

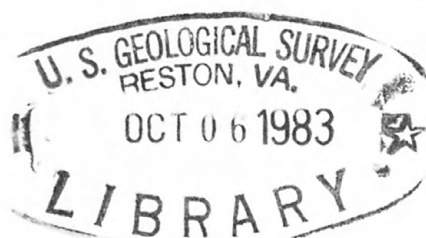
(200)
R290
no. 81-604



UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Estimated Oil and Gas Reserves,
Gulf of Mexico Outer Continental Shelf and Continental Slope,
December 31, 1980

By Jack E. Hewitt, Jefferson P. Brooke,
John H. Knipmeyer, and Patricia Y. Roy



Huand

Open-File Report 81-604
1981

Open-file report
(Geological Survey
(U.S.))

This report has not been edited for conformity
with Geological Survey editorial standards

CONTENTS

	Page
Abstract	1
Introduction	2
Definition of reserve and resource terms	2
Fields reported by area	3
Studies conducted	6
Field-size distribution	7
Reserves discovered each year, discovery trends, and annual production	9
Conclusions	12
References cited	12

ILLUSTRATIONS

Figure 1. Index map showing Outer Continental Shelf leasing areas off Texas and Louisiana	5
2. Histogram showing field-size distribution of gas fields...	8
3. Histogram showing field-size distribution of oil fields...	8
4. Graph showing gas reserves discovered and gas production	10
5. Graph showing oil reserves discovered and oil production	10

TABLES

Table 1. Estimated demonstrated oil and gas reserves, December 31, 1980	4
2. Summary and comparison of oil and gas reserves as of December 31, 1979, and December 31, 1980.....	11

INTRODUCTION

This report, which supersedes USGS Open-File Report 80-1312 (Hewitt, Knipmeyer, and Schluntz, 1980), presents estimates of original recoverable reserves, cumulative production, and estimates of remaining recoverable reserves as of December 31, 1980. The estimates of reserves for this report were completed in April 1981 and represent the combined efforts of engineers, geologists, and other personnel of the U.S. Geological Survey's Metairie, La., office.

As in previous reports (e.g., OF-78-87), 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 Miller and others (1975, p. 8-9). The quoted definitions of terms applicable to this report are:

"Resources.--Concentrations of naturally occurring solid, liquid, or gaseous materials in or on the Earth's crust in such form that economic extraction of a commodity is currently or potentially feasible."

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

"Measured reserves.--That part of the identified resource which can be economically extracted using existing technology, and whose amount is estimated from geologic evidence supported directly by engineering measurements. In this study, they are considered to be equivalent to API and AGA proved reserves."

"Indicated reserves.--Reserves that include additional recoveries in known reservoirs (in excess of the measured reserves) which engineering knowledge and judgment indicate will be economically available by application of fluid injection, whether or not such a program is currently installed (API, 1974). In this study indicated reserves are equivalent to API indicated additional reserves."

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

For this report, the identified resources considered are hydrocarbons only.

Production data are the metered volumes of oil and raw gas as reported by the lease operators, the only available source for individual well and reservoir data. Oil volume measurements and reserves are corrected to reference standard conditions of 60° Fahrenheit and 14.696 psia (one atmosphere); gas reserves and production measurements 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 based upon periodic well test "gauges." This introduces approximations in both production and reserves data by reservoirs, limiting accuracy to two or three significant figures.

FIELDS REPORTED BY AREA

Estimates for all producing fields as well as all fields discovered prior to December 31, 1978 are included in area totals (table 1). The areas are those delineated by the Bureau of Land Management for administrative purposes (fig. 1). The reserves reported in table 1 include estimates

Table 1.--Estimated demonstrated oil and gas reserves for 435 fields by area, Gulf of Mexico

Outer Continental Shelf and Slope, December 31, 1980

(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 non-associated gas. Remaining reserves estimated as of December 31, 1980.)

Area(s) (fig. 1)	No. of fields*	Original recoverable reserves		Cumulative production		Remaining recoverable reserves	
		Oil	Gas	Oil	Gas	Oil	Gas
Mustang Island and Padre Island.....	9	0	380	0	0	0	380
Matagorda Island.....	5	0	161	0	1	0	160
Brazos.....	8	6	670	2	320	4	350
Galveston.....	7	27	830	17	640	10	190
East Breaks and Garden Banks.....	3	18	340	0	0	18	340
High Island.....	59	137	7,700	17	1,900	120	5,800
West Cameron and Sabine Pass.....	57	200	14,700	70	7,400	130	7,300
East Cameron.....	38	160	6,700	80	4,300	80	2,400
Vermilion.....	50	350	10,500	180	6,700	170	3,800
South Marsh Island.....	33	550	9,600	260	5,200	290	4,400
Eugene Island.....	51	1,140	11,300	700	7,200	440	4,100
Ship Shoal.....	33	910	8,500	610	5,200	300	3,300
South Timbalier and Bay Marchand.....	18	1,060	4,500	840	2,600	220	1,900
South Pelto.....	4	90	350	50	150	40	200
Grand Isle.....	10	810	3,600	640	2,200	170	1,400
West Delta.....	15	1,140	3,600	790	2,500	350	1,100
South Pass.....	8	610	1,500	360	800	250	700
Main Pass, Breton Sound, and Viosca Knoll...	20	640	2,700	360	1,600	280	1,100
Mississippi Canyon and Ewing Bank.....	7	190	1,250	10	10	180	1,240
Total.....	435	8,038	88,881	4,986	48,721	3,052	40,160

*Represents 419 of the 466 active (Dec. 1980) fields and 16 formerly productive fields abandoned before December 31, 1980.

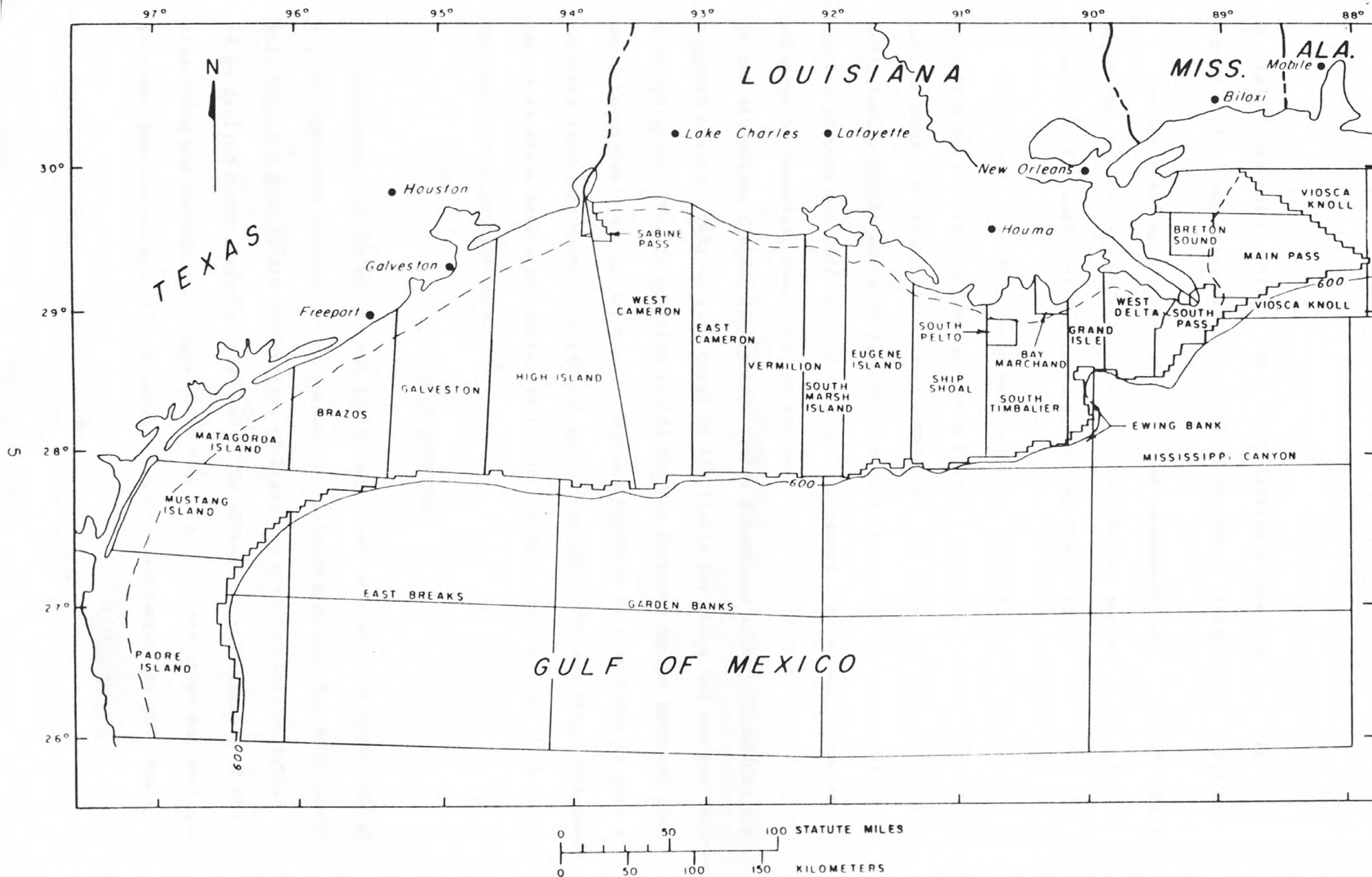


FIGURE 1.--INDEX MAP SHOWING OUTER CONTINENTAL SHELF LEASING AREAS OFF TEXAS AND LOUISIANA. DASHED LINES, SHOWN AT 3 MARINE LEAGUES (9 NAUTICAL MILES) FROM THE TEXAS COAST AND 3 NAUTICAL MILES FROM THE LOUISIANA COAST, INDICATE BOUNDARY BETWEEN STATE AND FEDERAL WATERS. SOLID LINE INDICATES 600-FOOT WATER DEPTH.

for 435 fields and constitute the current listing in the U.S. Geological Survey's Field and Reservoir Reserve Estimate (FRRE) data-processing system.

For the field count, the present report represents only a 3-month update since the December 31, 1979, reserves report. Future reports will reflect a full year for both reserves calculations and field count.

On December 31, 1980, there were 466 active fields in the federally regulated part of the Gulf of Mexico as listed by the U.S. Geological Survey, Gulf of Mexico Regional Field Names Committee. Of these, 419 were considered sufficiently developed to warrant estimation of reserves for this study. Another 47 were not sufficiently developed to permit a reasonably accurate estimate of reserves; therefore, no estimates have been attempted. In addition to the 419 active fields, 16 depleted fields (abandoned after production) are reported herein. This makes a total of 435 fields for which oil and gas reserves were estimated. The 16 depleted fields are not included in the Regional Field Names Committee's 466 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.

STUDIES CONDUCTED

Estimates for 340 of the 435 fields are based on studies of approximately 11,800 individual reservoirs. A volumetric estimate was made for each reservoir and, for many of the reservoirs, at least one other estimation method (e.g. 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

95 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 and 3. Figure 2 shows the field-size distribution of the original recoverable gas reserves for 355 fields. The field-size distribution of original recoverable oil reserves for 96 fields are shown on figure 3. Sixteen fields are included in both histograms because they contain significant oil and gas reserves. 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 81 billion cubic feet of gas and the mean (weighted average) is 220 billion cubic feet of gas. The largest 43 fields contained 57 percent of the total recoverable gas reserves.

Among the 96 oil fields (fig. 3), the median is 43 million barrels of oil and the mean is 72 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 fields considered in this report, 20 contained 100 million barrels or more, accounting for 62 percent of the total original recoverable reserves contained in the 96 fields.

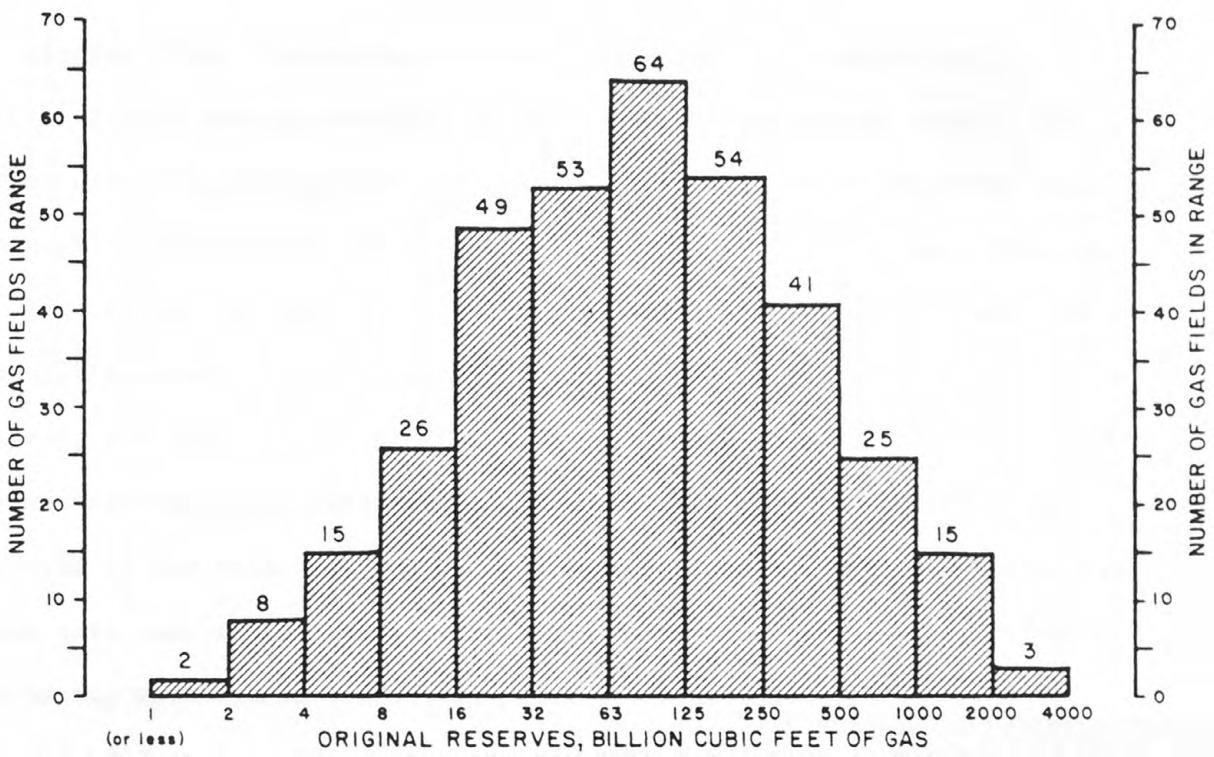


Figure 2. Field-size distribution
355 Gas Fields

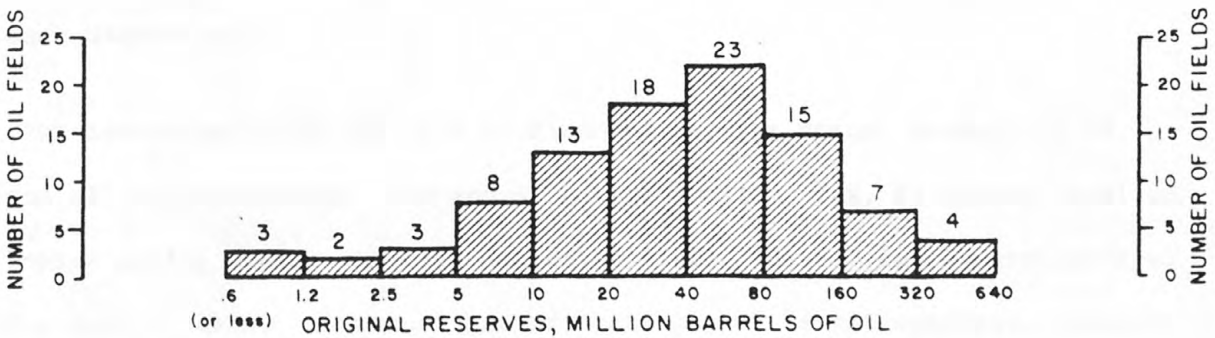


Figure 3. Field-size distribution
96 Oil Fields

RESERVES DISCOVERED EACH YEAR,
DISCOVERY TRENDS, AND ANNUAL PRODUCTION

Figures 4 and 5 show the reserves of gas and oil, 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, 1978. Data for 1977 and 1978 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 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 gas and oil is also shown. The annual gas production (fig. 4) almost equalled the 7-year moving average of discoveries in 1970. These 2 curves are parallel for the next 4 years. An annual gas production peak is not apparent. Annual oil production (fig. 5) exceeded the 7-year moving average of discoveries in 1967 and continued to increase until a peak was reached in 1971. Production

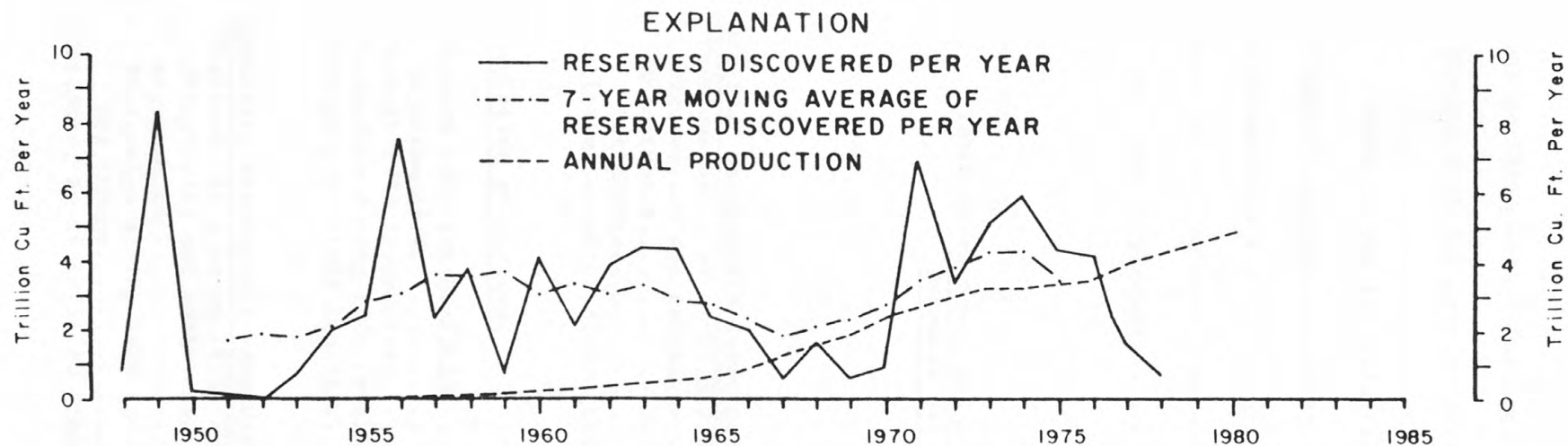


Figure 4--Gas Reserves Discovered And Gas Production

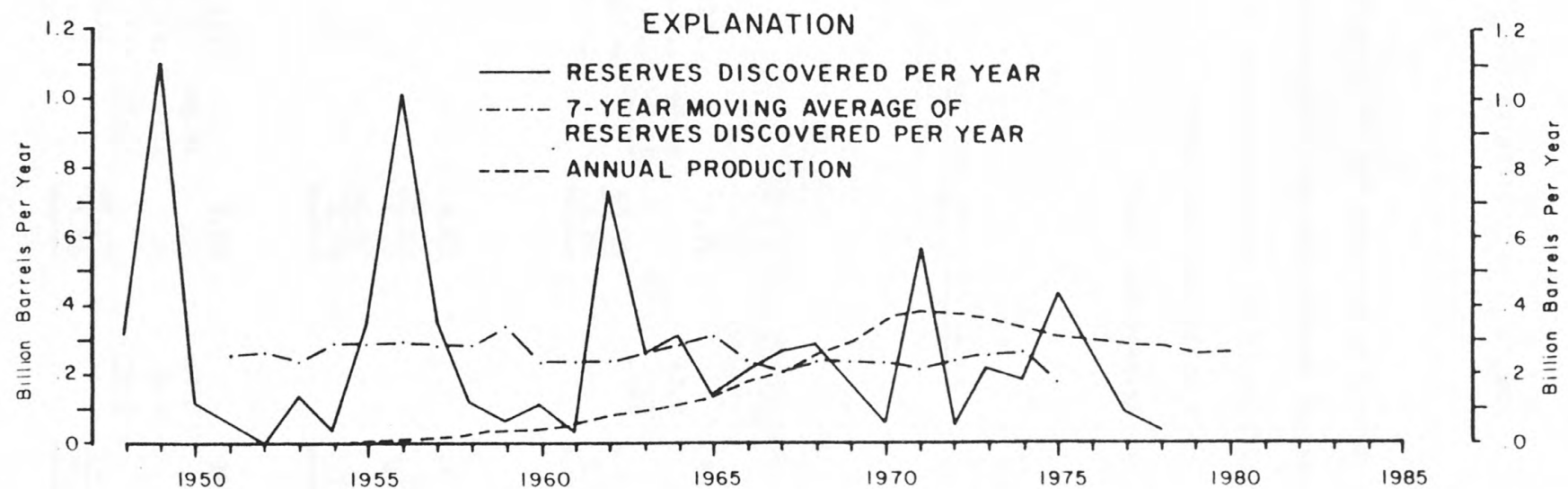


Figure 5--Oil Reserves Discovered And Oil Production

then declined each subsequent year until 1980, at which time a slight increase over the previous year occurred.

Owing to the approximations in the production and reserves as listed in table 1, partly caused by rounding field data to two significant figures, adjustments to cumulative production totals may be necessary in reconciling balances between annual reports. Further adjustments are related to the corrections of production along the boundary between State and Federal waters.

Table 2.--Summary and comparison of oil and gas reserves as of December 31, 1979, and December 31, 1980

	Oil (billion bbl)	Gas (trillion cu ft)
<u>Original recoverable reserves:</u>		
Previous est., as of 12/31/79 (OF-80-1312)..	7.71	82.2
Discoveries and revisions	+0.44	+7.0
Adjustments.....	-0.11	-0.3
Net change.....	+0.33	+ 6.7
Estimate, as of 12/31/80 (this report).....	<u>8.04</u>	<u>88.9</u>
<u>Cumulative production:</u>		
Through 1979 (OF-80-1312).....	4.83	44.2
Adjustments.....	-0.11	- 0.3
Through 1979 (corrected).....	4.72	43.9
Production during 1980 (preliminary).....	+0.27	+ 4.8
Through 1980 (this report).....	<u>4.99</u>	<u>48.7</u>
<u>Remaining recoverable reserves:</u>		
Previous est., as of 12/31/79 (OF-80-1312)..	2.88	38.0
Discoveries and revisions.....	+0.44	+7.0
Adjustments.....	0.00	0.0
Production during 1980 (preliminary).....	-0.27	-4.8
Net change.....	+0.17	+ 2.2
Estimate, as of 12/31/80 (this report).....	<u>3.05</u>	<u>40.2</u>

CONCLUSIONS

A significant change reflected in this report is the slight increase in annual oil production (fig. 5). This increase occurred after 8 consecutive years of declining production.

The 435 oil and gas fields studied in the federally regulated part of the Gulf of Mexico originally contained reserves estimated at 8.04 billion barrels of oil and 88.9 trillion cubic feet of gas. Remaining recoverable reserves, as of December 31, 1980, are estimated to be 3.05 billion barrels of oil and 40.2 trillion cubic feet of gas. These figures represent an increase in both oil and gas reserves reported as of December 31, 1979 (OF-80-1312).

REFERENCES CITED

- American Petroleum Institute, American Gas Association, and Canadian Petroleum Association, 1974, Reserves of crude oil, natural gas liquids, and natural gas in the United States and Canada as of December 31, 1973: Washington, D. C., Am. Petroleum Inst.
- Bryan, F. T., Knipmeyer, J. H., and Schluntz, E. K., 1978, Estimated oil and gas reserves, Gulf of Mexico Outer Continental Shelf, January 1, 1977: U.S. Geological Survey Open-File Report 78-87, 11 p.
- Hewitt, J. E., Knipmeyer, J. H., and Schluntz, E. K., 1980, Estimated oil and gas reserves, Gulf of Mexico Outer Continental Shelf, December 31, 1979: U.S. Geological Survey Open-File Report 80-1312, 11 p.
- Miller, Betty M., and others, 1975, Geological estimates of undiscovered recoverable oil and gas resources in the United States: U.S. Geological Survey Circular 725, 78 p.

USGS LIBRARY-RESTON



3 1818 00071353 5