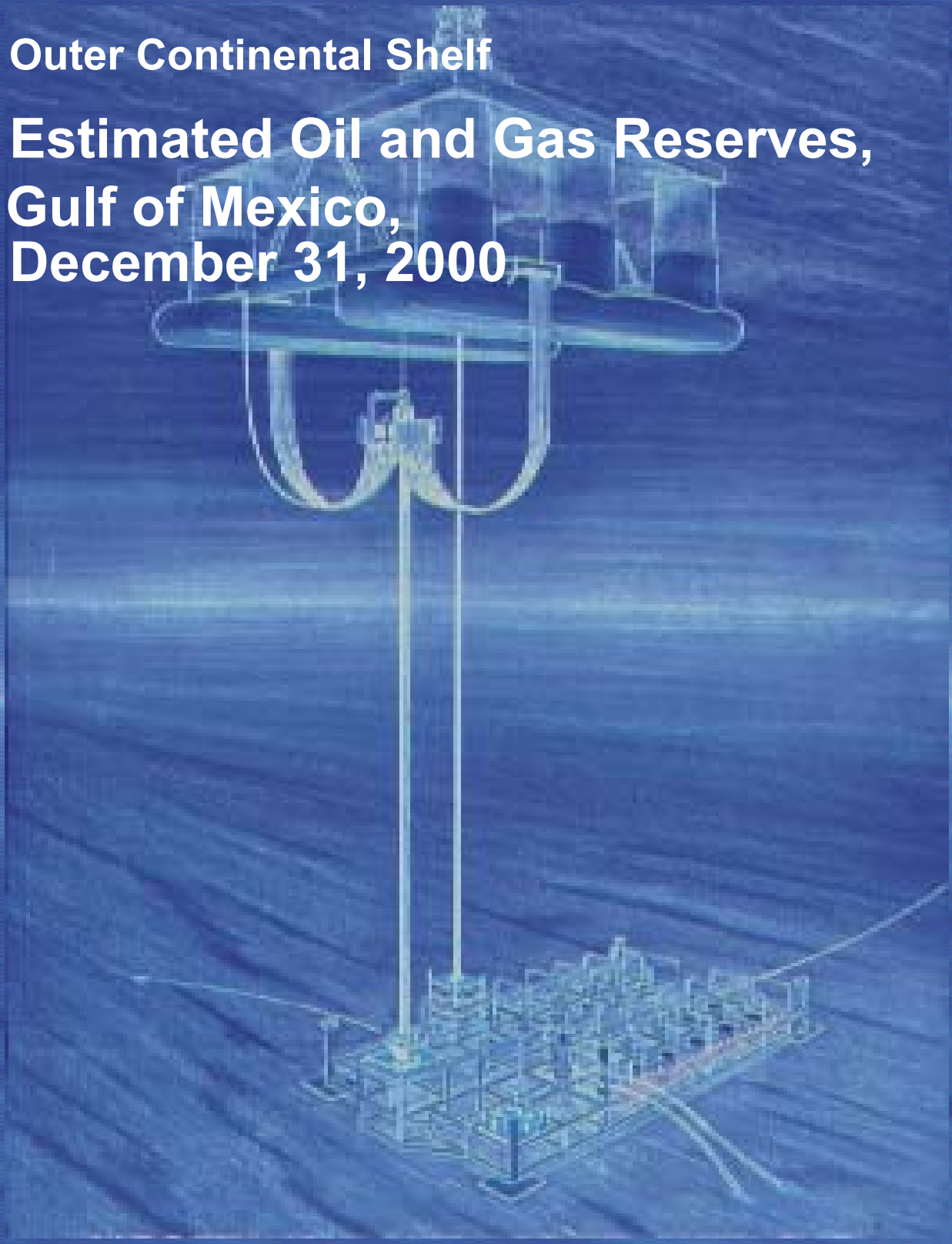
OCS Report
MMS 2003-050

Outer Continental Shelf

Estimated Oil and Gas Reserves, Gulf of Mexico, December 31, 2000



MMS
U. S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

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Estimated Oil and Gas Reserves, Gulf of Mexico, December 31, 2000

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Minerals Management Service
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Contents

Figures

Tables

Abstract

Proved reserves are estimated to be 14.93 billion barrels of oil* and 167.3 trillion cubic feet of gas from 1,050 proved fields in the same geographic area. Included in this number are 175 proved expired depleted fields: not included are the 51 unproved active fields. Estimates were derived for individual reservoirs from geologic mapping and reserve evaluation. Cumulative production from the proved fields accounts for 11.93 billion barrels of oil and 142.7 trillion cubic feet of gas.

Remaining proved reserves in the Gulf of Mexico Outer Continental Shelf (OCS) as of December 31, 2000, are estimated to be 3.00 billion barrels of oil and 24.6 trillion cubic feet of gas. These reserves are recoverable from 875 proved active fields.

Unproved reserves as of December 31, 2000, are estimated to be 2.22 billion barrels of oil and 4.1 trillion cubic feet of gas. These reserves are associated with the 51 unproved active fields studied. In total, there are 926 active fields located in Federal waters. The unproved reserves, associated with the 51 unproved active fields studied, are not added to proved reserves because of different levels of economic certainty and hydrocarbon assurance. For any field contained partly in State waters and partly in Federal waters, reserves are estimated for the Federal portion only.

In addition to the proved and unproved reserves discussed above, at a minimum there are 2.87 billion barrels of oil and 14.1 trillion cubic feet of gas that are not presented in this report. This oil and gas occurs on leases that have not yet qualified (and therefore not placed in a field) or they occur as unproved reserves and/or known resources in proved fields, or as known resources in unproved fields. As further drilling and development occurs, these additional hydrocarbon volumes will become reportable, and MMS anticipates future proved and unproved reserves to increase

*The term "oil" as used in this report includes crude oil and condensate.

Introduction

This report, which supersedes the Minerals Management Service (MMS) OCS Report MMS 2002-007 (Crawford and others, 2002), presents estimated proved reserves, cumulative production, remaining proved reserves, and unproved reserves as of December 31, 2000, for the Gulf of Mexico (GOM). Reserves growth (an observed phenomenon that occurs when there is an incremental increase through time in the estimates of proved reserves) and undiscovered and known resources are not addressed in this report. A discussion of reserves growth can be found in OCS Report MMS 2001-0087 (Lore and others, 2001). The estimates of reserves for this report were completed in December 2000 and represent the combined efforts of engineers, geologists, geophysicists, paleontologists, and other personnel of the MMS Gulf of Mexico Region, Office of Resource Evaluation, in New Orleans, Louisiana.

As in previous reports, standard methods of estimating reserves were used, including volumetric calculations and performance analyses.

Definition of Resource and Reserve Terms

The MMS definitions and classification schema concerning reserves reflect those of the Society of Petroleum Engineers (SPE) and the World Petroleum Congress (WPC), 1996. SPE definitions have been used since 1988. The MMS definitions and classification schema concerning resources are modified as referenced by the U.S. Department of the Interior (DOI, 1989). The MMS petroleum resource and reserve classifications are presented in figures 1 and 2.

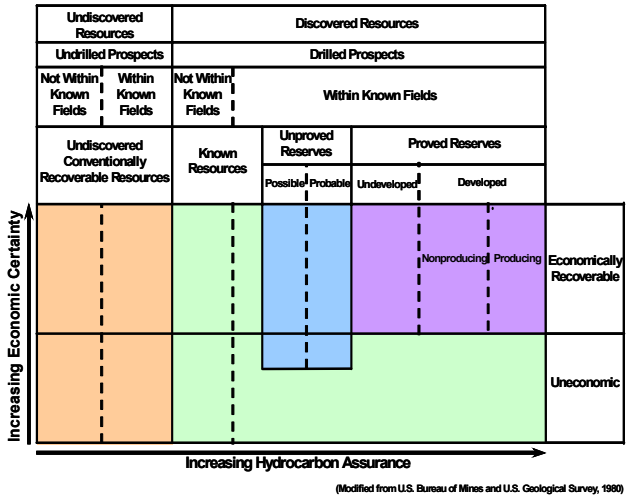

Figure 1. MMS conventionally recoverable petroleum resource classifications.

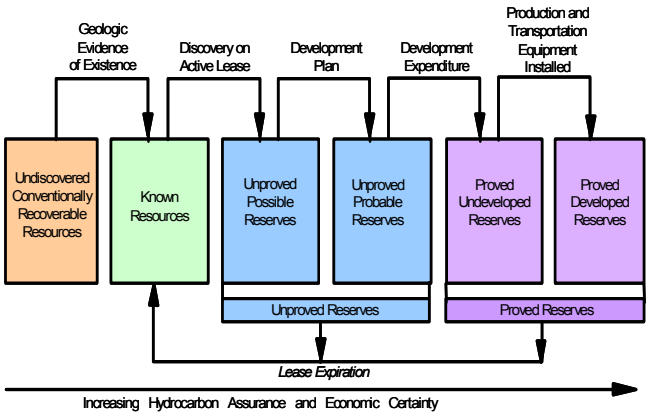

Figure 2. Gulf of Mexico MMS reserve classifications.

Field

A field is an area consisting of a single reservoir or multiple reservoirs all grouped on, or related to, the same general geologic structural feature and/or stratigraphic trapping condition. There may be two or more reservoirs in a field that are separated vertically by impervious strata, laterally by local geologic barriers, or by both. The area may include one OCS lease, a portion of an OCS lease, or a group of OCS leases with one or more wells that have been approved as producible by the MMS pursuant to the requirements of Title 30 Code of Federal Regulations (CFR) 250.116, Determination of Well Producibility. A field is usually named after the area and block on which the discovery well is located. Field names or field boundaries may be changed when additional geologic and/or production data support such a change. Using geological criteria, the MMS designates a new producible lease as a new field or assigns it to a preexisting field. A further explanation of field naming convention can be found in the "Reserves and Related Data Reported by Area" section on page 5 and in the Field Naming Handbook available on the Gulf of Mexico Region's Internet homepage at www.gomr.mms.gov.

Resources

Concentrations of naturally occurring liquid or gaseous hydrocarbons that can conceivably be discovered and recovered are called resources. Normal use encompasses both undiscovered and discovered resources.

Undiscovered Resources

Hydrocarbons estimated on the basis of geologic knowledge and theory to exist outside of known accumulations are *undiscovered resources*. Undiscovered resources analogous to those in existing fields producible with current recovery technology and efficiency, but without any consideration of economic viability, are *undiscovered conventionally recoverable resources.*

Discovered Resources

Hydrocarbons whose location and quantity are known or estimated from specific geologic evidence are *discovered resources*. Discovered resources include known resources, unproved reserves, and proved reserves depending upon economic, technical, contractual, or regulatory criteria.

Known Resources

Hydrocarbons associated with reservoirs penetrated by one or more wells that are not currently qualified under the MMS regulations as capable of producing in paying quantities pursuant to 30 CFR 250.116 are *known resources*. Known resources can exist on active, relinquished, or expired leases and fields.

Reserves

Those quantities of hydrocarbons which are anticipated to be recovered from known accumulations from a given date forward are reserves. All reserve estimates involve some degree of uncertainty. The uncertainty depends chiefly on the amount of reliable geologic and engineering data available at the time of the estimate and the interpretation of these data. The relative degree of uncertainty may be conveyed by placing reserves into one of two principal classifications, either unproved or proved.

Unproved Reserves

Those quantities of hydrocarbons that can be estimated with some certainty to be potentially recoverable from known reservoirs, assuming future economic conditions and technological developments, are *unproved reserves*. The MMS Gulf of Mexico Regional Field Names Committee designates a new producible lease as a new field or assigns it to a preexisting field. The reserves associated with new producible leases qualified pursuant to 30 CFR 250.116 are initially considered unproved reserves. Unproved reserves are less certain to be recovered than proved reserves and may be further subclassified as possible and probable reserves to denote progressively increasing certainty in their recoverability. This report does not present individual estimates for possible and probable reserves.

Unproved possible reserves are those unproved reserves which analysis of geological and engineering data suggests are less likely to be commercially recoverable than probable reserves. After a well on a lease qualifies, the reserves associated with the lease are initially classified as unproved possible because the only direct evidence of economic accumulations is a production test or electric log analysis.

Unproved probable reserves are those unproved reserves which analysis of geological and engineering data suggests are more likely than not to be commercially recoverable. Fields that have a Development Operations Coordination Document (DOCD) on file with the MMS would be classified as unproved probable.

Proved Reserves

Those quantities of hydrocarbons which can be estimated with reasonable certainty to be commercially recoverable from known reservoirs and under current economic conditions, operating methods, and government regulations are *proved reserves*. Establishment of current economic conditions includes consideration of relevant historical petroleum prices and associated costs and may involve an averaging period that is consistent with the purpose of the reserve estimate. Proved reserves must have either facilities operational at the time of the estimate to process and transport those reserves to market, or a commitment or reasonable expectation to install such facilities in the future. The application for a permit to install a platform is considered such a commitment. Proved reserves can be subdivided into undeveloped or developed.

Proved undeveloped reserves exist where there is a relatively large expenditure required to install production and/or transportation facilities and a commitment has been made by the operator to develop the field. Proved undeveloped reserves are reserves expected to be recovered from planned development wells or from existing wells where a relatively large expenditure is required for field development.

Proved developed reserves are expected to be recovered from existing wells (including reserves behind pipe). Reserves are considered developed only after the necessary production and transportation equipment has been installed, or when the costs to do so are relatively minor. Proved developed reserves are subcategorized as producing or nonproducing. This distinction is made at the reservoir level.

PROVED DEVELOPED PRODUCING RESERVES are in reservoirs that have produced any time during the 12 months before the reporting date. Once the first reservoir in a field begins production, the reservoir and the field are considered proved developed producing.

PROVED DEVELOPED NONPRODUCING RESERVES are in reservoirs that have not produced during the 12 months prior to the reporting date. This category includes off-production reservoirs behind pipe and reservoirs awaiting workovers or transportation facilities. If all reservoirs in a field are off production, the field is considered proved developed nonproducing.

Remaining proved reserves are the quantities of proved reserves currently estimated to be recoverable. Estimates of remaining proved reserves equal proved reserves minus cumulative production.

Reference Standard Conditions for Production and Reserves

Production data are the metered volumes of raw liquids and gas reported to the MMS by Federal unit and lease operators. Oil volume measurements and reserves are corrected to reference standard conditions of 60°F and one atmosphere (14.696 pounds per square inch absolute [psia]); gas measurements and reserves are corrected to 60°F and 15.025 psia. To convert gas volumes to 14.696 psia, multiply by 1.022 (DOE, 1989). Continuously measured volumes from production platforms and/or leases are allocated to individual wells and reservoirs on the basis of periodic well test gauges. These procedures introduce approximations in both production and remaining reserves data.

MMS Reporting of Reserve and Resource Data

OCS reserve estimates have been published by the Gulf of Mexico Region annually since 1977, presenting end-of-year totals starting with 1975. From 1977 to 1981, the estimates were published as United States Geological Survey (USGS) Open-File reports. The 1982 report was a joint publication between the USGS and the newly formed MMS, which assumed the OCS mission responsibilities at that time. The MMS has continued the reporting since 1983. The first report provided by the MMS that also includes unproved reserve estimates was published in 1995.

Figure 3 shows the relationship of evaluated data to hydrocarbon assurance. The data are progressively aggregated on both a geologic and a geographic basis at each step of the evaluation process (the reservoir level through the region level). The most detailed studies of discovered resources are MMS individual field studies. These studies are based on analysis at the reservoir level (an example being a single fault trap in a single sand) and are used as the basis for the reporting of discovered and undiscovered resources.

The geologic aggregation begins at the top of the figure at the reservoir level and progresses downward through the sand, pool, play, chronozone, series, and system to the regional level. Reservoirs correlated to a specific sand are aggregated to form the sand reporting level, which becomes the basis for further aggregations of data. A play is defined primarily (though not exclusively) by depositional style, geologic age at the chronozone level, and geographic area. Pools are based on the same characteristics of a play, but are specific to an individual field. Fields may contain one or more pools, with each pool representing a separate play. The geographic aggregation begins at the bottom of the figure, also at the reservoir level, and progresses upward through the field, area, and planning area to the regional level.

This report, ***Estimated Oil and Gas Reserves***, presents reserve data for the field level through the series level (see figure 3). This report is based on aggregation of MMS internal field studies completed at the reservoir and sand levels. All of the reservoir level data have been linked to the sand, pool, play, chronozone, and series level to support the Offshore Atlas Project (OAP).

The MMS OCS Report MMS 2001-086, ***Atlas of Gulf of Mexico Gas and Oil Sands as of January 1, 1999***, released in September 2001 on CD-ROM, provides a detailed geologic reporting of oil and gas proved and unproved reserves. Reserves data on more than 10,000 sands have been placed into 65 established

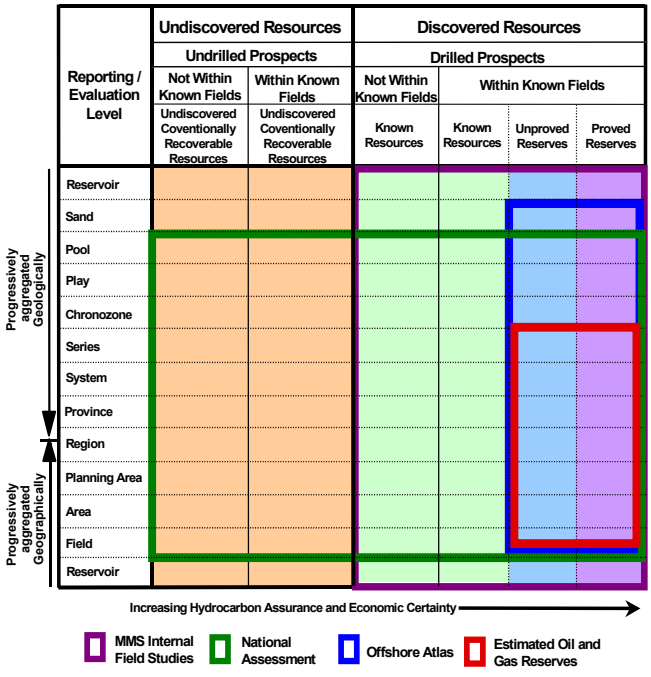

Figure 3. MMS evaluation of reserves and resources.

geological plays in Federal waters. This is the second MMS release of a comprehensive framework of geologic and reserve data and the associated attributes for each specific sand and field. Play, chronozone, series, system, province, and region levels can also be evaluated with the data provided.

The MMS OCS Report MMS 2001-087, ***2000 Assessment of Conventionally Recoverable Hydrocarbon Resources of the Gulf of Mexico and Atlantic Outer Continental Shelf as of January 1, 1999,*** also known as the National Assessment, addresses proved and unproved reserves, reserves appreciation, and undiscovered resources. To maintain credibility, an estimate of undiscovered resources must be based on discovered resources. The OAP supported this report by providing a framework of hydrocarbon plays that allowed for the logical extension of existing production rather than just a conceptual estimate. This report, made available in October 2001 on CD-ROM, contains reserves and resource estimates by play, planning area, water depth, and region.

For information on these reports, contact the Gulf of Mexico Region's Public Information Office at 1-800-200-GULF or 504-736-2519, or visit the GOM Region's Internet homepage at http://www.gomr.mms.gov.

Methods Used for Estimating Reserves

Reserve estimates from geological and engineering analyses have been completed for the 1,050 proved fields. Reserves accountability is dependent on the drilling and development phases of fields. When a field is in the unproved category, geophysical mapping and limited well data are the basis for defining reservoir limits. Once a field is moved into the proved category and more data become available, the reserve estimate is re-evaluated. Well logs, well file data, seismic data, and production data are continually analyzed to improve the accuracy of the reserve estimate. As a field is depleted and abandoned, the proved reserves of productive reservoirs are assigned a value equal to the amount produced and the reserve estimate of non-producing reservoirs is converted to known resources. Currently, there are 175 proved expired, depleted fields.

Estimation of reserves is done under conditions of uncertainty. The method of estimation is called deterministic if the estimate is a single "best estimate" based on known geological, engineering, and economic data, and probabilistic when the known geologic, engineering, and economic data are analyzed probabilistically and the estimate determined from continuous probability distributions (SPE/WPC, 1996). Reserve estimates in this report are deterministic.

Methods used for estimating reserves can be categorized into three groups: analog, volumetric, and performance. The accuracy of the proved reserve estimate improves as more reservoir data become available to geoscientists and engineers. Resources are based on analogy with similar fields, reservoirs, or wells in the same area. Reserve estimates in this report are based primarily on volumetric and performance methods.

Analog

In the estimation of resources by analogy, geoscientists use seismic data to generate maps of the extent of subsurface formations. Before any wells have been drilled on a prospect, estimates of undiscovered resources are based on analogy with similar fields, reservoirs, or wells in the same area. The seismic data help geoscientists identify prospects and resources, but do not provide enough direct data to estimate reserves.

The effective pore space, water saturation, net hydrocarbon thickness, pressure, volume, and temperature data, necessary to complete resource estimates for prospects, come from nearby field and reservoir well data. After one or more wells are drilled and found productive, a volumetric estimate is done. These estimates, while incorporating existing data, still rely on some information obtained from analogs.

Volumetric

In a volumetric reserve estimate, data from drilled wells and seismic surveys are used to develop geologic interpretations. The effective pore space (porosity), water saturation, and net hydrocarbon thickness of the subsurface formations are calculated through evaluation of well logs, core analysis, and formation test data. Subsurface formations are mapped to determine area and net hydrocarbon thickness for each reservoir. Reservoir pressure, fluid volume, and temperature data from formation fluid samples are used to determine the change in volume of oil and gas that flow from higher pressure conditions deep underground to lower pressure conditions at the surface. All of these data are compiled, analyzed and applied to standard equations for the calculation of hydrocarbons in place within the reservoirs. Standard recovery factor equations are then applied to the in-place estimates to calculate proved and unproved reserves.

Performance Methods

In performance-technique methods, reserves are estimated using mathematical or graphical techniques of production decline curve analysis and material balance. These techniques are used throughout the oil industry in assessing individual well, reservoir, or field performance and in forecasting future reserves. In decline analysis, a plot of daily production rate against time is most frequently used. Once a well or reservoir can no longer produce at its maximum capacity, the

production rate declines. This production rate plotted against time can be extrapolated into the future to predict the remaining reserves. Another type of decline analysis is daily production rate plotted against cumulative production, which can also be used to predict remaining reserves. The declining daily rate is extrapolated to predict remaining reserves.

Another performance method, material balance, is used to estimate the amount of hydrocarbons in place. Given the premise that the pressure-volume relationship of a reservoir remains constant as hydrocarbons are produced, it is possible to equate expansion of reservoir fluids with reservoir voidage caused by fluid withdrawal minus any water influx. For depletion-drive gas reservoirs, a plot of the pressure/gas compressibility factor (P/Z) versus cumulative gas production provides an estimate of gas-in-place. Recoverable gas reserves are extrapolated to an abandonment reservoir pressure.

Reserves and Related Data Reported by Area

The Gulf of Mexico has been divided into three planning areas for administrative purposes; these planning areas (Western, Central, and Eastern) are shown in figures 4, 5, and 6, respectively. Each planning area is subdivided into smaller areas, which in turn are divided into numbered blocks. Fields in the Gulf of Mexico are identified by the smaller area name and block number of discovery – for example, East Cameron Block 271 Field.

As the field is developed, the limits often expand into adjacent blocks and areas. These adjacent blocks are then identified as part of the original field and are given that field name. Statistics in this report are presented as area totals compiled under each field name. All of the data associated with East Cameron Block 271 Field are therefore included in the East Cameron totals, although part of the field extends into the adjacent area of Vermilion. There are four exceptions to the above field-naming techniques: Tiger Shoal and Lighthouse Point, included in South Marsh Island; Coon Point, included in Ship Shoal; and Bay Marchand, included in South Timbalier.

There were 926 active fields in the federally regulated part of the Gulf of Mexico. An updated list of the active and expired fields can be found in the ***OCS Operations Field Directory*** (April 2003) on the GOM Region's Internet homepage. For this report, 875 proved active producing and non-producing fields and 51 unproved active fields were studied. Included are the 175 proved expired, depleted fields, abandoned after producing 1.6% barrel oil equivalent of the total cumulative oil and

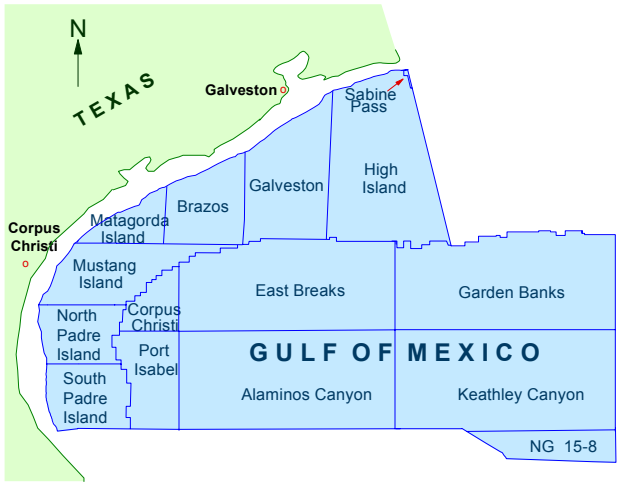

Figure 4. Western Planning Area, Gulf of Mexico, Outer Continental Shelf.

Figure 5. Central Planning Area, Gulf of Mexico, Outer Continental Shelf.

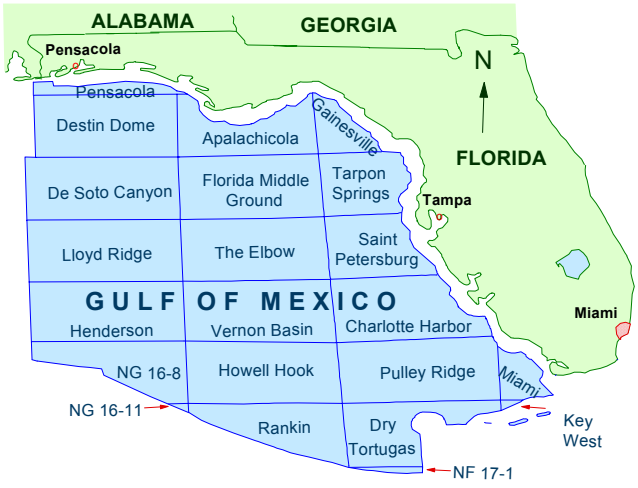

Figure 6. Eastern Planning Area, Gulf of Mexico, Outer Continental Shelf.

Table 1. Estimated oil and gas reserves for 1,050 proved and 51 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 2000.

(Reserves: oil expressed in millions of barrels at 60 °F and 1 atmosphere; gas in billions of cubic feet at 60 °F and 15.025 psia.)

Area(s) (Figs. 4, 5, and 6)	Number of fields						Proved reserves		Cumulative production through 2002		Remaining proved reserves		Unproved reserves	
	Proved active prod	Proved active nonprod	Proved expired depleted	Unproved active	Unproved studied	Expired nonprod	Oil	Gas	Oil	Gas	Oil	Gas	Oil	Gas
Western Planning Area														
Brazos	25	4	9	0	0	2	11	3,315	9	2,900	2	415	-	-
Galveston	21	4	18	0	0	4	53	2,026	43	1,692	10	334	-	-
High Island and Sabine Pass	84	3	32	1	1	15	368	14,357	327	13,097	41	1,260	-	-
Matagorda Island	25	1	2	0	0	3	25	5,482	20	4,450	5	1,032	-	-
Mustang Island	18	1	8	0	0	6	7	1,890	5	1,516	2	374	-	-
N.& S.Padre Island	5	0	4	0	0	2	0	510	0	445	0	65	-	-
Western Slope*	27	10	0	7	7	12	690	4,991	287	2,054	403	2,937	-	-
Western Planning Area Subtotal	***205***	***23***	***73***	***8***	***8***	***44***	***1,154***	***32,571***	***691***	***26,154***	***463***	***6,417***	***56***	***146***
Central Planning Area														
Chandeleur	6	1	3	0	0	0	0	339	0	328	0	11	-	-
East Cameron	47	6	12	2	2	1	330	10,608	298	9,858	32	750	-	-
Eugene Island	60	3	10	1	1	7	1,570	18,664	1,432	16,999	138	1,665	-	-
Grand Isle	18	1	1	0	0	1	960	4,898	901	4,152	59	746	-	-
Main Pass and Breton Sound	57	2	11	4	4	7	1,024	6,268	893	5,300	131	968	-	-
Mobile	21	2	2	0	0	3	0	2,139	0	1,260	0	879	-	-
Ship Shoal	51	1	8	2	2	3	1,346	11,836	1,234	10,880	112	956	-	-
South Marsh Island	39	3	4	1	1	1	856	13,854	782	12,892	74	962	-	-
South Pass	11	1	1	1	1	0	1,051	4,441	994	3,804	57	637	-	-
South Pelto	9	0	0	0	0	0	152	1,070	133	837	19	233	-	-
South Timbalier	43	3	5	3	3	2	1,463	9,029	1,332	7,840	131	1,189	-	-
Vermilion	65	5	13	0	0	2	530	16,270	473	14,891	57	1,379	-	-
Viosca Knoll	21	0	3	2	2	2	10	393	3	170	7	223	-	-
West Cameron and Sabine Pass	65	10	23	1	1	5	192	18,532	171	17,012	21	1,520	-	-
West Delta	21	1	2	0	0	2	1,373	5,397	1,278	4,886	95	511	-	-
Central Slope**	54	18	4	24	24	26	2,918	10,907	1,310	5,422	1,608	5,485	-	-
Central Planning Area Subtotal	***588***	***57***	***102***	***41***	***41***	***62***	***13,775***	***134,645***	***11,234***	***116,531***	***2,541***	***18,114***	***2,165***	***3,988***
Eastern Planning Area Subtotal***	***1***	***1***	***0***	***2***	***2***	***1***	***0***	***37***	***0***	***3***	***0***	***34***	***-***	***-***
GOM Total:	***794***	***81***	***175***	***51***	***51***	***107***	***14,929***	***167,253***	***11,925***	***142,688***	***3,004***	***24,565***	***2,221***	***4,134***
	1,050													

*Western Slope includes Alaminos Canyon, Corpus Christi, East Breaks, Keathley Canyon, and Port Isabel.

**Central Slope includes Atwater Valley, Ewing Bank, Green Canyon, Lund, Mississippi Canyon, Viosca Knoll (slope), and Walker Ridge.

***Eastern Planning Area includes Charlotte Harbor, Destin Dome, Pensacola and others. Unproved reserves data are included with Central Planning Area.

gas production. Not studied were 107 fields expired, relinquished, or terminated without production. In 2000, seventeen proved fields were depleted and no unproved fields expired.

Reserves data and various classifications of fields, leases, boreholes, and completions are presented as area totals in tables 1 and 2, and the table 3 series. Dashes on these tables are used to preserve the proprietary nature of data. (The table 3 series will be discussed in the section "Reserves Reported by Geologic Age," beginning on page 8.) Figure 7 provides a geographical representation of locations for the 1,050 proved fields in the Gulf of Mexico. The bar heights in the figure are proportional to total proved reserves (barrel of oil equivalent) for each decade.

Estimates of proved reserves for these fields, both producing and non-producing, are presented as area totals in table 1.

Figure 8 provides a geographical representation of the 51 unproved active fields in the Gulf of Mexico. Estimates of unproved reserves are presented as planning area subtotals. The bar heights in the figure are proportional to total unproved reserves (barrel of oil equivalent) for each unproved field.

The Eastern Planning Area totals for unproved reserves are included in the Central Planning Area subtotals. The status of Gulf of Mexico OCS Federal oil and gas leases as of December 31, 2000, is presented in table 2. There are 7,440 active leases (2,154 proved active, 101 unproved qualified, and 5,185 unqualified active) and 10,926 relinquished leases (1,658 proved depleted and 9,268 expired)

Definitions of the table 2 lease subgroups follow:

Proved Active — Leases within the designated 875 proved active fields presented in table 1.

Table 2. Status of oil and gas leases, boreholes, and completions by area, Gulf of Mexico, Outer Continental Shelf, December 31, 2000.

(All statistics associated with fields are presented within area totals compiled under each field name.)

Area(s) (Figs. 4, 5, and 6)	Number of leases					Number of boreholes		Number of active completions
	Proved active	Proved depleted	Unproved qualified	Unqualified active	Expired	Drilled	Abandoned	
Western Planning Area								
Brazos	46	48	0	77	273	517	366	208
Galveston	41	67	0	89	488	650	561	175
High Island and Sabine Pass	190	159	1	173	818	2,932	1,919	1,465
Matagorda Island	51	38	0	22	127	558	309	352
Mustang Island	28	41	0	65	339	377	262	183
N.& S.Padre Island	7	14	0	34	281	146	119	46
Western Slope*	76	26	10	1,539	1,198	704	454	292
Western Planning Area Subtotal	***439***	***393***	***11***	***1,999***	***3,524***	***5,884***	***3,990***	***2,721***
Central Planning Area								
Chandeleur	8	11	0	2	28	66	41	28
East Cameron	121	146	6	121	463	2,018	1,343	1,001
Eugene Island	210	128	1	96	367	4,528	2,730	2,351
Grand Isle	60	33	0	22	111	1,728	1,326	662
Main Pass and Breton Sound	142	111	6	68	306	2,682	1,481	1,718
Mobile	35	11	0	32	64	133	74	80
Ship Shoal	162	107	6	74	380	3,320	2,003	1,739
South Marsh Island	128	81	2	78	238	2,529	1,421	1,411
South Pass	45	21	2	16	75	2,075	1,150	1,344
South Pelto	20	7	0	6	23	353	217	229
South Timbalier	130	72	11	97	361	2,770	1,718	1,596
Vermilion	155	166	0	108	447	2,762	1,795	1,436
Viosca Knoll	51	26	8	130	258	425	255	191
West Cameron and Sabine Pass	207	250	3	208	711	3,236	2,186	1,583
West Delta	89	46	0	38	144	2,702	1,760	1,269
Central Slope**	149	49	41	1,951	1,430	1,823	1,220	764
Central Planning Area Subtotal	***1,712***	***1,265***	***86***	***3,047***	***5,406***	***33,150***	***20,720***	***17,402***
Eastern Planning Area Subtotal*	***3***	***0***	***4***	***139***	***338***	***49***	***43***	***4***
GOM Total:	***2,154***	***1,658***	***101***	***5,185***	***9,268***	***39,083***	***24,753***	***20,127***

*Western Slope includes Alaminos Canyon, Corpus Christi, East Breaks, Keathley Canyon, and Port Isabel.
**Central Slope includes Atwater Valley, Ewing Bank, Green Canyon, Lund, Mississippi Canyon, Viosca Knoll (slope), and Walker Ridge.
***Eastern Planning Area includes Charlotte Harbor, Destin Dome, Pensacola and others.

Proved Depleted — Leases relinquished after oil and gas production. The leases associated with the 175 depleted fields are represented here along with other produced, relinquished leases that are part of currently active fields.

Unproved Qualified — Leases associated with the 51 unproved active fields. The leases have qualified as producible under 30 CFR 250.116, but the operators have not established a commitment to produce. These fields may be classified as unproved possible or unproved probable.

Unqualified Active — Active exploratory leases not yet qualified as producible or associated with any field.

Expired — Leases relinquished by the operator without having produced any oil or gas, although some were once qualified as producible under 30 CFR 250.116. There are 107 expired fields with no production.

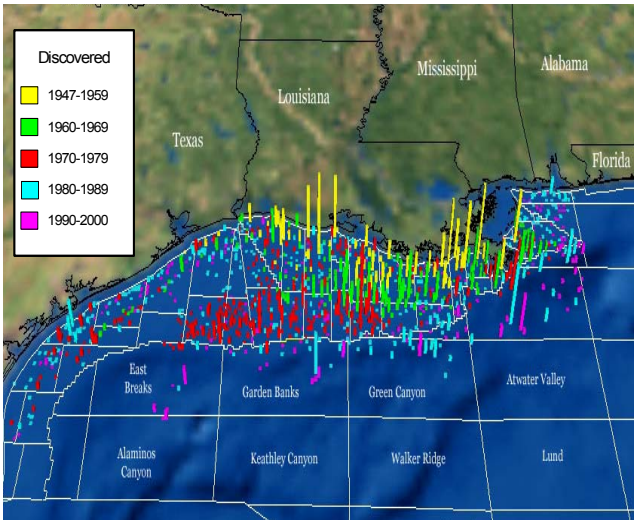

Figure 7. Gulf of Mexico, 1,050 proved fields (875 active and 175 depleted)

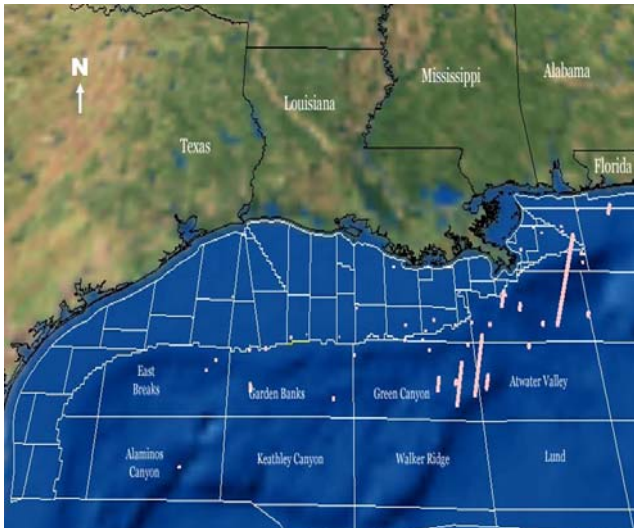

Figure 8. Gulf of Mexico, 51 unproved active fields.

The total number of boreholes drilled and the number of boreholes plugged and abandoned are also shown in table 2. There were 1,376 boreholes spudded during 2000, compared with 1,027 during 1999, and 1,153 during 1998. The last column of table 2 presents the total number of active completions per area. Active completions are defined as those with perforations open to the formation and not isolated by permanent plugs; service wells (injection, disposal, or water source) are included. The presence or absence of production or injection is not considered. The number of boreholes and the number of active completions as of December 31, 2000, are based on reports received by the MMS at the time the count was made in 2002. These numbers may change when all data have been received, processed, and edited.

Reserves Reported by Geologic Age

In this report, the 1,050 proved and 51 unproved fields have been classified at the geologic series level. The different geologic age classifications in use by MMS are shown in figure 9. Paleontological examinations of borehole cuttings, along with regional analysis of geological and geophysical data, were used in determining the age classifications. Table 3 shows the distribution of reserves and production data by geologic age and planning area. Tables 3a through 3d also show the distribution of reserves and production data by geologic age, but further subdivide the planning areas as area totals. Unproved reserves are not reported as area totals to maintain the confidential nature of unproved fields. Please note that this report contains the term "Spanners" which is used to denote a geologic age classification that spans several series.

Province	System	Series	Chronozone	
			Name	Biozone
Cenozoic	Quaternary	Pleistocene	UPL	Sangamon fauna Trimosina "A" 1st Trimosina "A" 2nd Hyalinea "B" / Trimosina "B"
			MPL	Angulogerina "B" 1st Angulogerina "B" 2nd
			LPL	Lenticulina 1 Valvulineria "H"
	Tertiary	Pliocene	UP	Buliminella 1
			LP	Textularia "X"
		Miocene	UM3	Robulus "E" / Bigenerina "A" Cristellaria "K"
			UM1	Discorbis 12
			MM9	Bigenerina 2 Textularia "W"
			MM7	Bigenerina humblei Cristellaria "I" Cibicides opima
			MM4	Amphistegina "B" Robulus 43 Cristellaria 54 / Eponides 14 Gyroidina "K"
			LM4	Discorbis "B" Marginulina "A"
			LM2	Siphonina davisi
			LM1	Lenticulina hanseni
		Oligocene	UO	Discorbis Zone / Robulus "A" Heterostegina texana
			MO	Camerina "A"
			LO	Textularia warreni
		Eocene	UE	Hantkenina alabamensis Camerina moodybranchensis
			ME	Discorbis yeguaensis
			LE	Globorotalia wilcoxensis
		Paleocene	UL	Globorotalia velascoensis Cristellaria longiforma
			LL	Globorotalia uncinata
Mesozoic	Cretaceous	Upper	UK5	Globotruncana mayaroensis Globotruncana fornicata Globotruncana concavata
			UK2	Planulina eaglefordensis Rotalipora cushmani
		Lower	LK8	Lenticulina washitaensis Cythereis fredericksburgensis
			LK6	Eocytheropteron trinitiensis Orbitolina texana Rehacythereis? aff. R. glabrella
			LK3	 Choffatella decipiens Schuleridea acuminata
	Jurassic	Upper	UJ4	Epistomina uhligi Epistomina mosquensis Pseudocyclammina jaccardi
		Middle	MJ	
		Lower	LJ	
	Triassic	Upper	UTR	
		Middle	MTR	
		Lower	LTR	

* Lithostratigraphic nomenclature is often used informally to identify strata that are correlative to Gulf Coast chronostratigraphic reference sections (provincial stages). For example, subsurface beds containing diagnostic Upper Cretaceous faunas are frequently defined as "Navarro."

Figure 9. Gulf of Mexico MMS geologic time scale.

Table 3. Estimated oil and gas reserves for 1,050 proved and 51 unproved fields by geologic age, Gulf of Mexico, Outer Continental Shelf, December 31, 2000.

(Reserves: oil expressed in millions of barrels at 60 ºF and 1 atmosphere, gas in billions of cubic feet at 60 ºF and 15.025 psia.)

Area	Number of proved reservoirs	Proved reserves		Cumulative production through 2002		Remaining proved reserves		Number of unproved reservoirs	Unproved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas		Oil	Gas
Western Planning Area										
Pleistocene	1,621	723	13,936	459	10,840	264	3,096	15	56	117
Pliocene	28	282	880	119	354	163	526	1	0	25
Miocene	2,171	149	17,726	113	14,947	36	2,779	0	0	0
Spanners	0	0	0	0	0	0	0	3	0	5
Pre-Miocene, Cretaceous, and Jurassic	8	0	29	0	13	0	16	0	0	0
Western Planning Area Subtotal	***3,828***	***1,154***	***32,571***	***691***	***26,154***	***463***	***6,417***	***19***	***56***	***147***
Central Planning Area										
Pleistocene	8,690	4,610	52,284	3,845	46,728	765	5,556	60	44	191
Pliocene	6,336	4,254	26,558	3,558	22,998	696	3,560	28	296	400
Miocene	6,482	4,911	53,746	3,831	45,759	1,080	7,987	37	853	1,079
Spanners	0	0	0	0	0	0	0	26	972	1,724
Pre-Miocene, Cretaceous, and Jurassic	33	0	2,057	0	1,046	0	1,011	3	0	593
Central Planning Area Subtotal	***21,541***	***13,775***	***134,645***	***11,234***	***116,531***	***2,541***	***18,114***	***154***	***2,165***	***3,987***
Eastern Planning Area Subtotal*	***4***	***0***	***37***	***0***	***3***	***0***	***34***	***2***	***-***	***-***
GOM Total	***25,373***	***14,929***	***167,253***	***11,925***	***142,688***	***3,004***	***24,565***	***175***	***2,221***	***4,134***

***Eastern Planning Area includes Charlotte Harbor, Destin Dome, Pensacola and others. Unproved reserves data are included with Central Planning Area.

Table 3a. Estimated oil and gas reserves for Pleistocene reservoirs in 548 proved and 22 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 2000.

(Reserves: oil expressed in millions of barrels at 60 ºF and 1 atmosphere, gas in billions of cubic feet at 60 ºF and 15.025 psia.)

Area	Number of proved reservoirs	Proved reserves		Cumulative production through 2002		Remaining proved reserves		Number of unproved reservoirs	Unproved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas		Oil	Gas
Western Planning Area										
Galveston	20	2	81	1	78	1	3	0	-	-
High Island and Sabine Pass	1,339	323	9,798	289	9,058	34	740	2	-	-
Western Slope*	262	398	4,057	169	1,704	229	2,353	13	-	-
Western Planning Area Subtotal	***1,621***	***723***	***13,936***	***459***	***10,840***	***264***	***3,096***	***15***	***56***	***117***
Central Planning Area										
East Cameron	642	242	5,373	218	4,958	24	415	5	-	-
Eugene Island	1,793	970	11,592	890	10,853	80	739	4	-	-
Grand Isle	125	9	1,465	8	1,351	1	114	0	-	-
Main Pass and Breton Sound	32	50	124	43	115	7	9	0	-	-
Ship Shoal	1,447	807	7,041	750	6,517	57	524	2	-	-
South Marsh Island	814	511	3,523	467	3,227	44	296	2	-	-
South Pass	249	159	1,403	148	1,238	11	165	0	-	-
South Pelto	77	23	24	20	17	3	7	0	-	-
South Timbalier	1,002	359	5,085	319	4,549	40	536	12	-	-
Vermilion	932	187	3,625	156	3,118	31	507	0	-	-
Viosca Knoll	1	0	0	0	0	0	0	0	-	-
West Cameron and Sabine Pass	915	43	7,971	34	7,237	9	734	4	-	-
West Delta	189	203	827	188	715	15	112	0	-	-
Central Slope**	472	1,047	4,231	604	2,833	443	1,398	31	-	-
Central Planning Area Subtotal	***8,690***	***4,610***	***52,284***	***3,845***	***46,728***	***765***	***5,556***	***60***	***44***	***191***
Eastern Planning Area Subtotal*	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***
GOM Total	***10,311***	***5,333***	***66,220***	***4,304***	***57,568***	***1,029***	***8,652***	***75***	***100***	***308***

*Western Slope includes Alaminos Canyon, Corpus Christi, East Breaks, Garden Banks, Keathley Canyon, and Port Isabel.
**Central Slope includes Atwater Valley, Ewing Bank, Green Canyon, Lund, Mississippi Canyon, Viosca Knoll (slope), and Walker Ridge.
***Eastern Planning Area includes Charlotte Harbor, Destin Dome, Pensacola and others. Unproved reserves data are included with Central Planning Area.

Table 3b. Estimated oil and gas reserves for Pliocene reservoirs in 313 proved and 10 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 2000.

(Reserves: oil expressed in millions of barrels at 60 ºF and 1 atmosphere, gas in billions of cubic feet at 60 ºF and 15.025 psia.)

Area	Number of proved reservoirs	Proved reserves		Cumulative production through 2002		Remaining proved reserves		Number of unproved reservoirs	Unproved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas		Oil	Gas
Western Planning Area										
High Island and Sabine Pass	1	0	4	0	4	0	0	0	-	-
Western Slope*	27	282	876	119	350	163	526	1	-	-
Western Planning Area Subtotal	***28***	***282***	***880***	***119***	***354***	***163***	***526***	***1***	***0***	***25***
Central Planning Area										
Chandeleur	1	0	14	0	12	0	2	0	-	-
East Cameron	151	16	998	13	904	3	94	0	-	-
Eugene Island	1,024	439	3,203	407	2,802	32	401	0	-	-
Grand Isle	334	346	1,117	327	1,004	19	113	0	-	-
Main Pass and Breton Sound	376	236	1,212	202	1,123	34	89	1	-	-
Ship Shoal	718	378	2,675	341	2,404	37	271	0	-	-
South Marsh Island	617	147	4,538	134	4,214	13	324	0	-	-
South Pass	858	774	2,542	736	2,105	38	437	1	-	-
South Pelto	174	71	359	66	311	5	48	0	-	-
South Timbalier	514	284	2,039	243	1,644	41	395	0	-	-
Vermilion	617	192	3,295	174	2,964	18	331	0	-	-
Viosca Knoll	4	0	4	0	4	0	0	0	-	-
West Cameron and Sabine Pass	174	4	1,050	3	950	1	100	0	-	-
West Delta	586	525	1,285	481	1,125	44	160	0	-	-
Central Slope**	188	842	2,227	431	1,432	411	795	26	-	-
Central Planning Area Subtotal	***6,336***	***4,254***	***26,558***	***3,558***	***22,998***	***696***	***3,560***	***28***	***296***	***400***
Eastern Planning Area Subtotal***	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***
GOM Total	***6,364***	***4,536***	***27,438***	***3,677***	***23,352***	***859***	***4,086***	***29***	***296***	***425***

*Western Slope includes Alaminos Canyon, Corpus Christi, East Breaks, Garden Banks, Keathley Canyon, and Port Isabel.
**Central Slope includes Atwater Valley, Ewing Bank, Green Canyon, Lund, Mississippi Canyon, Viosca Knoll (slope), and Walker Ridge.
***Eastern Planning Area includes Charlotte Harbor, Destin Dome, Pensacola and others. Unproved reserves data are included with Central Planning Area.

The Pleistocene reserves trend is presented in figure 10 and corresponds to the *Sangamon Fauna* through *Valvulineria "H"* biozones. Production within the Pleistocene extends from the Galveston area to east of the modern-day mouth of the Mississippi River. Pleistocene productive sands are limited to the east and west because of a lack of sediment influx at the edge of the depocenter. Downdip deepwater Pleistocene production occurs in the East Breaks through Mississippi Canyon areas, and well control suggests sands continue beyond the Sigsbee Escarpment. As of December 31, 2000, the Pleistocene produced from 548 fields. Proved reserves were 5.33 billion barrels (Bbbl) and 66.2 trillion cubic feet (Tcf). Remaining proved reserves were 1.03 Bbbl and 8.7 Tcf.

The Pliocene reserves trend is presented in figure 11 and corresponds to *the Buliminella 1* through *Textularia "X"* biozones. Production within the Pliocene extends

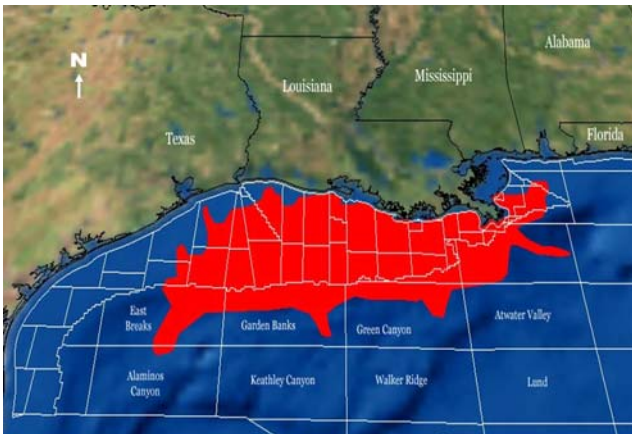

Figure 10. Pleistocene reserves trend.

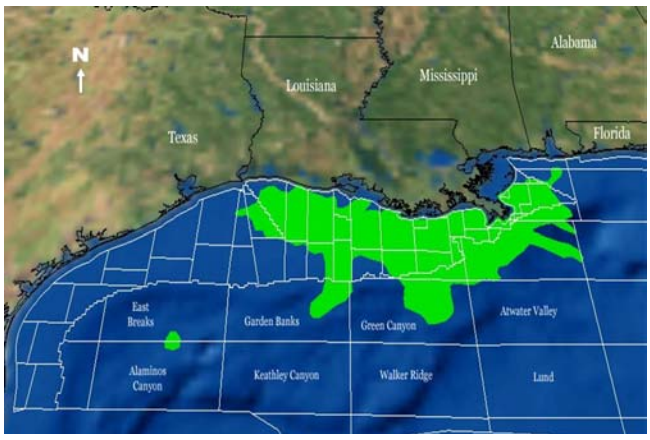

Figure 11. Pliocene reserves trend.

Table 3c. Estimated oil and gas reserves for Miocene reservoirs in 539 proved and 14 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 2000.

(Reserves: oil expressed in millions of barrels at 60 ºF and 1 atmosphere, gas in billions of cubic feet at 60 ºF and 15.025 psia.)

Area	Number of proved reservoirs	Proved reserves		Cumulative production through 2002		Remaining proved reserves		Number of unproved reservoirs	Unproved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas		Oil	Gas
Western Planning Area										
Brazos	391	11	3,315	9	2,900	2	415	0	-	-
Galveston	368	52	1,944	42	1,614	10	330	0	-	-
High Island and Sabine Pass	535	44	4,555	38	4,035	6	520	0	-	-
Matagorda Island	448	25	5,482	20	4,450	5	1,032	0	-	-
Mustang Island	332	6	1,861	4	1,503	2	358	0	-	-
N.& S.Padre Island	93	0	510	0	445	0	65	0	-	-
Western Slope*	4	11	59	0	0	11	59	0	-	-
Western Planning Area Subtotal	***2,171***	***149***	***17,726***	***113***	***14,947***	***36***	***2,779***	***0***	***0***	***0***
Central Planning Area										
Chandeleur	22	0	325	0	315	0	10	0	-	-
East Cameron	306	72	4,237	67	3,996	5	241	0	-	-
Eugene Island	475	161	3,869	134	3,345	27	524	0	-	-
Grand Isle	430	605	2,316	566	1,797	39	519	0	-	-
Main Pass and Breton Sound	1,001	739	4,932	649	4,060	90	872	5	-	-
Mobile	29	0	312	0	263	0	49	0	-	-
Ship Shoal	448	161	2,120	144	1,959	17	161	7	-	-
South Marsh Island	435	197	5,793	181	5,451	16	342	0	-	-
South Pass	218	118	496	109	461	9	35	0	-	-
South Pelto	227	57	687	47	508	10	179	0	-	-
South Timbalier	584	819	1,904	770	1,648	49	256	1	-	-
Vermilion	571	151	9,353	143	8,810	8	543	0	-	-
Viosca Knoll	22	10	159	3	117	7	42	0	-	-
West Cameron and Sabine Pass	979	146	9,510	134	8,826	12	684	0	-	-
West Delta	625	645	3,284	610	3,046	35	238	0	-	-
Central Slope**	110	1,030	4,449	274	1,157	756	3,292	24	-	-
Central Planning Area Subtotal	***6,482***	***4,911***	***53,746***	***3,831***	***45,759***	***1,080***	***7,987***	***37***	***853***	***1,079***
Eastern Planning Area Subtotal*	***4***	***0***	***37***	***0***	***3***	***0***	***34***	***1***	***-***	***-***
GOM Total	***8,657***	***5,060***	***71,509***	***3,944***	***60,709***	***1,116***	***10,800***	***38***	***853***	***1,079***

*Western Slope includes Alaminos Canyon, Corpus Christi, East Breaks, Garden Banks, Keathley Canyon , and Port Isabel.
**Central Slope includes Atwater Valley, Ewing Bank, Green Canyon, Lund, Mississippi Canyon, Viosca Knoll (slope), and Walker Ridge.
***Eastern Planning Area includes Charlotte Harbor, Destin Dome, Pensacola and others. Unproved reserves data are included with Central Planning Area.

Table 3d. Estimated oil and gas reserves for Pre-Miocene, Cretaceous, and Jurassic reservoirs in 20 proved and 3 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 2000.

(Reserves: oil expressed in millions of barrels at 60 ºF and 1 atmosphere, gas in billions of cubic feet at 60 ºF and 15.025 psia.)

Area	Number of proved reservoirs	Proved reserves		Cumulative production through 2002		Remaining proved reserves		Number of unproved reservoirs	Unproved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas		Oil	Gas
Western Planning Area										
Mustang Island and N. & S. Padre	8	0	29	0	13	0	16	0	-	-
Western Slope*	0	0	0	0	0	0	0	0	-	-
Western Planning Area Subtotal	***8***	***0***	***29***	***0***	***13***	***0***	***16***	***0***	***0***	***0***
Central Planning Area										
Main Pass and Breton Sound	1	0	0	0	0	0	0	0	-	-
Mobile	24	0	1,827	0	997	0	830	0	-	-
Viosca Knoll	8	0	230	0	49	0	181	3	-	-
Central Slope**	0	0	0	0	0	0	0	0	-	-
Central Planning Area Subtotal	***33***	***0***	***2,057***	***0***	***1,046***	***0***	***1,011***	***3***	***0***	***593***
Eastern Planning Area Subtotal*	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***1***	***-***	***-***
GOM Total	***41***	***0***	***2,086***	***0***	***1,059***	***0***	***1,027***	***4***	***0***	***593***

*Western Slope includes Alaminos Canyon, Corpus Christi, East Breaks, Garden Banks, Keathley Canyon , and Port Isabel.
**Central Slope includes Atwater Valley, Ewing Bank, Green Canyon, Lund, Mississippi Canyon, Viosca Knoll (slope), and Walker Ridge.
***Eastern Planning Area includes Charlotte Harbor, Destin Dome, Pensacola and others. Unproved reserves data are included with Central Planning Area.

from south of Mobile Bay in the east to North Padre Island in the west. Upper Pliocene productive sands also extend into the deepwater areas of Garden Banks, Green Canyon, Ewing Bank, and Mississippi Canyon. Well control suggests Pliocene sands extend at least as far as the Sigsbee Escarpment. As of December 31, 2000, the Pliocene produced from 313 fields. Proved reserves were 4.54 Bbbl and 27.4 Tcf. Remaining proved reserves were 0.86 Bbbl and 4.1 Tcf.

The Miocene reserves trend is presented in figure 12 and corresponds to the *Robulus "E" / Bigenerina "A"* through *Lenticulina hanseni* biozones. Production within the Miocene extends from east of the Mississippi River to as far west as North Padre Island. Miocene productive sands also extend into deep waters in Viosca Knoll and Mississippi Canyon. Well control suggests sands continue beyond the Sigsbee Escarpment. As of December 31, 2000, the Miocene produced from 539 fields. Proved reserves were 5.06 Bbbl and 71.5 Tcf. Remaining proved reserves were 1.12 Bbbl and 10.8 Tcf.

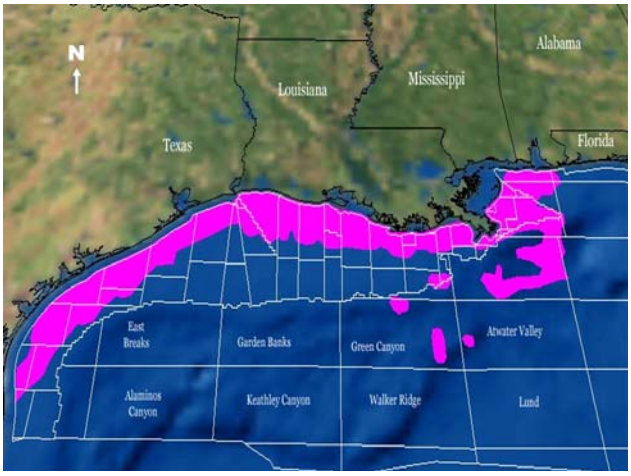

Figure 12. Miocene reserves trend.

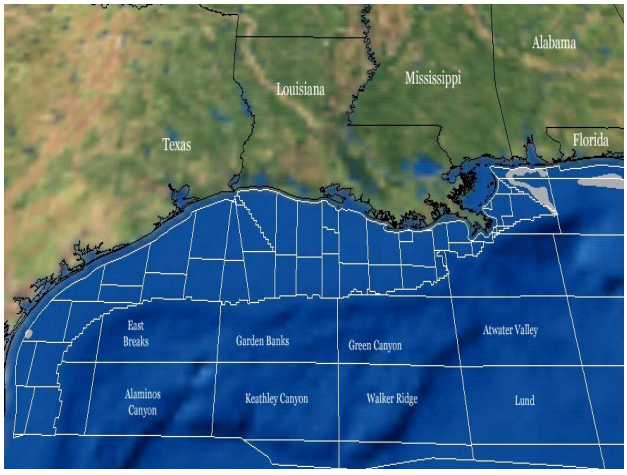

Figure 13. Pre-Miocene, Cretaceous, and Jurassic reserves trends.

The Pre-Miocene (Oligocene, Eocene, and Paleocene), Cretaceous, and Jurassic reserves trends are presented in figure 13. These reservoirs are mainly Jurassic Norphlet sands, but also include Lower Cretaceous Carbonates. Production within the Jurassic is limited to east of the Mississippi River in the Mobile area. Well control suggests reservoir sands continuing eastward into Destin Dome. As of December 31, 2000, these trends produced from 20 fields. Proved reserves were less than 0.01 Bbbl and 2.1 Tcf. Remaining proved reserves were less than 0.01 Bbbl and 1.0 Tcf.

Figure 14 shows the percentages of reserves and production data by geologic age. There is a fairly even distribution of oil reserves; however, the Pliocene has a significantly lower percentage of gas reserves than the Miocene and Pleistocene.

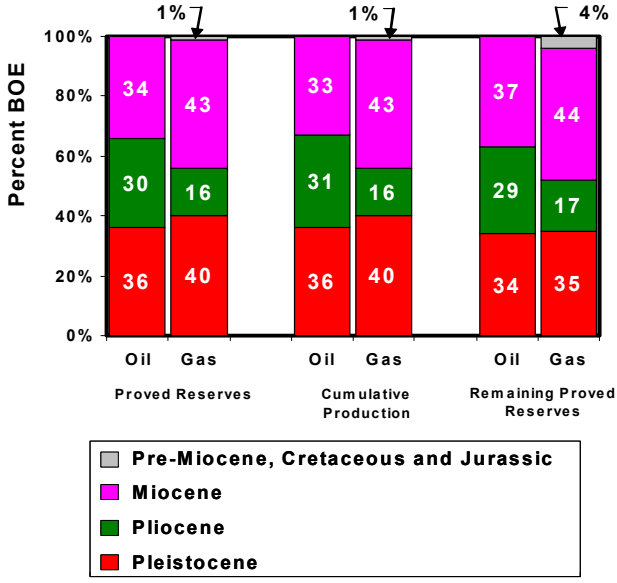

Figure 14. Distribution of reserves and production data by geologic age.

Historical Exploration and Discovery Pattern and Trends

In large part, the following section was taken from ***An Exploration and Discovery Model: a Historic Perspective - Gulf of Mexico Outer Continental Shelf*** by Gary Lore (1994). The information presented has been updated to reflect the current database.

It is informative to review the historic exploration and development activities that resulted in the world-class hydrocarbon-producing basin that is the Gulf of Mexico. Each of the four decades of activity will be examined by reviewing the status of exploration and development

activity and the number of fields and quantities of proved reserves discovered during each decade. The discovery year is defined as the year in which the first well encountering significant hydrocarbons reached total depth. This date may differ from the year in which the field discovery was announced.

Figures 15-19 depict locations of proved fields by decade with bar heights proportional to total proved reserves (barrels of oil equivalent). Figure 15 shows the locations of the proved fields discovered prior to December 31, 1959. As expected, initial development was in shallower, nearshore waters concentrated mainly in the areas off central and western Louisiana. This development primarily reflected the gradual extension of existing inland drilling and development technologies into the open-water marine environments, and the infancy of marine seismic acquisition activities. Early exploratory drilling in very shallow water on the shelf utilized barges and platforms. The mid-1950's witnessed the introduction of submersible and jack-up drilling rigs. During this period, 272 exploratory wells were drilled, culminating in the discovery of 67 proved fields. It was also during this period that 7 of the top 10 fields in the Gulf of Mexico, based on proved reserves, were discovered.

Figure 16 shows the location of the proved fields discovered in the 1960's. These discoveries were still concentrated offshore central and western Louisiana. Though still confined to the shelf (650 feet [ft] or less), field discoveries advanced seaward into deeper waters. During this decade, 2,075 exploratory wells were drilled and 146 proved fields discovered. The tenth largest proved field in the Gulf of Mexico, Ship Shoal 208, was discovered in the sixties.

Figure 17 shows the location of the proved fields discovered in the 1970's. This period reflects continued drilling and development on the shelf, with an increase in field discoveries on the seaward portion of the shelf, predominantly in the Pleistocene depocenter. The introduction of dynamic positioning systems, used on drillships and semi-submersible drilling rigs, further opened up deepwater exploration. Frontier drilling on the shelf-slope margin led to discoveries of new fields that have been termed the Flexure Trend. During this decade, 2,939 exploratory wells were drilled, resulting in the discovery of 276 proved fields. The largest field in the Gulf of Mexico, Eugene Island 330, was discovered in 245 ft of water during this decade. Another significant field discovery was Mississippi Canyon 194, the first field in over 1,000 ft of water.

During the 1980's, development activities occurred over practically the entire central and western Gulf of Mexico shelf, as well as on the upper slope, as can be

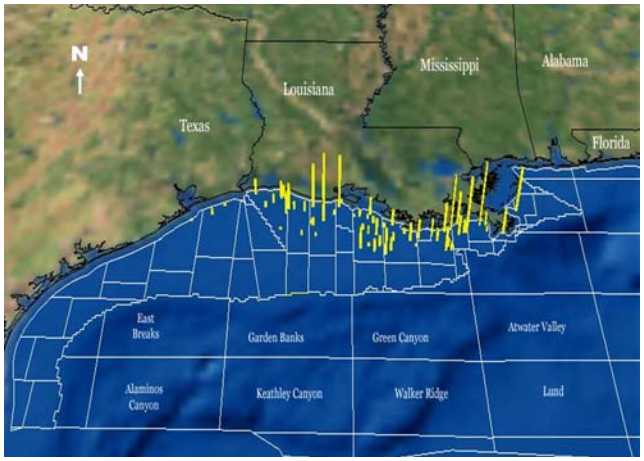

Figure 15. Location of proved fields discovered 1947-1959, Gulf of Mexico OCS.

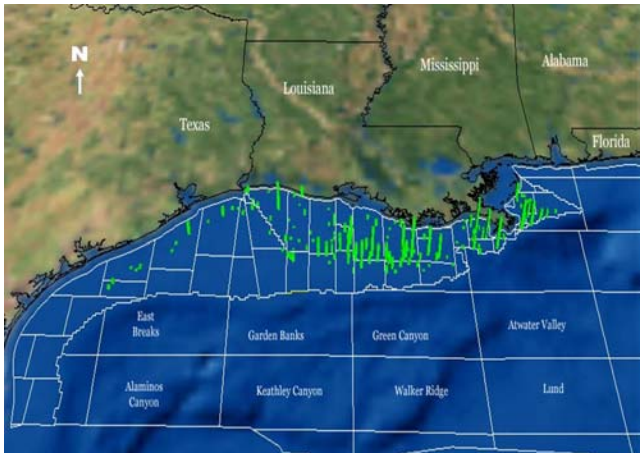

Figure 16. Location of proved fields discovered 1960-1969, Gulf of Mexico OCS.

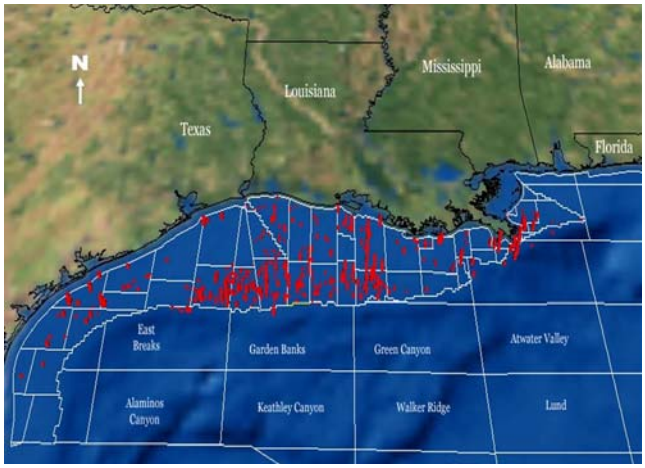

Figure 17. Location of proved fields discovered 1970-1979, Gulf of Mexico OCS.

Figure 18. Location of proved fields discovered 1980-1989, Gulf of Mexico OCS.

seen in figure 18. In addition, the first Norphlet fields and a Miocene shallow bright spot play were discovered in the eastern Central Gulf of Mexico planning area. Exploratory drilling had now reached water depths beyond 6,000 ft, putting the slope within reach. In this decade, 4,045 exploration wells were drilled, resulting in the discovery of 354 proved fields (26 were discovered in water depths greater than 1,000 ft).

From 1990 to 2000 (figure 19), 4,298 exploration wells were drilled, resulting in the discovery of 207 proved fields. The 1990's have seen the refinement and reduction in cost of tension leg platform design, and a much expanded use of subsea completions. Available production histories have documented high production rates for deepwater fields. The expanding use of horizontal drilling is also increasing productivity of specific reservoirs. Computer workstation technology using three-dimensional seismic data sets has allowed for reduced risk and greater geologic assurance in both exploration and field development. This has also allowed for exploration of new plays, such as the Subsalt Play. Reserve estimates for recent field discoveries may have significant increases due to increased well control, reservoir management and in-field exploration.

Figure 20 shows annual field discoveries by geologic age for the 1,050 proved fields. Figure 21 shows annual field discoveries of proved reserves by geologic age for the 1,050 proved fields. These two figures show several trends over the last 50 years. From the mid-1940's through the 1960's, the largest number of fields discovered were of Miocene age and these fields contributed the largest reserves additions. This trend reflected a continuation of the nearshore operating environment. The decade of the 1970's saw a large peak in the discovery of Pleistocene fields and a correspondingly large addition of Pleistocene age

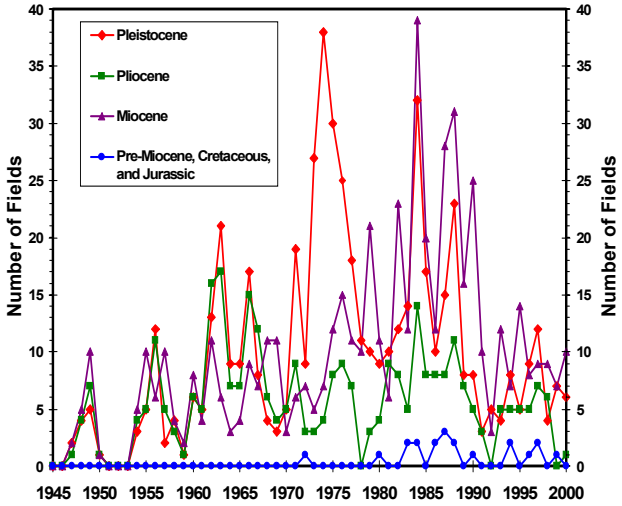

Figure 20. Annual number of field discoveries by geologic age, 1,050 proved fields.

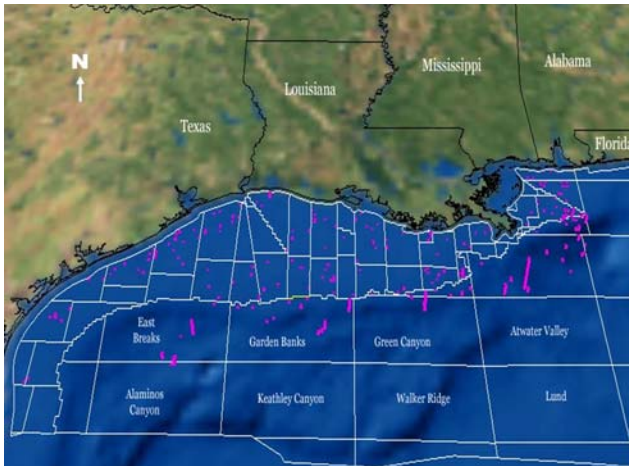

Figure 19. Location of proved fields discovered 1990-2000, Gulf of Mexico OCS.

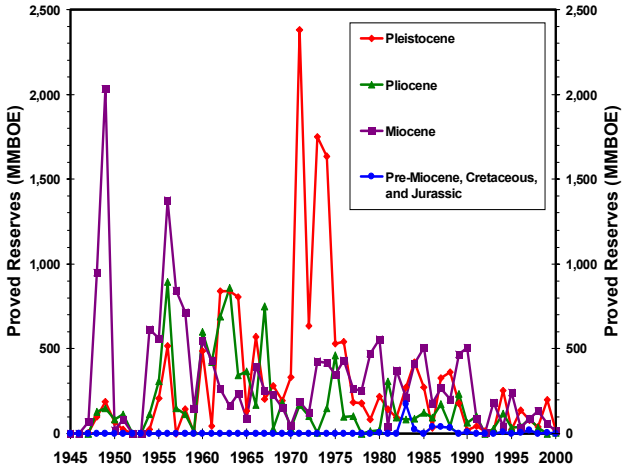

Figure 21. Annual discoveries of proved reserves by geologic age, 1,050 proved fields.

reserves. Technological advances in seismic data and deeper drilling accounted for the resurgence of Miocene field discoveries and reserve additions in the decade of the 1980's. This decade also saw the first Jurassic Norphlet discoveries. A complete evaluation of the 1990's is premature, but the large recent discoveries in Pleistocene, Pliocene, and Miocene deepwater reservoirs will play a major role in future production. The MMS OCS Report MMS 2002-021, ***Deepwater Gulf of Mexico 2002: America's Expanding Frontier***, available on the GOM Region's Internet homepage, provides detailed information on deepwater activities.

Field-Size Distribution

Reserve sizes are expressed in terms of barrels of oil equivalent (BOE) and added to the liquid reserves. The conversion factor of 5,620 standard cubic feet of gas equals 1 BOE is based on the average heating values of domestic hydrocarbons. A geometric progression, developed by the USGS (Drew and others, 1982), was selected for field-size distribution ranges (figure 22).

Class	Deposit-size range*	Class	Deposit-size range*	Class	Deposit-size range*
1	0 to 0.006	8	0.380 to 0.760	14	24.3 to 48.6
2	0.006 to 0.012	9	0.760 to 1.52	15	48.6 to 97.2
3	0.012 to 0.024	10	1.52 to 3.04	16	97.2 to 194.3
4	0.024 to 0.047	11	3.04 to 6.07	17	194.3 to 388.6
5	0.047 to 0.095	12	6.07 to 12.14	18	388.6 to 777.2
6	0.095 to 0.190	13	12.14 to 24.3	19	777.2 to 1554.4
7	0.190 to 0.380	*Million barrels of oil equivalent (MMBOE)			

Figure 22. Description of deposit-size classes.

In this report, fields are classified as either oil or gas; some fields do produce both products, making a field type determination difficult. Generally, fields with a gas/oil ratio (GOR) less than 9,700 standard cubic feet per stock tank barrel (SCF/STB) are classified as oil.

The field-size distribution based on proved reserves for 1,050 proved fields is shown in figure 23(a). Of the 1,050 proved oil and gas fields, there are 195 proved oil fields represented in figure 24(a) and 855 gas fields shown in figure 25(a). The Western Gulf of Mexico field-size distributions are displayed on figures 23(b), 24(b), and 25(b). Figures 23(c), 24(c), and 25(c) present the Central Gulf of Mexico field-size distributions of proved reserves. The field-size distribution, derived from unproved reserves for 51 unproved fields, is shown in figure 26(a). There are 23 unproved oil fields in figure 26(b) and 28 unproved gas fields in figure 26(c). All unproved active fields were studied.

Analysis of the 1,050 proved oil and gas fields indicates that the Gulf of Mexico is currently a gas-prone basin. Figure 27 summarizes the total reserves, the median (exceeded by 50%), and the mean (arithmetic average) from the field-size distributions. This figure also provides information on the largest two field-size ranges of the proved fields. The GOR of the 195 proved oil fields is 3,087 SCF/STB. The GOR of the 23 unproved oil fields is 1,484 SCF/STB. The mean yield (condensate divided by gas) for the 855 proved gas fields is 21.2 barrels of condensate per million cubic feet (MMcf) of gas. The mean yield of the 28 unproved gas fields is 25.8 barrels of condensate per MMcf.

Figure 28 shows the cumulative percent distribution of proved reserves in billion barrels of oil equivalent (BBOE), by field rank. All 1,050 proved fields in the Gulf of Mexico OCS are included in this figure. A characteristic often observed in hydrocarbon-producing basins is a rapid drop-off in size from that of largest known field to that of smaller ones. Twenty-five percent of the proved reserves are contained in the 26 largest fields. Fifty percent of the proved reserves are contained in the 81 largest fields. Ninety percent of the proved reserves are contained in the 386 largest fields.

Figure 29 shows the distribution of the number of fields and proved reserves by water depth. The field's water depth is determined by averaging the water depth of the wells drilled in the field. The water depth ranges used in this figure, 651-1,300 ft, 1,301-2,600 ft, and greater than 2,600 ft, closely approximate the 200-400 meter, 400-800 meter, and greater than 800 meter water depths used in the OCS Deepwater Royalty Relief Act of 1995 (DWRRA). Proved reserves, reported in million barrels of oil equivalent (MMBOE), are associated with the 1,050 proved fields. The 51 unproved active fields are presented to show current activity. Sixty-three percent of the proved reserves in the Gulf of Mexico are located in less than 200 ft of water. The shelf, generally considered as less than 650 ft of water, accounts for 87 percent of the proved reserves. Development of the slope, generally considered greater than 650 ft of water, reflects a sizable amount of proved reserves associated with a

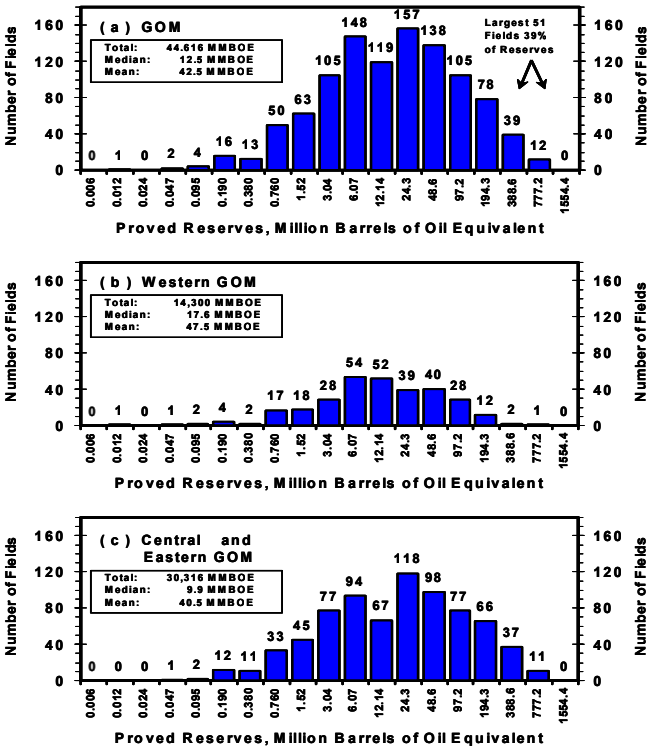

Figure 23. Field-size distribution of proved fields: (a) 1,050 fields, GOM; (b) 301 fields, Western GOM; (c) 749 fields, Central and Eastern GOM.

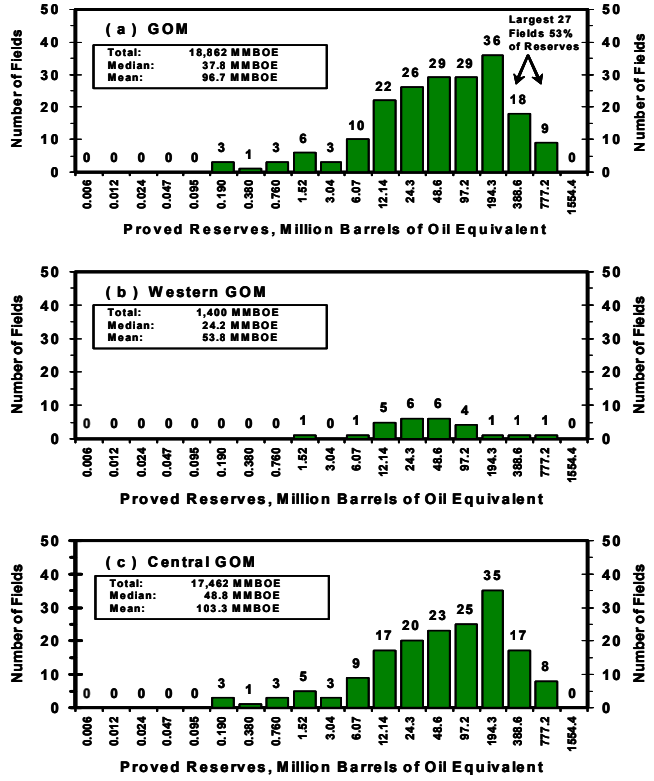

Figure 24. Field-size distribution of proved oil fields: (a) 195 fields, GOM; (b) 26 fields, Western GOM; (c) 169 fields, Central GOM.

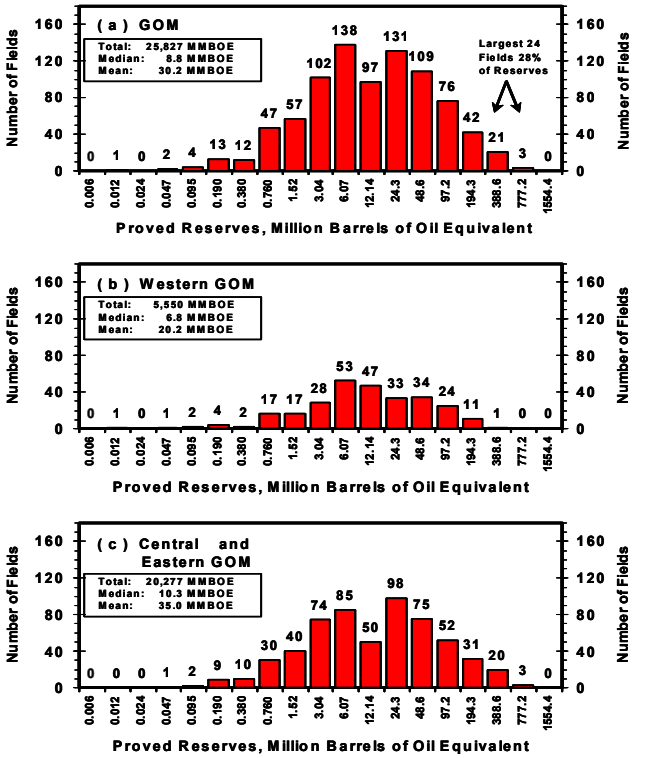

Figure 25. Field-size distribution of proved gas fields: (a) 855 fields, GOM; (b) 275 fields, Western GOM; (c) 580 fields, Central and Eastern GOM.

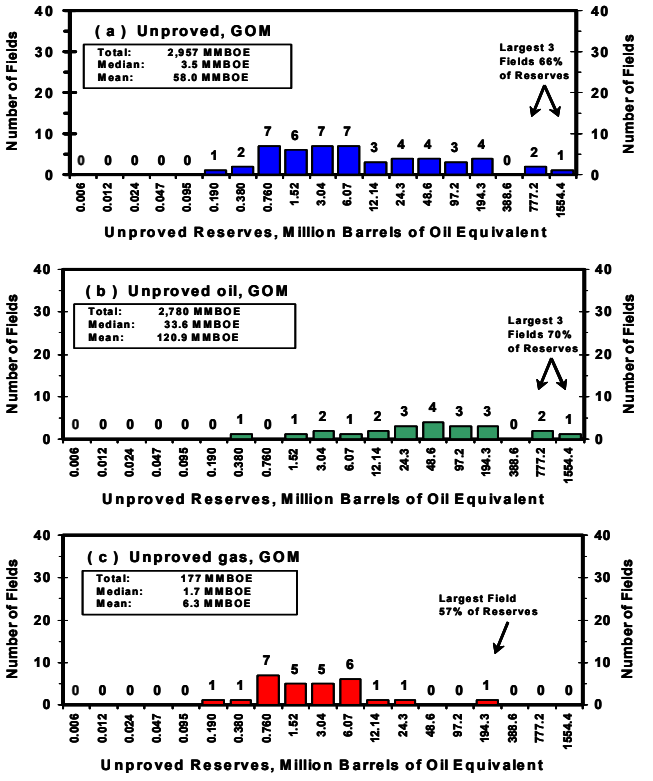

Figure 26. Field-size distribution of unproved fields: (a) 51 fields, GOM; (b) 23 oil fields, GOM; (c) 28 gas fields, GOM.

Description of Fields	Figure Number	Median*	Mean*	Largest Fields	
				Number	Reserves
1,050 Proved	Fig. 23a	12.5	42.6	51	39%
195 Proved Oil	Fig. 24a	37.8	96.7	27	53%
855 Proved Gas	Fig. 25a	8.8	30.2	24	28%
51 Unproved	Fig. 26a	3.5	58.0	3	66%
23 Unproved Oil	Fig. 26b	33.6	120.9	3	70%
28 Unproved Gas	Fig. 26c	1.7	6.3	1	57%
* Million barrels of oil equivalent (MMBOE)					

Figure 27. GOM field–size distribution.

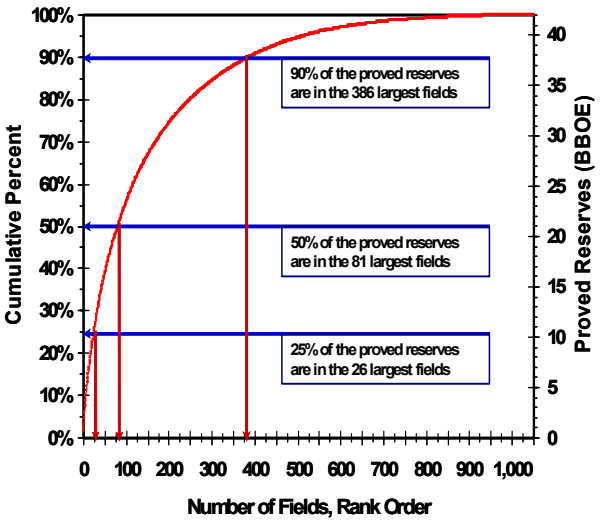

Figure 28. Cumulative percent total reserves versus rank order of field size for 1,050 proved fields.

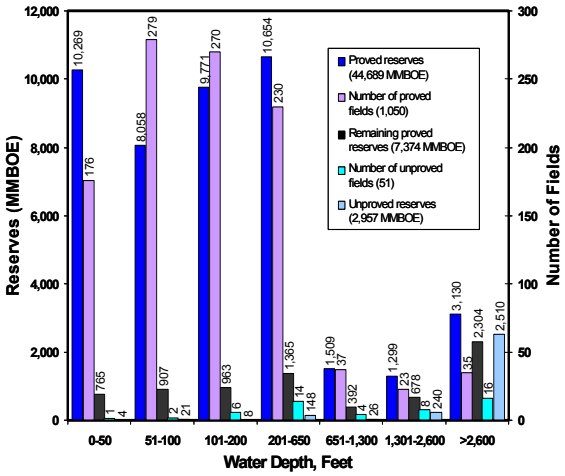

Figure 29. Field and reserves distribution by water depth. (Totals are in parentheses).

few fields. The mean proved reserves per proved field in the Gulf of Mexico is 42.6 MMBOE. For fields in water depths between 651 and 1,300 ft., the mean proved reserves per proved field is 40.8 MMBOE. This is expected, given the economics associated with deepwater drilling and development.

Figure 30 shows the largest 20 fields ranked in order by remaining proved reserves. Thirteen of the twenty top fields lie in water depths of greater than 1,300 ft and account for 23 percent of the remaining proved reserves in the Gulf of Mexico.

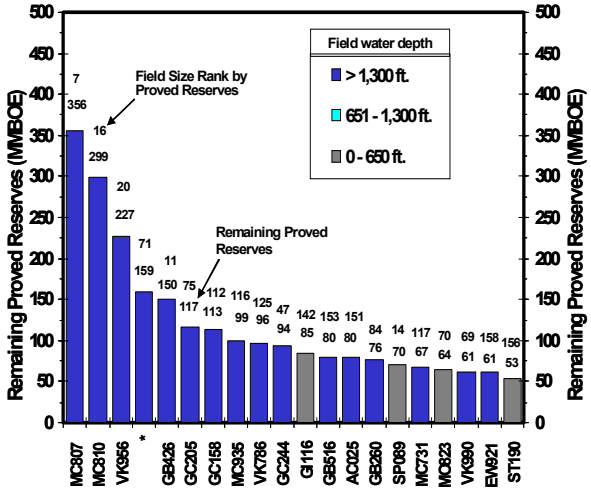

Figure 30. Largest 20 fields ranked by remaining proved reserves. (Note: * indicates the field is proprietary)

Estimates of proved reserves on the slope are increasing. This trend is expected to continue in the future because of additional exploration and development. Of the 95 proved fields in water depths greater than 650 ft, 64 are producing, 5 are depleted, and 26 have yet to produce. Included in these totals are 2 new proved fields containing proved reserves of 17 MMBOE. There are 28 unproved active fields in water depths greater than 650 feet. These fields contain 2,777 MMBOE, representing 94 percent of the Gulf of Mexico total of estimated unproved reserves.

Planned deepwater development in the Gulf of Mexico will likely help slow the trend of declining domestic production and rising oil imports. Exploration and development are gradually increasing with technological advances, expansion of the infrastructure, and the enactment of the DWRRA. This act has given industry the incentive to explore and produce deepwater resources.

Table 4 lists the 50 largest proved fields ranked by proved reserves expressed in BOE. Rank, field name, new discoveries, discovery year, water depth, field type, field GOR, proved reserves, cumulative production through 2000, and remaining proved reserves are presented. If a new field was discovered in 1999 or 2000, the name is replaced with an asterisk to preserve the proprietary nature of the data. There were 56 new fields proved in 2000, and if there were any in the top 50, they would be identified with an asterisk in the column labeled "New Disc." Unproved fields' reserve data will not be listed. A complete listing of all 1,050 proved fields, ranked by proved reserves, is available on the Gulf of Mexico Region's Internet homepage or by contacting the MMS at 1-800-200-GULF.

Reservoir-Size Distribution

The size distributions of the proved reservoirs are shown in figures 31, 32, and 33. The size ranges, which are based on proved reserves, are presented on a geometrically progressing, horizontal scale. These sizes also correspond with the USGS deposit-size ranges shown in figure 22; however, for figures 32 and 33, the proved reserves are presented in MMbbl and Bcf, respectively. The number of reservoirs in each size grouping, shown as percentages of the total, is presented on a linear vertical scale. For the combination reservoirs (saturated oil rims with associated gas caps), shown in figure 31, gas is converted to BOE and added to the liquid reserves. Proved uneconomic reservoirs are excluded from these distributions, but are included in the table 3 series.

Figure 31 shows the reservoir-size distribution, on the basis of proved BOE, for 1,810 proved combination reservoirs. The median is 1.0 MMBOE and the mean is 3.3 MMBOE. The GOR for the oil portion of the reservoirs is 1,291 SCF/STB, and the yield for the gas cap is 23.8 barrels of condensate per MMcf of gas.

Figure 32 shows the reservoir-size distribution, on the basis of proved oil, for 7,537 proved undersaturated oil reservoirs. The median is 0.3 MMbbl, the mean is 1.3 MMbbl, and the GOR is 1,401 SCF/STB.

Figure 33 shows the reservoir-size distribution, on the basis of proved gas, for 14,534 proved nonassociated gas reservoirs. The median is 2.6 billion cubic feet (Bcf) of gas, the mean is 9.6 Bcf, and the yield is 12.0 barrels of condensate per MMcf of gas.

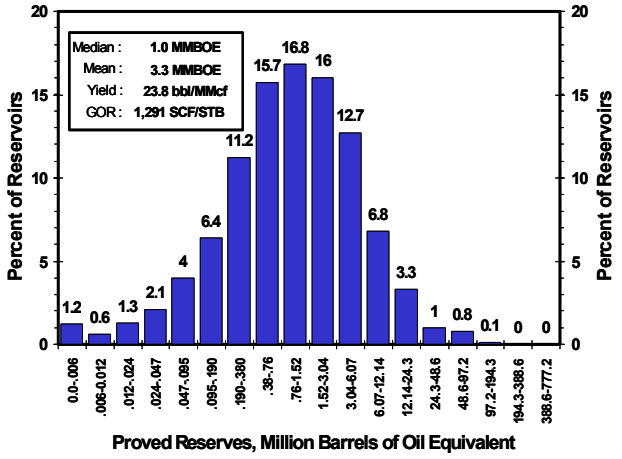

Figure 31. Reservoir-size distribution, 1,810 proved combination reservoirs.

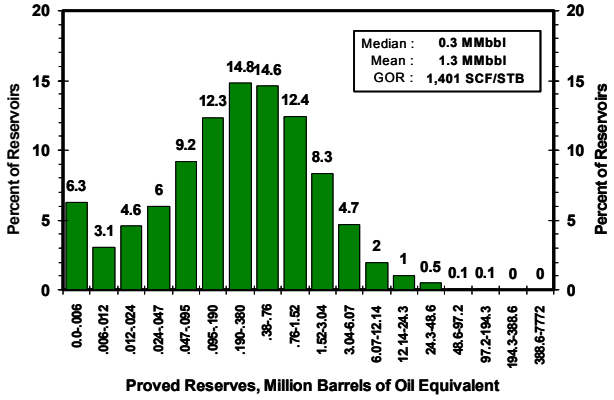

Figure 32. Reservoir-size distribution, 7,537 proved oil reservoirs.

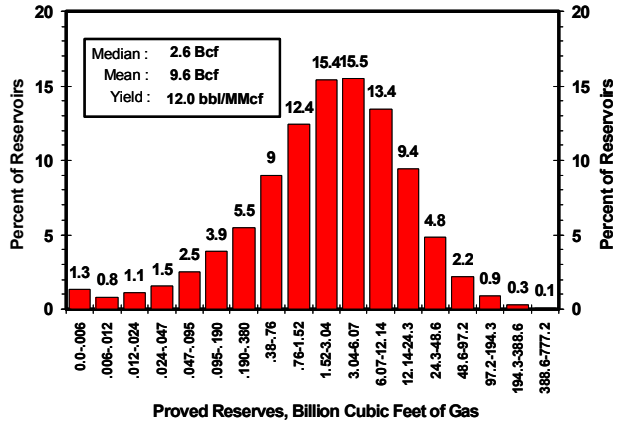

Figure 33. Reservoir-size distribution, 14,534 proved gas reservoirs.

Table 4. Gulf of Mexico fields by rank order, based on proved BOE reserves, top 50 fields.

Rank	Field name	New disc	Disc year	Water depth (feet)	Field type	Field GOR (SCF/STB)	Proved reserves			Cumulative production through 2000			Remaining proved reserves		
							Oil (MMbbl)	Gas (Bcf)	BOE (MMbbl)	Oil (MMbbl)	Gas (Bcf)	BOE (MMbbl)	Oil (MMbbl)	Gas (Bcf)	BOE (MMbbl)
1	EI330		3/1/1971	246	O	4,449	411.9	1,832.5	737.9	388.6	1,732.6	696.9	23.3	100.0	41.1
2	WD030		4/13/1949	49	O	1,476	564.3	832.7	712.4	537.5	787.6	677.7	26.8	45.1	34.8
3	GI043		9/1/1956	139	O	4,308	365.4	1,574.1	645.5	348.9	1,458.8	608.5	16.5	115.2	37.0
4	BM002		3/26/1949	50	O	1,056	519.9	549.0	617.6	505.1	511.3	596.1	14.8	37.7	21.5
5	TS000		7/1/1958	13	G	86,531	36.7	3,173.7	601.4	36.2	3,113.6	590.2	0.5	60.1	11.2
6	VR014		6/1/1956	26	G	64,142	48.2	3,092.7	598.5	47.6	3,000.5	581.5	0.6	92.2	17.0
7	MC807		4/1/1989	2,990	O	1,036	486.2	503.5	575.8	185.1	196.6	220.1	301.1	307.0	355.7
8	MP041		5/1/1956	42	O	5,743	251.1	1,442.2	507.8	235.7	1,348.8	475.7	15.4	93.5	32.1
9	VR039		11/1/1948	38	G	84,179	31.2	2,628.8	499.0	30.3	2,472.5	470.2	0.9	156.3	28.8
10	SS208		12/1/1960	103	O	6,332	217.9	1,380.1	463.5	206.7	1,267.7	432.3	11.2	112.5	31.3
11	GB426		5/1/1987	2,863	O	4,042	230.4	931.5	396.2	157.1	501.6	246.3	73.4	429.9	149.9
12	WD073		11/1/1962	177	O	2,571	271.4	697.7	395.6	248.0	559.4	347.6	23.4	138.3	48.0
13	GI016		11/1/1948	53	O	1,275	299.8	382.2	367.8	291.9	366.4	357.1	8.0	15.8	10.8
14	SP089		10/16/1969	425	O	5,111	187.9	960.3	358.7	175.1	639.1	288.8	12.8	321.2	69.9
15	SP061		7/1/1967	220	O	1,957	259.5	507.8	349.9	244.8	472.9	329.0	14.7	34.9	20.9
16	MC810		10/1/1990	3,877	O	2,156	252.8	544.8	349.7	39.7	63.9	51.0	213.1	480.9	298.7
17	ST172		9/2/1962	98	G	164,492	10.9	1,791.6	329.7	9.9	1,731.8	318.1	1.0	59.8	11.6
18	EI238		1/1/1964	146	G	17,793	78.8	1,402.4	328.3	68.2	1,242.8	289.3	10.6	159.6	39.0
19	WC180		1/1/1961	48	G	135,034	13.0	1,750.5	324.4	12.2	1,676.2	310.4	0.8	74.4	14.0
20	VK956		5/1/1985	3,243	O	6,786	146.4	993.2	323.1	45.1	288.6	96.5	101.3	704.6	226.6
21	SM048		2/1/1961	100	G	57,350	28.3	1,620.2	316.5	26.6	1,461.1	286.6	1.7	159.1	30.0
22	ST021		1/1/1957	46	O	1,630	243.9	397.6	314.6	237.4	379.8	304.9	6.5	17.8	9.7
23	EI292		7/1/1964	211	G	86,647	18.8	1,627.6	308.4	16.6	1,556.5	293.6	2.2	71.1	14.8
24	EC271		4/1/1971	171	G	19,826	67.8	1,344.8	307.1	64.2	1,261.4	288.7	3.6	83.4	18.4
25	MC194		7/1/1975	1,023	O	3,953	179.2	708.3	305.2	167.3	580.0	270.5	11.9	128.3	34.8
26	EC064		5/1/1957	49	G	57,572	26.7	1,536.9	300.2	25.6	1,493.2	291.3	1.1	43.7	8.9
27	WC587		8/1/1971	210	G	126,506	12.6	1,598.8	297.1	12.2	1,458.7	271.8	0.4	140.1	25.3
28	SS169		7/28/1960	63	O	5,359	151.5	811.8	295.9	136.1	737.6	267.3	15.4	74.3	28.6
29	SS176		11/1/1956	100	G	20,655	62.0	1,280.1	289.7	59.1	1,231.0	278.2	2.9	49.1	11.6
30	SP027		8/16/1954	63	O	5,024	152.5	766.5	288.9	146.3	722.2	274.8	6.3	44.3	14.2
31	ST176		4/1/1963	127	G	13,696	79.6	1,089.6	273.4	74.8	1,013.1	255.0	4.8	76.5	18.4
32	WD079		6/1/1966	125	O	3,811	162.2	618.1	272.2	158.5	601.8	265.6	3.7	16.3	6.6
33	EI296		3/1/1971	213	G	69,323	20.2	1,403.0	269.9	20.1	1,379.6	265.6	0.1	23.4	4.3
34	ST135		9/1/1956	130	O	3,396	165.8	563.2	266.0	157.8	502.4	247.2	8.0	60.8	18.8
35	HI573A		10/1/1973	340	O	8,080	106.3	859.2	259.2	100.1	817.2	245.5	6.2	42.0	13.7
36	MI623		3/23/1980	83	G	94,108	14.2	1,336.3	252.0	11.5	1,096.1	206.5	2.7	240.3	45.4
37	SM023		8/1/1960	82	G	38,900	30.3	1,177.0	239.7	28.2	1,078.1	220.1	2.0	99.0	19.6
38	SM130		2/1/1973	215	O	1,366	181.9	248.4	226.1	175.5	230.5	216.5	6.4	17.9	9.6
39	GI047		8/1/1955	88	O	3,596	137.5	494.5	225.5	133.1	473.7	217.4	4.4	20.8	8.1
40	WC192		7/14/1954	57	G	61,531	18.8	1,155.8	224.4	17.9	1,105.7	214.6	0.9	50.0	9.8
41	SP078		12/1/1972	203	G	12,436	69.6	865.4	223.6	63.0	805.8	206.4	6.6	59.6	17.2
42	SM066		1/1/1963	124	G	253,928	4.8	1,229.0	223.5	4.7	1,199.0	218.1	0.1	30.0	5.4
43	VR076		4/1/1949	32	G	166,871	7.2	1,201.5	221.0	5.1	1,100.8	200.9	2.1	100.6	20.0
44	PL020		6/1/1951	31	O	5,533	111.1	614.7	220.5	100.8	552.9	199.2	10.3	61.8	21.3
45	SS222		3/1/1966	142	G	12,680	66.1	837.6	215.1	63.0	807.0	206.6	3.1	30.6	8.5
46	EI266		10/1/1962	160	G	113,945	10.0	1,136.5	212.2	6.0	991.2	182.4	4.0	145.3	29.8
47	GC244		5/30/1994	2,679	O	2,014	154.3	310.9	209.6	86.4	165.2	115.8	67.9	145.7	93.8
48	SP062		10/1/1965	332	O	1,533	155.9	238.9	198.4	148.2	219.8	187.3	7.7	19.1	11.1
49	SS113		5/1/1955	41	O	3,988	115.8	461.6	197.9	111.0	438.7	189.0	4.8	23.0	8.9
50	WC071		12/1/1955	40	G	56,015	18.0	1,006.0	197.0	17.3	975.9	190.9	0.7	30.1	6.0

Production Rates and Discovery Trends

The mean daily production in the Gulf of Mexico OCS during 2000 was 1,169,000 bbl of crude oil, 172,000 bbl of gas condensate, 2.28 Bcf of casinghead gas, and 10.94 Bcf of gas-well gas. The mean GOR of oil wells was 1,947 SCF/STB, and the mean yield from gas wells was 15.70 barrels of condensate per MMcf of gas. Monthly production plots and data by field are also available on the Gulf of Mexico Region's Internet homepage or can be obtained on CD-ROM by contacting the MMS at 1-800-200-GULF.

Figures 34 and 35 show the frequency distribution of monthly production for completions active during 2000. Since the number of completions within a given range changes from month to month, the completion numbers presented are means of the 2000 monthly completion totals for each production range. The numbers shown in parentheses are also means of monthly counts for completions considered to be on continuous production. Completions off production for more than two days a month are not counted as continuously producing completions.

Figure 36 summarizes the data from monthly distributions of oil and gas production rates. The highest reported monthly oil production volume was from a Miocene reservoir with a subsea depth of 17,985 ft, during the month of January. The highest reported monthly gas production volume was from a Pleistocene reservoir with a subsea depth of 17,000 ft, during the month of June. The mean number of oil completions producing more than 1,000 bbl per day was 177, and the mean number of gas completions producing more than 10 MMcf per day was 269.

Annual production in the Gulf of Mexico OCS is shown in figure 37. The oil plot includes condensate, and the gas plot includes casinghead gas. Annual oil production is trimodal, reaching 376 MMbbl per year in 1971, 356 MMbbl per year in 1986, and 522 MMbbls in 2000. From 1986 through 1990, annual oil production declined 23 percent. From 1990 through 2000, annual oil production rose from 275 MMbbl to 522 MMbbl, a 90 percent increase.

From 1990 through 1993, gas production declined 5 percent. From 1993 through 2000, annual gas production rose from 4.7 Tcf peaking at 5.2 Tcf in 1997, an 11 percent increase. Annual gas production reached at least 5.1 Tcf per year from 1996 through 1999.

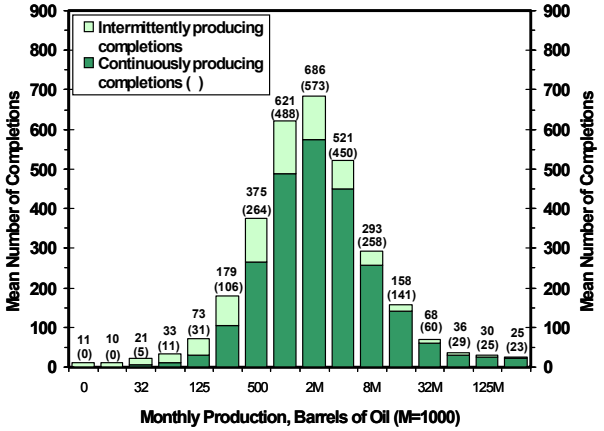

Figure 34. Monthly distribution of oil production, 3,140 completions, (2,464 continuously producing completions).

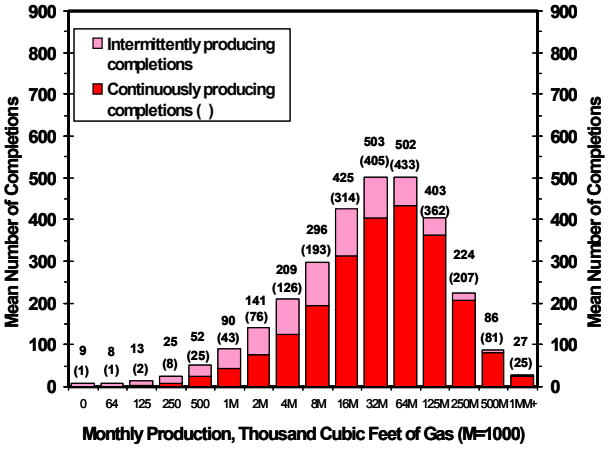

Figure 35. Monthly distribution of gas production, 3,013 completions, (2,302 continuously producing completions).

2000	Oil	Gas
Mean Number of Producing Completions	3,140	3,013
Mean Number of Continuously Producing Completions	2,464	2,302
Highest Monthly Mean Number of Producing Completions	3,177 (October)	3,044 (September)
Lowest Monthly Mean Number of Producing Completions	3,108 (September)	3,020 (October)
Mean Production	11,342 bbl (394 bbl per day)	111 MMcf (3.9 MMcf per day)
Median Production	2,537 bbl (90 bbl per day)	44.9 MMcf (1.7 MMcf per day)
Highest Producing Rate for a Completion	1,106,331 bbl (35,688 bbl per day)	2,663 MMcf (98.6 MMcf per day)

Figure 36. Monthly completion and production data.

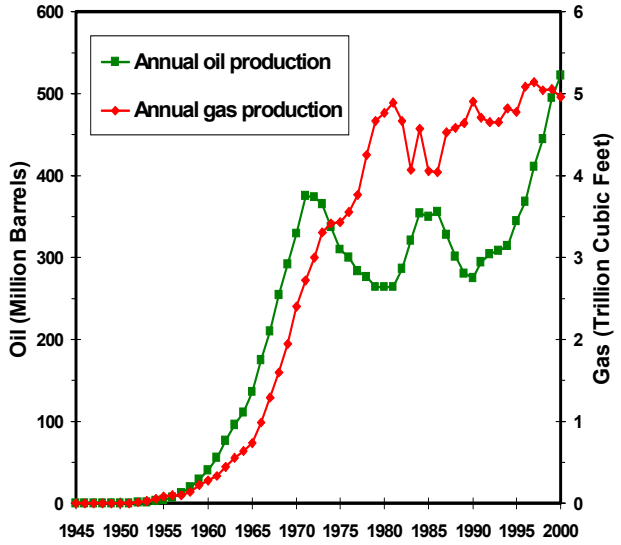

Figure 37. Annual oil and gas production.

Figure 38 presents proved reserves, cumulative production, and remaining proved reserves in BBOE as of December 31, 2000, summed according to field discovery year. Field depletion may be estimated by the relative positions of the cumulative production curve and the remaining proved reserves curve. For example, if the value of the remaining proved reserves is higher than the value of cumulative production for a given year, the aggregate depletion for fields discovered that year is less than 50 percent. The plot demonstrates in general that fields discovered after 1983, with the exception of 1988 and 1992, are less than 50 percent depleted. The current trend is showing that overall field sizes are decreasing.

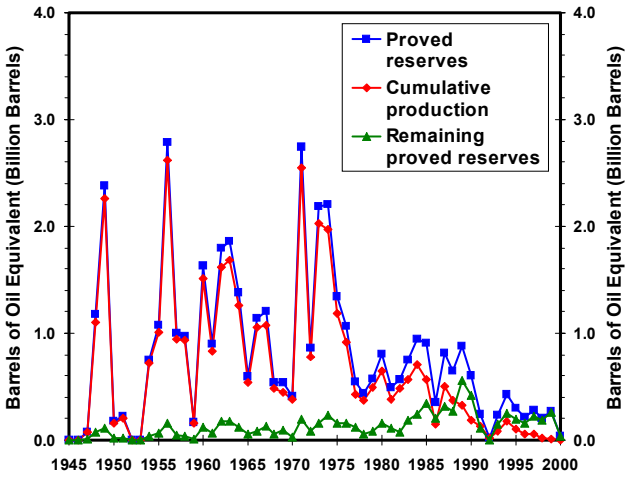

Figure 38. Proved reserves and production by field discovery year.

Figure 39 is a plot of the number of proved gas and oil fields by discovery year. The annual number of gas fields discovered steadily increased until 1985, declined until 1992, increased over the next five years, and is in a state of decline currently. The number of oil fields discovered has not varied much from year to year, never exceeding 11 and averaging only about 3.5 discoveries per year. Through 1959, 39 percent of all fields discovered were oil. This percentage declined steadily as more gas fields were discovered until only 13 percent of the fields discovered during the 1980's were oil fields. This reflects an industry change from oil production to gas production.

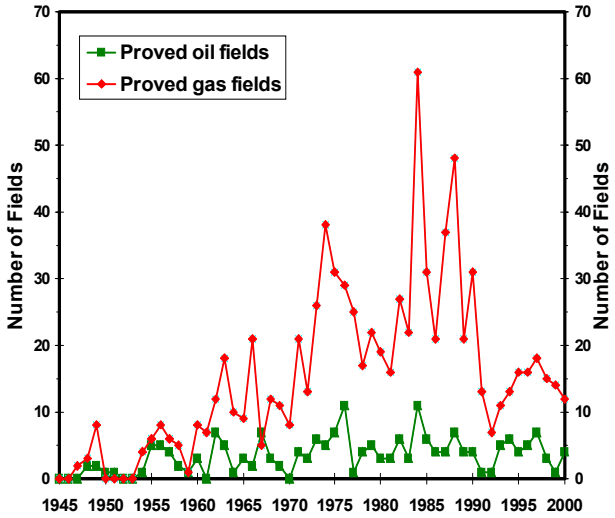

Figure 39. Annual number of proved oil and gas field discoveries.

Figure 40 presents the number of proved fields and the mean field size by field discovery year. This plot shows that, though the number of discovered fields has typically been increasing from year to year, the mean size of the fields has been getting smaller. The mean field size discovered for the last few years is expected to increase because of reserves growth and additions in proved fields and reserves from unproved fields discovered in recent years.

Figure 41 presents the number of proved and unproved fields and the average water depth of the fields discovered in each year. Clearly, exploration and resulting production have moved into deeper water.

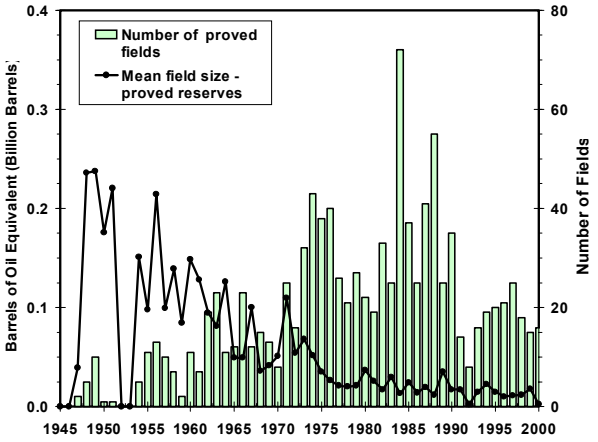

Figure 40. Number of proved fields and mean field size by field discovery year.

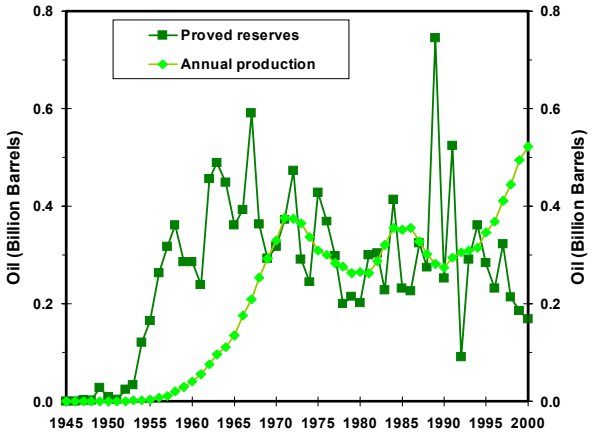

Figure 42. Proved oil reserves by reservoir discovery year and annual oil production.

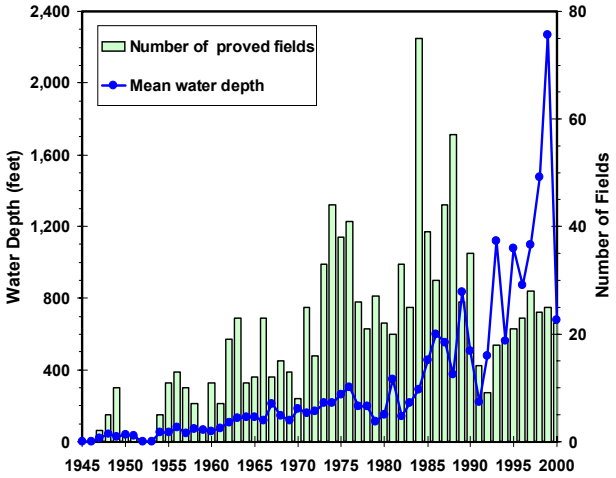

Figure 41. Number of fields and mean water depth by field discovery year.

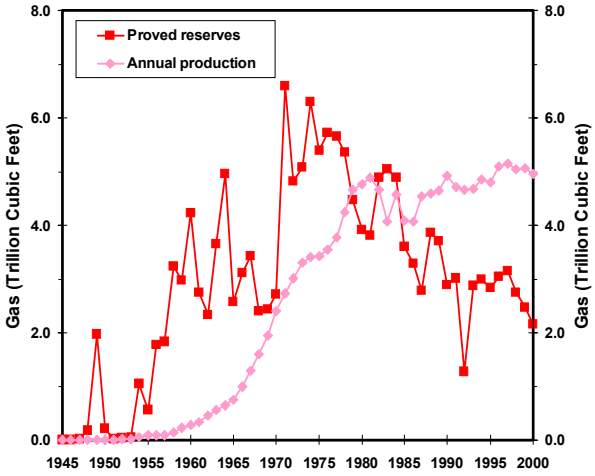

Figure 43. Proved gas reserves by reservoir discovery year and annual gas production.

Figures 42 and 43 show proved oil and gas reserves and annual production by reservoir discovery year. All data presented in figure 42 include crude oil and condensate, and all data presented in figure 43 include associated and nonassociated gas. The year of discovery assigned to a reservoir is the year in which the first well encountering hydrocarbons penetrated the reservoir. For comparison with the rate of discoveries, the annual production of oil and gas is also shown. Since 1984, new proved reservoir discoveries, except for 1989, 1991, and 1994 oil discoveries, are no longer offsetting annual production, indicating a decreasing trend in remaining proved reserves. Because of reserves growth, the proved reserves curve in both figures is expected to increase over what is shown.

Figure 44 presents the total footage drilled, the total number of wells drilled, and the number of exploratory and development wells drilled in the Gulf of Mexico OCS each year. All curves show a decline after the 1986 collapse in oil prices. A second decline occurred in 1991-92. Drilling increased from 1992 to 1997, reflecting stable energy prices and improvements in exploration and production technology. The decline from 1997 to 1999, indicative of a decrease in energy prices, was offset in 2000 by increased shelf activity.

Figure 45 presents the number of exploratory wells drilled each year by water depth. The plot shows the move toward drilling in deeper water, but also illustrates continued drilling on the shelf.

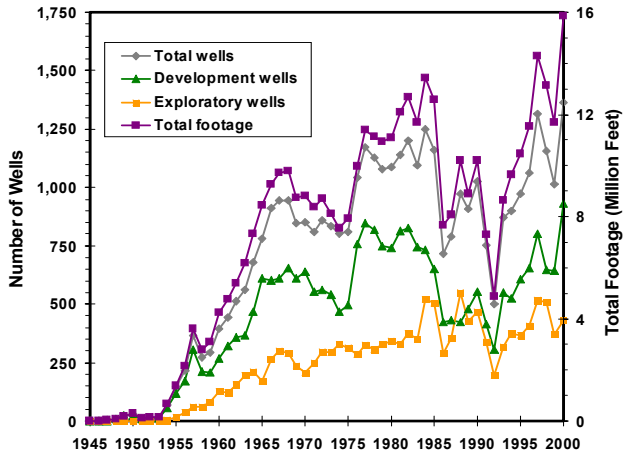

Figure 44. Wells and footage drilled.

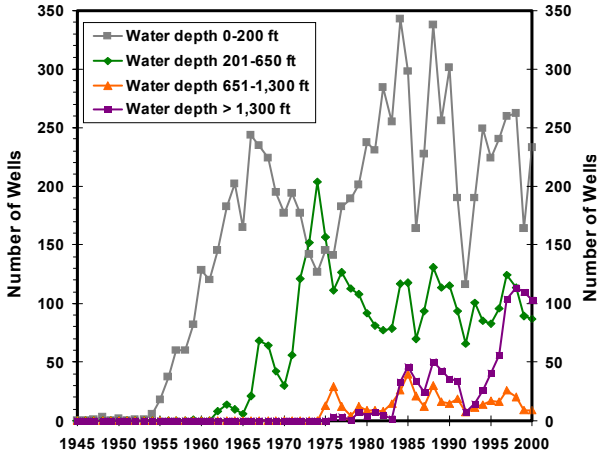

Figure 45. Number of exploratory wells drilled by water depth.

Summary and Comparison of Proved Reserves

A summary of proved reserve estimates during the year and a comparison with estimates from last year's report (December 31, 2000) are shown in table 5. Recent proved field discoveries (17 oil fields and 39 gas fields) are summarized and tabulated as increases to proved reserves. Note that recent field discoveries are identified as new fields added in the last year, even though some were discovered before 2000.

Proved reserve estimates are revised as needed, resulting in increases as additional wells are drilled and new leases are added to existing fields, and decreases as reservoirs are depleted and leases relinquished. Complete reevaluations of existing field studies are conducted on the basis of changes in field development and/or production history. Increases and decreases of proved reserves are summarized and

Table 5. Summary and comparison of proved oil and gas reserves as of December 31, 1999, and December 31, 2000.

	Oil (billion bbl)		Gas (trillion cu ft)	
Proved reserves:				
Previous estimates, as of 12/31/1999*	**14.38**		**161.4**	
Discoveries	0.33		2.6	
Revisions	0.22		3.3	
Adjustments	0.00		0.0	
Net Change	**0.55**		**5.9**	
Estimate, as of 12/31/2000 (this report)		**14.93**		**167.3**
Cumulative production:				
Previous estimates, as of 12/31/1999*	**11.40**		**137.7**	
Discoveries	0.00		0.0	
Revisions	0.53		5.0	
Net Change	**0.53**		**5.0**	
Estimate, as of 12/31/2000 (this report)		**11.93**		**142.7**
Remaining proved reserves:				
Previous estimates, as of 12/31/1999*	**2.98**		**23.6**	
Discoveries	0.33		2.6	
Revisions	0.22		3.3	
Adjustments	0.00		0.1	
Production during 2000	-0.53		-5.0	
Net Change	**0.02**		**1.0**	
Estimate, as of 12/31/2000 (this report)		**3.00**		**24.6**

*Crawford and others, 2002

presented as changes because of revisions. Based on periodic reviews and revisions of field studies conducted since the 1999 report, the revisions for proved oil and gas reserves have resulted in a net increase. A net change in the proved oil and gas reserves is a result of combining both the discoveries and the revisions.

Table 5 demonstrates that the 2000 proved oil and gas discoveries, adjustments, and field revisions did exceed production. The remaining proved oil and gas reserves have increased since 1999.

Table 6 presents all previous reserve estimates by year. Because of adjustments and corrections to production data submitted by Gulf of Mexico OCS operators, the difference between historical cumulative production for successive years does not always equal the annual production for the latter year. No comparisons will be made for unproved reserves.

Table 6. Proved oil and gas reserves and cumulative production at end of year, Gulf of Mexico, Outer Continental Shelf and Slope.

Oil expressed in billions of barrels; gas in trillions of cubic feet. "Oil" includes crude oil and condesate; "gas" includes associated and nonassociated gas. Remaining proved reserves estimated as of December 31 each year.

Year	Number of fields included	Proved reserves		Historical cumulative production		Remaining proved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas
1975	255	6.61	59.9	3.82	27.2	2.79	32.7
1976	306	6.86	65.5	4.12	30.8	2.74	34.7
1977	334	7.18	69.2	4.47	35.0	2.71	34.2
1978	385	7.52	76.2	4.76	39.0	2.76	37.2
1979 *	417	7.71	82.2	4.83	44.2	2.88	38.0
1980	435	8.04	88.9	4.99	48.7	3.05	40.2
1981	461	8.17	93.4	5.27	53.6	2.90	39.8
1982	484	8.56	98.1	5.58	58.3	2.98	39.8
1983	521	9.31	106.2	5.90	62.5	3.41	43.7
1984	551	9.91	111.6	6.24	67.1	3.67	44.5
1985	575	10.63	116.7	6.58	71.1	4.05	45.6
1986	645	10.81	121.0	6.93	75.2	3.88	45.8
1987	704	10.76	122.1	7.26	79.7	3.50	42.4
1988 +	678	10.95	126.7	7.56	84.3	3.39	42.4
1989	739	10.87	129.1	7.84	88.9	3.03	40.2
1990	782	10.64	129.9	8.11	93.8	2.53	36.1
1991	819	10.74	130.5	8.41	98.5	2.33	32.0
1992	835	11.08	132.7	8.71	103.2	2.37	29.5
1993	849	11.15	136.8	9.01	107.7	2.14	29.1
1994	876	11.86	141.9	9.34	112.6	2.52	29.3
1995	899	12.01	144.9	9.68	117.4	2.33	27.5
1996	920	12.79	151.9	10.05	122.5	2.74	29.4
1997	957	13.67	158.4	10.46	127.6	3.21	30.8
1998	984	14.27	162.7	10.91	132.7	3.36	30.0
1999	1003	14.38	161.3	11.40	137.7	2.98	23.6
2000	1050	14.93	167.3	11.93	142.7	3.00	24.6

* Gas plant liquids dropped from system
\+ Basis of reserves changed from demonstrated to SPE proved.

Conclusions

As of December 31, 2000, the 1,050 proved oil and gas fields in the federally regulated part of the Gulf of Mexico OCS contained proved reserves estimated to be 14.93 billion barrels of oil and 167.3 trillion cubic feet of gas. Cumulative production from the proved fields accounts for 11.93 billion barrels of oil and 142.7 trillion cubic feet of gas. Remaining proved reserves are estimated to be 3.00 billion barrels of oil and 24.6 trillion cubic feet of gas. Remaining proved oil reserves have increased 1 percent and the remaining proved gas reserves have increased 4 percent from last year's report.

The 51 unproved oil and gas fields studied in the federally regulated part of the Gulf of Mexico OCS contained an estimated 2.22 billion barrels of oil and 4.1 trillion cubic feet of gas. Included are unproved reserves of 2.16 billion barrels of oil and 3.3 trillion cubic feet of gas from 25 fields in water depths greater than 1,000 feet. Estimated unproved reserves for oil are 4.1 times annual oil production, and for gas are 0.6 times less than annual gas production.

The large increase in oil production is primarily due to large deepwater oil-prone fields coming on production. The decrease in proved oil reserves is likely due to a time lag in recent discoveries being placed into the proved status because of qualification requirements.

In addition to the proved and unproved reserves discussed above, at a minimum there are 2.87 billion barrels of oil and 14.1 trillion cubic feet of gas that are not presented in this report. This oil and gas occurs on leases that have not yet qualified (and therefore are not placed in a field) or they occur as unproved reserves and/or known resources in proved fields, or as known resources in unproved fields. As further drilling and development occurs these additional hydrocarbon volumes will become reportable, and it is anticipated that future proved and unproved reserves will increase accordingly.

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Notice

This report, *Estimated Oil and Gas Reserves, Gulf of Mexico, December 31, 2000,* has undergone numerous changes over the last few years. We are continually striving to provide meaningful information to the users of this document. Suggested changes, additions, or deletions to our data or statistical presentations are encouraged so we can publish the most useful report possible. Please contact the Reserves Section Chief at (504) 736-2429 at Minerals Management Service, 1201 Elmwood Park Boulevard, MS 5130, New Orleans, Louisiana 70123-2394, to communicate your ideas for consideration in our next report.

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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 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 territories under U.S. administration.

The Minerals Mangement Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Mangement Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.