OCS Report
MMS 2002-007

Outer Continental Shelf

Estimated Oil and Gas Reserves, Gulf of Mexico, December 31, 1999

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New Orleans
February 2002

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Abstract

Remaining proved reserves in the Gulf of Mexico Outer Continental Shelf (OCS) as of December 31, 1999, have been estimated to be 2.98 billion barrels of oil* and 23.6 trillion cubic feet of gas. These reserves are recoverable from 815 proved active fields. Unproved reserves as of December 31, 1999, have been estimated to be 2.40 billion barrels of oil and 9.7 trillion cubic feet of gas. These reserves are associated with the 60 unproved active fields studied. There are 5 unproved active fields not studied. In total, there are 880 active fields located in Federal waters.

Proved reserves are estimated to have been 14.38 billion barrels of oil and 161.4 trillion cubic feet of gas from 1,003 proved fields in the same geographic area. Included in this number are 188 proved expired depleted fields: not included are the 65 unproved active fields. Estimates were derived for individual reservoirs from geologic mapping and reserve evaluation.

The unproved reserves, associated with the 60 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.

*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 2000-069 (Crawford and others, 2000), presents proved reserves, cumulative production, remaining proved reserves, and unproved reserves as of December 31, 1999, for the Gulf of Mexico (GOM). This report does not consider the reserves growth phenomena when addressing remaining proved reserves, nor does it report undiscovered or known resources. 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 1999 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 calculation 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.

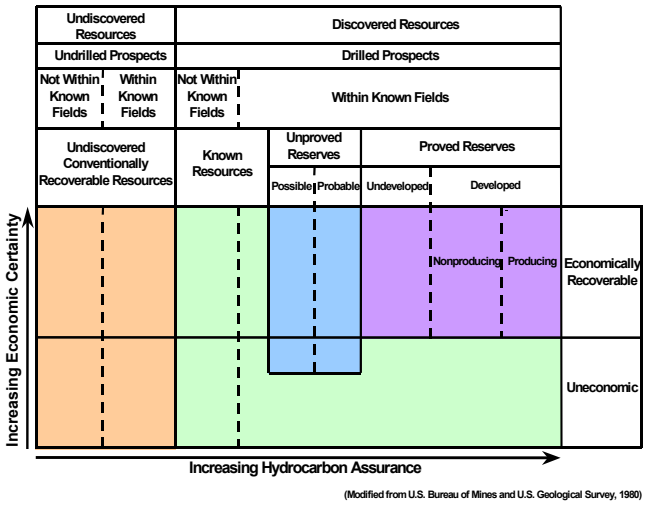

Figure 1. MMS conventionally recoverable petroleum resource classifications.

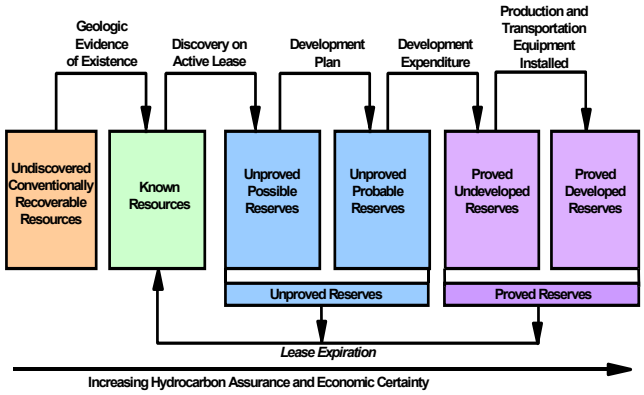

Figure 2. Gulf of Mexico MMS reserve classifications.

Field

A field is an area consisting of a single reservoir or multiple reservoirs all grouped on, or related to, the same general geological structural feature and/or stratigraphic trapping condition. There may be two or more reservoirs in a field that are separated vertically by intervening impervious strata, or laterally by geological barriers, or 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) 250.111, 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 http://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 250.111 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 250.111 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.

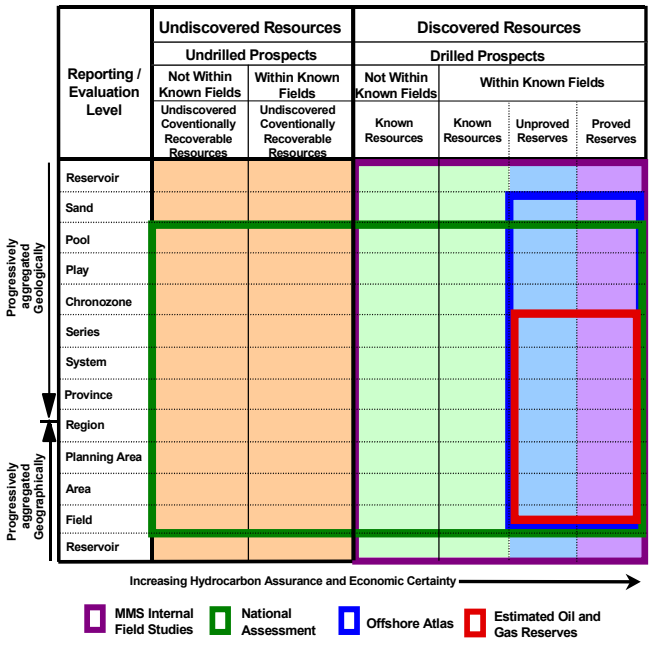

Figure 3. MMS evaluation of reserves and resources.

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 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 1,003 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 188 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 gives a good 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.

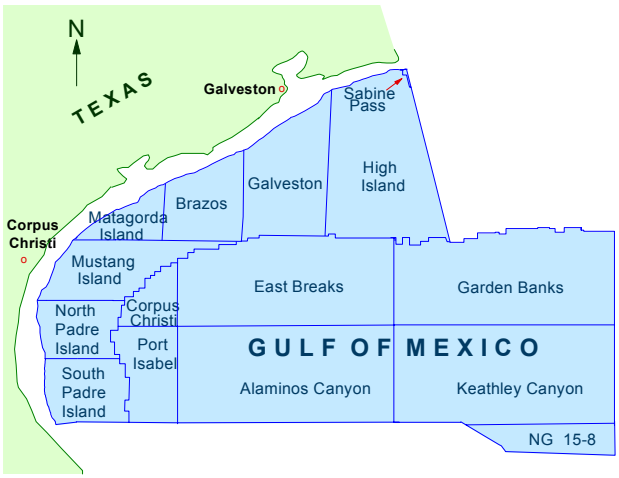

Figure 4. Western Planning Area, Gulf of Mexico, Outer Continental Shelf.

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

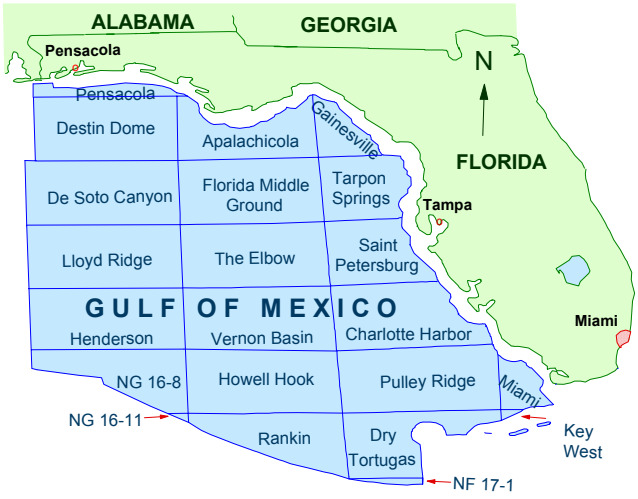

Figure 6. Eastern Planning Area, Gulf of Mexico, Outer Continental Shelf.

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 880 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 (September 2001)*** on the GOM Region's Internet homepage. For this report, 815 proved active producing and non-producing fields and 60 unproved active fields were studied. Included are the 188 proved depleted fields, abandoned after producing 4.7% barrel oil equivalent of the total cumulative oil and gas production. Not studied were 120 fields expired, relinquished, or terminated without production and 5 unproved active fields. In 1998, twenty-five 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 1,003 proved fields in the Gulf of Mexico. Estimates of proved reserves for these fields, both producing and non-producing, are

Table 1. Estimated oil and gas reserves for 1,003 proved and 60 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 1999.

(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(s) (Figs. 4, 5, and 6)	Number of fields						Proved reserves		Cumulative production through 1999		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	3	9	1	0	2	11	3,452	9	2,801	2	651	-	-
Galveston	21	2	19	0	0	4	51	2,000	41	1,621	10	379	-	-
High Island and Sabine Pass	82	4	34	1	1	15	363	14,070	316	12,744	47	1,326	-	-
Matagorda Island	25	0	2	0	0	3	25	5,473	19	4,273	6	1,200	-	-
Mustang Island	18	1	8	0	0	6	7	2,038	4	1,458	3	580	-	-
N. & S. Padre Island	5	0	4	0	0	2	0	494	0	427	0	67	-	-
Western Slope*	24	2	0	15	14	12	586	3,439	233	1,663	353	1,776	-	-
Western Planning Area Subtotal	***200***	***12***	***76***	***17***	***15***	***44***	***1,043***	***30,966***	***622***	***24,987***	***421***	***5,979***	***288***	***2,015***
Central Planning Area														
Chandeleur	7	1	2	0	0	0	0	339	0	323	0	16	-	-
East Cameron	44	3	14	2	2	3	322	10,214	290	9,605	32	609	-	-
Eugene Island	59	1	12	0	0	8	1,567	18,402	1,397	16,609	170	1,793	-	-
Grand Isle	16	2	1	0	0	1	934	4,814	892	4,068	42	746	-	-
Main Pass and Breton Sound	53	2	11	3	3	8	993	6,143	869	5,034	124	1,109	-	-
Mobile	24	0	1	0	0	3	0	2,136	0	1,117	0	1,019	-	-
Ship Shoal	50	4	8	1	1	3	1,321	11,648	1,208	10,685	113	963	-	-
South Marsh Island	39	3	4	0	0	2	818	13,510	767	12,705	51	805	-	-
South Pass	11	1	1	0	0	2	1,045	4,361	974	3,662	71	699	-	-
South Pelto	8	0	0	1	0	0	148	967	130	797	18	170	-	-
South Timbalier	43	2	5	2	2	3	1,429	8,746	1,306	7,536	123	1,210	-	-
Vermilion	63	4	13	1	1	4	517	15,916	460	14,589	57	1,327	-	-
Viosca Knoll	17	1	3	3	3	2	0	296	0	121	0	175	-	-
West Cameron and Sabine Pass	63	4	30	1	1	6	189	17,955	166	16,641	23	1,314	-	-
West Delta	20	1	3	0	0	2	1,369	5,296	1,260	4,761	109	535	-	-
Central Slope**	52	4	4	31	29	28	2,684	9,661	1,061	4,494	1,623	5,167	-	-
Central Planning Area Subtotal	***569***	***33***	***112***	*45*	*42*	*75*	***13,336***	***130,404***	***10,780***	***112,747***	***2,556***	***17,657***	***2,111***	***7,639***
Eastern Planning Area Subtotal***	***1***	***0***	***0***	***3***	***3***	***1***	***0***	***5***	***0***	***2***	***0***	***3***	***-***	***-***
GOM Total	***770***	***45***	***188***	***65***	***60***	***120***	***14,379***	***161,375***	***11,402***	***137,736***	***2,977***	***23,639***	***2,399***	***9,654***
		1,003												

*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.

presented as area totals in table 1. Figure 8 provides a geographical representation of the 65 unproved active fields in the Gulf of Mexico. Estimates of unproved reserves are presented as planning area subtotals.

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, 1999, is presented in table 2. There are 8,342 active leases (2,015 proved active, 154 unproved qualified, and 6,173 unproved active) and 10,119 relinquished leases (875 proved depleted and 9,244 expired)

Definitions of the table 2 subgroups follow:

Proved Active — Leases within the designated 815 proved active fields presented in table 1.

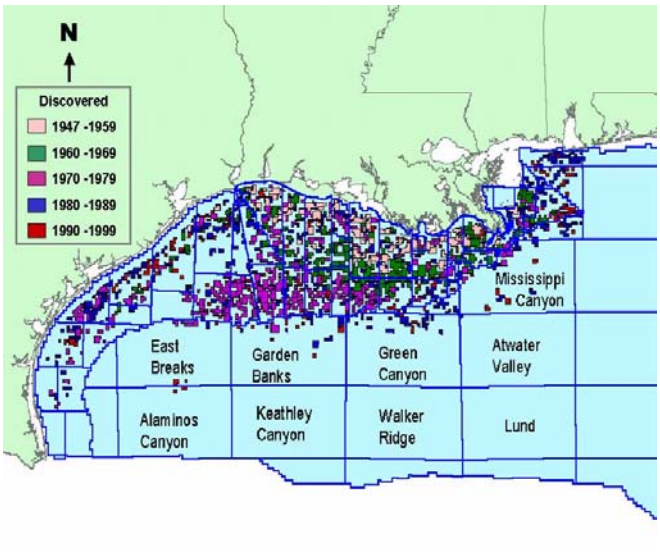

Figure 7. Gulf of Mexico, 1,003 proved fields (815 active and 188 depleted).

Table 2. Status of oil and gas leases, boreholes, and completions by area, Gulf of Mexico, Outer Continental Shelf, December 31, 1999.

(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	Unproved Active	Expired	Drilled	Abandoned	
Western Planning Area								
Brazos	46	26	1	85	281	505	342	196
Galveston	38	44	0	110	491	646	554	151
High Island and Sabine Pass	177	97	4	210	848	2,807	1,807	1,319
Matagorda Island	55	15	0	28	137	546	286	329
Mustang Island	31	15	0	69	358	369	246	157
N. & S. Padre Island	5	9	0	49	272	146	119	38
Western Slope*	55	3	20	1,707	1,058	609	380	234
Western Planning Area Subtotal	***407***	***209***	***25***	***2,258***	***3,445***	***5,628***	***3,734***	***2,424***
Central Planning Area								
Chandeleur	8	7	0	7	29	65	40	27
East Cameron	107	81	8	179	494	1,955	1,274	901
Eugene Island	204	73	2	142	387	4,373	2,577	2,189
Grand Isle	59	17	0	38	117	1,686	1,288	552
Main Pass and Breton Sound	139	55	17	109	321	2,564	1,384	1,784
Mobile	34	3	1	43	61	122	57	82
Ship Shoal	157	60	5	124	392	3,231	1,927	1,633
South Marsh Island	115	35	0	102	267	2,470	1,349	2,153
South Pass	43	11	2	23	81	2,031	1,117	1,175
South Pelto	18	4	1	6	26	344	207	176
South Timbalier	125	31	13	133	369	2,633	1,631	1,257
Vermilion	152	89	4	171	469	2,689	1,726	1,281
Viosca Knoll	52	7	13	163	246	392	221	172
West Cameron and Sabine Pass	198	160	1	309	741	3,121	2,097	1,405
West Delta	85	25	0	50	158	2,644	1,671	1,440
Central Slope**	111	8	56	2,177	1,303	1,649	1,067	697
Central Planning Area Subtotal	***1,607***	***666***	***123***	***3,776***	***5,461***	***31,969***	***19,633***	***16,924***
Eastern Planning Area Subtotal***	***1***	***0***	***6***	***139***	***338***	***49***	***43***	***1***
GOM Total	***2,015***	*875*	***154***	***6,173***	***9,244***	***37,646***	***23,410***	***19,349***

*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.

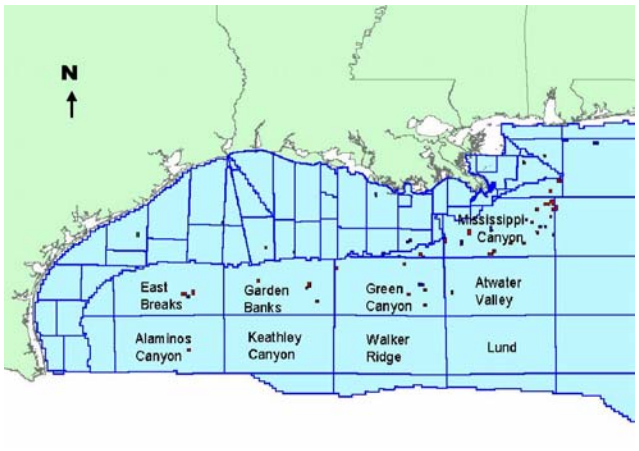

Figure 8. Gulf of Mexico, 65 unproved active fields (60 studied and 5 not studied).

Proved Depleted — Leases relinquished after oil and gas production. The leases associated with the 188 depleted fields are represented here along with other produced, relinquished leases that are part of currently active fields.

Unproved Qualified — Leases associated with the 65 unproved active fields. The leases have qualified as producible under 30 CFR 250.111, but the operators have not established a commitment to produce. These fields may be classified as unproved possible or unproved probable.

Unproved 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 250.111. There are 120 expired fields with no production.

The total number of boreholes drilled and the number of boreholes plugged and abandoned are also shown in table 2. There were 1,026 boreholes spudded during 1999, compared with 1,130 during 1998, and 1,307 during 1997. 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, 1999, are based on reports received by the MMS at the time the count was made in 2000. These numbers may change when all data have been received, processed, and edited.

Reserves Reported by Geologic Age

In this report, the 1,003 proved and 60 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.

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 Valvulinaria "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	Ecytheropteron 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 faunes are frequently defined as "Navarro."

Figure 9. Gulf of Mexico MMS geologic time scale.

Table 3. Estimated oil and gas reserves for 1,003 proved and 60 unproved fields by geologic age, Gulf of Mexico, Outer Continental Shelf, December 31, 1999.

(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.)

Geologic Age	Number of proved reservoirs	Proved reserves		Cumulative production through 1999		Remaining proved reserves		Number of unproved reservoirs	Unproved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas		Oil	Gas
Western Planning Area										
Pleistocene	1,477	661	12,502	418	10,360	243	2,142	255	177	1,469
Pliocene	24	246	661	96	247	150	414	22	106	282
Miocene	2,166	136	17,767	108	14,369	28	3,398	115	5	259
Oligocene, Cretaceous, and Jurassic	8	0	36	0	11	0	25	3	0	5
Western Planning Area Subtotal	***3,675***	***1,043***	***30,966***	***622***	***24,987***	***421***	***5,979***	***395***	***288***	***2,015***
Central Planning Area										
Pleistocene	8,627	4,491	50,949	3,675	45,469	816	5,480	280	151	874
Pliocene	6,384	3,983	25,383	3,407	22,069	576	3,314	137	331	630
Miocene	6,392	4,852	52,025	3,698	44,324	1,154	7,701	256	1,629	5,498
Oligocene, Cretaceous, and Jurassic	28	10	2,047	0	885	10	1,162	5	0	637
Central Planning Area Subtotal	***21,431***	***13,336***	***130,404***	***10,780***	***112,747***	***2,556***	***17,657***	***678***	***2,111***	***7,639***
Eastern Planning Area Subtotal*	***1***	***0***	***5***	***0***	***2***	***0***	***3***	***5***	***-***	***-***
GOM Total	***25,107***	***14,379***	***161,375***	***11,402***	***137,736***	***2,977***	***23,639***	***1,078***	***2,399***	***9,654***

***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 529 proved and 27 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 1999.

(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(s)	Number of proved reservoirs	Proved reserves		Cumulative production through 1999		Remaining proved reserves		Number of unproved reservoirs	Unproved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas		Oil	Gas
Western Planning Area										
Galveston	21	1	82	1	77	0	5	0	-	-
High Island and Sabine Pass	1,265	320	9,637	280	8,863	40	774	163	-	-
Western Slope*	191	340	2,783	137	1,420	203	1,363	92	-	-
Western Planning Area Subtotal	***1,477***	***661***	***12,502***	***418***	***10,360***	***243***	***2,142***	***255***	***177***	***1,469***
Central Planning Area										
East Cameron	683	238	5,209	212	4,827	26	382	15	-	-
Eugene Island	1,817	973	11,638	868	10,707	105	931	6	-	-
Grand Isle	122	10	1,412	8	1,332	2	80	3	-	-
Main Pass and Breton Sound	30	45	126	41	111	4	15	0	-	-
Ship Shoal	1,468	792	6,948	737	6,439	55	509	11	-	-
South Marsh Island	779	486	3,409	458	3,166	28	243	48	-	-
South Pass	237	161	1,385	144	1,196	17	189	0	-	-
South Pelto	75	22	22	20	17	2	5	0	-	-
South Timbalier	1,032	351	4,953	310	4,396	41	557	38	-	-
Vermilion	876	176	3,460	148	2,998	28	462	35	-	-
Viosca Knoll	1	0	0	0	0	0	0	0	-	-
West Cameron and Sabine Pass	880	43	7,684	32	7,061	11	623	19	-	-
West Delta	184	204	792	187	696	17	96	1	-	-
Central Slope**	443	990	3,911	510	2,523	480	1,388	104	-	-
Central Planning Area Subtotal	***8,627***	***4,491***	***50,949***	***3,675***	***45,469***	***816***	***5,480***	***280***	***151***	***874***
Eastern Planning Area Subtotal*	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***
GOM Total	***10,104***	***5,152***	***63,451***	***4,093***	***55,829***	***1,059***	***7,622***	***535***	***328***	***2,343***

*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 299 proved and 12 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 1999.

(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(s)	Number of proved reservoirs	Proved reserves		Cumulative production through 1999		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	5	0	4	0	0	0	-	-
Western Slope*	23	246	656	96	243	150	414	22	-	-
Western Planning Area Subtotal	***24***	***246***	***661***	***96***	***247***	***150***	***414***	***22***	***106***	***282***
Central Planning Area										
Chandeleur	1	0	14	0	12	0	2	0	-	-
East Cameron	165	15	972	13	883	2	89	2	-	-
Eugene Island	1,131	435	3,083	398	2,678	37	405	5	-	-
Grand Isle	360	340	1,081	323	980	17	101	4	-	-
Main Pass and Breton Sound	369	230	1,202	199	1,107	31	95	0	-	-
Ship Shoal	722	373	2,592	330	2,322	43	270	1	-	-
South Marsh Island	603	143	4,449	132	4,159	11	290	21	-	-
South Pass	831	768	2,477	722	2,010	46	467	0	-	-
South Pelto	163	67	276	62	242	5	34	0	-	-
South Timbalier	536	268	1,899	235	1,564	33	335	9	-	-
Vermilion	596	191	3,206	169	2,899	22	307	29	-	-
Viosca Knoll	4	0	5	0	4	0	1	0	-	-
West Cameron and Sabine Pass	170	3	968	2	910	1	58	0	-	-
West Delta	584	521	1,247	469	1,077	52	170	2	-	-
Central Slope**	149	629	1,912	353	1,222	276	690	64	-	-
Central Planning Area Subtotal	***6,384***	***3,983***	***25,383***	***3,407***	***22,069***	***576***	***3,314***	***137***	***331***	***630***
Eastern Planning Area Subtotal***	-	-	-	-	-	-	-	-	-	-
GOM Total	***6,408***	***4,229***	***26,044***	***3,503***	***22,316***	***726***	***3,728***	***159***	***437***	***912***

*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, 1999, the Pleistocene produced from 529 fields. Proved reserves were 5.15 billion barrels (Bbbl) and 63.5 trillion cubic feet (Tcf). Remaining proved reserves were 1.06 Bbbl and 7.6 Tcf.

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

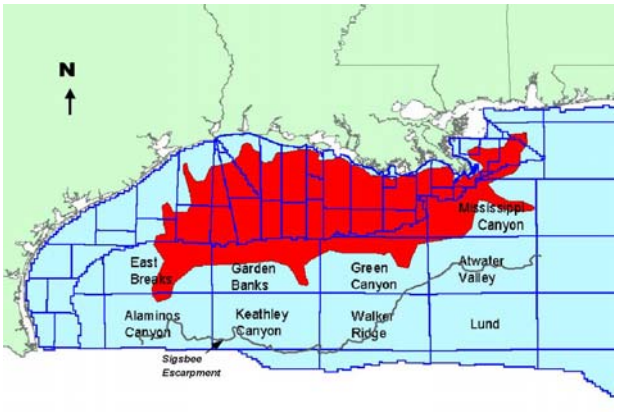

Figure 10. Pleistocene reserves trend.

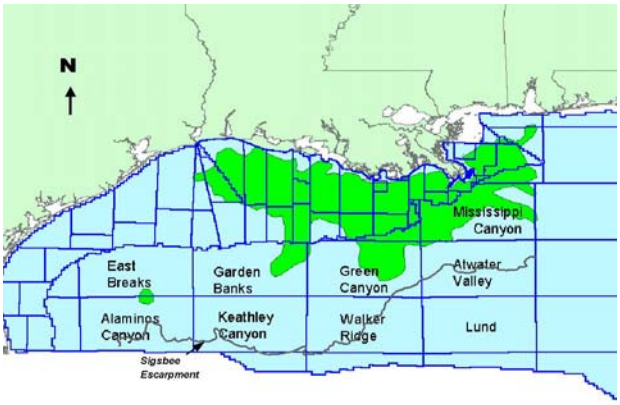

Figure 11. Pliocene reserves trend.

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Table 3c. Estimated oil and gas reserves for Miocene reservoirs in 507 proved and 27 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 1999.

(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(s)	Number of proved reservoirs	Proved reserves		Cumulative production through 1999		Remaining proved reserves		Number of unproved reservoirs	Unproved reserves	
		Oil	Gas	Oil	Gas	Oil	Gas		Oil	Gas
Western Planning Area										
Brazos	410	11	3,452	9	2,801	2	651	15	-	-
Galveston	391	50	1,918	40	1,544	10	374	12	-	-
High Island and Sabine Pass	484	43	4,429	36	3,877	7	552	53	-	-
Matagorda Island	460	25	5,473	19	4,273	6	1,200	7	-	-
Mustang Island	332	7	2,001	4	1,447	3	554	28	-	-
N. & S. Padre Island	89	0	494	0	427	0	67	0	-	-
Western Slope*	0	0	0	0	0	0	0	0	-	-
Western Planning Area	***2,166***	***136***	***17,767***	***108***	***14,369***	***28***	***3,398***	***115***	***5***	***259***
Central Planning Area										
Chandeleur	22	0	324	0	311	0	13	3	-	-
East Cameron	305	69	4,033	65	3,895	4	138	2	-	-
Eugene Island	472	149	3,594	131	3,224	18	370	8	-	-
Grand Isle	491	585	2,322	561	1,755	24	567	6	-	-
Main Pass and Breton Sound	955	717	4,815	628	3,815	89	1,000	11	-	-
Mobile	27	0	324	0	247	0	77	0	-	-
Ship Shoal	463	157	2,108	141	1,925	16	183	11	-	-
South Marsh Island	408	189	5,653	178	5,380	11	273	30	-	-
South Pass	216	116	500	109	457	7	43	0	-	-
South Pelto	212	59	668	48	537	11	131	1	-	-
South Timbalier	609	809	1,895	760	1,576	49	319	21	-	-
Vermilion	539	149	9,250	142	8,693	7	557	34	-	-
Viosca Knoll	24	0	143	0	103	0	40	1	-	-
West Cameron and Sabine Pass	965	144	9,303	132	8,671	12	632	19	-	-
West Delta	611	643	3,257	603	2,988	40	269	5	-	-
Central Slope**	73	1,066	3,836	200	747	866	3,089	104	-	-
Central Planning Area Subtotal	***6,392***	***4,852***	***52,025***	***3,698***	***44,324***	***1,154***	***7,701***	***256***	***1,629***	***5,499***
Eastern Planning Area	1	0	5	0	2	0	3	4	**-**	**-**
GOM Total	***8,559***	***4,988***	***69,797***	***3,806***	***58,695***	***1,182***	***11,102***	***375***	***1,634***	***5,758***

*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 Oligocene, Cretaceous, and Jurassic reservoirs in 19 proved and 5 unproved fields by area, Gulf of Mexico, Outer Continental Shelf, December 31, 1999.

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

Area(s)	Number of proved reservoirs	Proved reserves		Cumulative production through 1999		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	36	0	11	0	25	0	-	-
Western Slope*	0	0	0	0	0	0	0	3	-	-
Western Planning Area Subtotal	***8***	***0***	***36***	***0***	***11***	***0***	***25***	***3***	***0***	***5***
Central Planning Area										
Eugene Island	1	10	87	0	0	10	87	0	-	-
Main Pass and Breton Sound	1	0	0	0	0	0	0	0	-	-
Mobile	21	0	1,812	0	871	0	941	0	-	-
Viosca Knoll	5	0	148	0	14	0	134	5	-	-
Central Planning Area Subtotal	***28***	***10***	***2,047***	***0***	***885***	***10***	***1,162***	***5***	***0***	***636***
Eastern Planning Area	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***1***	**-**	**-**
GOM Total	***36***	***10***	***2,083***	***0***	***896***	***10***	***1,187***	***9***	***0***	***641***

*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, 1999, the Pliocene produced from 299 fields. Proved reserves were 4.23 Bbbl and 26.0 Tcf. Remaining proved reserves were 0.73 Bbbl and 3.7 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, 1999, the Miocene produced from 507 fields. Proved reserves were 4.99 Bbbl and 69.8 Tcf. Remaining proved reserves were 1.18 Bbbl and 11.1 Tcf.

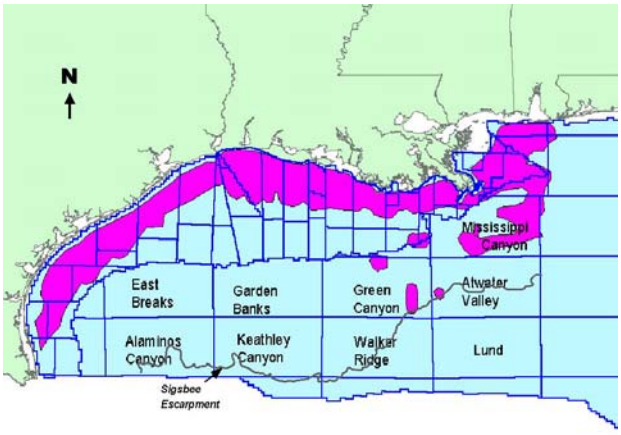

Figure 12. Miocene reserves trend.

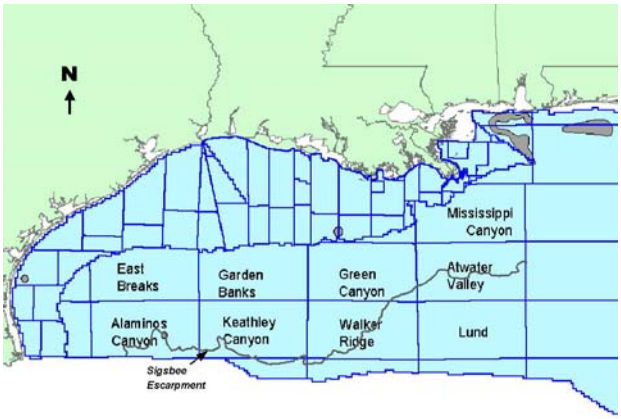

Figure 13. Oligocene, Cretaceous, and Jurassic reserves trends.

The Oligocene, 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, 1999, these trends produced from 19 fields. Proved reserves were 0.01 Bbbl and 2.1 Tcf. Remaining proved reserves were 0.01 Bbbl and 1.2 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.

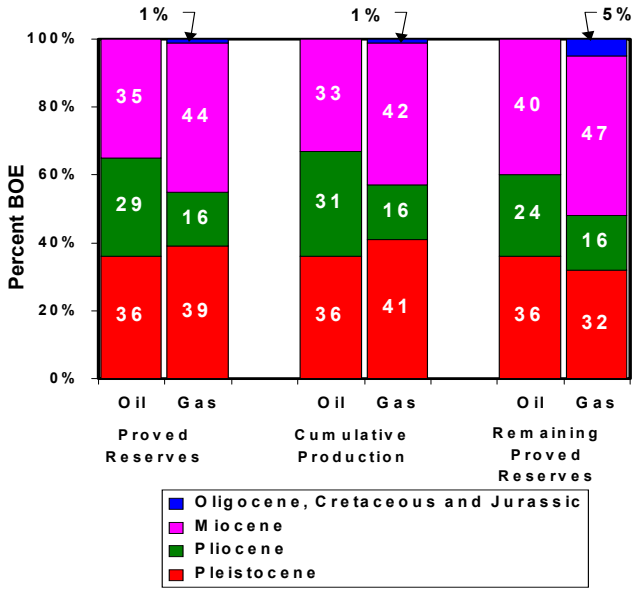

Figure 14. Distribution of reserves and production data by geologic age.

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. 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.

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, 2,073 exploratory wells were drilled and 146 proved fields discovered. The tenth largest 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 274 proved fields. The largest field in the Gulf of Mexico, EI 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

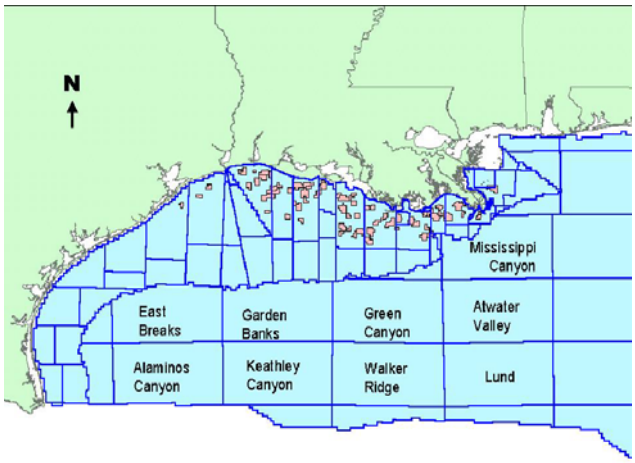

Figure 15. Location of proved fields discovered 1947-1959, Gulf of Mexico OCS.

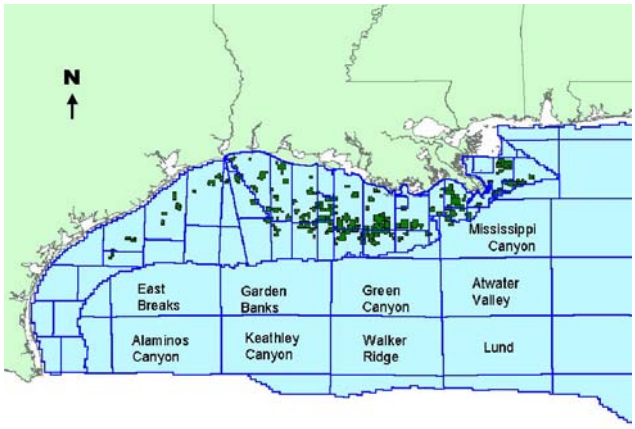

Figure 16. Location of proved fields discovered 1960-1969, Gulf of Mexico OCS.

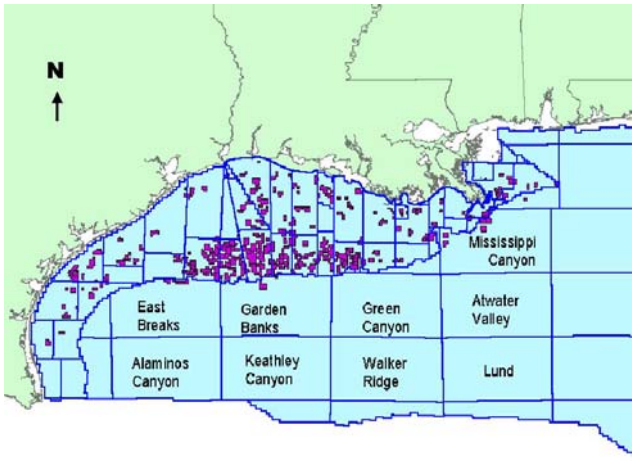

Figure 17. Location of proved fields discovered 1970-1979, Gulf of Mexico OCS.

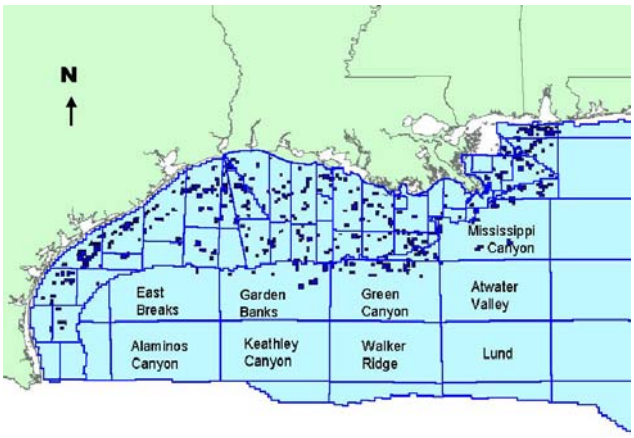

Figure 18. Location of proved fields discovered 1980-1989, Gulf of Mexico OCS.

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, 4,032 exploration wells were drilled, resulting in the discovery of 351 proved fields (21 were discovered in water depths greater than 1,000 ft).

From 1990 to 1999 (figure 19), 3,843 exploration wells were drilled, resulting in the discovery of 165 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

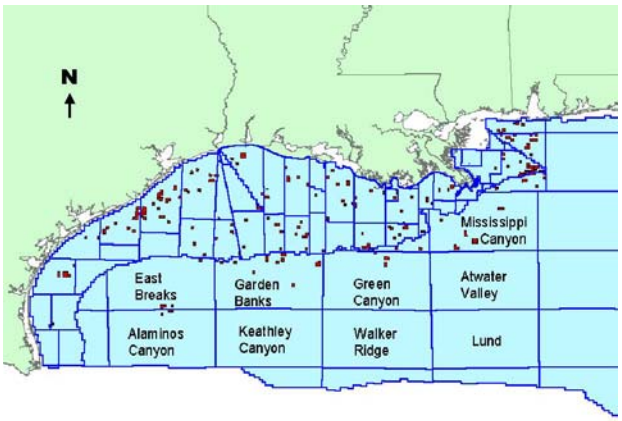

Figure 19. Location of proved fields discovered 1990-1999, Gulf of Mexico OCS.

exploration and field development. This has also allowed for exploration of new plays, such as the *Subsalt Play*. Reserve estimates for individual fields discovered in the 1990's are generally conservative and will experience significant reserves appreciation.

Figure 20 shows annual field discoveries by geologic age for the 1,003 proved fields. Figure 21 shows annual field discoveries of proved reserves by geologic age for the 1,003 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 reserves. Technological advances in seismic data and

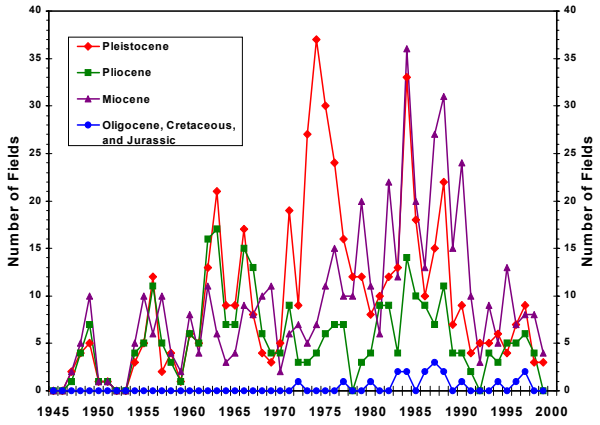

Figure 20. Annual number of field discoveries by geologic age, 1,003 proved fields.

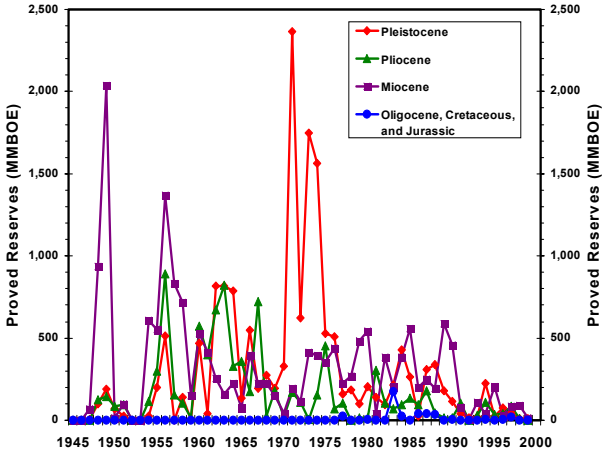

Figure 21. Annual discoveries of proved reserves by geologic age, 1,003 proved fields.

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. Completing an evaluation of the 1990's is premature, but the large discoveries in Pleistocene, Pliocene, and Miocene deepwater reservoirs will surely play a major role in future production. The MMS OCS Report MMS 2000-022, ***Deepwater Gulf of Mexico: America's Emerging Frontier***, available on the GOM Region's Internet homepage, provides a detailed report of 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 1,003 proved fields is shown in figure 23(a). Of the 1,003 proved oil and gas fields, there are 178 proved oil fields represented in figure 24(a) and 825 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 60 unproved fields, is shown in figure 26(a). There are 28 unproved oil fields in figure 26(b) and 32 unproved gas fields in figure 26(c). Table 5 indicates 5 unproved active fields were not studied.

Analysis of the 1,003 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 178 proved oil fields is 3,071 SCF/STB. The GOR of the 28 unproved oil fields is 2,196 SCF/STB. The mean yield (condensate divided by gas) for the 825 proved gas fields is 20.5 barrels of condensate per million cubic feet (MMcf) of gas. The mean yield of the 32 unproved gas fields is 27.1 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 1,003 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 25 largest fields. Fifty percent of the proved reserves are contained in the 78 largest fields. Ninety percent of the proved reserves are contained in the 368 largest fields.

Figure 29 shows the distribution of the number of fields and proved reserves by water depth. 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 (DWRRA). Proved reserves, reported in million barrels of oil equivalent (MMBOE), are associated with the 1,003 proved fields. The 60 unproved active fields are presented to show current interest and development. Sixty-four 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 88 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 few fields. The mean

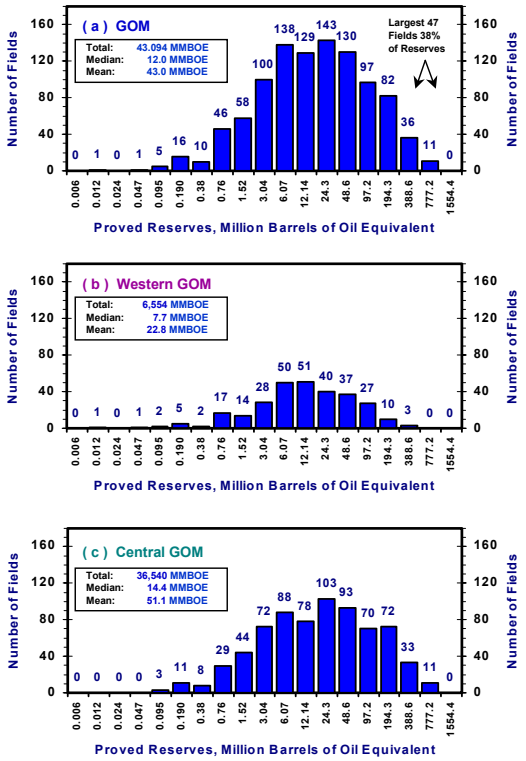

Figure 23. Field-size distribution of proved fields: (a) 1,003 fields, GOM; (b) 288 fields, Western GOM; (c) 715 fields, Central and Eastern GOM.

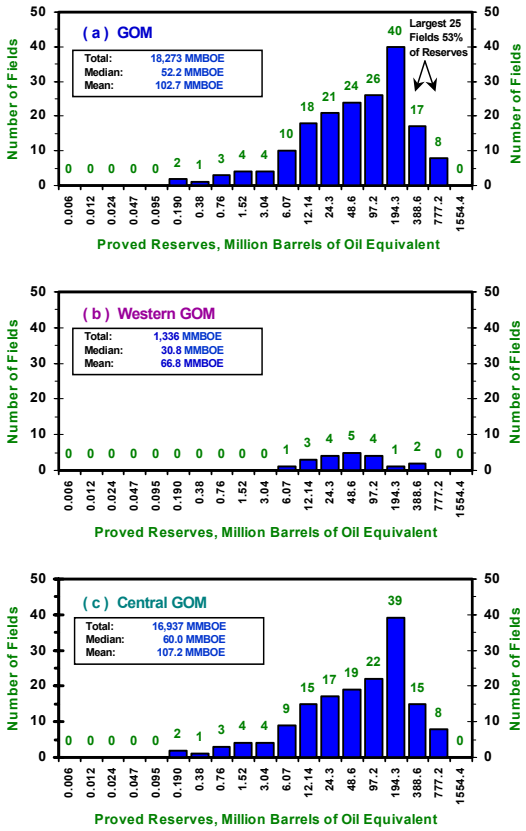

Figure 24. Field-size distribution of proved oil fields: (a) 178 fields, GOM; (b) 20 fields, Western GOM; (c) 158 fields, Central GOM.

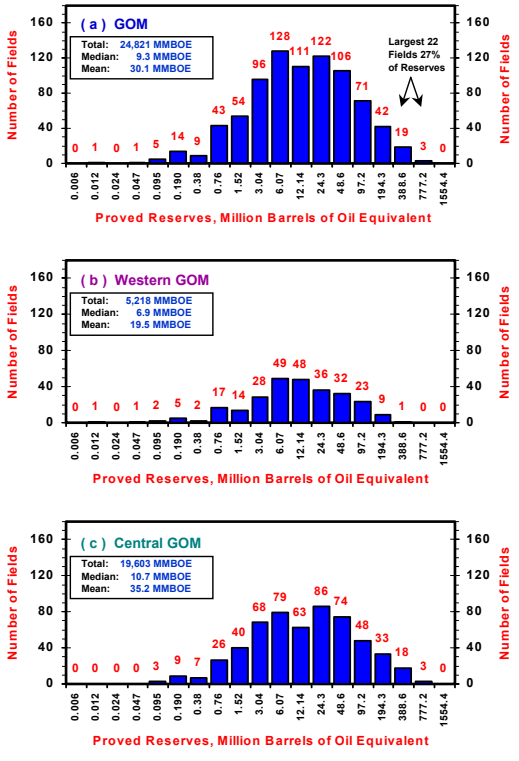

Figure 25. Field-size distribution of proved gas fields: (a) 825 fields, GOM; (b) 268 fields, Western GOM; (c) 557 fields, Central and Eastern GOM.

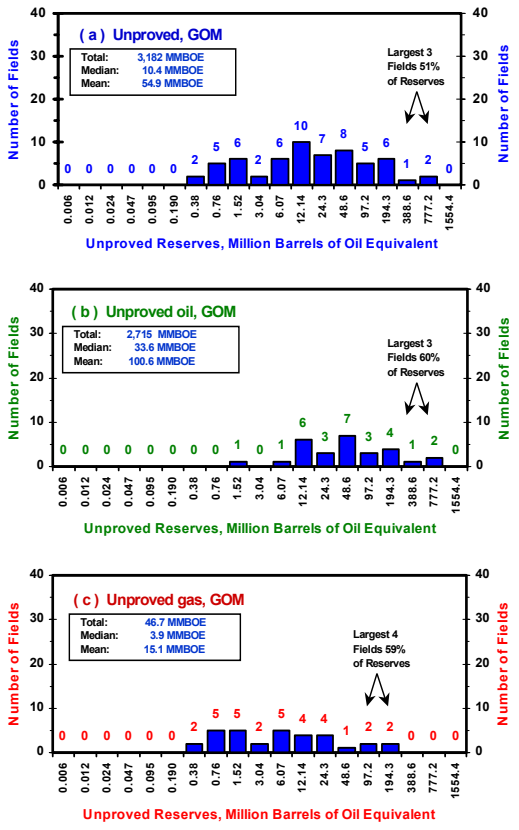

Figure 26. Field-size distribution of unproved fields: (a) 60 fields, GOM; (b) 28 oil fields, GOM; (c) 32 gas fields, GOM.

Description of Fields	Figure Number	Median *	Mean *	Largest Fields	
				Number	Reserves
1,003 Proved	Fig. 23a	12.0	43.0	47	38 %
178 Proved Oil	Fig. 24a	52.2	102.7	25	53 %
825 Proved Gas	Fig. 25a	9.3	30.1	22	27 %
60 Unproved	Fig. 26a	10.4	54.9	3	51 %
28 Unproved Oil	Fig. 26b	33.6	100.6	3	60 %
32 Unproved Gas	Fig. 26c	3.9	15.1	3	59 %
* Million barrels of oil equivalent (MMBOE)					

Figure 27.—GOM field–size distribution.

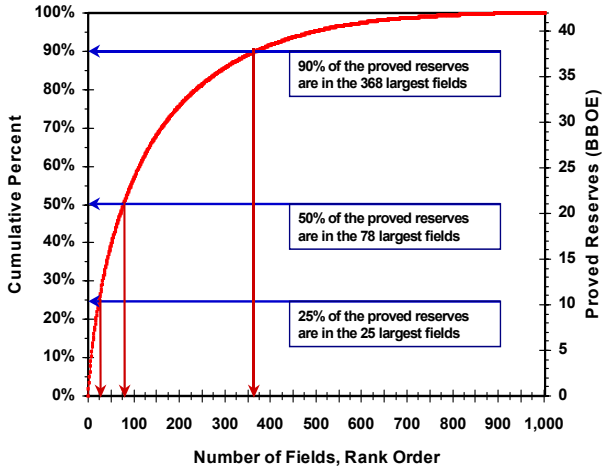

Figure 28. Cumulative percent total reserves versus rank order of field size for 1,003 proved fields.

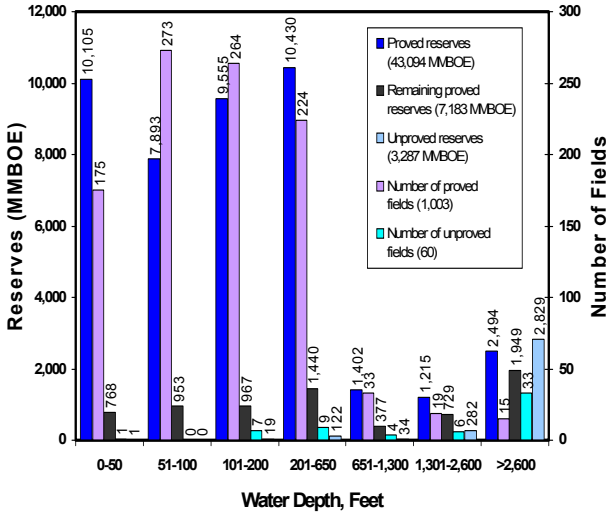

Figure 29.—Field and reserves distribution by water depth.

proved reserves per proved field in the Gulf of Mexico is 43.0 MMBOE. For fields in water depths between 651 and 1,300 ft, the mean proved reserves per proved field is 42.5 MMBOE. For fields in water depths greater than 1,300 ft, the mean proved reserves per proved field is 109.1 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. Fifteen of the twenty top fields lie in water depths of greater than 1,300 ft and account for 32 percent of the remaining proved reserves in the Gulf of Mexico.

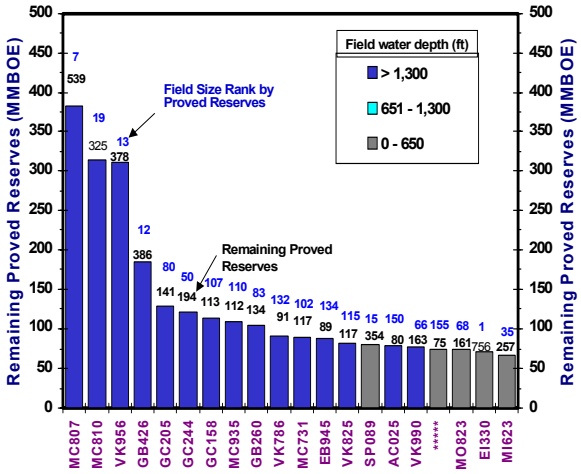

Figure 30. Largest 20 fields ranked by remaining proved reserves. (Note: ** indicates the field is proprietary)**

Estimates of proved reserves on the slope are increasing. This trend is expected to continue in the future due to additional exploration and development. Of the 67 proved fields in water depths greater than 650 ft, 59 are producing, 4 are depleted, and 4 are undeveloped. Included in these totals are 5 new proved fields containing proved reserves of 199 MMBOE. There are 49 unproved active fields in water depths greater than 650 feet. These fields contain 3,147 MMBOE of estimated unproved reserves, representing 76 percent of the Gulf of Mexico total.

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 is 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 1999, and remaining proved reserves are presented. If a new field was discovered in 1998 or 1999, the name is replaced with an asterisk to preserve the proprietary nature of the data. There were 33 new fields proved in 1999, 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 1,003 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 1,671 proved combination reservoirs. The median is 1.1 MMBOE and the mean is 3.5 MMBOE. The GOR for the oil portion of the reservoirs is 1,367 SCF/STB, and the yield for the gas cap is 23.0 barrels of condensate per MMcf of gas.

Figure 32 shows the reservoir-size distribution, on the basis of proved oil, for 7,342 proved undersaturated oil reservoirs. The median is 0.3 MMbbl, the mean is 1.3 MMbbl, and the GOR is 1,425 SCF/STB.

Figure 33 shows the reservoir-size distribution, on the basis of proved gas, for 13,703 proved nonassociated gas reservoirs. The median is 2.7 billion cubic feet (Bcf) of gas, the mean is 9.8 Bcf, and the yield is 11.4 barrels of condensate per MMcf of gas.

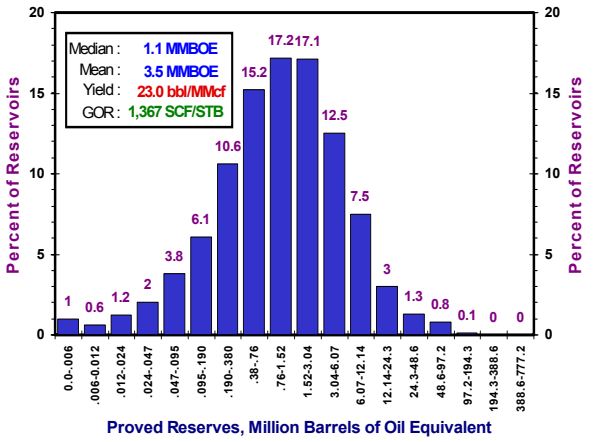

Figure 31. Reservoir-size distribution, 1,671 proved combination reservoirs.

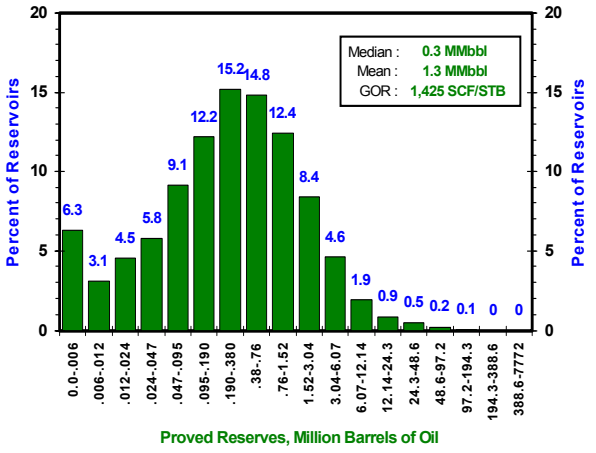

Figure 32. Reservoir-size distribution, 7,342 proved oil reservoirs.

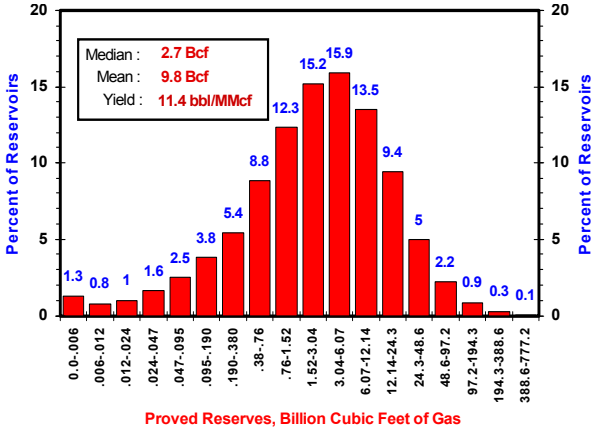

Figure 33. Reservoir-size distribution, 13,703 proved gas reservoirs.

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 1999			Remaining proved reserves		
							Oil (MMbbl)	Gas (Bcf)	BOE (MMbbl)	Oil (MMbbl)	Gas (Bcf)	BOE (MMbbl)	Oil (MMbbl)	Gas (Bcf)	BOE (MMbbl)
1	EI 330	-	1971	246	O	4,650	414.1	1,925.3	756.6	381.0	1,707.8	684.9	33.1	217.5	71.8
2	WD 030	-	1949	49	O	1,520	563.6	856.5	716.0	531.1	784.4	670.7	32.5	72.0	45.3
3	GI 043	-	1956	139	O	4,301	364.4	1,567.5	643.4	346.8	1,446.4	604.2	17.7	121.1	39.2
4	BM 002	-	1949	50	O	1,064	516.6	549.9	614.4	501.9	505.7	591.9	14.7	44.2	22.5
5	VR 014	-	1956	26	G	63,538	49.1	3,119.9	604.3	47.4	2,981.8	578.0	1.7	138.2	26.3
6	TS 000	-	1958	13	G	86,373	36.7	3,168.3	600.4	36.1	3,103.8	588.3	0.6	64.5	12.1
7	MC 807	-	1989	2,992	O	1,013	456.3	462.4	538.6	132.2	136.3	156.5	324.1	326.1	382.1
8	MP 041	-	1956	42	O	5,827	243.5	1,418.9	495.9	232.2	1,314.4	466.1	11.3	104.5	29.9
9	VR 039	-	1948	38	G	83,429	30.8	2,568.4	487.8	30.0	2,433.6	463.0	0.8	134.8	24.8
10	SS 208	-	1960	105	O	6,144	212.4	1,304.7	444.5	201.9	1,215.8	418.2	10.5	88.9	26.3
11	WD 073	-	1962	177	O	2,451	272.6	668.2	391.5	245.1	532.6	339.8	27.5	135.6	51.7
12	GB 426	-	1987	2,863	O	4,051	224.4	909.1	386.2	133.6	383.0	201.8	90.8	526.1	184.4
13	VK 956	-	1985	3,243	O	5,818	185.7	1,080.1	377.8	34.3	185.2	67.2	151.4	894.9	310.6
14	GI 016	-	1948	53	O	1,271	294.9	374.9	361.7	289.9	363.1	354.5	5.1	11.8	7.2
15	SP 089	-	1969	424	O	4,901	189.2	927.5	354.3	169.6	582.2	273.2	19.7	345.3	81.1
16	SP 061	-	1967	220	O	1,912	254.6	486.8	341.2	239.5	456.3	320.7	15.0	30.5	20.5
17	ST 172	-	1962	98	G	162,827	11.0	1,794.7	330.4	9.6	1,708.2	313.6	1.4	86.5	16.8
18	EI 238	-	1964	147	G	18,583	76.0	1,411.5	327.1	63.8	1,200.5	277.4	12.2	211.1	49.7
19	MC 810	-	1990	3,877	O	2,030	239.1	485.3	325.4	8.5	14.0	11.0	230.6	471.2	314.4
20	ST 021	-	1957	46	O	1,661	247.2	410.6	320.2	236.4	378.0	303.7	10.7	32.6	16.6
21	SM 048	-	1961	100	G	55,895	28.1	1,572.3	307.9	26.4	1,442.8	283.1	1.8	129.5	24.8
22	WC 180	-	1961	48	G	154,284	10.7	1,657.2	305.6	10.2	1,603.9	295.6	0.5	53.3	10.0
23	EI 292	-	1964	211	G	87,691	18.3	1,605.4	304.0	16.0	1,539.6	290.0	2.3	65.7	14.0
24	MC 194	-	1975	1,023	O	3,670	183.3	672.7	303.0	164.6	519.1	257.0	18.7	153.6	46.0
25	EC 271	-	1971	171	G	19,253	67.8	1,304.5	299.9	63.1	1,233.7	282.6	4.7	70.8	17.3
26	SS 176	-	1956	100	G	20,750	61.7	1,280.6	289.6	58.3	1,226.5	276.6	3.4	54.2	13.0
27	SP 027	-	1954	63	O	5,099	151.5	772.7	289.0	145.7	718.7	273.6	5.8	53.9	15.4
28	EC 064	-	1957	49	G	59,092	24.9	1,469.7	286.4	24.0	1,433.8	279.2	0.8	35.9	7.2
29	WC 587	-	1971	211	G	117,515	12.9	1,519.1	283.2	12.1	1,432.1	266.9	0.8	87.0	16.3
30	SS 169	-	1960	63	O	5,263	144.5	760.7	279.9	131.6	716.8	259.2	12.9	43.9	20.7
31	WD 079	-	1966	125	O	3,806	162.9	620.2	273.3	158.0	600.1	264.8	4.9	20.1	8.5
32	EI 296	-	1971	214	G	67,196	20.8	1,397.8	269.5	20.1	1,372.6	264.3	0.7	25.1	5.2
33	ST 176	-	1963	127	G	13,510	78.2	1,056.8	266.3	73.1	993.3	249.9	5.1	63.5	16.4
34	ST 135	-	1956	130	O	3,423	164.5	563.2	264.7	156.0	481.5	241.7	8.5	81.7	23.0
35	MI 623	-	1980	83	G	94,213	14.5	1,362.1	256.8	10.7	1,008.8	190.2	3.7	353.4	66.6
36	HI 573A	-	1973	338	O	8,208	104.2	855.5	256.5	98.1	805.4	241.5	6.1	50.1	15.0
37	SM 023	-	1960	82	G	38,786	29.2	1,131.3	230.5	27.9	1,055.9	215.8	1.2	75.4	14.7
38	SP 078	-	1972	204	G	11,873	73.9	877.2	230.0	60.2	778.8	198.8	13.7	98.3	31.2
39	SM 066	-	1963	124	G	253,410	4.9	1,233.9	224.4	4.7	1,192.0	216.8	0.1	41.9	7.6
40	SM 130	-	1973	215	O	1,369	180.4	247.0	224.3	173.8	227.9	214.3	6.6	19.1	10.0
41	GI 047	-	1955	88	O	3,561	137.0	488.0	223.9	132.3	471.2	216.2	4.7	16.9	7.7
42	WC 192	-	1954	57	G	61,925	18.6	1,150.1	223.2	17.7	1,094.8	212.5	0.9	55.4	10.7
43	PL 020	-	1951	31	O	5,590	109.0	609.2	217.4	99.2	544.3	196.1	9.8	64.9	21.3
44	VR 076	-	1949	32	G	173,708	6.8	1,181.4	217.0	4.9	1,088.4	198.5	1.9	93.1	18.5
45	SS 222	-	1966	142	G	12,515	67.1	839.8	216.5	62.2	803.1	205.1	4.9	36.7	11.4
46	SS 113	-	1955	41	O	4,063	113.9	462.9	196.3	109.9	435.0	187.3	4.0	27.9	9.0
47	EI 032	-	1949	12	G	17,121	48.0	822.6	194.4	41.8	794.9	183.3	6.2	27.6	11.1
48	EI 266	-	1962	161	G	121,368	8.6	1,040.8	193.8	5.3	946.1	173.6	3.3	94.7	20.2
49	WC 071	-	1955	40	G	55,597	17.8	989.0	193.8	17.2	970.3	189.9	0.6	18.7	3.9
50	GC 244	-	1994	2,681	O	1,957	143.6	281.0	193.6	54.8	105.0	73.4	88.8	176.0	120.1

Production Rates and Discovery Trends

The mean daily production in the Gulf of Mexico OCS during 1999 was 1,127,000 bbl of crude oil, 161,000 bbl of gas condensate, 2.15 Bcf of casinghead gas, and 11.43 Bcf of gas-well gas. The mean GOR of oil wells was 1,907 SCF/STB, and the mean yield from gas wells was 14.09 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 1999. Since the number of completions within a given range changes from month to month, the completion numbers presented are means of the 1999 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 October. The highest reported monthly gas production volume was from a Miocene reservoir with a subsea depth of 15,395 ft, during the month of April. The mean number of oil completions producing more than 1,000 bbl per day was 168, and the mean number of gas completions producing more than 10 MMcf per day was 292.

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, and 350 to 356 MMbbl per year from 1984 through 1986. From 1986 through 1990, annual oil production declined 23 percent. From 1990 through 1999, annual oil production rose from 275 MMbbl to 494 MMbbl, an 80 percent increase. Annual gas production reached 4.9 Tcf per year in 1981 and 1990.

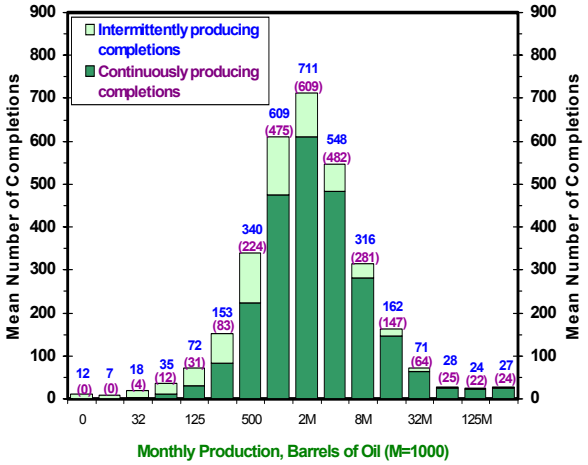

Figure 34. Monthly distribution of oil production, 3,133 completions, (2,483 continuously producing completions).

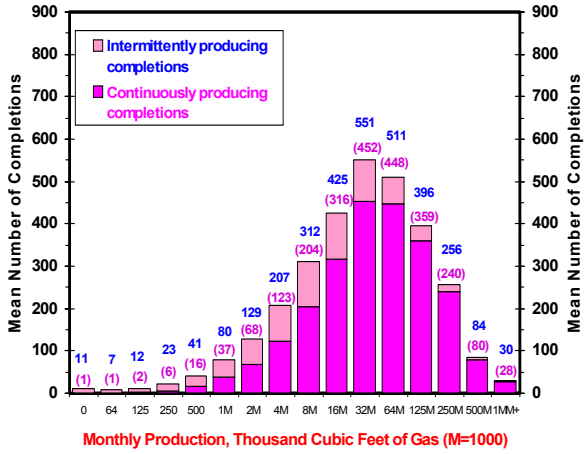

Figure 35. Monthly distribution of gas production, 3,075 completions, (2,381 continuously producing completions).

1999	Oil	Gas
Mean Number of Producing Completions	3,133	3,075
Mean Number of Continuously Producing Completions	2,483	2,381
Highest Monthly Mean Number of Producing Completions	3,159 (March)	3,103 (February)
Lowest Monthly Mean Number of Producing Completions	3,108 (September)	3,020 (October)
Mean Production	10,940 bbl (360 bbl per day)	113 MMcf (3.7 MMcf per day)
Median Production	2,715 bbl (97 bbl per day)	46.5 MMcf (1.5 MMcf per day)
Highest Producing Rate for a Completion	1,120,400 bbl (36,142 bbl per day)	3,407 MMcf (113.6 MMcf per day)

Figure 36. Monthly completion and production data.

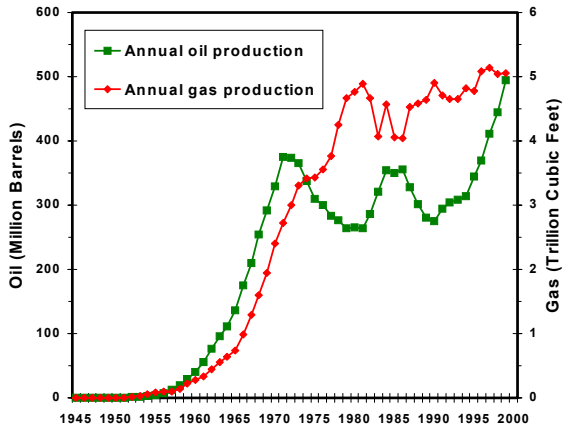

Figure 37. Annual oil and gas production.

From 1990 through 1993, gas production declined 6 percent. From 1993 through 1999, annual gas production rose from 4.6 Tcf to a peak of 5.1 Tcf in 1997, an 11 percent increase.

Figure 38 presents proved reserves, cumulative production, and remaining proved reserves in BBOE as of December 31, 1999, 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 that fields discovered after 1983, with the exception of 1988, are less than 50 percent depleted. The current trend is showing that overall field sizes are decreasing.

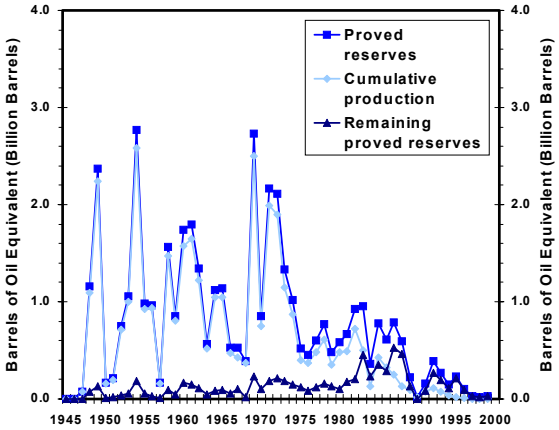

Figure 38. Proved reserves and production by field discovery year.

Figure 39 is a plot of the number of proved gas and oil fields by discovery year. Linear regressions indicate the annual number of gas fields discovered has been steadily increasing, while 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. The shift from oil to gas emphasis was fueled by several factors, including optimism concerning higher anticipated gas prices, realization of the inevitable decline in the size of oil fields being discovered, and the introduction of new seismic technologies that dramatically lowered the risk in identifying gas reservoirs (Lore, 1994).

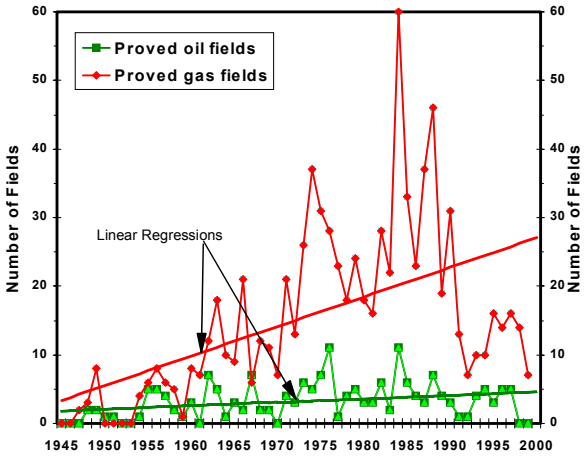

Figure 39. Annual number of proved oil and gas field discoveries.

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 in proved fields and reserves additions in 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 are moving into deeper water, and this trend is expected to continue.

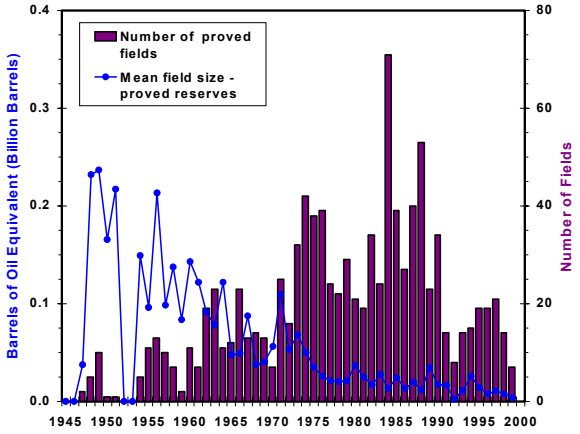

Figure 40. Number of proved fields and mean field size by field discovery year.

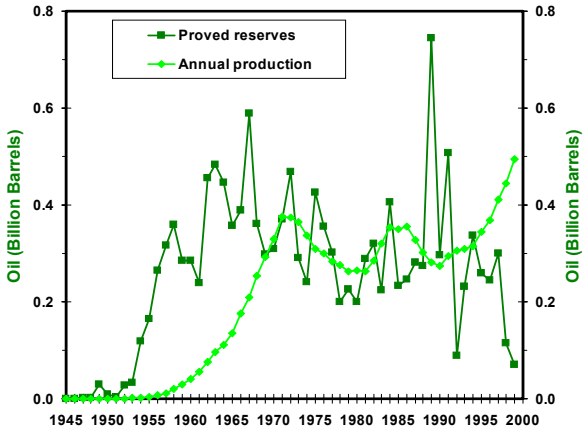

Figure 42. Proved oil reserves by reservoir discovery year and annual oil production.

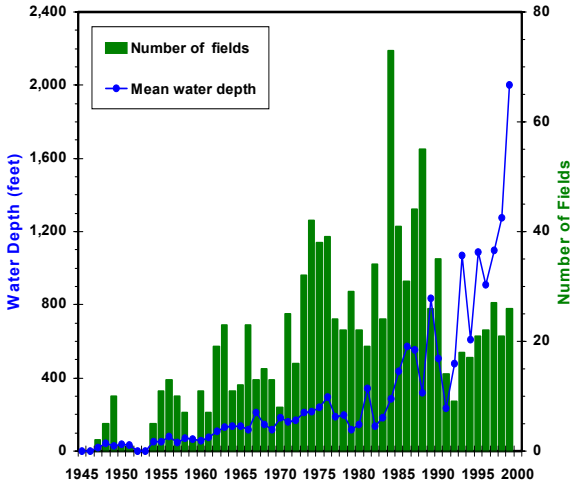

Figure 41. Number of fields and mean water depth by field discovery year.

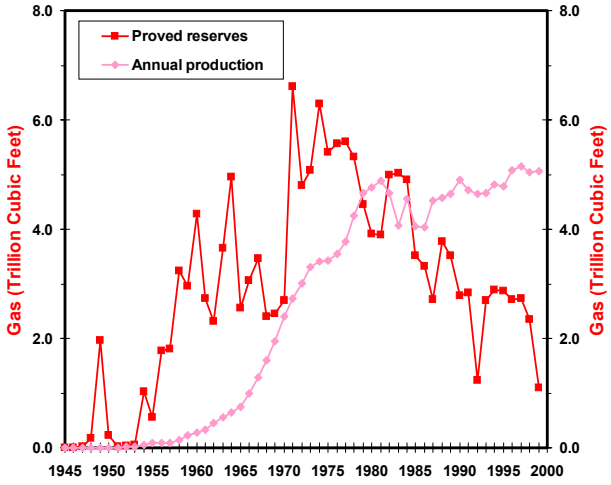

Figure 43. Proved gas reserves by reservoir discovery year and annual gas production.

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 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 is indicative of a decrease in energy prices.

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.

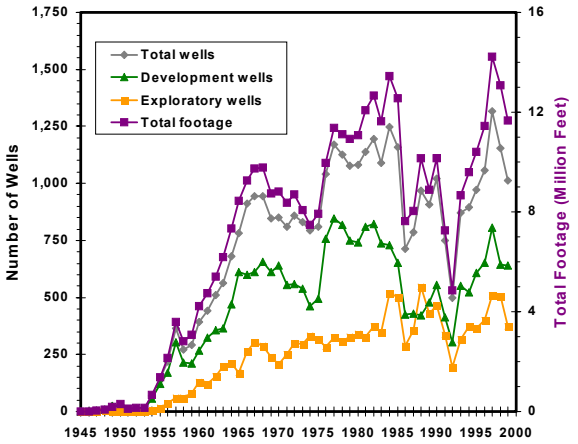

Figure 44. Wells and footage drilled.

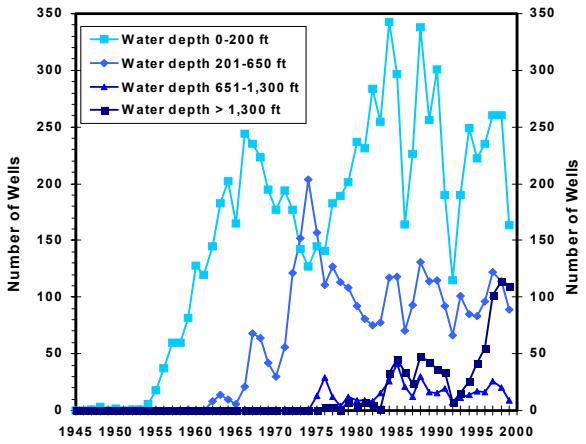

Figure 45. Number of exploratory wells drilled by water depth.

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, 1999) are shown in table 5. Recent proved field discoveries (7 oil fields and 25 gas fields) are summarized and tabulated as increases to proved reserves. For further clarification, recent field discoveries are identified as new fields added in the last year, even though some were discovered before 1999. 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 presented as changes because of revisions. Based on periodic reviews and revisions of field studies conducted since

Table 5. Summary and comparison of proved oil and gas reserves as of December 31, 1998, and December 31, 1999.

	Oil (billion bbl)		Gas (trillion cu ft)	
Proved reserves:				
Previous estimates, as of 12/31/98*	14.27		162.7	
Discoveries	+0.15		+1.3	
Revisions	-0.04		-2.6	
Adjustments	0.00		0.0	
Net change	**+0.11**		**-1.3**	
Estimate, as of 12/31/99 (this report)		**14.38**		**161.4**
Cumulative production:				
Previous estimates, as of 12/31/98*	10.91		132.7	
Adjustments	+0.00		+0.0	
Production during 1999	+0.49		+5.0	
Net change	**+0.49**		**+5.0**	
Estimate, as of 12/31/99 (this report)		**11.40**		**137.7**
Remaining proved reserves:				
Previous estimates, as of 12/31/98*	3.36		30.0	
Discoveries	+0.15		+1.3	
Revisions	-0.04		-2.6	
Adjustments	+0.00		-0.1	
Production during 1999	-0.49		-5.0	
Net change	**-0.38**		**-6.4**	
Estimate, as of 12/31/99 (this report)		**2.98**		**23.6**

*Crawford and others, 1999

the 1998 report, the revisions for proved oil and gas reserves have resulted in a net decrease. 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 1999 proved oil and gas discoveries, adjustments, and field revisions did not exceed production. The remaining proved oil and gas reserves have decreased since 1998.

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 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 condensate; "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	1,003	14.38	161.4	11.40	137.7	2.98	23.6

*Gas plant liquids dropped from reporting system.
†Basis of reserves changed from API demonstrated to SPE proved.

Conclusions

The 1,003 proved oil and gas fields in the federally regulated part of the Gulf of Mexico OCS contained proved reserves estimated to be 14.38 billion barrels of oil and 161.4 trillion cubic feet of gas. Remaining proved reserves, as of December 31, 1999, are estimated to be 2.98 billion barrels of oil and 23.6 trillion cubic feet of gas. Estimated remaining proved oil reserves have decreased 11 percent and estimated remaining proved gas reserves have decreased 21 percent from last year's report.

The 60 unproved oil and gas fields studied in the federally regulated part of the Gulf of Mexico OCS contained unproved reserves estimated to be 2.40 billion barrels of oil and 9.7 trillion cubic feet of gas. There are an additional 5 unproved active fields not included in this estimate. Included are unproved reserves of 2.01 billion barrels of oil and 6.2 trillion cubic feet of gas from 45 fields in water depths greater than 1,000 feet. Estimated unproved oil reserves are 4.8 times annual oil production, and estimated unproved gas reserves are 1.9 times greater than annual gas production. Estimated remaining proved reserves are expected to increase in future years because of significant moves of unproved reserves into the proved category.

Contributing Personnel

This report includes contributions from the following Gulf of Mexico Region, Office of Resource Evaluation, personnel.

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Notice

This report, *Estimated Oil and Gas Reserves, Gulf of Mexico, December 31,1999,* 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) 736-2950 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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