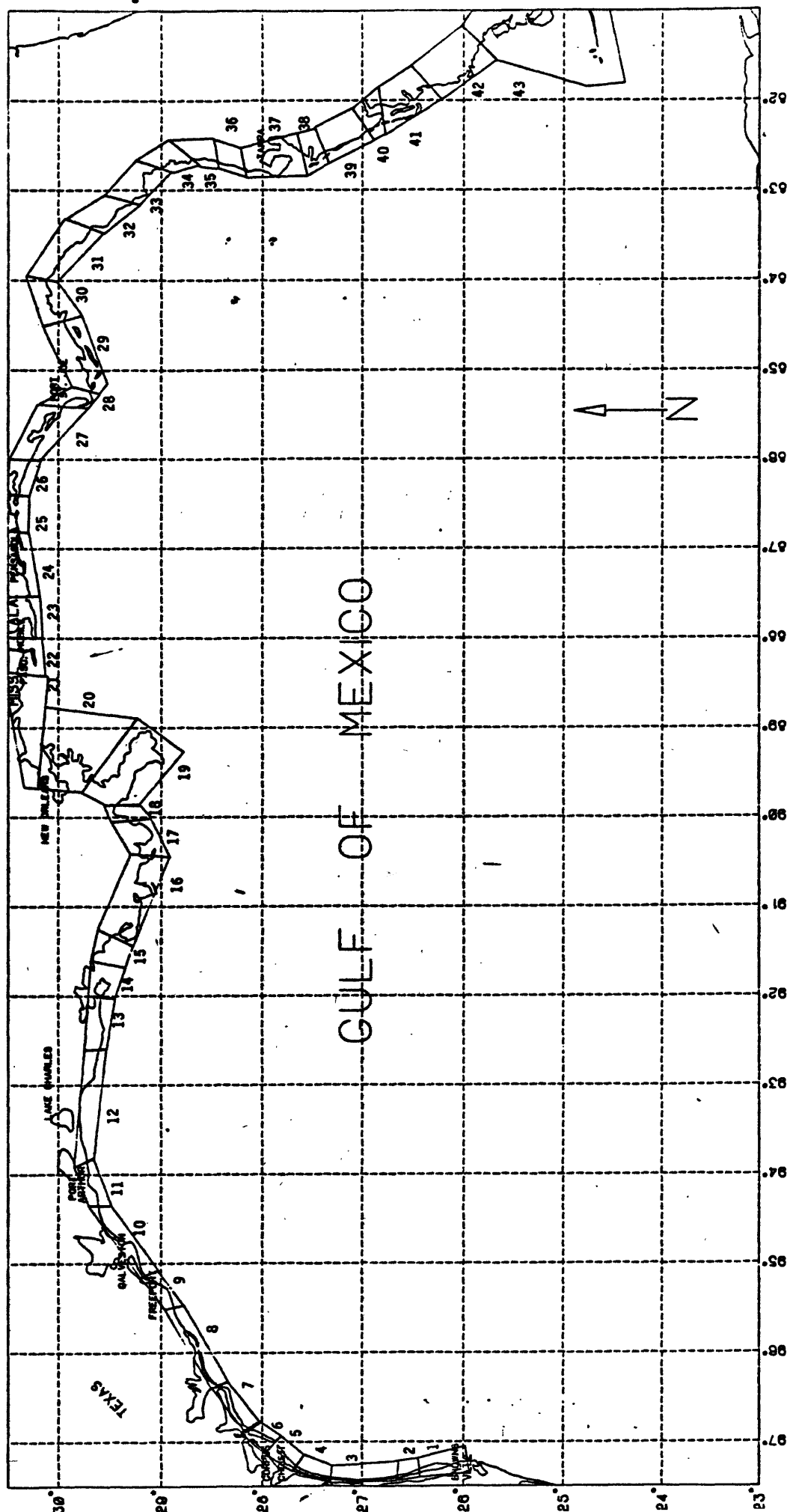


Figure 6.--Map showing the division of the Gulf of Mexico coastline into 43 segments (representing county boundaries) selected by MMS.

List of Tables

<u>Table</u>	<u>Page</u>
1. Oilspill probability estimates for spills greater than 1,000 barrels resulting over the expected production life of future OCS lease sales; from existing Federal Leases; and from tankering of crude oil imports in the study area. -----	24
1a. Oilspill probability estimates for spills greater than 10,000 barrels resulting over the expected production life of future OCS lease sales; from existing Federal Leases; and from tankering of crude oil imports in the study area. -----	25
2. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western Gulf most likely find scenario. -----	26
3. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western Gulf most likely find scenario. -----	27
4. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Central Gulf most likely find scenario. -----	28
5. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Central Gulf most likely find scenario. -----	29
6. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western and Central Gulf most likely find scenario. -----	30
7. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western and Central Gulf most likely find scenario. -----	31

List of Tables (continued)

<u>Table</u>	<u>Page</u>
8. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western Gulf total find scenario. -----	32
9. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western Gulf total find scenario. -----	33
10. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Central Gulf total find scenario. -----	34
11. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Central Gulf total find scenario. -----	35
12. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western and Central Gulf total find scenario. -----	36
13. Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western and Central Gulf total find scenario. -----	37

Table 1. -- Oilspill probability estimates for spills greater than 1,000 barrels resulting over the expected production life of future OCS lease sales; from existing Federal Leases; and from tankering of crude oil imports in the study area.

<u>Source</u>	<u>Assumed amount of oil (Bbbl)</u>	<u>Expected number of spills from platforms</u>	<u>Expected number of spills from transportation</u>	<u>Expected number of spills (total)</u>	<u>Probability of one or more spills (platforms)</u>	<u>Probability of one or more spills (transportation)</u>	<u>Probability of one or more spills (total)</u>
<u>Proposed Action:</u>							
<u>Total Find</u>							
<u>Scenario</u>							
Western Gulf	(1.40)	1.40	2.16	3.55	0.75	0.88	0.97
Central Gulf	(3.01)	3.01	4.79	7.80	0.95	0.99	0.99+
Western and Central	(4.41)	4.41	6.96	11.36	0.99	0.99+	0.99+
<u>Most Likely Find</u>							
<u>Scenario</u>							
Western Gulf	(0.029)	0.03	0.05	0.08	0.03	0.05	0.08
Central Gulf	(0.065)	0.06	0.10	0.16	0.06	0.10	0.15
Western and Central	(0.094)	0.09	0.15	0.24	0.09	0.14	0.21
Existing Leases	(3.30)	3.30	5.28	8.58	0.96	0.99	0.99+
<u>Tankering of Crude Oil Imports:</u>							
Over 40 years	(47.90)	-	31.13	31.13	-	0.99+	0.99+
Over 18 years	(21.55)	-	14.01	14.01	-	0.99+	0.99+

Table 1a. -- Oilspill probability estimates for spills greater than 10,000 barrels resulting over the expected production life of future OCS lease sales; from existing Federal Leases; and from tankering of crude oil imports in the study area.

<u>Source</u>	<u>Assumed amount of oil (Bbbl)</u>	<u>Expected number of spills from platforms</u>	<u>Expected number of spills from transportation</u>	<u>Expected number of spills (total)</u>	<u>Probability of one or more spills (platforms)</u>	<u>Probability of one or more spills (transportation)</u>	<u>Probability of one or more spills (total)</u>
<u>Proposed Action:</u>							
<u>Total Find</u>							
<u>Scenario</u>							
Western Gulf	(1.40)	0.61	0.93	1.54	0.46	0.60	0.79
Central Gulf	(3.01)	1.32	2.01	3.33	0.73	0.87	0.96
Western and Central	(4.41)	1.94	2.94	4.88	0.86	0.95	0.99
<u>Most Likely Find</u>							
<u>Scenario</u>							
Western Gulf	(0.029)	0.01	0.02	0.03	0.01	0.02	0.03
Central Gulf	(0.065)	0.03	0.04	0.07	0.03	0.04	0.07
Western and Central	(0.094)	0.04	0.06	0.10	0.04	0.06	0.10
Existing Leases	(3.30)	1.45	2.21	3.66	0.76	0.89	0.97
<u>Tankering of Crude</u>							
<u>Oil Imports:</u>							
Over 40 years	(47.90)	-	15.57	15.57	-	0.99+	0.99+
Over 18 years	(21.55)	-	7.00	7.00	-	0.99+	0.99+

Table 2. -- Probabilities (expressed as percent change) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western Gulf most likely find scenario.

Target	Within 3 days				Within 10 days				Within 30 days			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	4	0.0	96	3.3	97	3.6	7	0.1	7	0.1	7	0.1
Coastal Inlet Areas	1	0.0	72	1.3	77	1.5	2	0.0	2	0.0	2	0.0
Sea Grass Beds	n	0.0	2	0.0	4	0.0	n	0.0	n	0.0	n	0.0
Flower Garden Banks	n	0.0	1	0.0	2	0.0	n	0.0	n	0.0	n	0.0
Env. Preser. Areas	n	0.0	14	0.2	17	0.2	n	0.0	n	0.0	n	0.0
TX Beaches	2	0.0	11	0.1	17	0.2	3	0.0	3	0.0	3	0.0
LA Beaches	n	0.0	7	0.1	7	0.1	n	0.0	n	0.0	n	0.0
MI Beaches	n	0.0	1	0.0	2	0.0	n	0.0	n	0.0	n	0.0
AL Beaches	n	0.0	3	0.0	3	0.0	n	0.0	n	0.0	n	0.0
FL Beaches	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Beaches	2	0.0	21	0.2	28	0.3	3	0.0	3	0.0	3	0.0
Hist./Preh. Sites	2	0.0	45	0.6	49	0.7	2	0.0	2	0.0	2	0.0
Brown Pelicans	1	0.0	34	0.4	37	0.5	3	0.0	3	0.0	3	0.0
MI Sandhill Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whooping Cranes	n	0.0	12	0.1	12	0.1	n	0.0	n	0.0	n	0.0
Sea Turtles	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Manatee Hab.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Dry Tortugas	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Florida Keys	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Straits of Florida	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Atchafalaya Riv. B.	n	0.0	6	0.1	6	0.1	n	0.0	n	0.0	n	0.0
Everglades Nat. Pk.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table 3. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western Gulf most likely find scenario.

Land Segment	----- Within 3 days -----				----- Within 10 days -----				----- Within 30 days -----			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
7	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
8	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
9	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
10	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
11	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
12	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
13	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
14	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
15	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
16	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
17	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
18	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
19	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
20	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
21	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
22	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
23	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table 4. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area Central Gulf most likely find scenario.

Target	Within 3 days			Within 10 days			Within 30 days							
	PROPOSED Prob Mean	PROPOSED AND EXISTING Prob Mean	PROPOSED EXISTING & IMPORT Prob Mean	PROPOSED Prob Mean	PROPOSED AND EXISTING Prob Mean	PROPOSED EXISTING & IMPORT Prob Mean	PROPOSED Prob Mean	PROPOSED AND EXISTING Prob Mean	PROPOSED EXISTING & IMPORT Prob Mean					
Land	9	0.1	96	3.3	97	3.6	13	0.1	15	0.2	**	7.2	**	11.2
Coastal Inlet Areas	3	0.0	73	1.3	77	1.5	5	0.1	6	0.1	94	2.8	99	4.7
Sea Grass Beds	1	0.0	2	0.0	5	0.0	1	0.0	1	0.0	6	0.1	13	0.1
Flower Garden Banks	n	0.0	1	0.0	2	0.0	n	0.0	n	0.0	14	0.2	41	0.5
Env. Preser. Areas	1	0.0	15	0.2	18	0.2	2	0.0	2	0.0	42	0.6	53	0.8
TX Beaches	n	0.0	9	0.1	16	0.2	n	0.0	n	0.0	33	0.4	63	1.0
LA Beaches	n	0.0	7	0.1	7	0.1	1	0.0	1	0.0	20	0.2	25	0.3
MI Beaches	1	0.0	2	0.0	3	0.0	1	0.0	1	0.0	5	0.1	11	0.1
AL Beaches	n	0.0	3	0.0	4	0.0	n	0.0	n	0.0	5	0.1	12	0.1
FL Beaches	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	3	0.0
Gulf Beaches	1	0.0	20	0.2	27	0.3	2	0.0	2	0.0	52	0.7	79	1.5
Hist./Preh. Sites	1	0.0	45	0.6	48	0.7	1	0.0	2	0.0	78	1.5	93	2.6
Brown Pelicans	1	0.0	34	0.4	36	0.5	2	0.0	3	0.0	70	1.2	87	2.0
MI Sandhill Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whooping Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	5	0.1
Sea Turtles	n	0.0	12	0.1	12	0.1	1	0.0	1	0.0	32	0.4	41	0.5
Manatee Hab.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
Dry Tortugas	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Florida Keys	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Straits of Florida	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Atchafalaya Riv. B.	n	0.0	6	0.1	6	0.1	n	0.0	n	0.0	15	0.2	17	0.2
Everglades Nat. Pk.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0
Gulf Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	7	0.1
Gulf Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	4	0.0
Gulf Segment 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	7	0.1
	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	13	0.1

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table 5. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Central Gulf most likely find scenario.

Land Segment	Within 3 days				Within 10 days				Within 30 days			
	PROPOSED	PROPOSED AND EXISTING	PROPOSED EXISTING & IMPORT	Prob Mean	PROPOSED	PROPOSED AND EXISTING	PROPOSED EXISTING & IMPORT	Prob Mean	PROPOSED	PROPOSED AND EXISTING	PROPOSED EXISTING & IMPORT	Prob Mean
1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
3	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0
4	n	0.0	n	0.0	n	0.0	2	0.0	n	0.0	4	0.0
5	n	0.0	1	0.0	n	0.0	4	0.0	n	0.0	7	0.1
6	n	0.0	n	0.0	n	0.0	5	0.1	n	0.0	9	0.1
7	n	0.0	n	0.0	n	0.0	4	0.0	n	0.0	13	0.1
8	n	0.0	2	0.0	n	0.0	7	0.1	n	0.0	27	0.3
9	n	0.0	1	0.0	n	0.0	12	0.1	n	0.1	30	0.4
10	n	0.0	8	0.1	n	0.0	26	0.3	n	0.4	59	0.9
11	n	0.0	2	0.0	n	0.0	22	0.3	n	0.2	47	0.6
12	1	0.0	18	0.2	n	0.0	32	0.4	1	0.0	65	1.1
13	1	0.0	7	0.1	1	0.0	24	0.3	1	0.0	44	0.6
14	n	0.0	12	0.1	n	0.0	24	0.3	n	0.0	33	0.4
15	n	0.0	1	0.0	n	0.0	3	0.0	n	0.0	4	0.0
16	2	0.0	42	0.5	3	0.0	58	0.9	3	0.0	72	1.3
17	n	0.0	34	0.4	45	0.6	56	0.8	1	0.0	69	1.2
18	n	0.0	11	0.1	25	0.3	26	0.3	1	0.0	33	0.4
19	3	0.0	76	1.4	83	1.8	84	1.9	4	0.0	91	2.4
20	n	0.0	14	0.1	37	0.5	38	0.5	1	0.0	50	0.7
21	1	0.0	8	0.1	7	0.1	13	0.1	1	0.0	17	0.2
22	n	0.0	2	0.0	3	0.0	4	0.0	n	0.0	8	0.1
23	n	0.0	1	0.0	n	0.0	3	0.0	n	0.0	6	0.1
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table 6. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western and Central Gulf most likely find scenario.

Target	Within 3 days			Within 10 days			Within 30 days		
	PROPOSED	PROPOSED AND EXISTING	PROB Mean	PROPOSED	PROPOSED AND EXISTING	PROB Mean	PROPOSED	PROPOSED AND EXISTING	PROB Mean
Land	12	97	3.4	97	3.6	19	0.2	21	0.2
Coastal Inlet Areas	4	0.0		77	1.5	7	0.1	7	0.1
Sea Grass Beds	1	0.0		5	0.0	1	0.0	1	0.0
Flower Garden Banks	n	0.0		2	0.0	n	0.0	n	0.0
Env. Preser. Areas	1	0.0		18	0.2	2	0.0	2	0.0
TX Beaches	2	0.0		17	0.2	3	0.0	3	0.0
LA Beaches	n	0.0		7	0.1	1	0.0	1	0.0
MI Beaches	1	0.0		3	0.0	1	0.0	1	0.0
AL Beaches	n	0.0		4	0.0	n	0.0	5	0.1
FL Beaches	n	0.0		n	0.0	n	0.0	1	0.0
Gulf Beaches	3	0.0		28	0.3	4	0.0	5	0.0
Hist./Preh. Sites	2	0.0		49	0.7	4	0.0	4	0.0
Brown Pelicans	2	0.0		37	0.5	6	0.1	6	0.1
MI Sandhill Cranes	n	0.0		n	0.0	n	0.0	n	0.0
Whooping Cranes	n	0.0		n	0.0	n	0.0	n	0.0
Sea Turtles	n	0.0		12	0.1	1	0.0	1	0.0
Manatee Hab.	n	0.0		n	0.0	n	0.0	1	0.0
Dry Tortugas	n	0.0		n	0.0	n	0.0	32	0.4
Florida Keys	n	0.0		n	0.0	n	0.0	1	0.0
Straits of Florida	n	0.0		n	0.0	n	0.0	n	0.0
Atchafalaya Riv. B.	n	0.0		6	0.1	n	0.0	15	0.2
Everglades Nat. Pk.	n	0.0		n	0.0	n	0.0	n	0.0
Gulf Segment 1	n	0.0		n	0.0	n	0.0	n	0.0
Gulf Segment 2	n	0.0		n	0.0	n	0.0	n	0.0
Gulf Segment 3	n	0.0		n	0.0	n	0.0	n	0.0
Gulf Segment 4	n	0.0		n	0.0	n	0.0	n	0.0
Gulf Segment 5	n	0.0		n	0.0	n	0.0	n	0.0
Gulf Segment 6	n	0.0		n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table 7. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western and Central Gulf most likely find scenario.

Land Segment	Within 3 days			Within 10 days			Within 30 days		
	PROPOSED			PROPOSED			PROPOSED		
	Prob	Mean	EXISTING & IMPORT	Prob	Mean	EXISTING & IMPORT	Prob	Mean	EXISTING & IMPORT
1	n	0.0	n	n	0.0	n	n	0.0	1
2	n	0.0	n	n	0.0	n	n	0.0	1
3	n	0.0	n	n	0.0	1	n	0.0	4
4	n	0.0	n	n	0.0	2	1	0.0	5
5	n	0.0	2	n	0.0	5	3	0.0	7
6	n	0.0	3	n	0.0	6	n	0.0	10
7	n	0.0	n	n	0.0	4	n	0.0	13
8	1	0.0	3	1	0.0	8	1	0.0	28
9	n	0.0	4	6	0.1	12	13	0.1	30
10	1	0.0	13	16	0.2	27	2	0.0	60
11	1	0.0	9	7	0.1	23	1	0.0	48
12	1	0.0	21	28	0.3	33	1	0.0	65
13	1	0.0	7	24	0.3	24	1	0.0	44
14	n	0.0	12	24	0.3	24	n	0.0	33
15	2	0.0	42	53	0.8	58	3	0.0	72
16	n	0.0	34	45	0.6	56	3	0.0	69
17	n	0.0	11	25	0.3	26	1	0.0	33
18	3	0.0	76	83	1.8	84	4	0.0	91
19	14	0.1	14	37	0.5	38	1	0.0	50
20	5	0.0	8	7	0.1	13	9	0.1	17
21	n	0.0	2	3	0.0	4	n	0.0	8
22	n	0.0	1	2	0.0	3	n	0.0	6
23	n	0.0	n	n	0.0	n	n	0.0	2
24	n	0.0	n	n	0.0	n	n	0.0	2

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table 8. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western Gulf total find scenario.

Target	Within 3 days				Within 10 days				Within 30 days			
	PROPOSED	PROPOSED AND EXISTING	PROB MEAN	PROB MEAN	PROPOSED	PROPOSED AND EXISTING	PROB MEAN	PROB MEAN	PROPOSED	PROPOSED AND EXISTING	PROB MEAN	PROB MEAN
Land	43	0.6	98	3.8	99	4.4	76	1.4	93	2.7	97	9.7
Coastal Inlet Areas	10	0.1	74	1.4	83	1.8	28	0.3	50	0.7	97	3.5
Sea Grass Beds	n	0.0	2	0.0	7	0.1	n	0.0	n	0.0	6	0.1
Flower Garden Banks	6	0.1	7	0.1	9	0.1	12	0.1	20	0.2	31	0.4
Env. Preser. Areas	n	0.0	14	0.2	20	0.2	n	0.0	n	0.0	41	0.5
TX Beaches	26	0.3	33	0.4	43	0.6	47	0.6	65	1.0	76	1.4
LA Beaches	n	0.0	7	0.1	7	0.1	n	0.0	1	0.0	20	0.2
MI Beaches	n	0.0	1	0.0	4	0.0	n	0.0	n	0.0	4	0.0
AL Beaches	n	0.0	3	0.0	4	0.0	n	0.0	n	0.0	5	0.1
FL Beaches	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Gulf Beaches	26	0.3	40	0.5	51	0.7	47	0.6	65	1.0	83	1.8
Hist./preh. Sites	30	0.4	61	0.9	66	1.1	49	0.7	66	1.1	92	2.6
Brown Pelicans	23	0.3	48	0.7	53	0.7	53	0.8	77	1.5	93	2.6
MI Sandhill Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whooping Cranes	n	0.0	1	0.0	1	0.0	3	0.0	7	0.1	9	0.1
Sea Turtles	2	0.0	13	0.1	13	0.1	5	0.1	9	0.1	38	0.5
Manatee Hab.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Dry Tortugas	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Florida Keys	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Straits of Florida	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Atchafalaya Riv. B.	n	0.0	6	0.1	6	0.1	n	0.0	1	0.0	15	0.2
Everglades Nat. Pk.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table 9. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western Gulf total find scenario.

Land Segment	----- Within 3 days -----				----- Within 10 days -----				----- Within 30 days -----			
	PROPOSED	PROPOSED AND EXISTING	PROB Mean	PROB Mean	PROPOSED	PROPOSED AND EXISTING	PROB Mean	PROB Mean	PROPOSED	PROPOSED AND EXISTING	PROB Mean	PROB Mean
1	2	0.0	2	0.0	5	0.0	5	0.0	7	0.1	7	0.1
2	n	0.0	n	0.0	1	0.0	2	0.0	3	0.0	3	0.0
3	1	0.0	1	0.0	7	0.1	7	0.1	14	0.1	14	0.1
4	2	0.0	2	0.0	9	0.1	9	0.1	14	0.2	15	0.2
5	8	0.1	8	0.1	13	0.1	15	0.2	18	0.2	20	0.2
6	1	0.0	1	0.0	4	0.0	5	0.1	11	0.1	12	0.1
7	2	0.0	3	0.0	9	0.1	10	0.1	21	0.2	24	0.3
8	10	0.1	11	0.1	23	0.3	27	0.3	41	0.5	48	0.7
9	2	0.0	3	0.0	13	0.1	18	0.2	25	0.3	35	0.4
10	16	0.2	23	0.3	29	0.3	39	0.5	43	0.6	60	0.9
11	5	0.0	7	0.1	8	0.1	13	0.1	13	0.1	32	0.4
12	2	0.0	19	0.2	3	0.0	29	0.3	10	0.1	62	1.0
13	n	0.0	6	0.1	n	0.0	23	0.3	2	0.0	43	0.6
14	n	0.0	12	0.1	1	0.0	24	0.3	1	0.0	31	0.4
15	n	0.0	1	0.0	n	0.0	3	0.0	n	0.0	3	0.0
16	2	0.0	42	0.5	3	0.0	53	0.8	3	0.0	56	0.8
17	n	0.0	34	0.4	n	0.0	44	0.6	n	0.0	47	0.6
18	n	0.0	11	0.1	n	0.0	24	0.3	n	0.0	25	0.3
19	n	0.0	75	1.4	n	0.0	83	1.8	n	0.0	84	1.9
20	n	0.0	13	0.1	n	0.0	36	0.4	n	0.0	41	0.5
21	n	0.0	4	0.0	n	0.0	5	0.1	n	0.0	7	0.1
22	n	0.0	1	0.0	n	0.0	2	0.0	n	0.0	3	0.0
23	n	0.0	1	0.0	n	0.0	2	0.0	n	0.0	2	0.0
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
25	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table 10. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Central Gulf total find scenario.

Target	Within 3 days				Within 10 days				Within 30 days			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED AND EXISTING		PROPOSED AND EXISTING		PROPOSED AND EXISTING		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	88	2.1	88	2.1	88	2.1	88	2.1	88	2.1	88	2.1
Coastal Inlet Areas	51	0.7	51	0.7	51	0.7	51	0.7	51	0.7	51	0.7
Sea Grass Beds	5	0.0	5	0.0	5	0.0	5	0.0	5	0.0	5	0.0
Flower Garden Banks	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Env. Preser. Areas	18	0.2	18	0.2	18	0.2	18	0.2	18	0.2	18	0.2
TX Beaches	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
LA Beaches	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
MI Beaches	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
FL Beaches	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
FL Beaches	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Beaches	10	0.1	10	0.1	10	0.1	10	0.1	10	0.1	10	0.1
Hist./Preh. Sites	30	0.4	30	0.4	30	0.4	30	0.4	30	0.4	30	0.4
Brown Pelicans	24	0.3	24	0.3	24	0.3	24	0.3	24	0.3	24	0.3
MI Sandhill Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whooping Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Turtles	13	0.1	13	0.1	13	0.1	13	0.1	13	0.1	13	0.1
Manatee Hab.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Dry Tortugas	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Florida Keys	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Straits of Florida	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Atchafalaya Riv. 0.	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
Everglades Nat. Pk.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table 11. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Central Gulf total find scenario.

Land Segment	Within 3 days				Within 10 days				Within 30 days			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
3	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	7	0.1
4	n	0.0	n	0.0	n	0.0	3	0.0	1	0.0	7	0.1
5	n	0.0	1	0.0	n	0.0	7	0.1	2	0.0	12	0.1
6	n	0.0	n	0.0	n	0.0	11	0.1	2	0.0	19	0.2
7	n	0.0	n	0.0	n	0.0	7	0.1	5	0.0	23	0.3
8	n	0.0	2	0.0	n	0.0	10	0.1	16	0.2	45	0.6
9	2	0.0	10	0.1	7	0.1	20	0.2	19	0.2	50	0.7
10	2	0.0	16	0.2	20	0.2	42	0.5	26	0.3	84	1.8
11	23	0.3	36	0.5	38	0.5	55	0.8	25	0.3	76	1.4
12	15	0.2	21	0.2	27	0.3	44	0.6	59	0.9	89	2.2
13	8	0.1	19	0.2	17	0.2	36	0.5	41	0.5	68	1.1
14	n	0.0	1	0.0	2	0.0	4	0.0	25	0.3	52	0.7
15	29	0.3	58	0.9	41	0.5	72	1.3	3	0.0	8	0.1
16	20	0.2	47	0.6	28	0.3	60	0.9	48	0.7	77	1.5
17	5	0.0	15	0.2	10	0.1	32	0.4	34	0.4	65	1.1
18	47	0.6	87	2.0	65	1.0	94	2.8	13	0.1	35	0.4
19	15	0.2	27	0.3	37	0.5	59	0.9	72	1.3	96	3.1
20	9	0.1	12	0.1	13	0.1	17	0.2	47	0.6	68	1.1
21	1	0.0	2	0.0	2	0.0	5	0.0	19	0.2	25	0.3
22	n	0.0	2	0.0	n	0.0	3	0.0	6	0.1	8	0.1
23	n	0.0	n	0.0	n	0.0	4	0.0	2	0.0	4	0.0
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	11	0.1
25	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	4	0.0
											1	0.0

Note: n = less than 0.5 percent; ++ = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table 12. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western and Central Gulf total find scenario.

Target	----- Within 3 days -----				----- Within 10 days -----				----- Within 30 days -----			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	93	2.7	**	5.9	**	6.5	99	5.3	**	8.7	**	15.7
Coastal Inlet Areas	56	0.8	87	2.1	92	2.5	84	1.8	**	3.0	**	5.8
Sea Grass Beds	5	0.0	6	0.1	11	0.1	8	0.1	13	0.1	18	0.2
Flower Garden Banks	7	0.1	8	0.1	10	0.1	15	0.2	31	0.4	40	0.5
Env. Preser. Areas	18	0.2	30	0.4	35	0.4	37	0.5	50	0.7	70	1.2
TX Beaches	28	0.3	35	0.4	45	0.6	52	0.7	73	1.3	82	1.7
LA Beaches	3	0.0	10	0.1	10	0.1	7	0.1	12	0.1	29	0.3
MI Beaches	3	0.0	5	0.0	7	0.1	7	0.1	13	0.1	17	0.2
AL Beaches	1	0.0	4	0.0	5	0.1	2	0.0	6	0.1	11	0.1
FL Beaches	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Gulf Beaches	33	0.4	46	0.6	56	0.8	59	0.9	81	1.7	91	2.4
Hist./Preh. Sites	51	0.7	73	1.3	76	1.4	73	1.3	90	2.3	98	3.8
Brown Pelicans	41	0.5	61	0.9	64	1.0	75	1.4	91	2.4	97	3.6
MI Sandhill Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whooping Cranes	n	0.0	1	0.0	1	0.0	3	0.0	8	0.1	9	0.1
Sea Turtles	14	0.2	24	0.3	25	0.3	33	0.4	42	0.5	60	0.9
Nanatee Hab.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Dry Tortugas	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Florida Keys	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Straits of Florida	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Atchafalaya Riv. B.	4	0.0	9	0.1	9	0.1	5	0.1	12	0.1	25	0.3
Everglades Nat. Pk.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table 13. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western and Central Gulf total find scenario.

[illegible]

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Appendix A

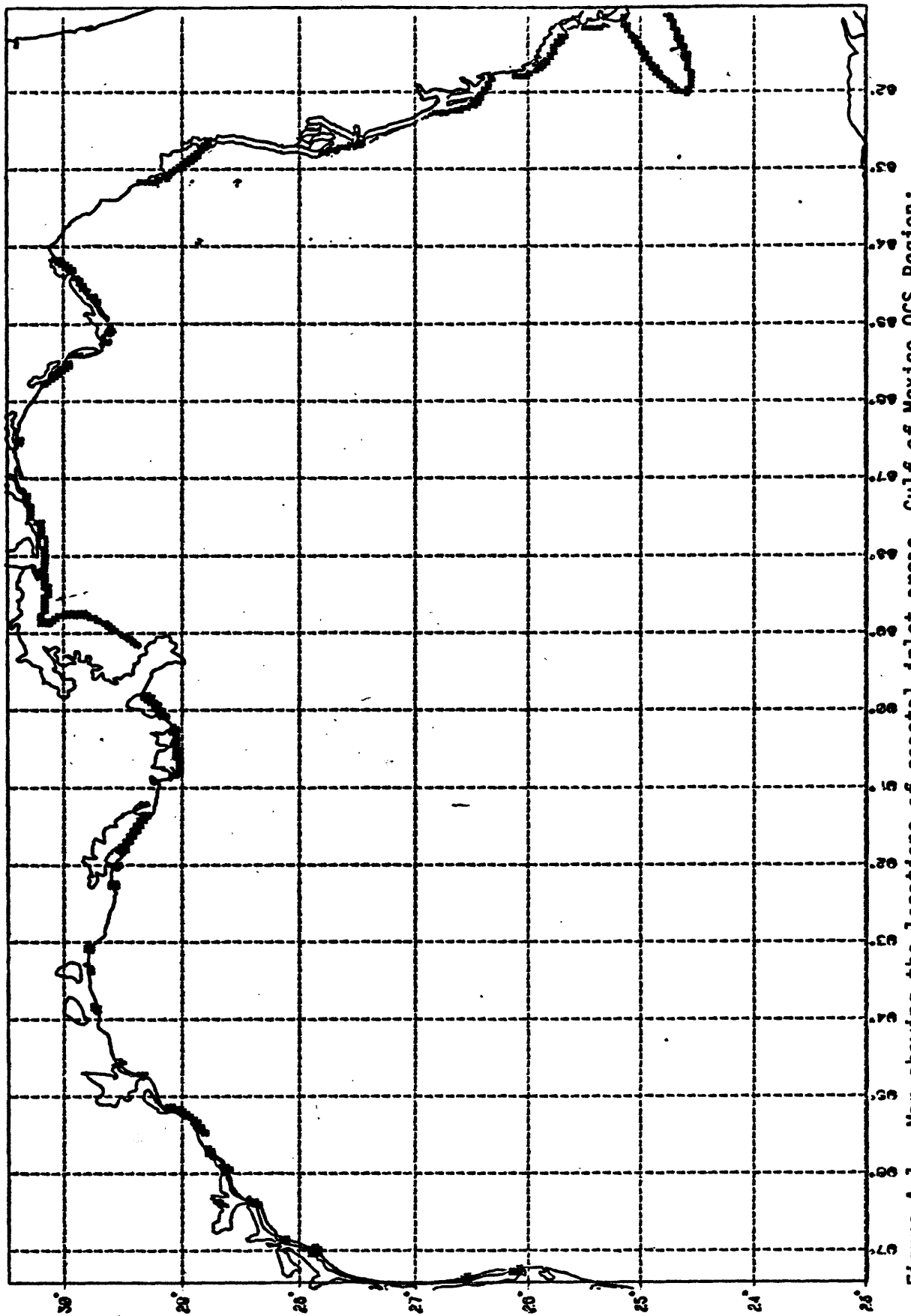
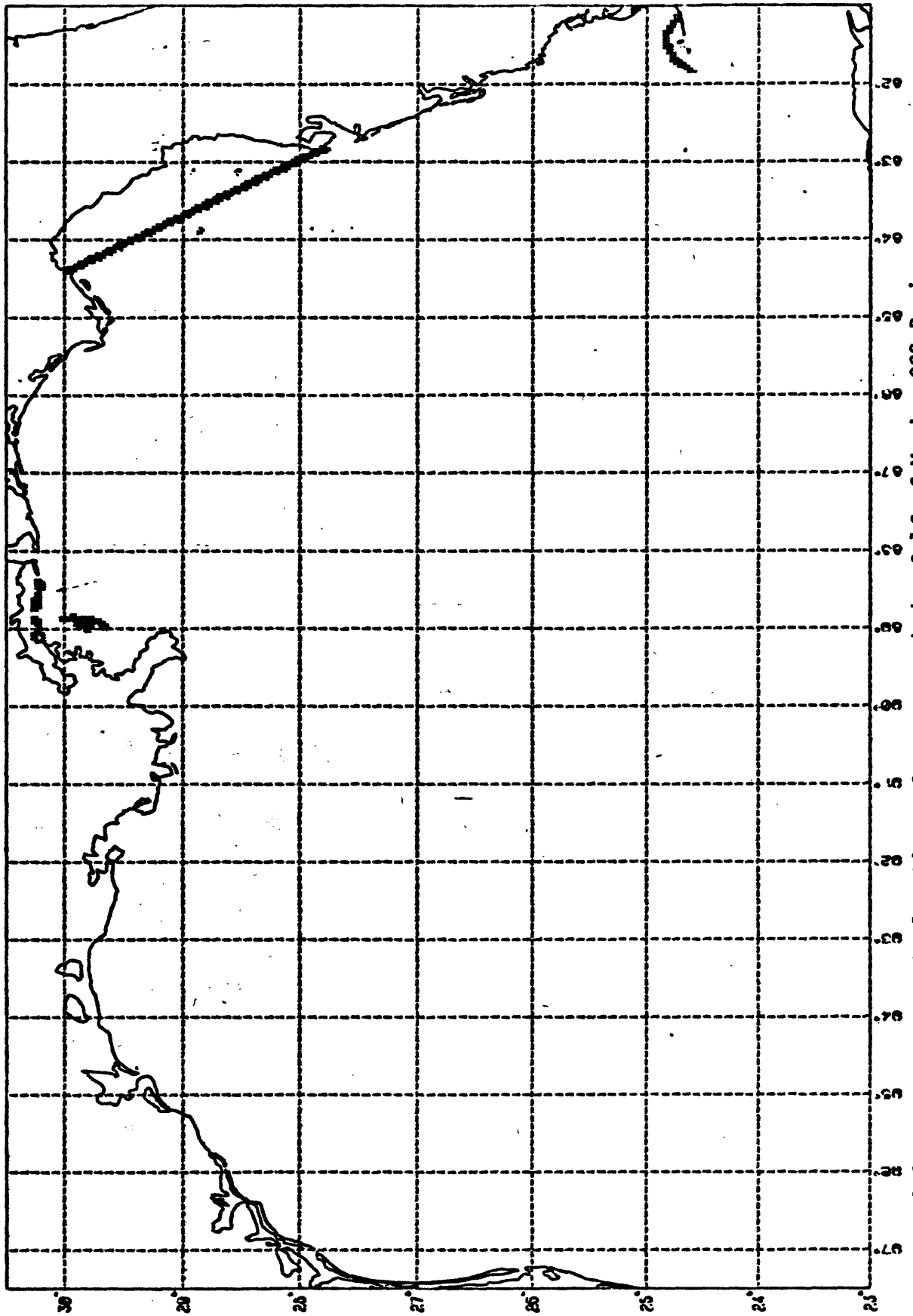


Figure A-1.--Map showing the locations of coastal inlet areas, Gulf of Mexico OCS Region: crosshatching indicates areal extent.



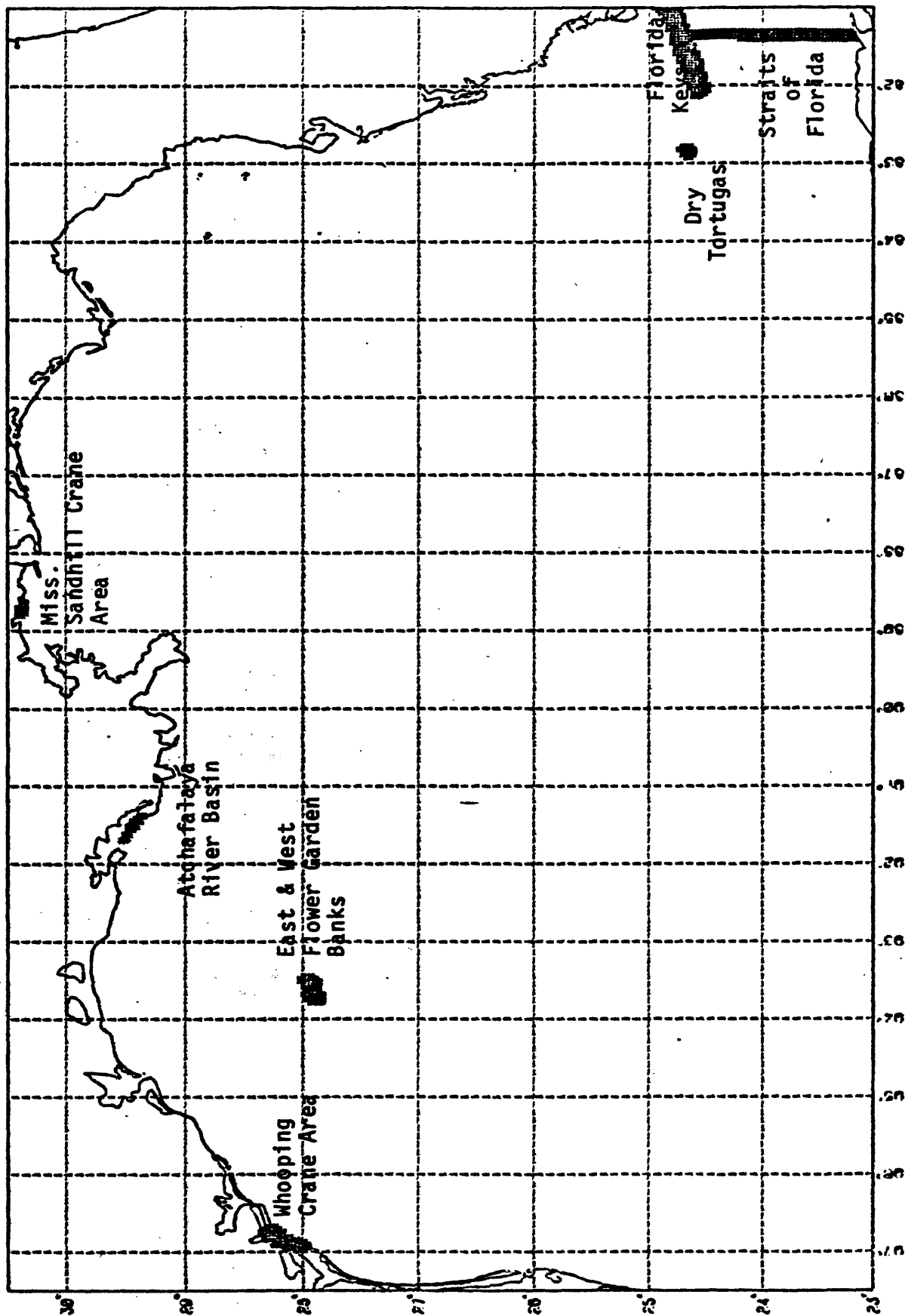


Figure A-3.--Map showing the locations of seven targets, Gulf of Mexico OCS Region: crosshatching indicates areal extent.

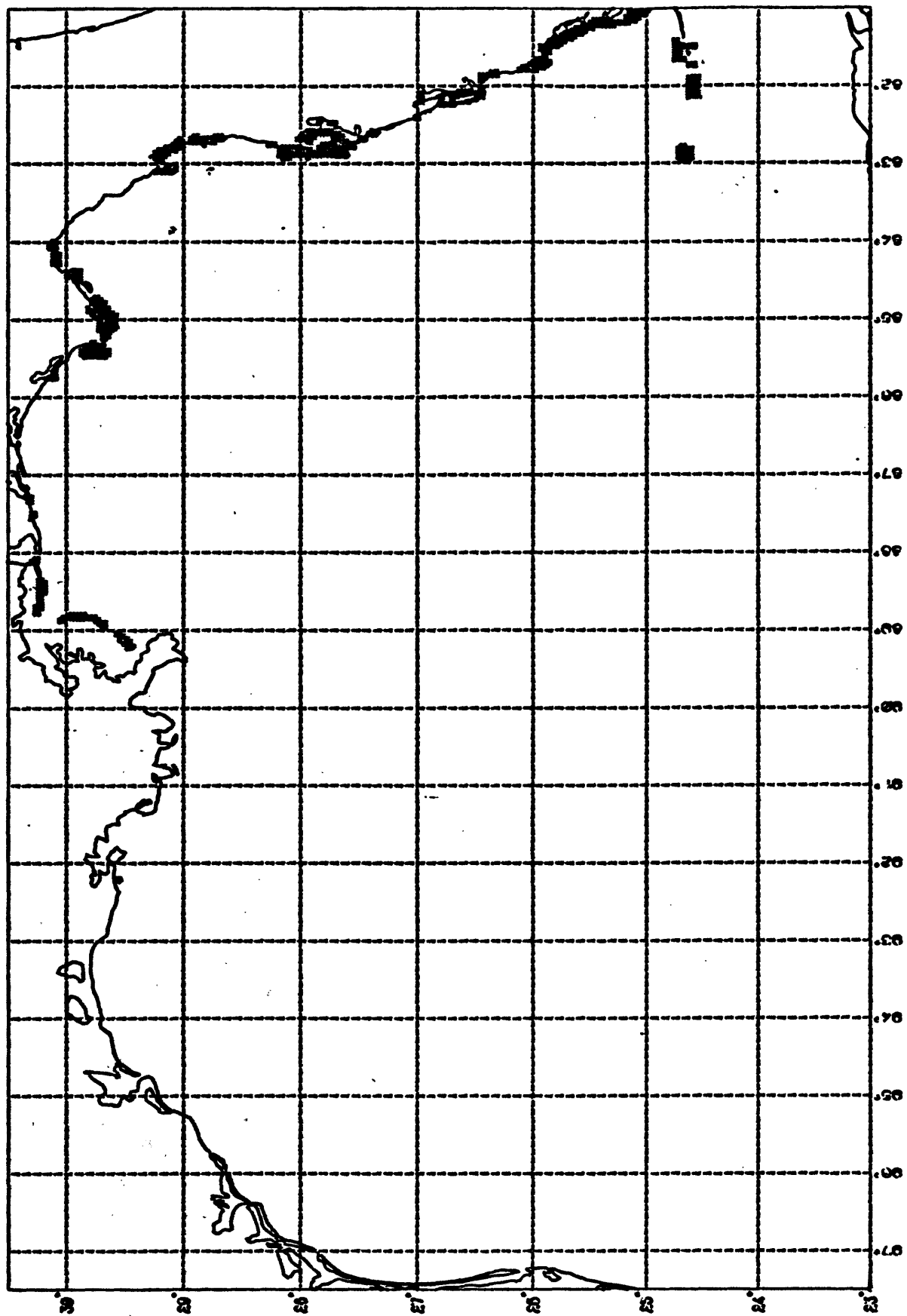


Figure A-4.--Map showing the locations of designated environmental preservation areas, Gulf of Mexico
OCS Region: crosshatching indicates areal extent.

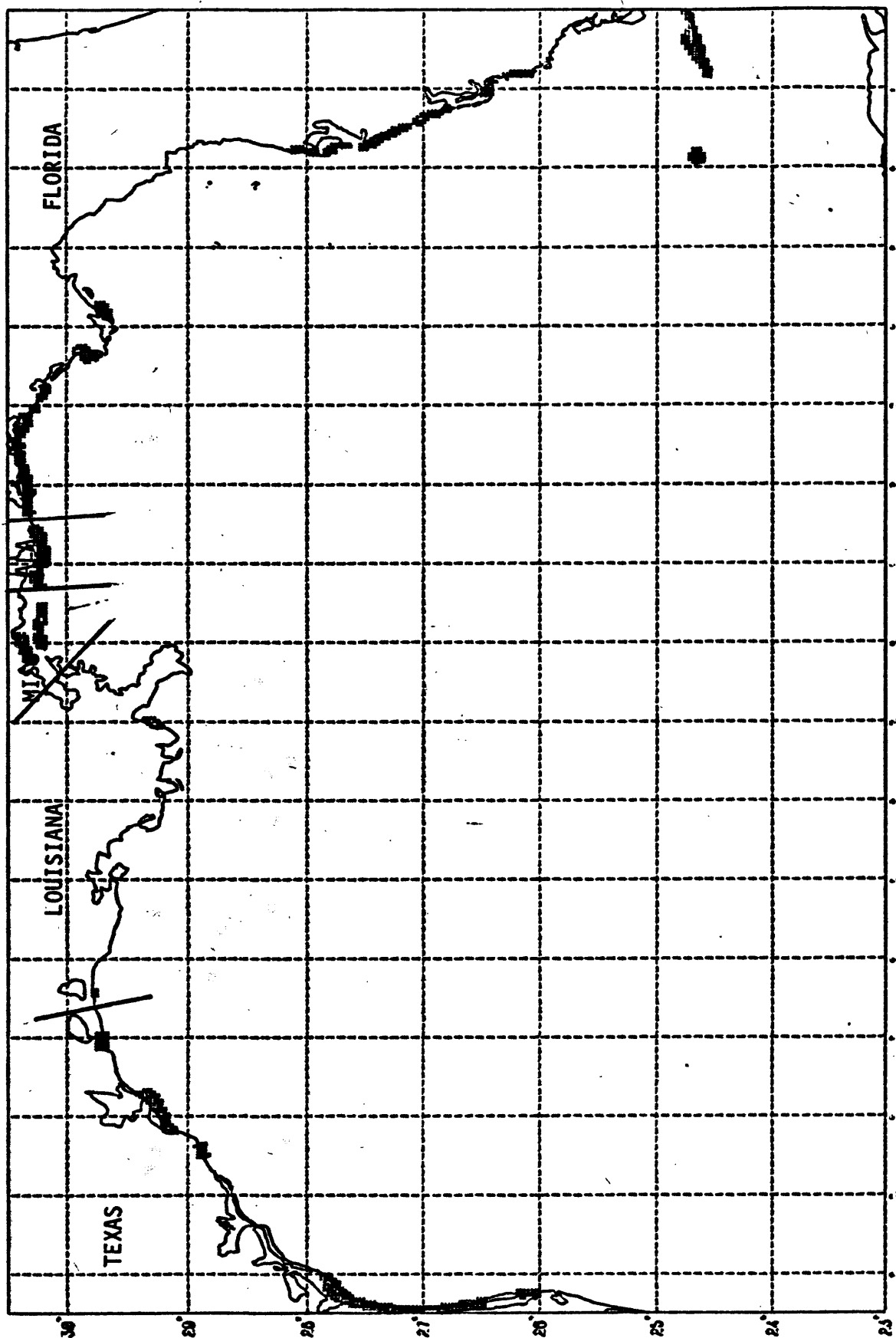


Figure A-5.--Map showing the locations of major beach areas by state, Gulf of Mexico OCS Region: crosshatching indicates areal extent. Major Gulf beaches target is total of those shown.

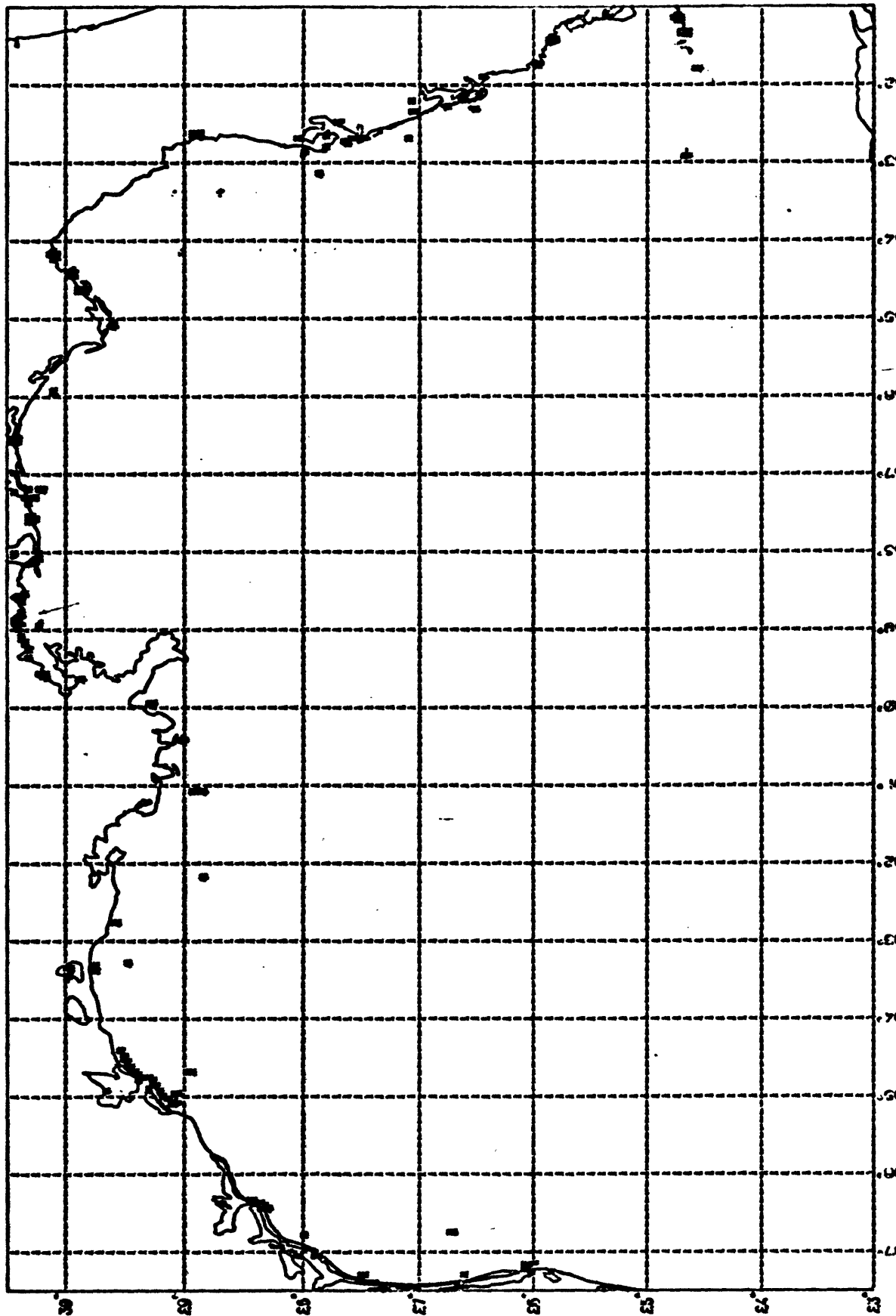


Figure A-6.--Map showing the locations of historic and prehistoric sites, Gulf of Mexico OCS Region: crosshatching indicates area extent.

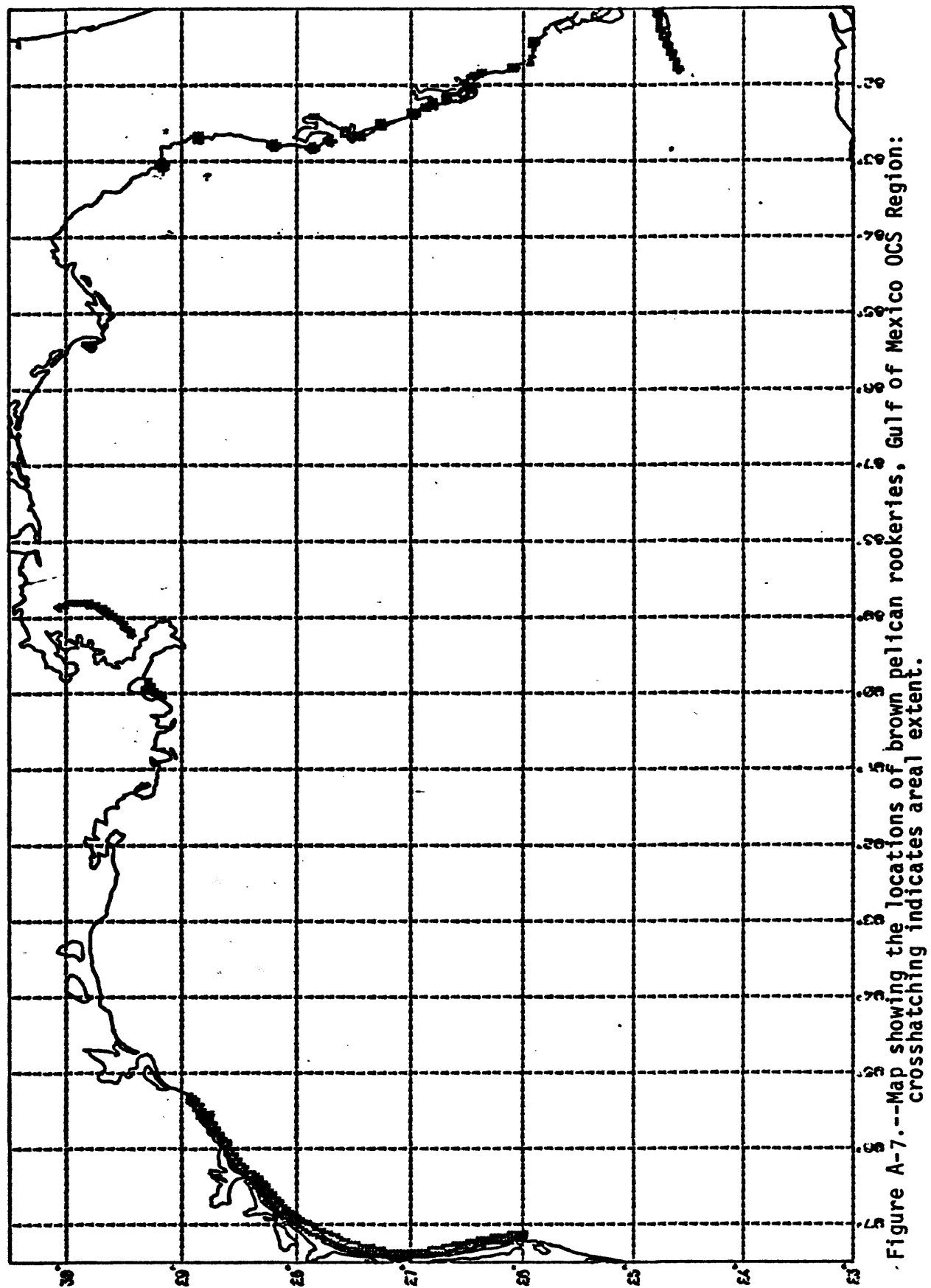


Figure A-7.--Map showing the locations of brown pelican rookeries, Gulf of Mexico OCS Region: crosshatching indicates area extent.

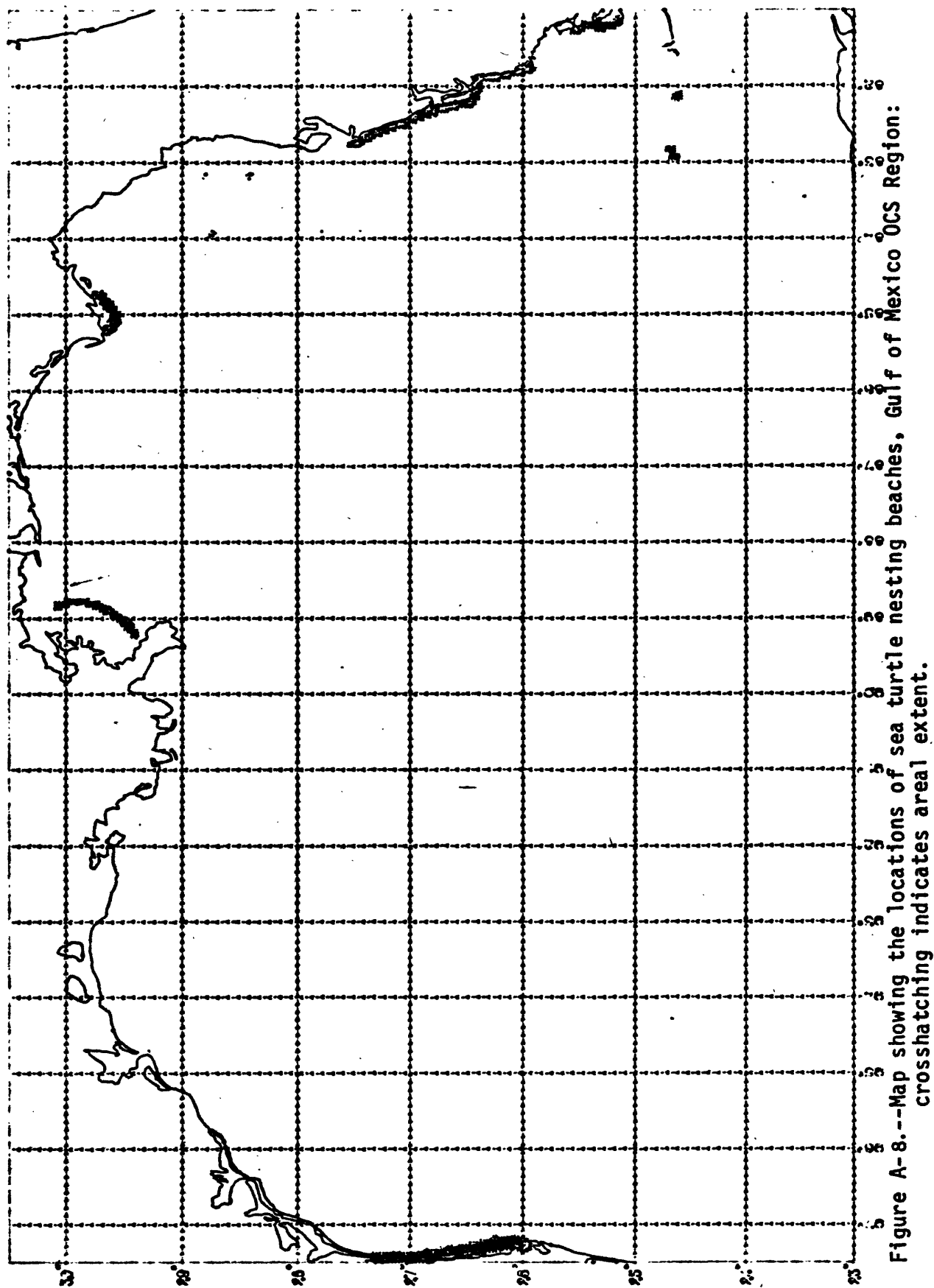


Figure A-8.--Map showing the locations of sea turtle nesting beaches, Gulf of Mexico OCS Region:
crosshatching indicates areal extent.

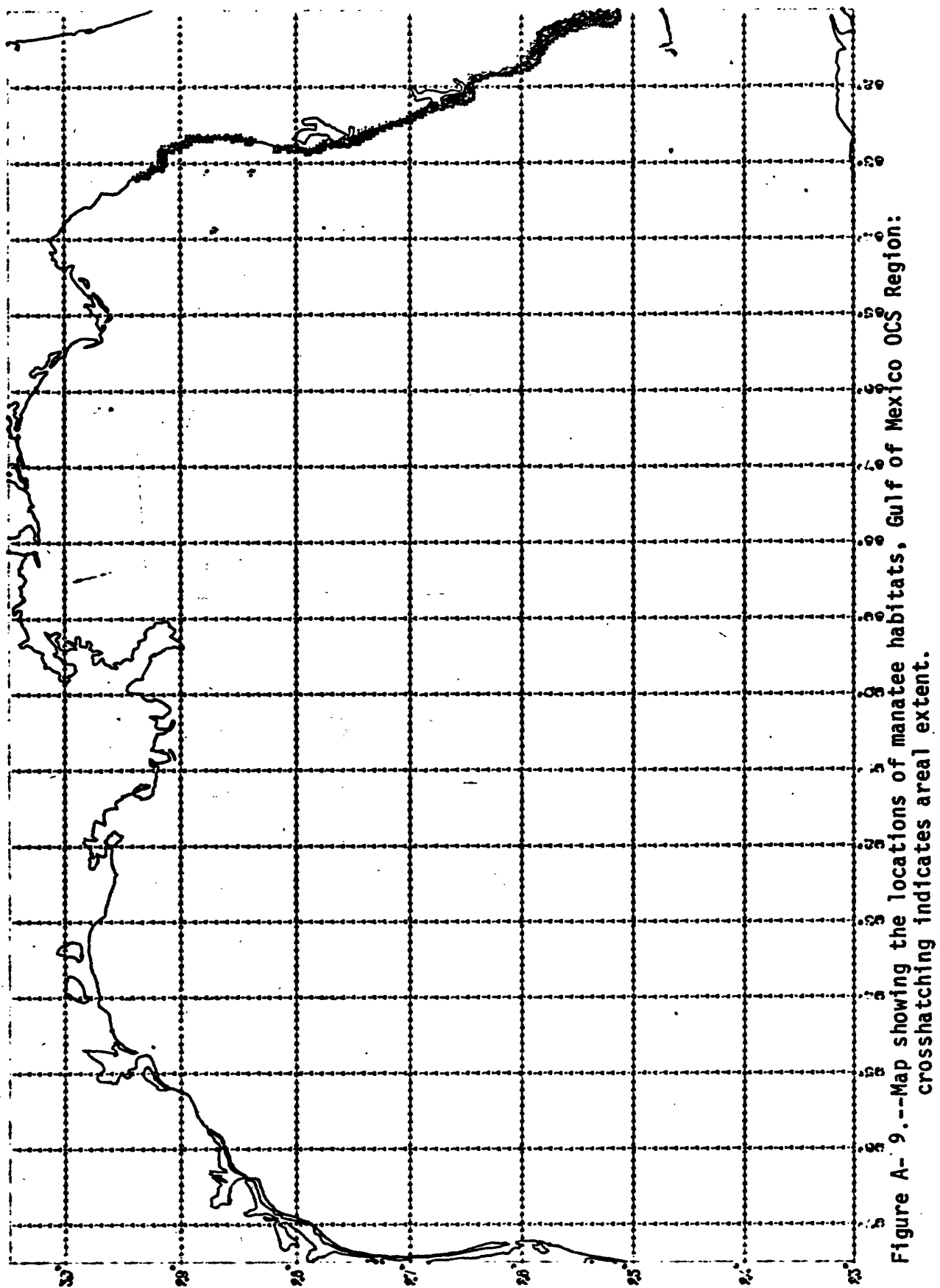


Figure A-9.--Map showing the locations of manatee habitats, Gulf of Mexico OCS Region:
crosshatching indicates areal extent.

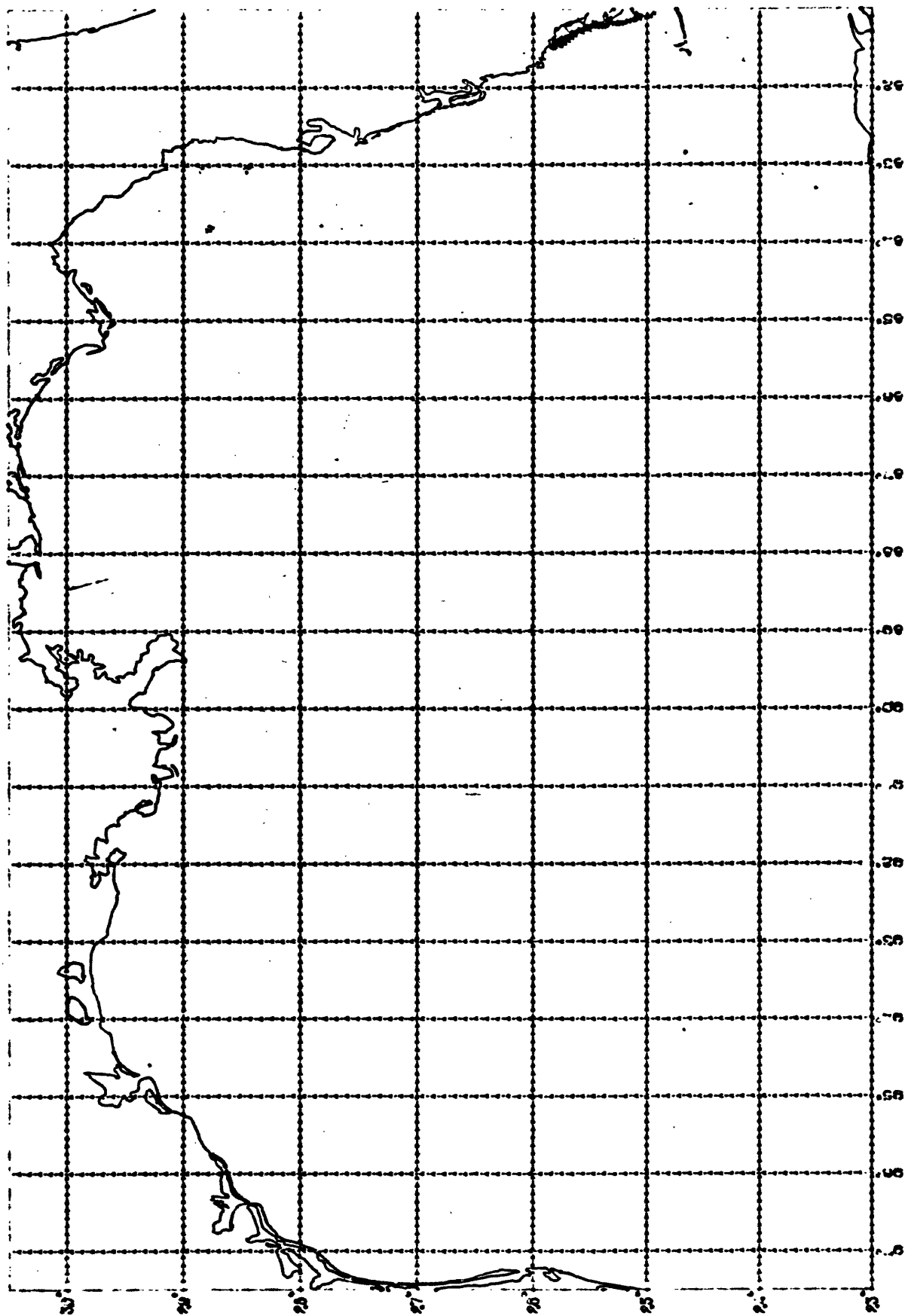


Figure A-10.--Map showing the locations of Everglades National Park, Gulf of Mexico OCS Region: crosshatching indicates areal extent.

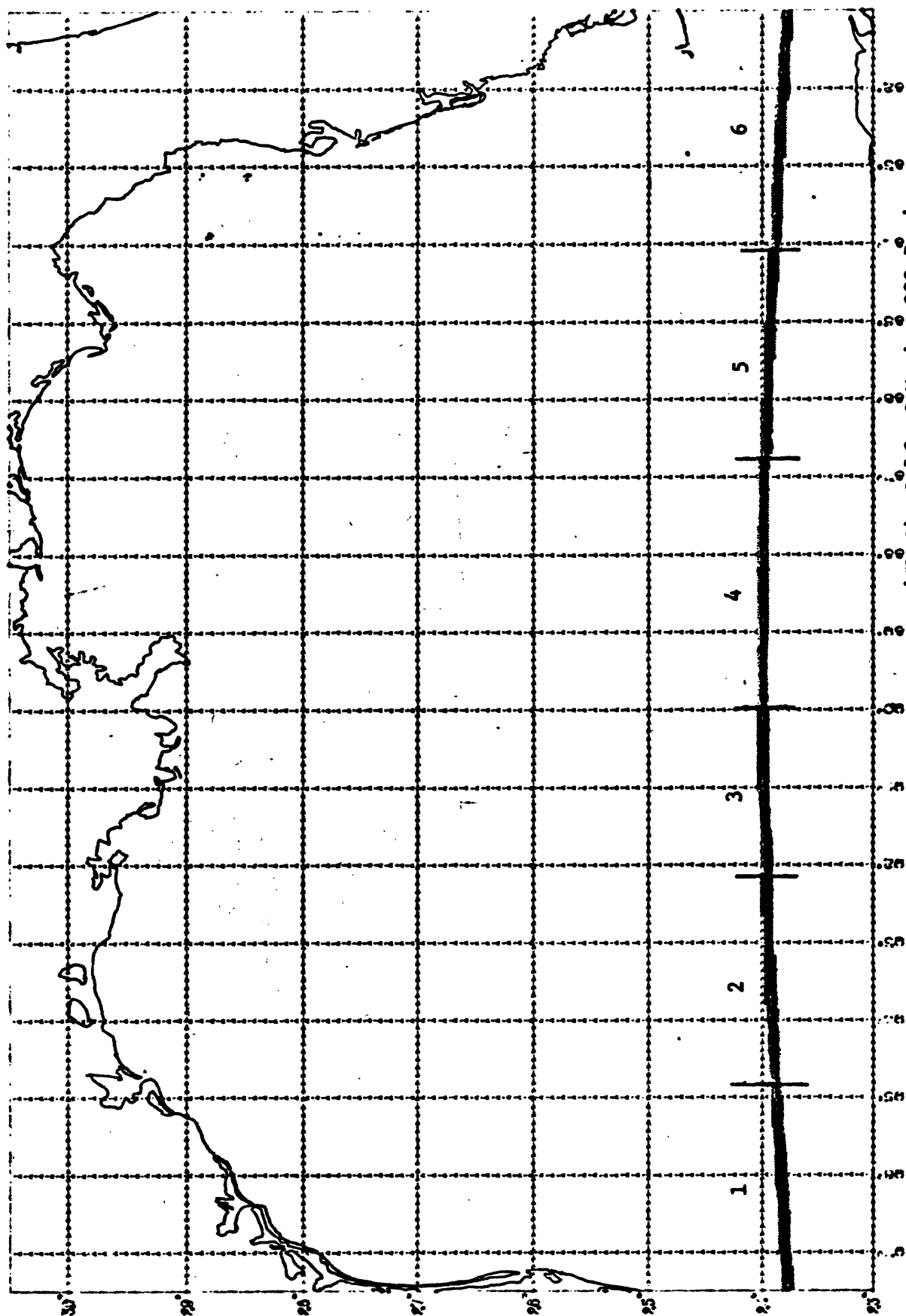


Figure A-11.--Map showing the locations of Gulf segments (#1-6), Gulf of Mexico OCS Region: crosshatching indicates areal extent.

Appendix B

Table B-1. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western Gulf total find scenario, for spills greater than 10,000 barrels.

[illegible]

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table B-2. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western Gulf total find scenario, for spills greater than 10,000 barrels.

Land Segment	Within 3 days				Within 10 days				Within 30 days			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
1	1	0.0	1	0.0	2	0.0	2	0.0	4	0.0	4	0.0
2	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0
3	n	0.0	n	0.0	3	0.0	3	0.0	6	0.1	7	0.1
4	1	0.0	1	0.0	4	0.0	4	0.0	6	0.1	7	0.1
5	3	0.0	4	0.0	6	0.1	6	0.1	8	0.1	9	0.1
6	n	0.0	3	0.0	2	0.0	2	0.0	5	0.1	5	0.1
7	1	0.0	1	0.0	4	0.0	5	0.0	10	0.1	11	0.1
8	4	0.0	5	0.1	11	0.1	12	0.1	20	0.2	24	0.3
9	1	0.0	4	0.0	6	0.1	8	0.1	12	0.1	17	0.2
10	2	0.1	14	0.2	13	0.1	19	0.2	21	0.2	32	0.4
11	2	0.0	10	0.1	3	0.0	6	0.1	6	0.1	15	0.2
12	1	0.0	13	0.1	1	0.0	14	0.1	4	0.0	34	0.4
13	n	0.0	3	0.0	n	0.0	11	0.1	1	0.0	21	0.2
14	n	0.0	5	0.1	n	0.0	11	0.1	n	0.0	15	0.2
15	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0
16	1	0.0	21	0.2	1	0.0	28	0.3	1	0.0	29	0.3
17	n	0.0	19	0.2	n	0.0	22	0.3	n	0.0	24	0.3
18	n	0.0	5	0.0	n	0.0	11	0.1	n	0.0	12	0.1
19	n	0.0	45	0.6	n	0.0	53	0.7	n	0.0	55	0.8
20	n	0.0	6	0.1	n	0.0	17	0.2	n	0.0	20	0.2
21	n	0.0	5	0.1	n	0.0	2	0.0	n	0.0	3	0.0
22	n	0.0	1	0.0	n	0.0	1	0.0	n	0.0	1	0.0
23	n	0.0	1	0.0	n	0.0	1	0.0	n	0.0	1	0.0
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table B-3. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Central Gulf total find scenario, for spills greater than 10,000 barrels.

Target	----- Within 3 days -----				----- Within 10 days -----				----- Within 30 days -----			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	59	0.9	90	2.3	92	2.6	81	1.6	98	3.9	99	5.1
Coastal Inlet Areas	26	0.3	57	0.8	65	1.0	47	0.6	79	1.6	90	2.3
Sea Grass Beds	2	0.0	3	0.0	5	0.1	4	0.0	5	0.1	10	0.1
Flower Garden Banks	1	0.0	1	0.0	2	0.0	2	0.0	3	0.0	15	0.2
Env. Preser. Areas	8	0.1	14	0.2	17	0.2	18	0.2	31	0.4	36	0.4
TX Beaches	1	0.0	5	0.1	12	0.1	3	0.0	11	0.1	28	0.3
LA Beaches	1	0.0	4	0.0	4	0.0	3	0.0	9	0.1	10	0.1
MI Beaches	1	0.0	2	0.0	3	0.0	3	0.0	4	0.0	8	0.1
AL Beaches	n	0.0	2	0.0	2	0.0	1	0.0	3	0.0	5	0.1
FL Beaches	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Beaches	4	0.0	12	0.1	21	0.2	10	0.1	25	0.3	43	0.6
Hist./Preh. Sites	14	0.1	33	0.4	37	0.5	24	0.3	50	0.7	64	1.0
Brown Pelicans	11	0.1	25	0.3	28	0.3	24	0.3	49	0.7	58	0.9
MI Sandhill Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whooping Cranes	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Turtles	6	0.1	11	0.1	11	0.1	13	0.1	25	0.3	26	0.3
Manatee Hab.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Dry Tortugas	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Florida Keys	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Straits of Florida	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Atchafalaya Riv. B.	2	0.0	4	0.0	4	0.0	4	0.0	9	0.1	9	0.1
Everglades Nat. Pk.	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table B-4. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Central Gulf total find scenario, for spills greater than 10,000 barrels.

Land Segment	Within 3 days				Within 10 days				Within 30 days			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
7	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
8	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
9	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
10	1	0.0	4	0.0	3	0.0	8	0.1	12	0.1	25	0.3
11	1	0.0	2	0.0	4	0.0	8	0.1	12	0.1	25	0.3
12	11	0.1	17	0.2	21	0.2	29	0.3	32	0.4	39	0.5
13	7	0.1	9	0.1	9	0.1	22	0.2	20	0.2	27	0.3
14	3	0.0	8	0.1	8	0.1	17	0.2	11	0.1	24	0.3
15	n	0.0	n	0.0	n	0.0	2	0.0	1	0.0	3	0.0
16	14	0.1	31	0.4	31	0.4	42	0.5	25	0.3	46	0.6
17	9	0.1	24	0.3	27	0.3	32	0.4	16	0.2	36	0.4
18	2	0.0	7	0.1	7	0.1	15	0.2	6	0.1	17	0.2
19	24	0.3	58	0.9	58	0.9	70	1.2	42	0.5	74	1.3
20	7	0.1	12	0.1	13	0.1	32	0.4	24	0.3	39	0.5
21	4	0.0	5	0.1	9	0.1	8	0.1	9	0.1	12	0.1
22	n	0.0	1	0.0	1	0.0	2	0.0	2	0.0	4	0.0
23	n	0.0	1	0.0	1	0.0	1	0.0	1	0.0	2	0.0
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table B-5. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting targets over the expected production life of the lease area, Western and Central Gulf total find scenario, for spills greater than 10,000 barrels.

Target	----- Within 3 days -----				----- Within 10 days -----				----- Within 30 days -----			
	PROPOSED	PROPOSED AND EXISTING	PROPOSED EXISTING & IMPORT	Prob Mean	PROPOSED	PROPOSED AND EXISTING	PROPOSED EXISTING & IMPORT	Prob Mean	PROPOSED	PROPOSED AND EXISTING	PROPOSED EXISTING & IMPORT	Prob Mean
Land	68	1.1	92	2.5	94	2.8	94	2.8	98	3.7	98	3.7
Coastal Inlet Areas	29	0.3	59	0.9	66	1.1	66	1.1	73	1.3	73	1.3
Sea Grass Beds	2	0.0	3	0.0	5	0.1	5	0.1	6	0.1	6	0.1
Flower Garden Banks	3	0.0	4	0.0	4	0.0	4	0.0	15	0.2	15	0.2
Env. Preser. Areas	8	0.1	14	0.2	17	0.2	17	0.2	20	0.2	20	0.2
TX Beaches	13	0.1	17	0.2	23	0.3	23	0.3	25	0.3	25	0.3
LA Beaches	1	0.0	4	0.0	4	0.0	4	0.0	44	0.6	44	0.6
MI Beaches	1	0.0	2	0.0	3	0.0	3	0.0	6	0.1	6	0.1
AL Beaches	n	0.0	2	0.0	2	0.0	2	0.0	7	0.1	7	0.1
FL Beaches	n	0.0	2	0.0	2	0.0	2	0.0	3	0.0	3	0.0
Gulf Beaches	16	0.2	23	0.3	31	0.4	31	0.4	n	0.0	n	0.0
Hist./Preh. Sites	26	0.3	42	0.6	46	0.6	46	0.6	51	0.7	51	0.7
Brown Pelicans	20	0.2	33	0.4	36	0.4	36	0.4	63	1.0	63	1.0
MI Sandhill Cranes	n	0.0	n	0.0	n	0.0	n	0.0	65	1.0	65	1.0
Whooping Cranes	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	n	0.0
Sea Turtles	6	0.1	11	0.1	11	0.1	11	0.1	3	0.0	3	0.0
Manatee Hab.	n	0.0	n	0.0	n	0.0	n	0.0	21	0.2	21	0.2
Dry Tortugas	n	0.0	n	0.0	n	0.0	n	0.0	33	0.4	33	0.4
Florida Keys	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Straits of Florida	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Atchafalaya Riv. B.	2	0.0	4	0.0	4	0.0	4	0.0	n	0.0	n	0.0
Everglades Nat. Pk.	n	0.0	n	0.0	n	0.0	n	0.0	5	0.1	5	0.1
Gulf Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 4	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Gulf Segment 6	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0

Note: n = Less than 0.5 percent; ** = greater than 99.5 percent.

Table B-6. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, Western and Central Gulf total find scenario, for spills greater than 10,000 barrels.

Land Segment	----- Within 3 days -----				----- Within 10 days -----				----- Within 30 days -----			
	PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING		PROPOSED		PROPOSED AND EXISTING	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
1	1	0.0	1	0.0	2	0.0	2	0.0	4	0.0	4	0.0
2	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0
3	n	0.0	n	0.0	3	0.0	4	0.0	6	0.1	10	0.1
4	1	0.0	1	0.0	4	0.0	5	0.1	6	0.1	10	0.1
5	3	0.0	5	0.0	6	0.1	9	0.1	8	0.1	14	0.2
6	n	0.0	3	0.0	2	0.0	7	0.1	5	0.1	14	0.2
7	1	0.0	1	0.0	4	0.0	8	0.1	10	0.1	21	0.2
8	4	0.0	5	0.1	11	0.1	15	0.2	22	0.2	40	0.5
9	1	0.0	4	0.0	6	0.1	15	0.2	15	0.2	37	0.5
10	8	0.1	11	0.1	16	0.2	33	0.4	31	0.4	67	1.1
11	3	0.0	10	0.1	7	0.1	27	0.3	17	0.2	52	0.7
12	12	0.1	22	0.2	20	0.2	35	0.4	35	0.4	64	1.0
13	7	0.1	9	0.1	13	0.1	22	0.2	21	0.2	40	0.5
14	3	0.0	8	0.1	8	0.1	18	0.2	12	0.1	28	0.3
15	n	0.0	n	0.0	1	0.0	2	0.0	1	0.0	4	0.0
16	14	0.2	31	0.4	21	0.2	42	0.5	25	0.3	68	1.1
17	9	0.1	24	0.3	13	0.1	32	0.4	16	0.2	65	1.0
18	2	0.0	7	0.1	4	0.0	15	0.2	6	0.1	26	0.3
19	24	0.3	58	0.9	36	0.4	70	1.2	42	0.5	86	1.9
20	7	0.1	12	0.1	18	0.2	32	0.4	24	0.3	48	0.7
21	4	0.0	5	0.1	6	0.1	8	0.1	9	0.1	21	0.2
22	n	0.0	1	0.0	1	0.0	2	0.0	2	0.0	8	0.1
23	n	0.0	1	0.0	n	0.0	1	0.0	1	0.0	5	0.1
24	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Appendix C

Table C-1. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting coastal subareas over the expected production life of the lease area, Western Gulf most likely find scenario.

Coastal Subarea	----- Within 3 days -----						----- Within 10 days -----						----- Within 30 days -----					
	Proposed and Existing			Proposed and Existing & Import			Proposed and Existing			Proposed and Existing & Import			Proposed and Existing			Proposed and Existing & Import		
	Prob	Mean		Prob	Mean		Prob	Mean		Prob	Mean		Prob	Mean		Prob	Mean	
W1	n	0.0	1	0.0	5	0.1	1	0.0	7	0.1	16	0.2	2	0.0	11	0.1	35	0.4
W2	3	0.0	15	0.2	25	0.3	5	0.1	30	0.4	55	0.8	5	0.1	60	0.9	89	2.2
C1	n	0.0	31	0.4	34	0.4	n	0.0	57	0.8	60	0.9	n	0.0	83	1.8	87	2.0
C2	n	0.0	61	1.0	62	1.0	n	0.0	74	1.4	81	1.7	n	0.0	76	1.4	91	2.4
C3	n	0.0	81	1.6	81	1.7	n	0.0	92	2.5	92	2.6	n	0.0	93	2.7	97	3.5
C4	n	0.0	6	0.1	10	0.1	n	0.0	10	0.1	17	0.2	n	0.0	12	0.1	27	0.3
E1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	.2	0.0

Note: n = Less than 0.5 percent; ** = greater than 99.5 percent. Subareas with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table C-2. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting coastal subareas over the expected production life of the lease area, Central Gulf most likely find scenario.

[illegible]

Note: n = Less than 0.5 percent; ** = greater than 99.5 percent. Subareas with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table C-3. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting coastal subareas over the expected production life of the lease area, Western and Central Gulf most likely find scenario.

[illegible]

Note: n = Less than 0.5 percent; ** = greater than 99.5 percent. Subareas with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table C-4. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting coastal subareas over the expected production life of the lease area, Western Gulf total find scenario.

Coastal Subarea	----- Within 3 days -----			----- Within 10 days -----			----- Within 30 days -----		
	Proposed	Proposed and Existing	Proposed Existing & Import	Proposed	Proposed and Existing	Proposed Existing & Import	Proposed	Proposed and Existing	Proposed Existing & Import
	Prob Mean	Prob Mean	Prob Mean	Prob Mean	Prob Mean	Prob Mean	Prob Mean	Prob Mean	Prob Mean
W1	15 0.2	16 0.2	22 0.2	40 0.5	43 0.6	56 0.8	62 1.0	65 1.0	82 1.7
W2	30 0.4	39 0.5	54 0.8	56 0.8	68 1.1	88 2.1	78 1.5	91 2.4	** 5.3
C1	2 0.0	32 0.4	38 0.5	4 0.0	59 0.9	65 1.0	13 0.1	85 1.9	92 2.5
C2	2 0.0	62 1.0	65 1.0	3 0.0	75 1.4	88 2.1	3 0.0	77 1.5	98 3.7
C3	n 0.0	81 1.6	81 1.7	n 0.0	92 2.5	93 2.7	n 0.0	93 2.7	99 4.4
C4	n 0.0	6 0.1	17 0.2	n 0.0	10 0.1	26 0.3	n 0.0	12 0.1	41 0.5
E1	n 0.0	n 0.0	n 0.0	n 0.0	n 0.0	n 0.0	n 0.0	n 0.0	5 0.1

Note: n = Less than 0.5 percent; ** = greater than 99.5 percent. Subareas with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table C-5. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting coastal subareas over the expected production life of the lease area, Central Gulf total find scenario.

[illegible]

Note: n = Less than 0.5 percent; ** = greater than 99.5 percent. Subareas with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

Table C-6. -- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) occurring and contacting coastal subareas over the expected production life of the lease area, Western and Central Gulf total find scenario.

Coastal Subarea	----- Within 3 days -----				----- Within 10 days -----				----- Within 30 days -----			
	Proposed		Proposed and Existing		Proposed		Proposed and Existing		Proposed		Proposed and Existing	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
W1	15	0.2	16	0.2	39	0.5	43	0.6	62	1.0	66	1.1
W2	32	0.4	41	0.5	63	1.0	73	1.3	89	2.2	96	3.1
C1	42	0.5	60	0.9	64	1.0	84	1.9	84	1.8	97	3.6
C2	45	0.6	78	1.5	60	0.9	89	2.2	68	1.1	92	2.6
C3	58	0.9	92	2.5	80	1.6	98	4.1	87	2.0	99	4.7
C4	10	0.1	16	0.2	15	0.2	24	0.3	25	0.3	34	0.4
E1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
											5	0.1

Note: n = Less than 0.5 percent; ** = greater than 99.5 percent. Subareas with less than 0.5 percent probability of one or more contacts within 30 days are not shown.