

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERALS MANAGEMENT SERVICE

and

GEOLOGICAL SURVEY

Estimated Oil and Gas Reserves,
Southern California Outer Continental Shelf,
December 31, 1981

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Open-File Report 82-37

1982

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

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ABSTRACT

Remaining recoverable reserves of oil* and gas in the Outer Continental Shelf off Southern California are estimated at approximately 861 million barrels of oil and about 1,733 billion cubic feet of gas, as of December 31, 1981. Reserves for a new field, Point Arguello, that was discovered during 1981 are not included in these estimates, as available data are not sufficient to allow a reasonably accurate estimate of reserves at the present time. Original reserves of the 13 known fields are estimated at about 1,082 million barrels of oil and 1,847 billion cubic feet of gas. The estimates for both the remaining and the original reserves of oil are higher, but those of gas are lower, than the corresponding December 31, 1980, estimates for the same fields.

Reserves estimates for 11 fields were based on individual volumetric reservoir studies. Decline-curve and volumetric analyses were used to estimate the reserves for the remaining two fields.

By the end of 1981, five fields were on production and two more were scheduled to start producing during 1982.

INTRODUCTION

This report, which supersedes USGS Open-File Report 81-623 (Kalil, 1981), presents estimates of original oil and gas reserves, cumulative production through 1981, and estimates of remaining reserves as of December 31, 1981, in the Outer

*The term "oil" as used in this report includes crude oil, condensate and gas-plant liquids.

Continental Shelf off Southern California. These estimates were completed in June 1982.

The annual update of this report is part of a Minerals Management Service continuing program aimed at providing and maintaining a current inventory of oil and gas reserves on the Outer Continental Shelf.

Acknowledgments.--The estimates presented here represent the combined efforts of geologists, geophysicists, petroleum engineers, and other technical personnel within the Minerals Management Service's Los Angeles, California, office.

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.

APPLICATION OF TERMS IN PRESENT REPORT

In fields with limited well control, "measured reserves" as used in this report refers to hydrocarbons within boundaries defined by the use of both seismic interpretation and well control.

Two producing oil fields in the Southern California Outer Continental Shelf-- Dos Cuadras and Carpinteria Offshore (fig. 1) are undergoing fluid injection, and recovery beyond primary production is in progress or can be anticipated. For some remaining fields, where it was determined that "indicated reserves" could be anticipated by comparison with similar producing fields, "indicated reserves" were included with the "measured reserves" for a total estimate of "demonstrated reserves."

Pacific Region OCS Order No. 4, "Determination of Well Producibility" provides criteria for determining, through evaluation of borehole testing, whether a well is capable of producing in paying quantities (U.S. Geological Survey, 1976). The quality and quantity of the data vary from field to field. In some instances, these "paying quantities" as defined in the OCS Order may not prove to be "economically extractable" reserves, and these accumulations are generally omitted from reserve calculations. The accumulations are included here, however, because they may be necessary for effective planning and lease management.

METHODS USED FOR RESERVES ESTIMATION

Volumetric calculation.--The amount of original oil and gas in place is estimated from the bulk volume of the reservoir as mapped, using data from drill holes and seismic profiles. Maps of net oil-sand and gas thickness are made and planimetered, and the results are converted to bulk volume by use of pyramidal

formulas. Porosity of the rock and the amount of water, oil, and gas in the pore space are interpreted from borehole logs and analyses of cores. The total amount of oil and gas in place is converted to standard conditions by analysis of pressure, volume, and temperature relationships and the use of standard correlation charts.

The amount of the original oil and gas in place that can be recovered is estimated from knowledge of the reservoir-drive mechanism, spacing of the wells, and API recovery-factor equations (Arps and others, 1967, p. 19-20).

Decline curves.--In the decline-curve method, future production is estimated by extrapolating plots of production rates and fluid percentage against time. The original recoverable reserves are determined by adding past production to predicted future production.

FIELDS REPORTED

As of December 31, 1981, fourteen fields in the Outer Continental Shelf off Southern California (fig. 1) are recognized as producing or capable of producing, on the basis of the "producible in paying quantities" criterion. Two of these fields are gas fields, six are oil fields, and six are combination oil and gas fields.

Reserves for the new field, Point Arguello, that was discovered during 1981 are not included in the combined estimate totals given in this report. Only one well has been drilled in this field and the available data are not sufficient to allow a reasonably accurate estimate of reserves at the present time.

Estimates for both the remaining and the original reserves for oil are higher, but those of the gas are lower, than the corresponding December 31, 1980, estimates for the same fields. This reflects modified estimates of previous discoveries on the basis of additional data supplied by more drilling and testing done during 1981.

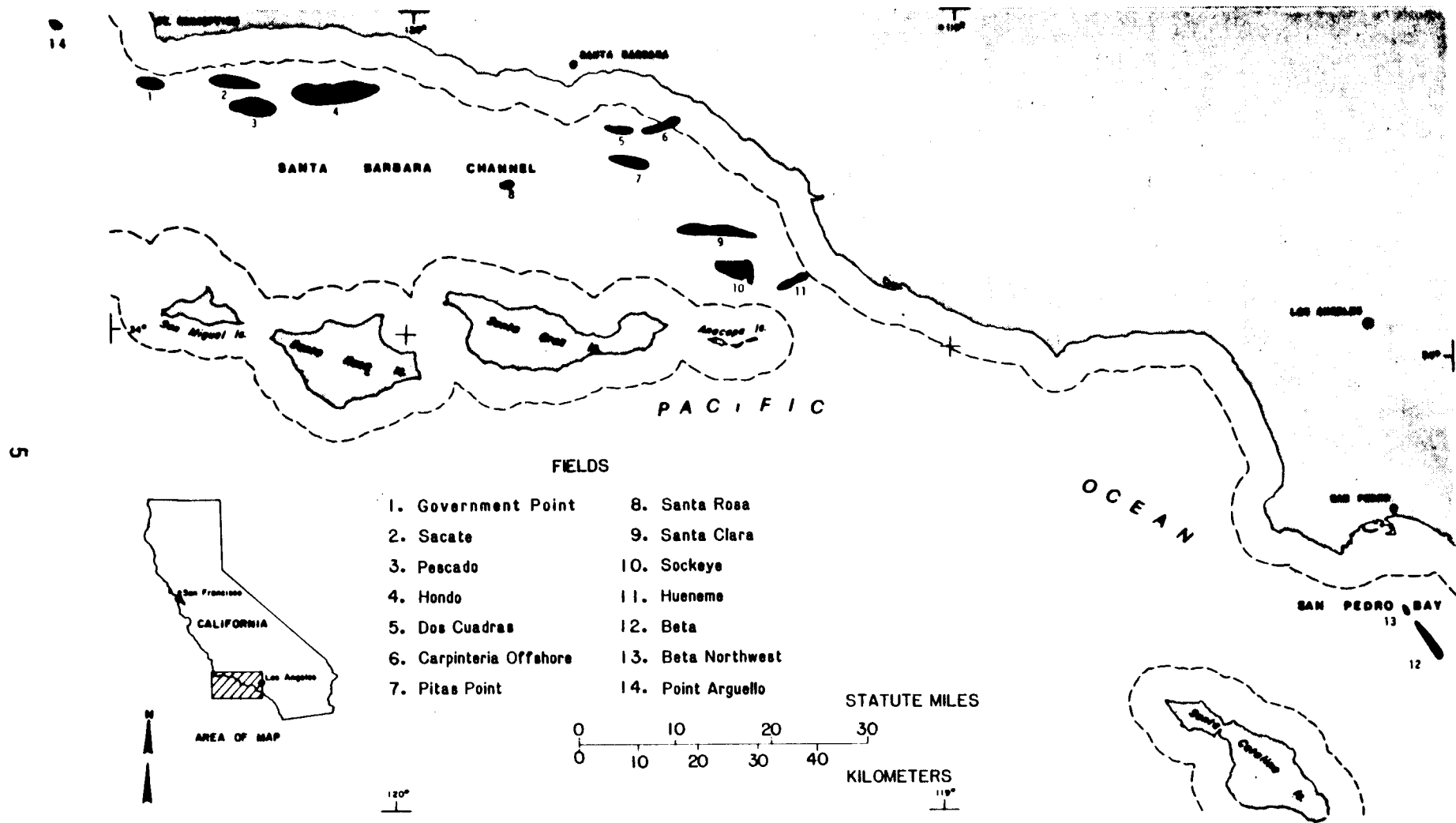


Figure 1. Recognized discoveries of federally controlled oil and gas fields in the Southern California Outer Continental Shelf. Dashed lines indicate 3-nautical-mile boundary between State and Federal waters. Fields are identified by names instead of OCS Lease numbers.

Reserves are estimated only for the Federal portions of those fields that lie partly in State and partly in Federal lands.

Estimates of the combined totals for 13 fields within the Southern California OCS are shown in table 1. Separate totals are given for oil and gas. These totals appear as composite numbers so as to protect the proprietary nature of the data used to determine the estimates.

STATUS OF DEVELOPMENT

As of December 31, 1981, none of the fields in the Southern California Outer Continental Shelf was fully developed. Of the 14 recognized fields, only five were producing at this time, namely Hondo, Dos Cuadras, Carpinteria Offshore, Santa Clara, and Beta (fig. 1, Fields Nos. 4, 5, 6, 9 and 12). Two more fields, Pitas Point (a gas field) and Hueneme (fig. 1, Fields Nos. 7 and 11) are scheduled to go on production during 1982. Additional exploratory and delineation drilling is anticipated in many of the remaining fields, so as to further define productive limits and aid in effective development.

TABLE 1.---Estimated demonstrated oil and gas reserves for 13 fields, Southern California Outer Continental Shelf, December 31, 1980

["Demonstrated reserves" is the sum of measured and indicated reserves.
 "Oil" includes crude oil, condensate, and gas-plant products sold;
 "gas" includes both associated and nonassociated dry gas]

	Oil (million bbl)	Gas (billion ft ³)
Original reserves:		
Estimated as of 12/31/81 (this report)..	1,082	1,847
Estimated as of 12/31/80 (OF-81-623)....	988	1,853
Change.....	+94	-6
Cumulative production:		
Through 1981.....	221	114
Through 1980.....	201	101
Remaining reserves:		
Estimated as of 12/31/81 (this report)..	861	1,733
Estimated as of 12/31/80 (OF-81-623)....	787	1,752
Change.....	+74	-19

STUDIES CONDUCTED

Estimates of two of the producing fields, Dos Cuadras and Carpinteria Offshore (fig. 1, fields 5 and 6), were made on the basis of volumetric and decline-curve analyses. Individual reservoirs in each field were grouped for volumetric calculations. Decline-curve analyses were made on a lease-by-lease basis. The remaining fields were studied on a reservoir-by-reservoir basis and the reserve estimates were made by the volumetric method.

FIELD-SIZE DISTRIBUTION

Figure 2 shows the field-size distribution of the original recoverable reserves of eleven oil and gas fields, and two gas fields. For convenience of comparison, gas reserves are expressed in terms of oil on the basis of equivalent heating values (6,000 cubic feet of gas is equivalent to 1 barrel of oil). This histogram exhibits a lognormal distribution, with a majority of the fields in the 0-100 million barrel category. About 80 percent of the combined reserves, however, are in the larger fields. The new field, Point Arguello, discovered during 1981 is not included in this size distribution.

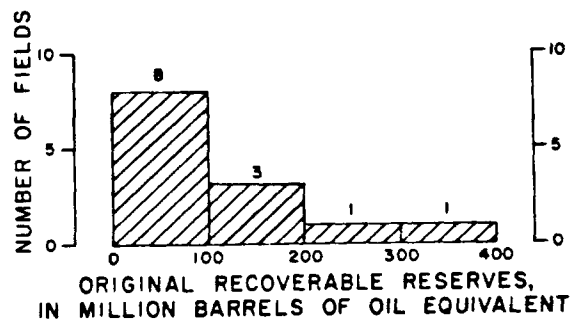


Figure 2. HISTOGRAM SHOWING FIELD-SIZE DISTRIBUTION OF OIL AND GAS FIELDS

CONCLUSIONS

As of December 31, 1981, the remaining recoverable reserves in 13 known oil and gas fields in the Southern California Outer Continental Shelf are estimated at approximately 861 million barrels of oil and 1,733 billion cubic feet of gas. These figures represent an increase of about 74 million barrels of oil and a decrease of about 19 billion cubic feet of gas, from the December 31, 1980 estimates. This reflects modified estimates of previous discoveries, on the basis of data supplied by additional drilling and testing done during 1981.

Reserves for a new field, Point Arguello, that was discovered in 1981 are not included in these estimates.

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