

UNITED STATES DEPARTMENT OF THE INTERIOR  
MINERALS MANAGEMENT SERVICE

Estimated Oil and Gas Reserves,  
Gulf of Mexico Outer Continental Shelf and Continental Slope,

December 31, 1982

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U. S. Geological Survey Open-File Report 83-122

1983

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ABSTRACT

Remaining recoverable reserves of oil\* and gas in the Gulf of Mexico Outer Continental Shelf and Continental Slope have been estimated to be about 2.98 billion barrels of oil and 39.8 trillion cubic feet of gas, as of December 31, 1982. These reserves are recoverable from 468 studied fields under the Federal submerged lands off the coasts of Louisiana and Texas. An additional 53 fields, discovered since December 31, 1980, have not been sufficiently developed to permit a reasonably accurate estimate of reserves.

Original recoverable reserves are estimated to have been 8.56 billion barrels of oil and 98.1 trillion cubic feet of gas from 484 fields in the same geographic area. Included in this number are 16 fields that are depleted and were abandoned; not included are the 53 insufficiently developed fields. Estimates were made for individual reservoirs in 382 fields and on a field-wide basis for the other 102 fields.

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

## INTRODUCTION

This report, which supersedes USGS Open-File Report 82-34 (Hewitt, Brooke, Knipmeyer, and Surcouf, 1982), presents estimates of original recoverable reserves, cumulative production, and estimates of remaining recoverable reserves as of December 31, 1982. The estimates of reserves for this report were completed in April 1983 and represent the combined efforts of engineers, geologists, and other personnel of the Minerals Management Service, Metairie, Louisiana.

As in previous reports (for example, Bryan and others, 1978), standard methods of estimating reserves were used, including volumetric calculations, decline curve analysis, material balance, and mathematical simulation.

### DEFINITION OF RESERVE AND RESOURCE TERMS

The reserve and resource terminology in this report conforms with Dolton and others (1981, p. 6-7). The quoted definitions of terms applicable to this report are:

"Resources.--Concentrations of naturally occurring liquid or gaseous hydrocarbons in the Earth's crust, some part of which is currently or potentially economically extractable."

"Measured reserves.--That part of the economic identified resource that is estimated from geologic evidence supported directly by engineering measurements. Measured reserves here are equivalent to proved reserves as defined by API (1976, p. 1)."

"Indicated reserves.--Reserves equivalent to API indicated additional reserves, that are defined as economic reserves in 'known productive reservoirs in existing fields expected to respond to improved recovery techniques such as

fluid injection where (a) an improved recovery technique has been installed but its effect cannot yet be fully evaluated; or (b) an improved technique has not been installed but knowledge of reservoir characteristics and the results of a known technique installed in a similar situation are available for use in the estimating procedure.' (API, 1976, p. 1, 2.)"

For this report other definitions used are:

Reserves.--That portion of the identified resource which can be economically extracted.

Demonstrated reserves.--A collective term for the sum of measured and indicated reserves.

Production data are the metered volumes of raw liquids and gas reported to Minerals Management Service by Federal lessees and operators. Oil volume measurements and reserves are corrected to reference standard conditions of 60° Fahrenheit and 14.696 psia (one atmosphere); gas measurements and reserves are corrected to 60°F and 15.025 psia. Continuously measured volumes from production platforms and/or leases are allocated to individual wells and reservoirs on the basis of periodic well test "gauges." This introduces approximations in both production and reserves data by reservoirs, limiting accuracy to two or three significant figures.

#### RESERVES AND RELATED DATA REPORTED BY AREA

On December 31, 1982, there were 521 active fields in the federally regulated part of the Gulf of Mexico as listed by the Minerals Management Service Gulf of Mexico Regional Field Names Committee. Of these, 468 were considered sufficiently developed to warrant estimation of reserves for this

study. Another 53 were not sufficiently developed to permit a reasonably accurate estimate of reserves; therefore, no estimates have been attempted. In addition to the 468 active fields, 16 depleted fields (abandoned after production) are reported herein. This makes a total of 484 fields for which oil and gas reserves were estimated. The 16 depleted fields are not included in the Regional Field Names Committee's 521 active fields, but are reported here in order to give a complete record of cumulative oil and gas production. For any field contained partly in State waters and partly in Federal waters, reserves are estimated for the Federal portion only.

Reserve data and various classifications of fields, leases, boreholes, and completions are presented as area totals in tables 1 and 2. The areas are those used by the Minerals Management Service for administrative purposes (fig. 1). Estimates of demonstrated reserves for all producing fields as well as all fields discovered prior to December 31, 1980, are presented as area totals in table 1. The 484 fields studied (468 active fields and 16 depleted fields) constitute the current listing in the Minerals Management Service Field and Reservoir Reserve Estimate (FRRE) data processing system. The 53 fields not sufficiently developed for study are not represented in the reserve data or in the FRRE files.

All Gulf of Mexico Outer Continental Shelf and Slope Federal leases as of December 31, 1982, are represented in table 2. The 2,087 active leases and 1,869 relinquished leases are each classified into two main groups, studied and not studied. Further subgrouping and definitions of the groups are shown below:

Studied Active.--Active leases associated with the 468 active studied fields presented in table 1.



Table 1.--Estimated demonstrated oil and gas reserves for 484 fields by area, Gulf of Mexico

Outer Continental Shelf and Slope, December 31, 1982

(Demonstrated reserves: the sum of measured and indicated reserves. Oil expressed in millions of barrels, gas in billions of cubic feet. "Oil" includes crude oil and condensate; "gas" includes associated and nonassociated gas. Remaining reserves estimated as of December 31, 1982.)

Area(s) (fig. 1)	Number of fields		Original recoverable reserves		Cumulative production through 1982		Remaining recoverable reserves	
	Studied Active	Not studied	Oil	Gas	Oil	Gas	Oil	Gas
Mustang Island and Padre Island.....	11	0	1	490	0	30	1	460
Matagorda Island.....	8	0	6	430	0	70	0	360
Brazos.....	10	2	9	900	2	400	3	500
Galveston.....	8	0	6	840	20	670	5	170
High Island.....	63	0	53	8,200	50	3,300	290	4,900
West Cameron and Sabine Pass.....	64	2	61	16,100	80	8,800	120	7,300
East Cameron.....	35	3	34	7,400	110	4,900	80	2,500
Vermilion.....	51	3	47	12,200	220	8,000	220	4,200
South Marsh Island.....	37	1	33	10,400	330	6,200	290	4,200
Eugene Island.....	51	1	45	12,800	770	8,500	490	4,300
Ship Shoal.....	37	1	33	9,200	670	5,900	250	3,300
South Timbalier and Bay Marchand...	19	1	18	4,600	880	3,100	190	1,500
South Pelto.....	5	0	5	410	60	240	30	170
Grand Isle.....	9	1	9	3,900	670	2,600	180	1,300
West Delta.....	16	0	16	4,000	860	2,700	230	1,300
South Pass.....	8	0	8	1,740	420	1,060	210	680
Main Pass, Breton Sound, and Chandeleur Area.....	23	1	18	2,700	410	1,800	230	900
Continental Slope*.....	13	0	4	1,810	30	60	160	1,750
Subtotal.....	468	16	411	98,120	5,582	58,330	2,979	39,790
Total.....	484	53	411	98,120	5,582	58,330	2,979	39,790

\*Continental Slope includes the following areas: Corpus Christi, East Breaks, Garden Banks, Green Canyon, Ewing Bank, Mississippi Canyon, and Viosca Knoll.

Table 2.--Status of leases, boreholes, and completions by area, Gulf of Mexico

Outer Continental Shelf and Slope, December 31, 1982

Area(s)	Number of leases studied		Number of leases not studied		Number of boreholes of Drilled Abandoned	Number of active completions
	Active Abandoned	Productible	Exploratory	Expired		
Mustang Island and Padre Island.....	17	0	1	55	92	105
Matagorda Island.....	19	0	3	36	17	57
Brazos.....	18	2	5	24	59	120
Galveston.....	19	1	1	34	208	166
High Island.....	133	7	5	60	195	653
West Cameron and Sabine Pass.....	173	22	7	109	145	807
East Cameron.....	84	11	3	29	149	548
Vermilion.....	126	11	4	42	134	717
South Marsh Island.....	84	12	2	25	59	615
Eugene Island.....	157	26	6	38	104	1,121
Ship Shoal.....	114	13	4	21	100	783
South Timbalier and Bay Marchand....	79	6	4	26	107	526
South Pelto.....	14	0	2	1	9	91
Grand Isle.....	48	4	4	5	36	398
West Delta.....	51	9	0	33	60	785
South Pass.....	40	2	3	7	18	429
Main Pass, Breton Sound, and Chandeleur Area.....	75	8	4	39	97	469
Continental Slope*.....	33	0	4	79	50	189
MAFLA**.....	0	0	0	78	96	29
Total.....	1,284	134	62	741	1,735	8,608
						20,534
						14,443

\*Continental Slope includes the following areas: Corpus Christi, East Breaks, Garden Banks, Green Canyon, Ewing Bank, Mississippi Canyon, and Viosca Knoll.

\*\*MAFLA includes the areas off the Mississippi, Alabama, and Florida coasts.

Studied Abandoned.--Leases relinquished after oil or gas production. The leases associated with the 16 depleted fields are represented here along with other relinquished leases that were once part of fields still active.

Not Studied Producing.--Leases associated with the 53 fields insufficiently developed for study. The leases have qualified as producing under OCS Order No. 4, Determination of Well Productivity, but have not established continuous production.

Not Studied Exploratory.--Active leases not yet qualified as producing or associated with any field.

Not Studied Expired.--Leases relinquished by the operator without ever having produced any oil or gas even though some were once qualified producing under OCS Order No. 4, Determination of Well Productivity.

Also shown in table 2 are the total number of boreholes drilled and the number of those boreholes that have been plugged and abandoned in accordance with OCS Order No. 3, Plugging and Abandonment of Wells. 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. The presence or absence of production or injection is not considered.

#### STUDIES CONDUCTED

Estimates for 382 of the 484 fields are based on studies of approximately 13,700 individual reservoirs. A volumetric estimate was made for each reservoir and, for many of the reservoirs, at least one other estimation method (for example, decline curve analysis) was used. The subsequent performances of the reservoirs are periodically compared to the original predictions, and revisions

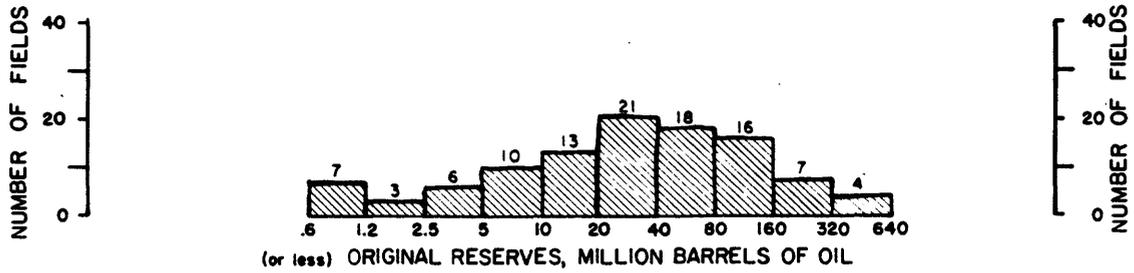
to these predictions are made as needed. Reserve estimates for the remaining 102 fields in the FRRE system were made on a field-wide basis from production studies or, for nonproducing fields, from volumetric estimates.

Each abandoned field that had production has been assigned a value for original recoverable hydrocarbons equal to the amount actually produced.

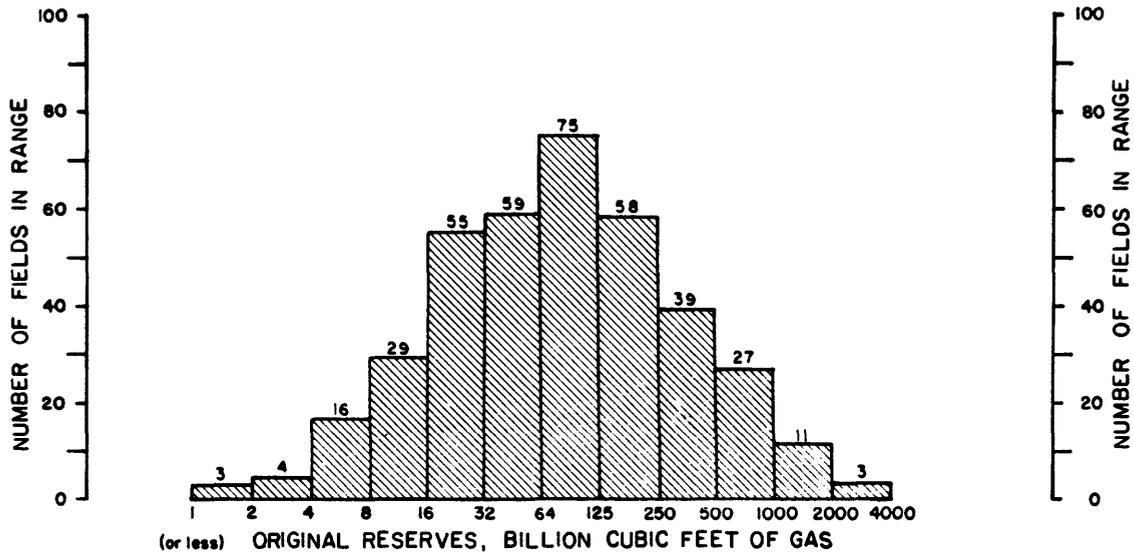
### FIELD-SIZE DISTRIBUTION

The distribution of the various sizes of recoverable field reserve is shown in figures 2, 3, and 4. Figure 2 shows the field-size distribution of the original recoverable oil reserves for the 105 fields primarily producing oil and figure 3 shows the field-size distribution of original recoverable gas reserves for the 379 fields primarily producing gas. Figure 4 shows the field-size distribution of the total original recoverable hydrocarbon reserves for the 484 fields included in this report. A geometric progression was selected for the horizontal scales in consideration of the log-normal type of distribution.

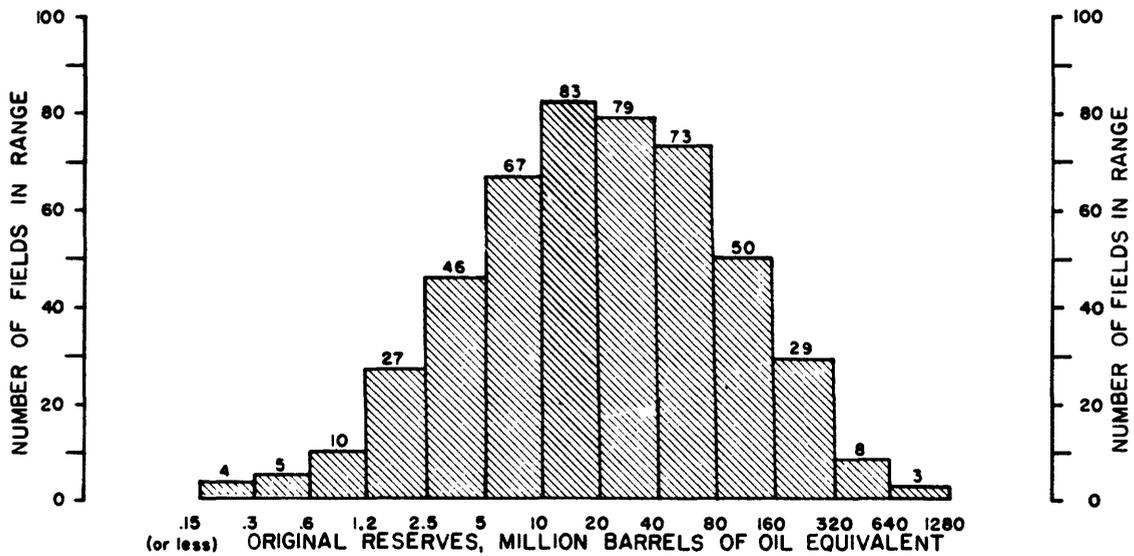
Figure 2 illustrates that the median (exceeded by 50 percent of the fields) is 29 million barrels of oil and the mean (weighted average) is 66 million barrels of oil. The petroleum industry commonly rates oil fields having original recoverable reserves of 100 million barrels or more as "major oil fields." Of the oil fields considered in this report, 21 contained 100 million barrels or more, accounting for 64 percent of the total original recoverable reserves contained in the 105 fields. Among the 379 gas fields (fig. 3), the median is 82 billion cubic feet of gas and the mean is 204 billion cubic feet of gas. The largest 41 gas fields contained 53 percent of the total recoverable gas reserves.



**Figure 2. Field-size distribution  
105 Oil Fields**



**Figure 3. Field-size distribution  
379 Gas Fields**



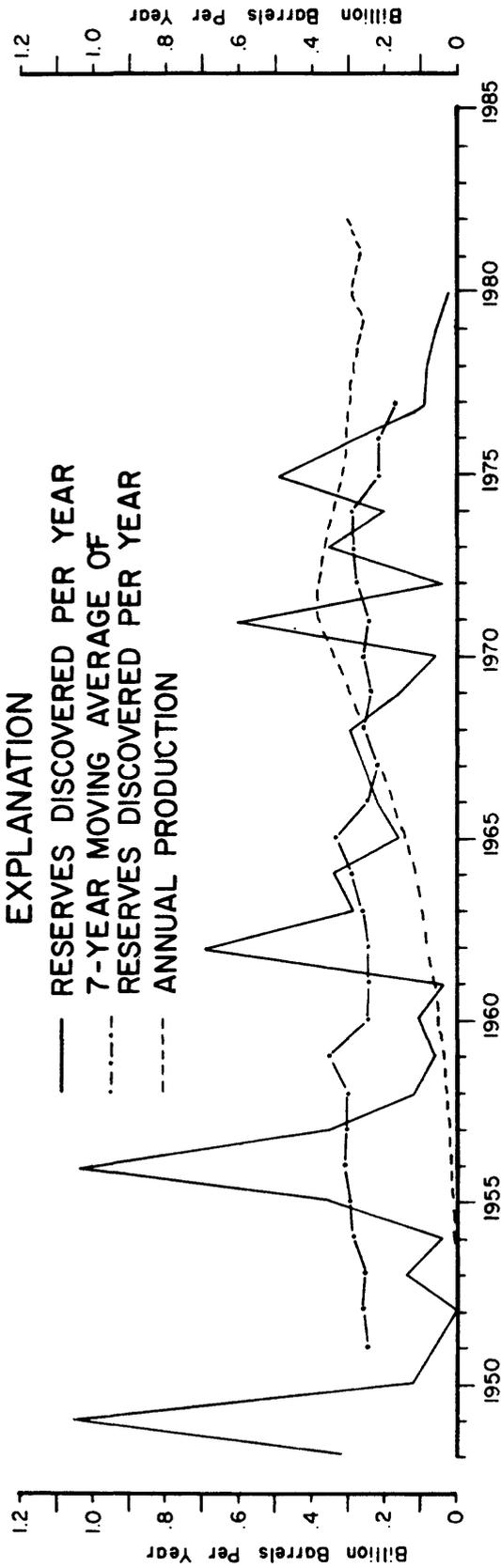
**Figure 4. Field-size distribution  
484 Fields**

Figure 4 shows, combined, the field-size distribution of the original recoverable hydrocarbon reserves of the 484 fields. For the convenience of comparison, gas reserves are expressed in terms of barrels of oil equivalent (BOE) and added to the liquid reserves expressed in barrels. Based on the heating values of average Gulf of Mexico OCS hydrocarbons, a conversion factor of 5,400 standard cubic feet of gas equals one BOE was utilized. The median field reserve is 20 million BOE and the mean is 55 million BOE. Ten percent of the fields (the largest 48 fields) contained 51 percent of the total recoverable hydrocarbon reserves.

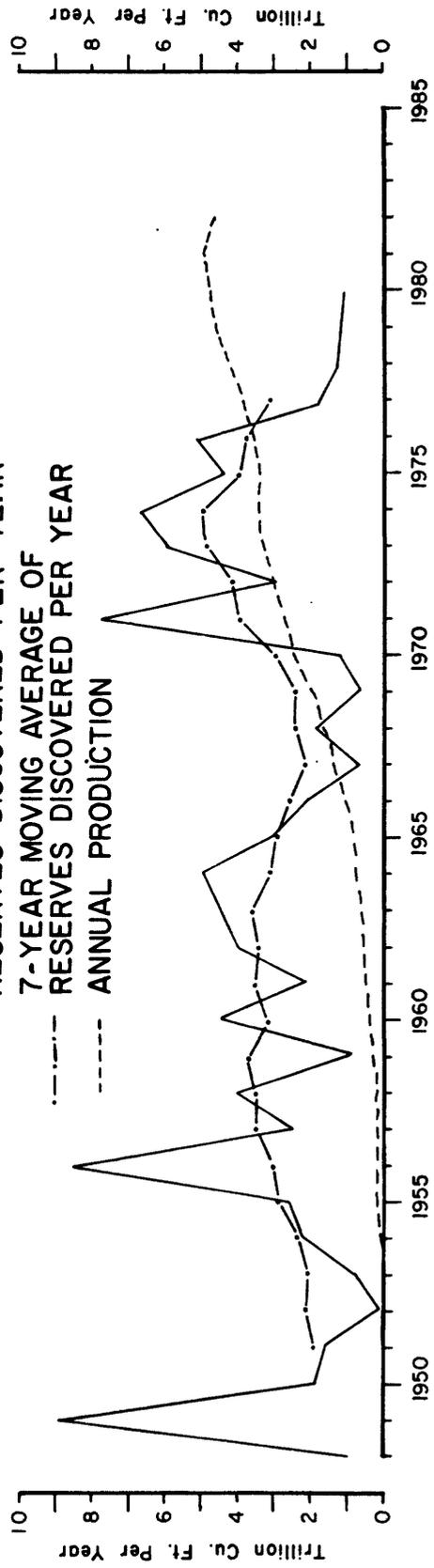
#### RESERVES DISCOVERED EACH YEAR, DISCOVERY TRENDS, AND ANNUAL PRODUCTION

Figures 5 and 6 show the reserves of oil and gas, respectively, discovered each year in the Gulf of Mexico Outer Continental Shelf. The year of discovery assigned to a field is the year in which the first well encountering significant hydrocarbons in that field was drilled. This date may differ from the year in which the field discovery was announced. The total field reserves, as currently estimated, are allocated to the year of discovery and combined for plotting. As a field develops, the total field reserves as originally estimated may subsequently change. This will be reflected by new totals at the field's discovery date. The annual discovery curves have been replotted to reflect new discoveries and annual revisions terminating with fields discovered prior to December 31, 1980. Data for 1979 and 1980 are presented, but are probably too recent to permit a lasting assessment of the reserves discovered in those years.

Superimposed on each plot of yearly discoveries is a line depicting the 7-year moving average, which better indicates the overall trend by



**Figure 5 --- Oil Reserves Discovered And Oil Production**



**Figure 6 --- Gas Reserves Discovered And Gas Production**

EXPLANATION

- CRUDE OIL ANNUAL PRODUCTION
- - - NONASSOCIATED GAS ANNUAL PRODUCTION

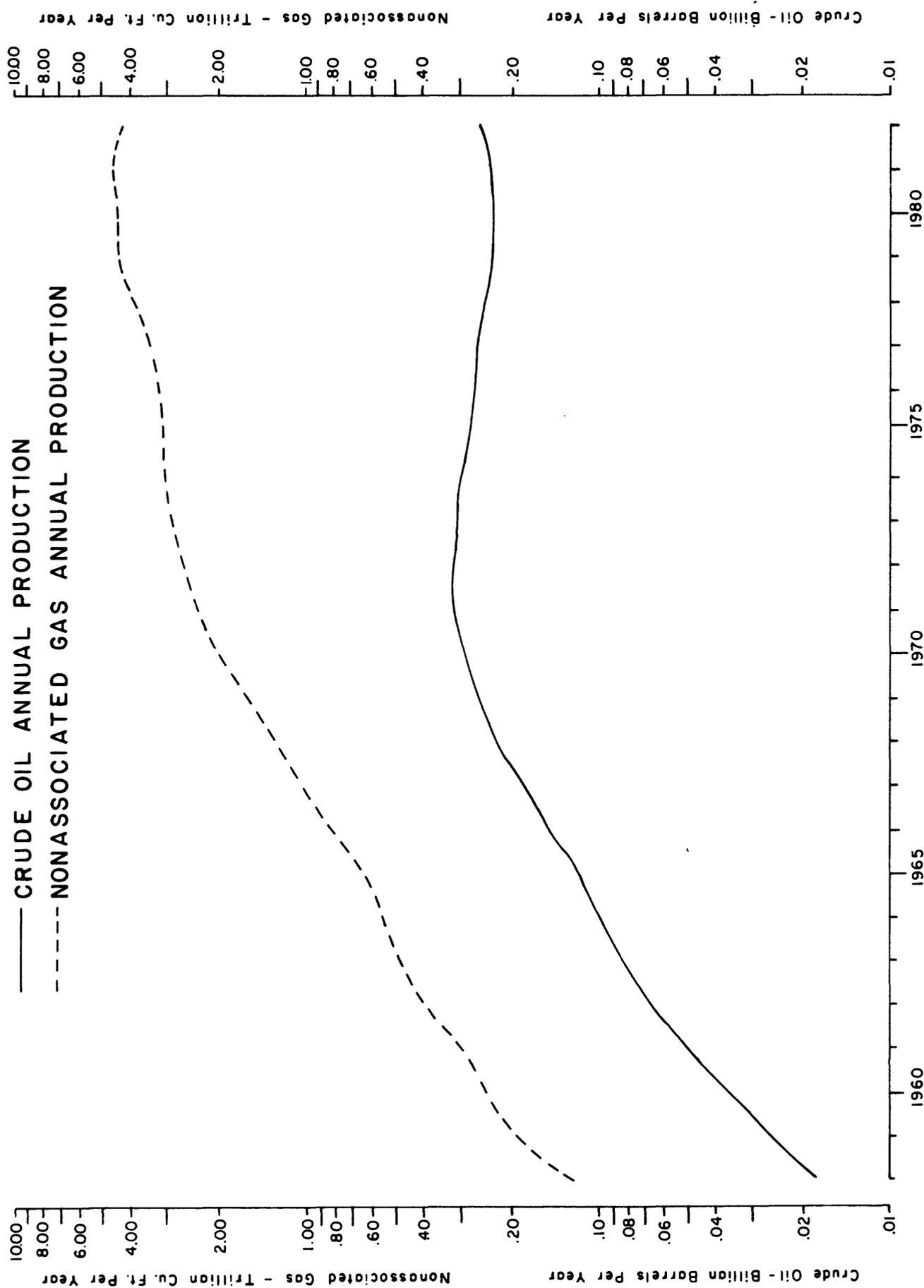


Figure 7 -- Crude Oil And Nonassociated Gas Production

smoothing out the peaks. The average presented is the total of the hydrocarbons discovered in a 7-year period divided by seven and plotted for each middle year.

For comparison with the rate of discoveries, the annual production of oil and gas is also shown. The annual oil production (fig. 5) has exceeded the 7-year moving average of discoveries every year since 1967. The annual gas production (fig. 6) exceeded the 7-year moving average of gas discoveries for the first time in 1977. All data presented in figure 5 include crude oil and condensate, and all data presented in figure 6 include associated and nonassociated gas.

Annual production of crude oil and nonassociated gas (gas-well gas) is shown in figure 7 with production volumes plotted on logarithmic scales. The annual crude oil production reached a peak of 0.32 billion barrels in 1972 and has decreased every year since, except for the two years of 1980 and 1982. The 1980 production was only a slight increase over the previous year, but the 1982 increase was significant. The annual crude oil production in 1982 was the highest production since 1976. However, the annual nonassociated gas production decreased for the first time in 1982, establishing the 1981 production of 4.5 trillion cubic feet as the highest annual nonassociated gas production to date.

#### SUMMARY

A summary of reserve estimate changes during the year and comparisons with the estimates as of December 31, 1981, are shown in table 3. The increase of original recoverable reserves resulting from new field discoveries (5 oil fields and 23 gas fields) is summarized and tabulated as

Table 3.--Summary and comparison of oil and gas reserves as of December 31, 1981, and December 31, 1982

	<u>Oil</u> (billion bbl)	<u>Gas</u> (trillion cu ft)
<u>Original recoverable reserves:</u>		
Previous est., as of 12/31/81 (Hewitt and others, 1982).....	8.17	93.4
Discoveries.....	+0.04	+0.9
Revisions.....	+0.33	+3.8
Adjustments.....	<u>+0.02</u>	<u>0.0</u>
Net change.....	+0.39	+ 4.7
Estimate, as of 12/31/82 (this report).....	<u><u>8.56</u></u>	<u><u>98.1</u></u>
 <u>Cumulative production:</u>		
Through 1981 (Hewitt and others, 1982).....	5.27	53.6
Adjustments.....	<u>+0.02</u>	<u>0.0</u>
Through 1981 (corrected).....	5.29	53.6
Production during 1982 (preliminary).....	<u>+0.29</u>	<u>+ 4.7</u>
Through 1982 (this report).....	<u><u>5.58</u></u>	<u><u>58.3</u></u>
 <u>Remaining recoverable reserves:</u>		
Previous est., as of 12/31/81 (Hewitt and others, 1982).....	2.90	39.8
Discoveries.....	+0.04	+0.9
Revisions.....	+0.33	+3.8
Adjustments.....	0.00	0.0
Production during 1982 (preliminary).....	<u>-0.29</u>	<u>-4.7</u>
Net change.....	+0.08	0.0
Estimate, as of 12/31/82 (this report).....	<u><u>2.98</u></u>	<u><u>39.8</u></u>

changes to original recoverable reserves. Reserve estimates are revised as warranted, increasing reserves as additional wells are drilled and new leases are added to existing fields and decreasing reserves as reservoirs are depleted and leases are relinquished. Complete reevaluations of existing field studies are conducted as field development and production history indicate the need. These increases and decreases of reserve figures are summarized and presented as changes due to revisions.

Owing to the approximations in the production and reserves as listed in table 1, partly caused by rounding field data to two significant figures and subsequent correction of lease production reports, adjustments to cumulative production totals may be necessary in reconciling balances between annual reports. These adjustments are also shown in table 3.

Table 3 demonstrates that the 1982 oil discoveries and field revisions exceeded oil production by 0.08 billion barrels of oil and annual gas production equaled the new discoveries and field revisions for gas.

#### CONCLUSIONS

The 484 oil and gas fields studied in the federally regulated part of the Gulf of Mexico originally contained reserves estimated at 8.56 billion barrels of oil and 98.1 trillion cubic feet of gas. Remaining recoverable reserves, as of December 31, 1982, are estimated to be 2.98 billion barrels of oil and 39.8 trillion cubic feet of gas. These figures represent an increase in estimated oil reserves but no change in gas reserves.

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