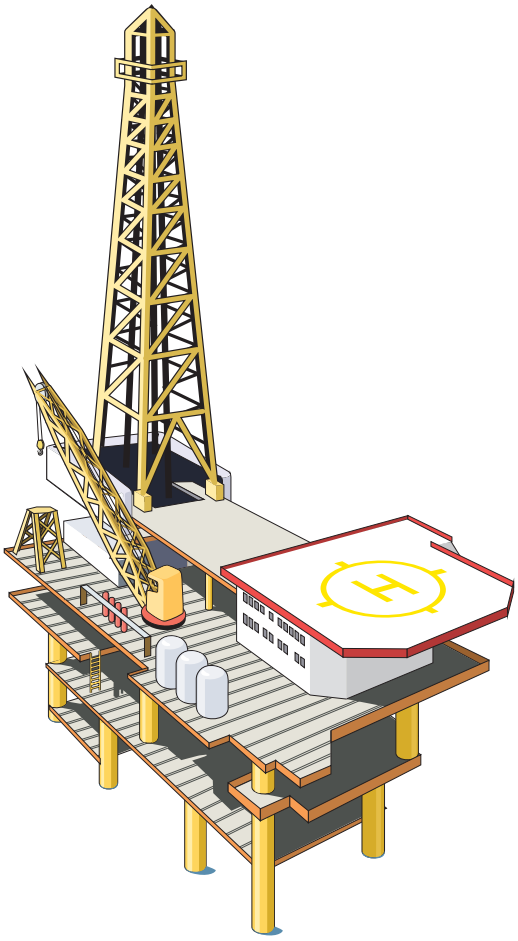
OCS Report
MMS 94-0059

Estimated Oil and Gas Reserves
Pacific Outer Continental Shelf

(as of December 31, 1993)



U.S. Department of the Interior
Minerals Management Service
Pacific OCS Region

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by
Scott B. Sorensen
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U.S. Department of the Interior
Minerals Management Service
Pacific OCS Region

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Abbreviations

ACT . . . . . Actively Drilling
APD . . . . . Application for Permit to Drill
API . . . . . American Petroleum Institute
°API . . . . . Oil Gravity
bbl . . . . . Barrel of Oil (42 gallons)
Bcf . . . . . Billion Cubic Feet of Gas
BOE . . . . . Barrels of Oil Equivalent
bpd . . . . . Barrels per Day
cf . . . . . Cubic Feet
CFB . . . . . Cubic Feet per Barrel
CFR . . . . . Code of Federal Regulations
COM . . . . . Completion
cp . . . . . Centipoise
CRPNTR . Carpinteria Offshore Field
DPP . . . . . Development and Production Plan
DSCDRS . Dos Cuadras Field
DSI . . . . . Drilling Shut-In
°F . . . . . Degrees Fahrenheit
GIW . . . . . Gas Injection Well
GLO . . . . . Gas Lift Oil Well
GOR . . . . . Gas-Oil Ratio
GSI . . . . . Gas Well Shut-in
HUENEM Hueneme Field
Mbbl . . . . . Thousand Barrels of Oil
Mcf . . . . . Thousand Cubic Feet of Gas
Mcfpd . . . . Thousand Cubic Feet of Gas per Day
md . . . . . Millidarcies
MMbbl . . . Million Barrels of Oil
MMcf . . . . Million Cubic Feet of Gas
MMS . . . . . Minerals Management Service
OCS . . . . . Outer Continental Shelf
OFR . . . . . Open File Report
OFSHR . . . Offshore
OSI . . . . . Oil Well Shut-in
OS&T . . . . Offshore Storage and Treating Vessel
PA . . . . . Plugged and Abandoned
PESCDO . Pescado Field
PGW . . . . . Producing Gas Well
PITSPT . Pitas Point Field
POW . . . . . Producing Oil Well
ppm . . . . . Parts per Million
psia . . . . . Pounds per Square Inch Absolute
psig . . . . . Pounds per Square Inch Gauge
PTARGL . Point Arguello Field
PTPDNS . Point Pedernales Field
RB . . . . . Reservoir Barrel
SCF . . . . . Standard Cubic Feet
SNTCLR . Santa Clara Field
SOCKEY . Sockeye Field
SPE . . . . . Society of Petroleum Engineers
ST . . . . . Side Track
STB . . . . . Stock Tank Barrel
SUSP . Suspended (includes temporarily abandoned and inactive completions)
TA . . . . Temporarily Abandoned
WDW . Water Disposal Well
WIW . . Water Injection Well
WSW . Water Source Well

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Abstract

Proved reserves of oil[1] and gas[2] in the Pacific Outer Continental Shelf, offshore California, are estimated to be 860 million barrels and 1,697 billion cubic feet, respectively, as of December 31, 1993. These reserves are attributed to 13 fields. Original recoverable oil and gas reserves for these fields are estimated to be 1,479 million barrels and 2,384 billion cubic feet, respectively. Unproved reserves are estimated to be 570 million barrels of oil and 745 billion cubic feet of gas, in 25 fields.

Reserve estimates for 31 of the 38 fields were calculated using individual reservoir volumetric studies. Both decline-curve and volumetric analyses were used for the remaining seven. Approximately two-thirds of the original recoverable oil and gas reserves and over two-thirds of the remaining reserves are attributed to reservoirs in the Monterey Formation. One-half of the remaining oil reserves are contained within fields that have not yet been developed.

Eleven of the 38 fields were producing at yearend. Oil production during 1993 exceeded 50 million barrels, setting a new record for the Pacific Outer Continental Shelf. Annual gas production approached 52 billion cubic feet. To date, 619 million barrels of oil and 687 billion cubic feet of gas have been produced from 11 fields.

[1] *"Oil,"* as used in this report, includes crude oil and condensate.

[2] *"Gas,"* as used in this report, includes associated and nonassociated dry gas.

Introduction

This report, which in part supersedes OCS Report MMS 94-0008 (Sorensen and others, 1993), presents estimates of original recoverable oil and gas reserves, cumulative production through 1993, and estimates of remaining reserves as of December 31, 1993, for the Pacific Outer Continental Shelf (OCS), offshore California. These estimates were completed in June 1994. Detailed reserves estimates are included in the annual update of this report as part of a Minerals Management Service (MMS) continuing program to provide a current inventory of oil and gas reserves for the Pacific OCS.

The estimates presented here were prepared by petroleum engineers, geologists, geophysicists, and other personnel from the MMS Pacific OCS Regional Office, Camarillo, California. Previous reports were used as a basis for parts of this update. Contributions by Dennis Tayman and the members of the Production and Development Section were particularly important, and this report could not have been completed without their assistance.

Definition of Resource and Reserve Terminology

The MMS has standardized its definitions of resources (*Estimates of Undiscovered Conventional Oil and Gas Resources in the United States — A Part of the Nation's Energy Endowment*, U.S. Geological Survey and Minerals Management Service, 1989). The Society of Petroleum Engineers (SPE) has also adopted a standardized set of reserve categories and definitions (1987, p. 577-578). The definitions used within this report conform with both these sources. Figure 1 shows how resource and reserve definitions are related.

Undiscovered Resources

Resources estimated from broad geologic knowledge or theory and existing outside of known fields or known accumulations are undiscovered resources. Undiscovered resources can exist in untested prospects on unleased acreage, or on undrilled leased acreage, or in known fields. In known fields, undiscovered resources occur in undiscovered pools that are controlled by distinctly separate structural features or stratigraphic conditions (U.S. Geological Survey and Minerals Management Service, 1989). Estimates of undiscovered resources in the Pacific OCS are not included in this report.

Discovered Resources

Once leased acreage is drilled and is determined to contain oil or gas under Code of Federal Regulations (CFR) Title 30, Part 250, Subpart A, Section 11, Determination of Well Producibility (hereinafter referred to as 30 CFR 250.11), the lease is considered to have discovered resources. Discovered resources are the equivalent of identified resources as reported

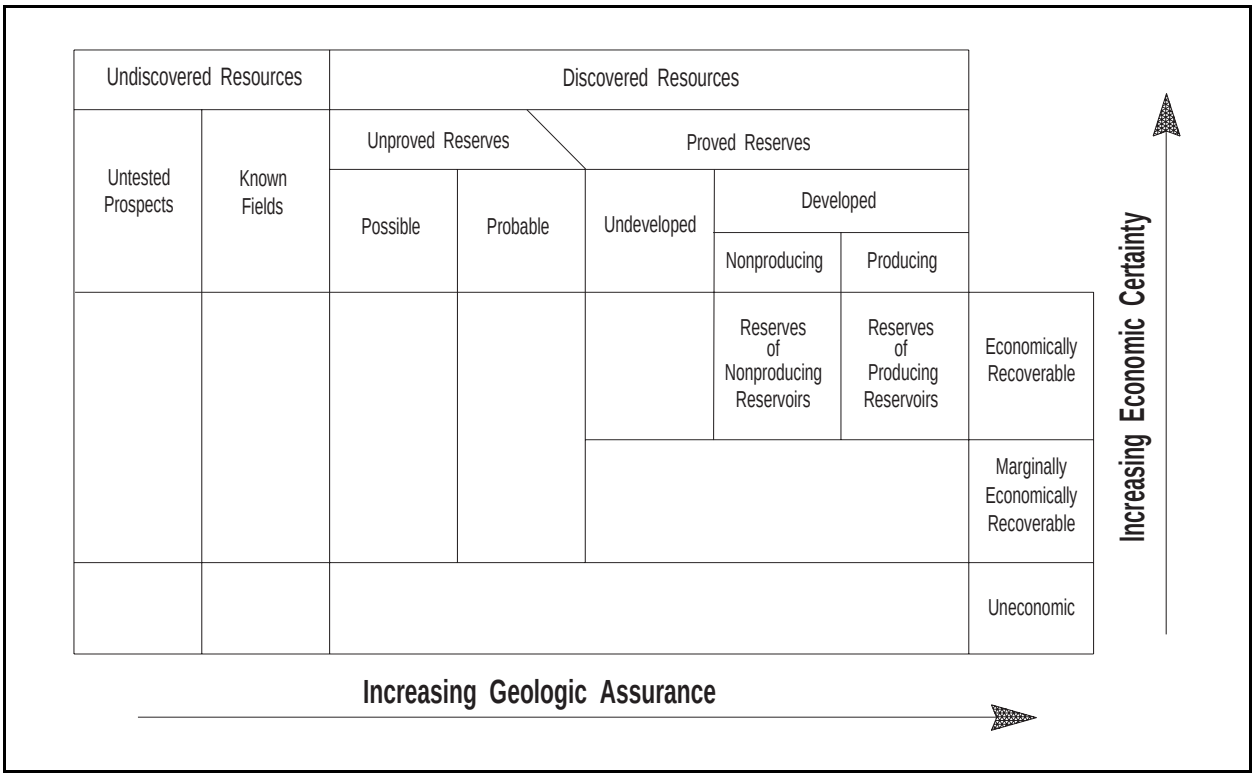

Figure 1. MMS petroleum reserves classification (modified from USGS and MMS, 1989; and SPE, 1987).

by Dolton and others (1981). Identified resources are resources whose location and quantity are known or are estimated from specific geologic or engineering evidence and include economic, marginally economic, and subeconomic components. Discovered resources can be further characterized as unproved or proved reserves, depending upon evidence of economic and geologic viability. Changing economic conditions and new geologic data and interpretations can result in reclassification of resources. The number of wells determined to be producible in accordance with 30 CFR 250.11 is shown in figure 2.

Unproved Reserves

After a lease qualifies under 30 CFR 250.11, the MMS Field Naming Committee reviews the new producible lease to assign it to an existing field or, if the lease is not associated with an established geologic structure, to a new field. Regardless of where the lease is assigned, the reserves associated with the lease are initially considered to be unproved reserves. Unproved reserves are based on geologic or engineering information similar to that used in estimates of proved reserves, but technical, contractual, economic, or regulatory uncertainties preclude such reserves being classified as proved.

Unproved reserves may be divided into two subclassifications, possible and probable, which are similarly based on the level of uncertainty.

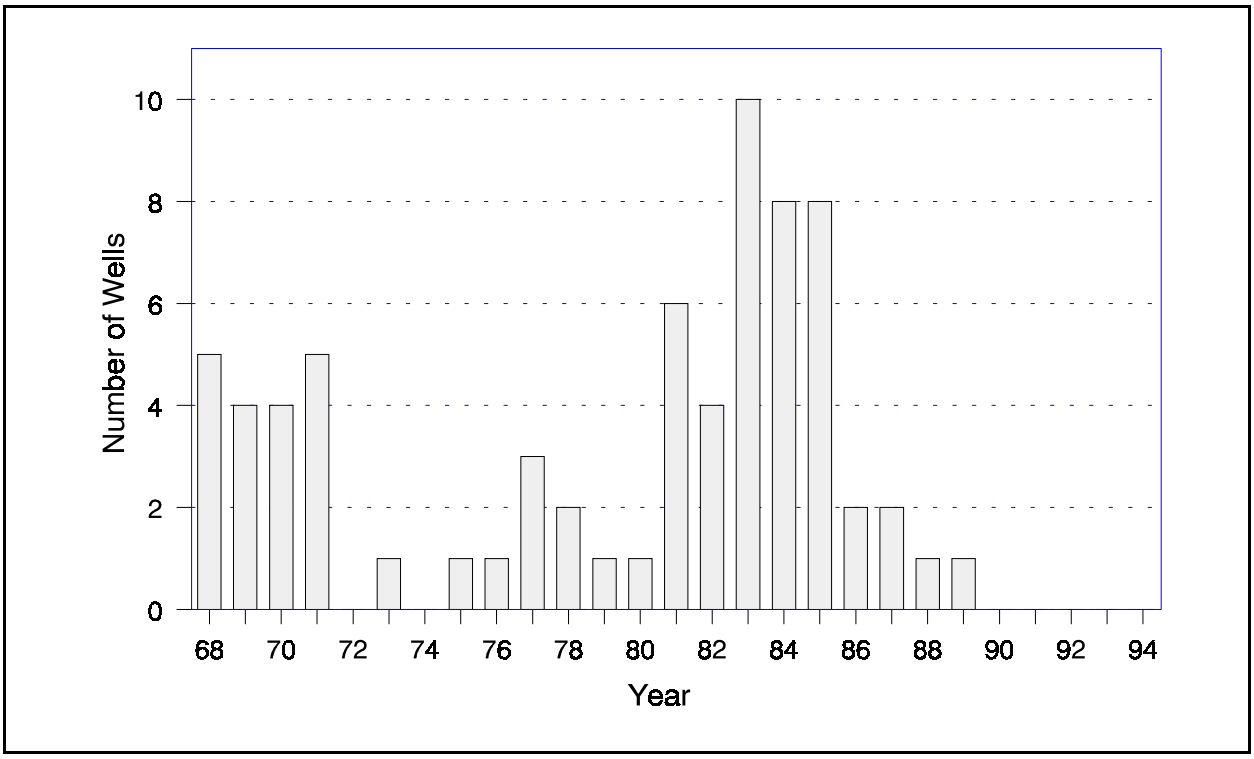

Figure 2. Wells determined to be producible in accordance with 30 CFR 250.11, Pacific OCS.

"Unproved possible reserves are less certain than unproved probable reserves and can be estimated with a low degree of certainty, which is insufficient to indicate whether they are more likely to be recovered than not. Reservoir characteristics are such that a reasonable doubt exists that the project will be commercial" (SPE, 1987). After a lease qualifies under 30 CFR 250.11, the reserves associated with the lease are initially classified as unproved possible.

"Unproved probable reserves are less certain than proved reserves and can be estimated with a degree of certainty sufficient to indicate they are more likely to be recovered than not" (SPE, 1987). Reserves in fields for which a schedule leading to a Development and Production Plan (DPP) has been submitted to the MMS have been classified as unproved probable.

Proved Reserves

"Proved reserves can be estimated with reasonable certainty to be recoverable under current economic conditions, such as prices and costs prevailing at the time of the estimate. Proved reserves must either have facilities that are 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" (SPE, 1987). Proved reserves can be subdivided into undeveloped and developed.

Proved undeveloped reserves are classified proved undeveloped when a relatively large expenditure is required to install production and/or transportation facilities, a commitment by the operator is made, and a timeframe to begin production is established. Proved undeveloped reserves are reserves expected to be recovered from (1) yet undrilled wells, (2) deepening existing wells, or (3) existing wells for which a relatively large expenditure is required for recompletion.

"Reserves that are expected to be recovered from existing wells (including reserves behind pipe) are classified as proved developed reserves. Reserves are considered developed only after necessary production and transportation equipment have been installed or when the installation costs are relatively minor. Proved developed reserves are subcategorized as producing or non-producing" (SPE, 1987). This distinction is made at the reservoir level and not at the field level.

Once the first reservoir in a field begins production, the reservoir is considered to contain proved developed producing reserves, and the field is considered on production. If a reservoir had sustained production during the last year, it is considered to contain proved developed producing reserves.

Any developed reservoir in a developed field that has not produced or has not had sustained production during the past year is considered to contain proved developed nonproducing reserves. This category includes reserves contained in nonproducing reservoirs, reserves contained behind-pipe, and reservoirs awaiting well workovers or transportation facilities. The reserves classification procedure is shown in figure 3.

Total reserves are the sum of proved and unproved reserves.

The amount of oil and gas expected to be recovered from the original oil in place or the amount equal to the sum of cumulative production and remaining reserves is considered to be the original recoverable reserves.

The term production data consists of the measured volumes of gross hydrocarbons reported to the MMS by Federal lessees and operators. Oil and gas volume measurements and reserves are corrected to reference standard conditions of 60^{o} F and 14.73 psia. Continuously measured volumes from production platforms or leases are allocated to individual wells and reservoirs on the basis of periodic well tests. These procedures introduce approximations in both production and reserves data by reservoirs and by fields.

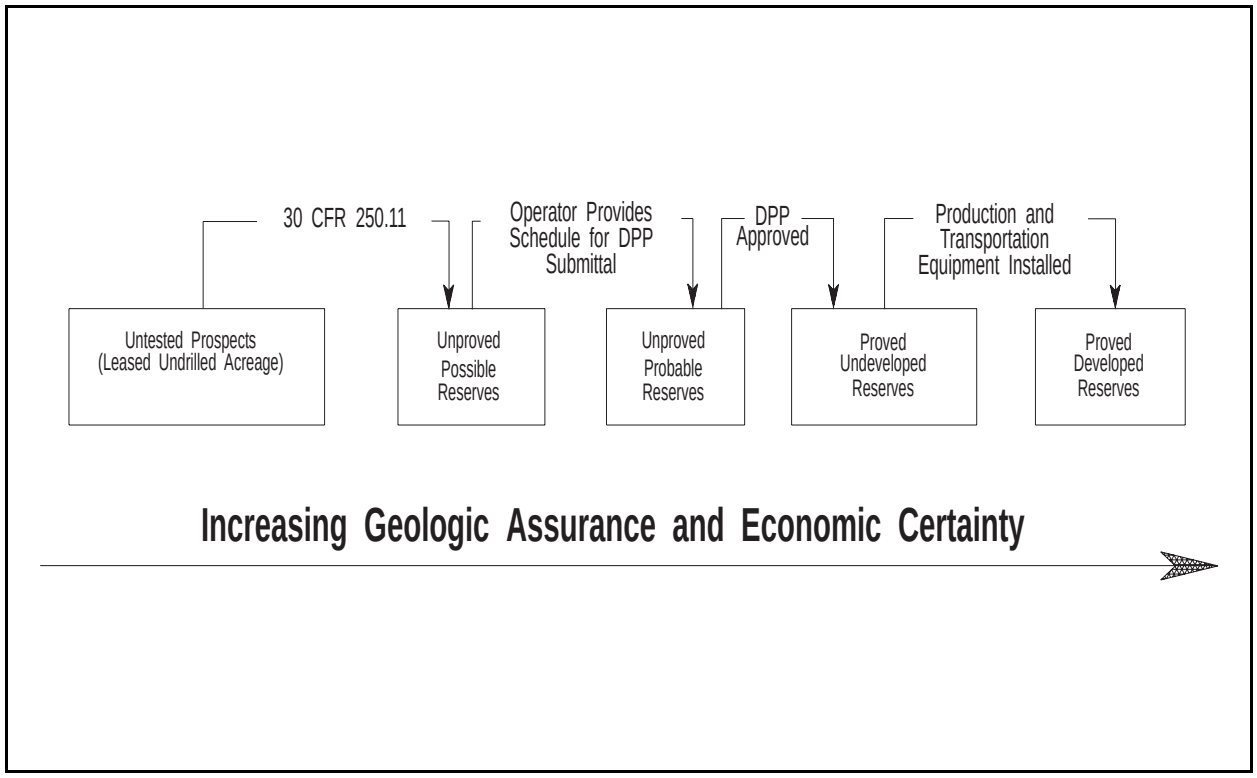

Figure 3. MMS Pacific OCS reserves classification procedure.

Methods Used for Estimating Reserves

Volumetric Calculation

For the volumetric calculation of reserves, the amounts of original oil and gas in place are estimated from the bulk volume of the reservoir as mapped using data from boreholes and seismic profiles. Maps of net oil and gas sand thicknesses are generated with the aid of a computer mapping system, and the results are converted to bulk reservoir volume using the appropriate equations. Rock porosities and the amounts of water, oil, and gas in the pore space are derived from well log interpretations and core analyses. The estimated original amounts of oil and gas in place are converted to standard conditions through analyses of pressure, volume, and temperature relationships and by the use of standard correlations. The amounts of the original oil and gas in place that can be recovered are estimated from information about the reservoir drive mechanism, well spacing, analog field recovery factors, and American Petroleum Institute (API) recovery factor equations (Arps and others, 1967, p. 19-20).

Decline-curve Analysis

In the decline-curve analysis method, future production is estimated by extrapolating plots of production rates and fluid percentages versus time. The ultimate production is determined by adding cumulative past production to predicted future production.

Fields Reported

As of December 31, 1993, there are 38 fields in the Pacific OCS that are recognized as containing reserves under the established criteria. Two of these fields are gas fields, 27 are oil fields, and 9 are combination oil and gas fields (figure 4).

Thirteen fields were determined to have proved reserves of oil and/or gas. These 13 fields are San Miguel, Point Pedernales, Point Arguello, Pescado, Sacate, Hondo, Dos Cuadras, Pitas Point, Carpinteria Offshore, Santa Clara, Sockeye, Hueneme, and Beta (figure 4, fields 2, 7, 11, 20, 21, 23, 29, 30, 31, 33, 34, 36, and 38). All of these fields, with the exceptions of Sacate and San Miguel, were producing at yearend. The remaining 25 fields were determined to have unproved reserves of oil and/or gas.

Reserve estimates for seven of the producing fields were obtained from volumetric calculations and decline-curve analyses: Hondo, Dos Cuadras, Pitas Point, Carpinteria Offshore, Santa Clara, Hueneme, and Beta (figure 4, fields 23, 29, 30, 31, 33, 36, and 38). Individual reservoirs in each field were grouped for volumetric calculations, while decline-curve analyses were made on lease-by-lease and platform bases. The 31 remaining fields (4 producing and 27 nonproducing) were studied on a reservoir-by-reservoir basis, and the reserve estimates were determined solely by the volumetric calculation method.

Estimated Oil and Gas Reserves

As of December 31, 1993, total original recoverable oil and gas reserves in the Pacific OCS are estimated to be 2,050 million barrels (Mmbbl) and 3,129 billion cubic feet (Bcf), respectively. Total remaining reserves are estimated to be 1,430 MMbbl of oil and 2,442 Bcf of gas.

The current aggregated estimates of Pacific OCS oil and gas reserves are shown in table 1, by SPE reserves category, for both original recoverable and remaining reserves. Nonaggregated estimates of the original recoverable and remaining reserves for each of the 11 producing oil and gas fields are presented in figures 5 and 6 and table 2.

These estimates have been updated annually as additional information has become available. Past updates have caused both increases and decreases in estimates of original recoverable and remaining oil and gas reserves. Previous reserves estimates for the Pacific OCS are presented in appendix A.

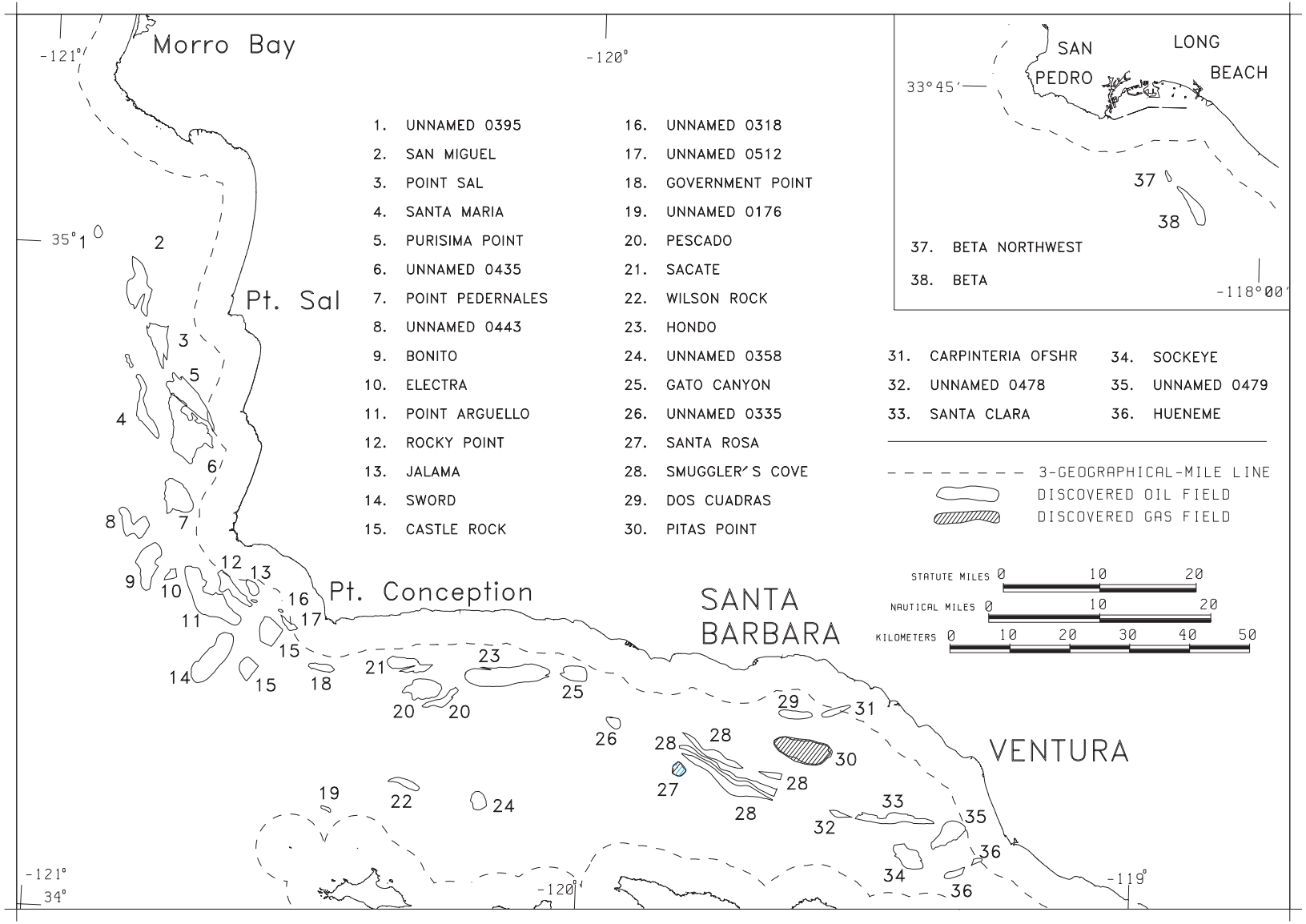

Figure 4. Recognized discoveries of federally controlled oil and gas fields in the Pacific OCS. (Dashed lines indicate 3-geographical mile boundary between State and Federal waters.)

The current estimate of original recoverable oil reserves has decreased, as compared with the most recent previous estimate. As a result, estimated remaining reserves of oil have also decreased. The estimate of original recoverable gas reserves has increased. The amount of gas produced during 1993, however, was greater than the increase in estimated original recoverable gas reserves, causing a net decrease in remaining gas reserves at yearend (table 3).

Table 1. Estimated reserves of oil and gas by SPE category, Pacific OCS, December 31, 1993.

Reserves Category	Number of Fields	Original Recoverable Reserves		Cumulative Production		Annual Production		Remaining Reserves	
		Oil (MMbbl)	Gas (Bcf)	Oil (MMbbl)	Gas (Bcf)	Oil (MMbbl)	Gas (Bcf)	Oil (MMbbl)	Gas (Bcf)
Proved Developed Reserves	11	1,336	2,146	619	687	51	52	716	1,458
Proved Undeveloped Reserves	2	144	238	0	0	0	0	144	238
Unproved Probable Reserves	10	362	357	0	0	0	0	362	357
Unproved Possible Reserves	15	208	389	0	0	0	0	208	389
Total	**38**	**2,050**	**3,129**	**619**	**687**	**51**	**52**	**1,430**	**2,442**

Table 2. Production and estimated reserves of oil and gas for producing fields, Pacific OCS, December 31, 1993.

Field	Original Recoverable Reserves		Cumulative Production		1993 Annual Production		Remaining Reserves	
	Oil (MMbbl)	Gas (Bcf)	Oil (MMbbl)	Gas (Bcf)	Oil (MMbbl)	Gas (Bcf)	Oil (MMbbl)	Gas (Bcf)
Beta	116.50	32.25	63.42	20.95	3.79	0.92	53.08	11.30
Carpinteria	61.72	52.10	58.83	49.77	1.01	0.84	2.89	2.33
Dos Cuadras	256.80	137.60	229.86	113.72	3.57	3.01	26.94	23.88
Hondo	278.90	834.02	130.24	202.53	7.36	14.94	148.66	631.49
Hueneme	10.57	4.05	8.46	2.69	0.44	0.22	2.11	1.36
Pescado	109.01	218.63	0.04	0.01	0.04	0.01	108.98	218.62
Pitas Point	0.27	239.22	0.17	1-75.99	0.01	10.46	0.09	63.23
Point Arguello	283.88	336.84	48.74	21.00	25.90	11.17	235.13	315.83
Point Pedernales	77.30	17.00	38.35	8.27	4.38	1.01	38.95	8.73
Santa Clara	69.86	109.22	28.88	55.87	1.68	1.73	40.98	53.35

Table 3. Changes in reported reserves and production, Pacific OCS, December 31, 1993.

Production and Reserves	Oil (MMbbl)	Gas (Bcf)
Original Recoverable Reserves:		
Estimated as of 12/31/93 (This Report)	2,049	3,129
Estimated as of 12/31/92 (MMS 94-0008)	2,055	3,121
Change	-6	+8
Cumulative Production:		
Through 1993	619	687
Through 1992	569	635
Proved Reserves:		
Estimated as of 12/31/93 (This Report)	860	1,697
Estimated as of 12/31/92 (MMS 94-0008)	916	1,753
Change	-56	-56

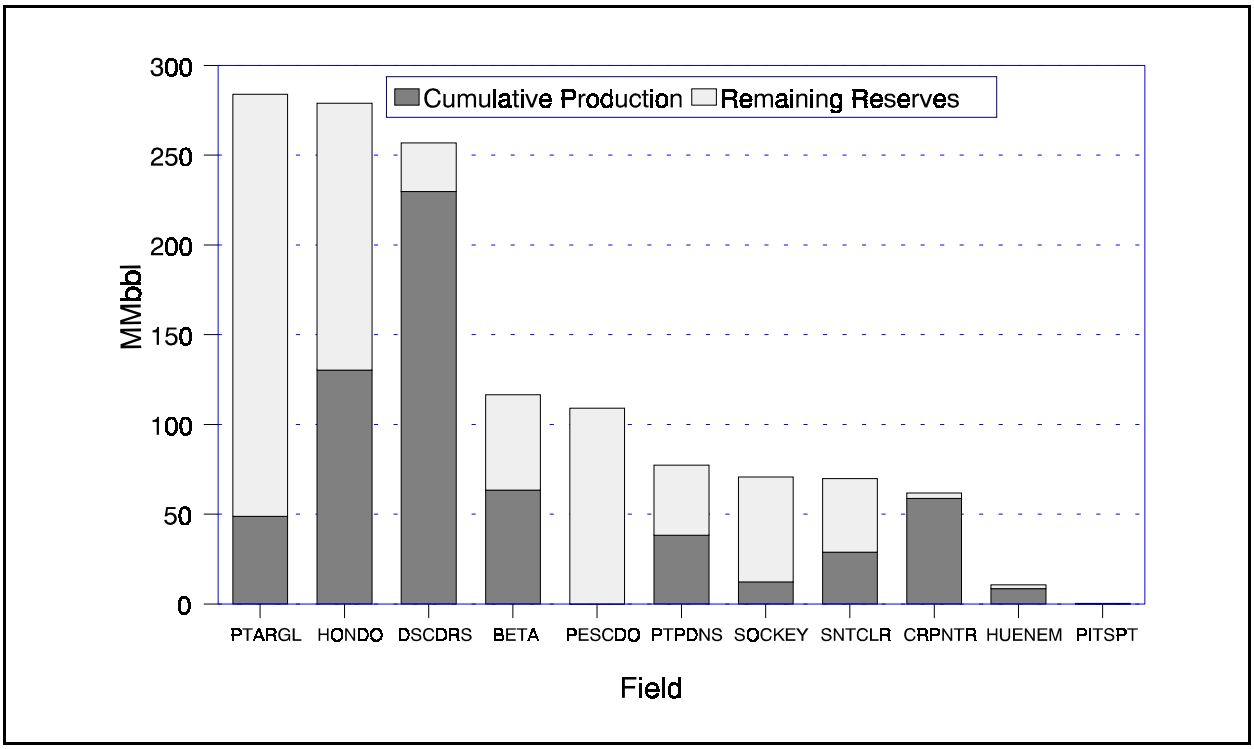

Figure 5. Production and estimated reserves of oil for producing fields, Pacific OCS.

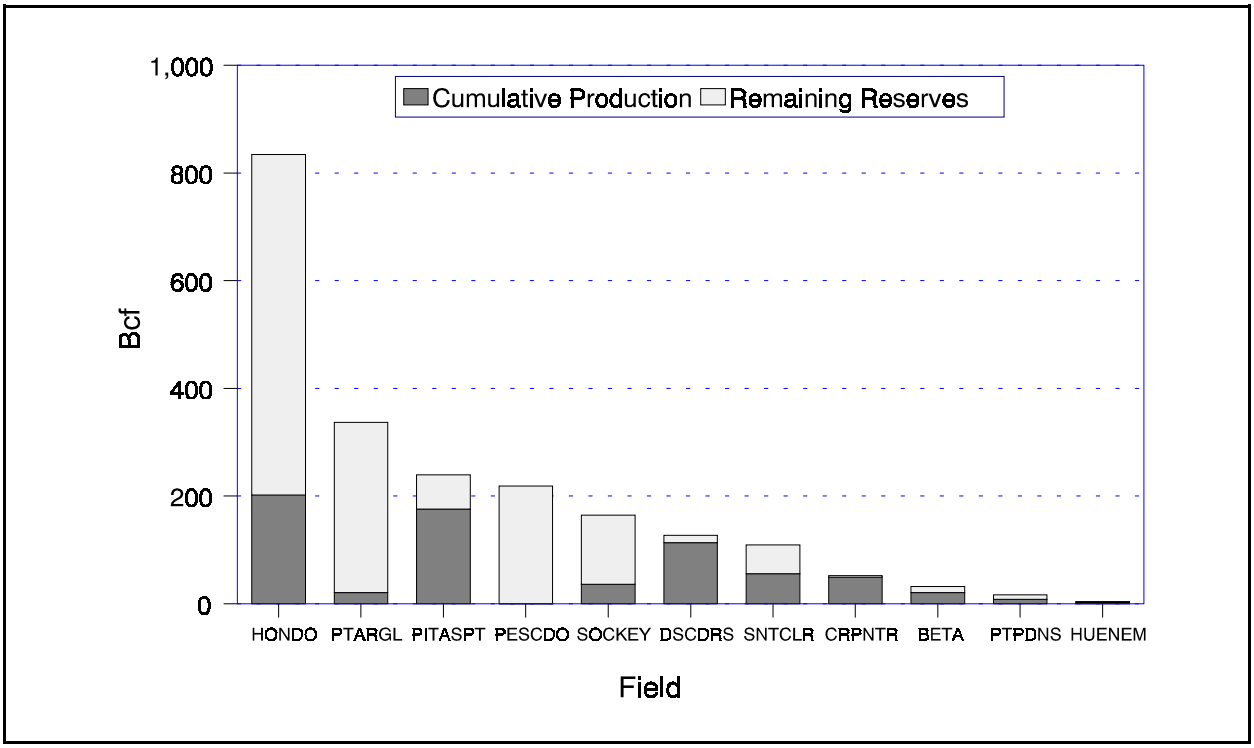

Figure 6. Production and estimated reserves of gas for producing fields, Pacific OCS.

Distribution of Reserves

The field size distribution based on current estimated original recoverable reserves for 27 oil fields, 9 combination oil and gas fields, and 2 gas fields in the Pacific OCS is shown in figure 7. These 38 fields are located in three basins, offshore California. For comparison purposes, gas reserves are expressed in terms of barrels of oil equivalent on the basis of equivalent heating values (5,620 cubic feet of gas has the approximate heating value of one barrel of oil), hereinafter referred to as BOE. Producing fields are distinguished from nonproducing fields in this figure.

Over one-half of the original recoverable oil and gas reserves in the Pacific OCS are attributable to the 11 proved developed fields. These 11 producing fields also contain approximately one-half of the remaining recoverable reserves. An additional one-tenth of the remaining recoverable oil and gas reserves are attributable to the region's two proved undeveloped fields.

Gas reserves in the Pacific OCS are located in both oil and gas reservoirs. Approximately one-third of the original recoverable and remaining gas reserves occur as nonassociated gas contained in natural gas reservoirs. The remaining two-thirds of the gas reserves are associated gas contained within oil reservoirs (figure 8 and table 4).

Oil and gas reserves in the Pacific OCS are further categorized on the basis of the relative age of the reservoir rocks in which they exist (table 5). The three age groups of reservoir rocks are (1) Pre-Monterey: rocks older than the Monterey Formation (early Miocene age and older), (2) Monterey: rocks of the Monterey Formation (Miocene age), and (3) Post-Monterey: rocks younger than the Monterey Formation (late Miocene age and younger). The distribution of estimated original recoverable and remaining oil and gas reserves by reservoir age group are illustrated in figures 9 and 10.

Seven of the 11 producing fields in the Pacific OCS have substantial reserves attributed to the Monterey Formation, as do 21 of the 27 nonproducing fields. In 18 of the 27 nonproducing fields, all identified reserves are attributed to this formation. Over two-thirds of the original recoverable oil reserves and over three-fourths of the remaining oil reserves are in Monterey Formation reservoirs. The Monterey Formation also contains approximately two-thirds of all gas reserves in the Pacific OCS.

Status of Field Development

As of December 31, 1993, 11 of the 38 recognized fields in the Pacific OCS were producing: Point Pedernales, Point Arguello, Pescado, Hondo, Dos Cuadras, Pitas Point, Carpinteria Offshore, Santa Clara, Sockeye,

Hueneme, and Beta (figure 4, fields 7, 11, 20, 23, 29, 30, 31, 33, 34, 36, and 38). Pescado Field became the eleventh producing field in the Pacific Outer Continental Shelf when production began from Platform Heritage in December 1993. A brief history of the exploration and development of Pescado Field is presented in appendix B.

Development drilling occurred at 8 of the 11 producing fields during 1993: Point Pedernales, Point Arguello, Pescado, Hondo, Dos Cuadras, Santa Clara, Sockeye, and Beta (figure 4, Fields 7, 11, 20, 23, 29, 33, 34, and 38). The development of Pescado Field and the western portion of Hondo Field proceeded in 1993, with the commencement of drilling from newly installed platforms Heritage and Harmony. A summary of Pacific OCS development activities during 1993 is presented in appendix C.

Five producing oil and gas fields in the Pacific OCS are undergoing fluid injection: Hondo, Dos Cuadras, Santa Clara, Hueneme, and Beta (figure 4, Fields 23, 29, 33, 36, and 38). Recovery beyond primary production is occurring or can be anticipated. Two fields, Pescado and Hondo (figure 4, Fields 20 and 23), are undergoing gas injection for reservoir pressure maintenance. Water and gas injection volumes and rates are shown for each of these fields in table 6.

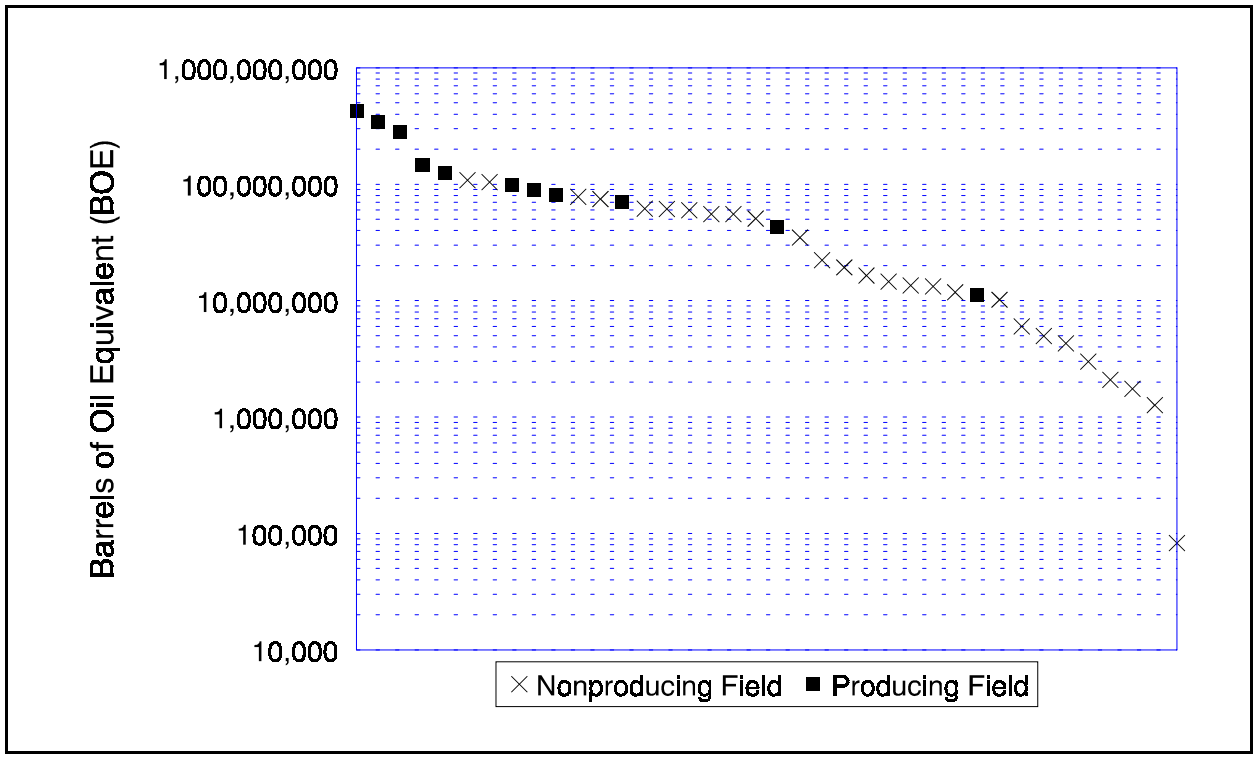

Figure 7. Size distribution of Pacific OCS oil and gas fields.

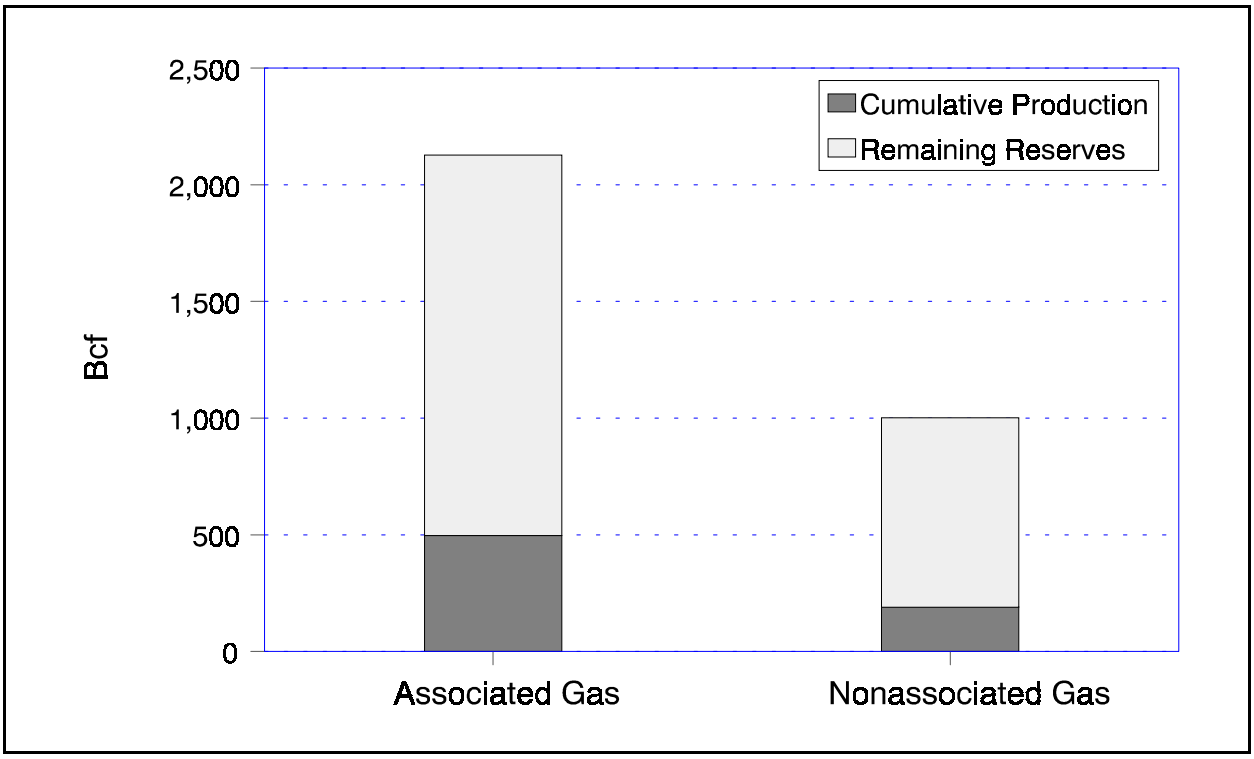

Figure 8. Production and estimated reserves of gas by type of occurrence, Pacific OCS.

Table 4. Production and estimated reserves of gas by type of occurrence, Pacific OCS, December 31, 1993.

Type of Occurrence	Original Recoverable Reserves (Bcf)	Cumulative Production (Bcf)	1993 Annual Production (Bcf)	Remaining Reserves (Bcf)
Associated	2,128	497	41	1,631
Nonassociated	1,001	190	11	811
Total	**3,129**	**687**	**52**	**2,442**

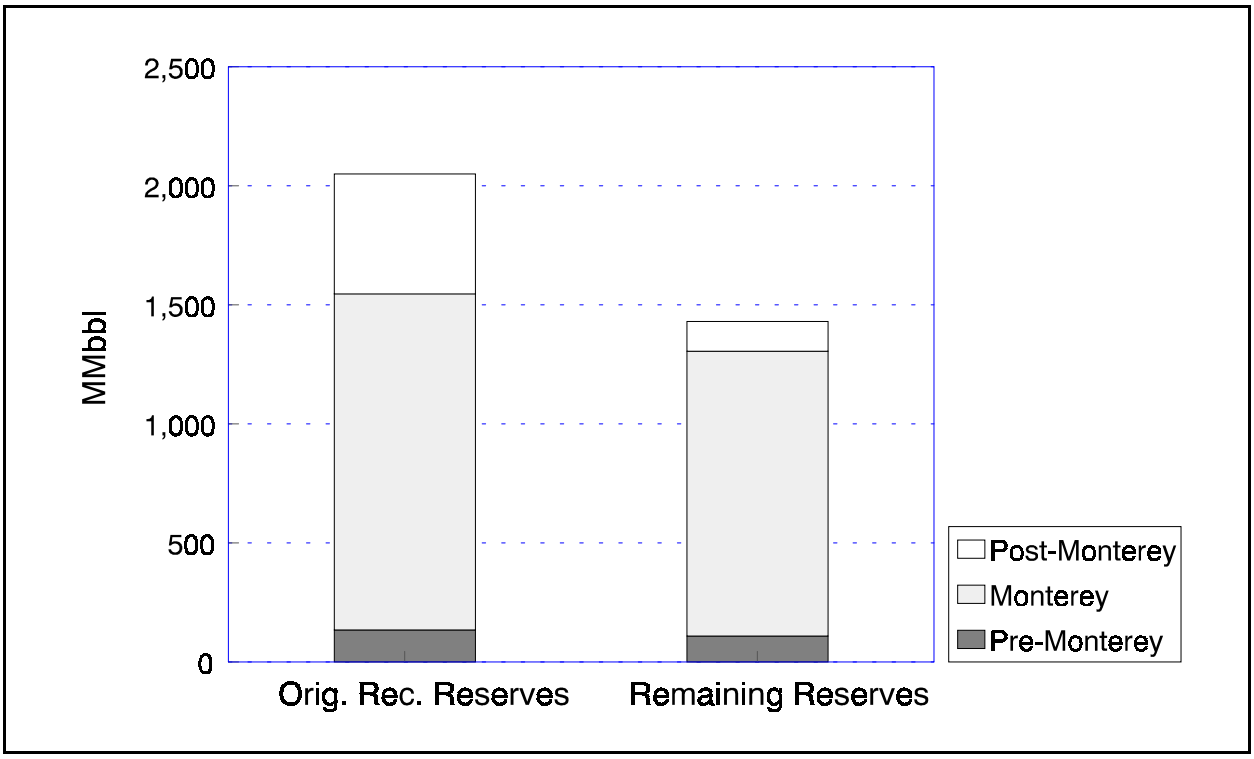

Figure 9. Estimated original recoverable and remaining oil reserves by reservoir age group.

Table 5. Estimated reserves of oil and gas by reservoir age group, Pacific OCS, December 31, 1993.

Reservoir Age Group	Geologic Formations	Original Recoverable Reserves		Remaining Reserves	
		Oil (MMbbl)	Gas (Bcf)	Oil (MMbbl)	Gas (Bcf)
Post-Monterey	Pico, Puente, "Repetto," Santa Margarita, Sisquoc	503	538	124	145
Monterey	Monterey	1,412	1,960	1,197	1,712
Pre-Monterey	Point Sal, Vaqueros, Topanga, Hueneme, Sespe/ Alegria, Gaviota, Matilija, Sacate, Juncal (Camino Cielo), Jalama	135	631	109	584

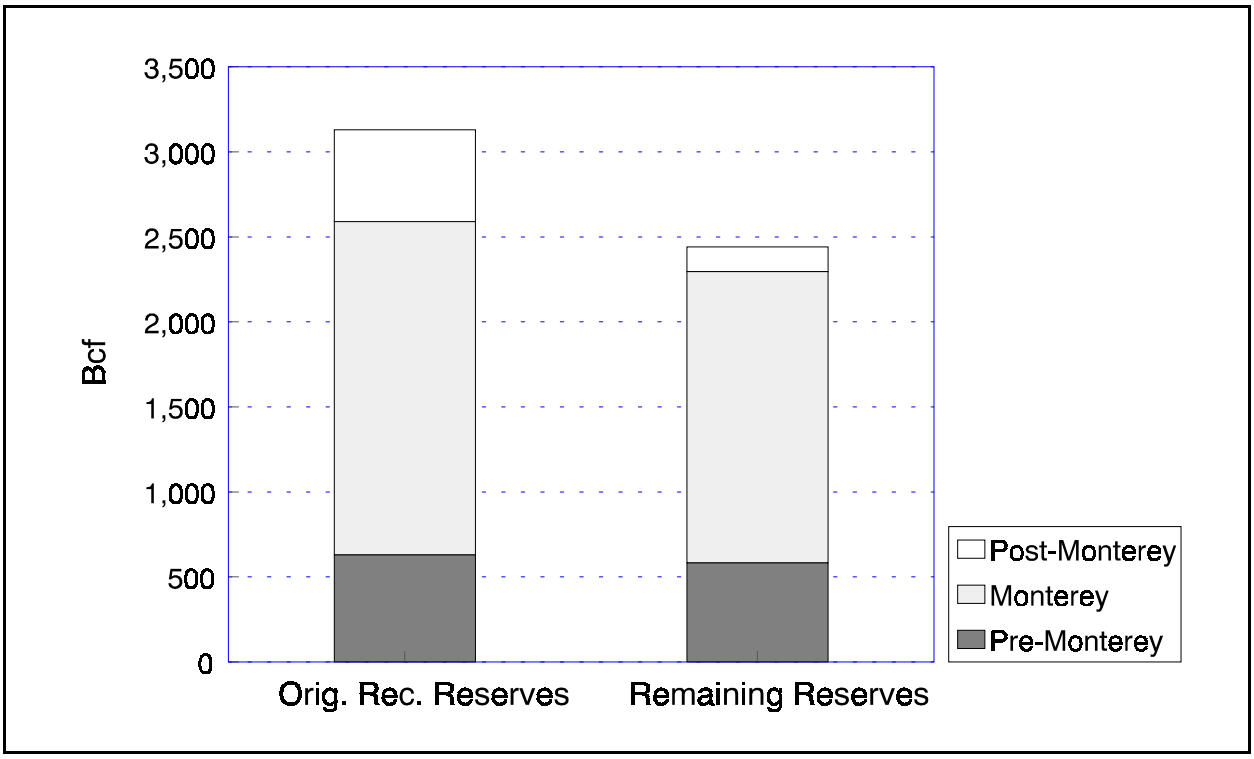

Figure 10. Estimated original recoverable and remaining gas reserves by reservoir age group.

Table 6. Gas and water injection volumes and rates, Pacific OCS, December 31, 1993.

Field	Gas Injection Volume (Mcf)	Average Gas Injection Rate (Mcfpd)	Water Injection Volume (bbl)	Average Water Injection Rate (bpd)
Beta	0	0	6,782,654	18,583
Dos Cuadras	0	0	6,629,661	18,623
Hondo	3,565,938	10,045	1,927,953	6,063
Hueneme	0	0	2,764,160	7,700
Pescado	6,330	703	0	0
Santa Clara	0	0	3,648,034	10,077

Drilling History and Production Rates

There were 329 exploratory wells and 734 development wells spudded by yearend. For the fourth consecutive year, no exploratory wells were drilled in the Pacific OCS. Twenty-one development wells and redrills were drilled during 1993, in eight fields. Total footage drilled in these wells exceeded 127,000 feet. Drilled footage by year for all wells in the Pacific OCS is displayed in figure 11. Additional exploratory and delineation wells are anticipated in many of the Pacific OCS fields as the operators seek to define productive limits and optimize oil and gas recovery.

Oil production from the Pacific OCS increased markedly during 1993. Annual production exceeded 50 MMbbl of oil, a record volume for the region. The 10 producing oil fields contributed approximately one-fifth of the nation's total OCS oil production; Point Arguello Field alone accounted for one-half of the region's oil production and one-tenth of the national OCS total. Over three-fourths of the oil was produced from Monterey Formation reservoirs. Most of the other oil production was obtained from reservoirs in rocks younger than the Monterey Formation.

Although gas production from the 11 producing fields declined slightly during 1993, the amount produced approached 52 Bcf. Only one gas field was producing at yearend; over three-fourths of the gas production was associated gas obtained from oil reservoirs. Approximately one-half of the gas was produced from Monterey Formation oil reservoirs.

Cumulative production exceeded 619 MMbbl of oil and 687 Bcf of gas in 1993. Over one-half of the oil and gas production in the Pacific OCS to date has been from Post-Monterey aged reservoirs. This proportion will decline, however, as production from Monterey Formation reservoirs continues to increase. Additional oil and gas production volume and rate data for the Pacific OCS are presented in appendix D.

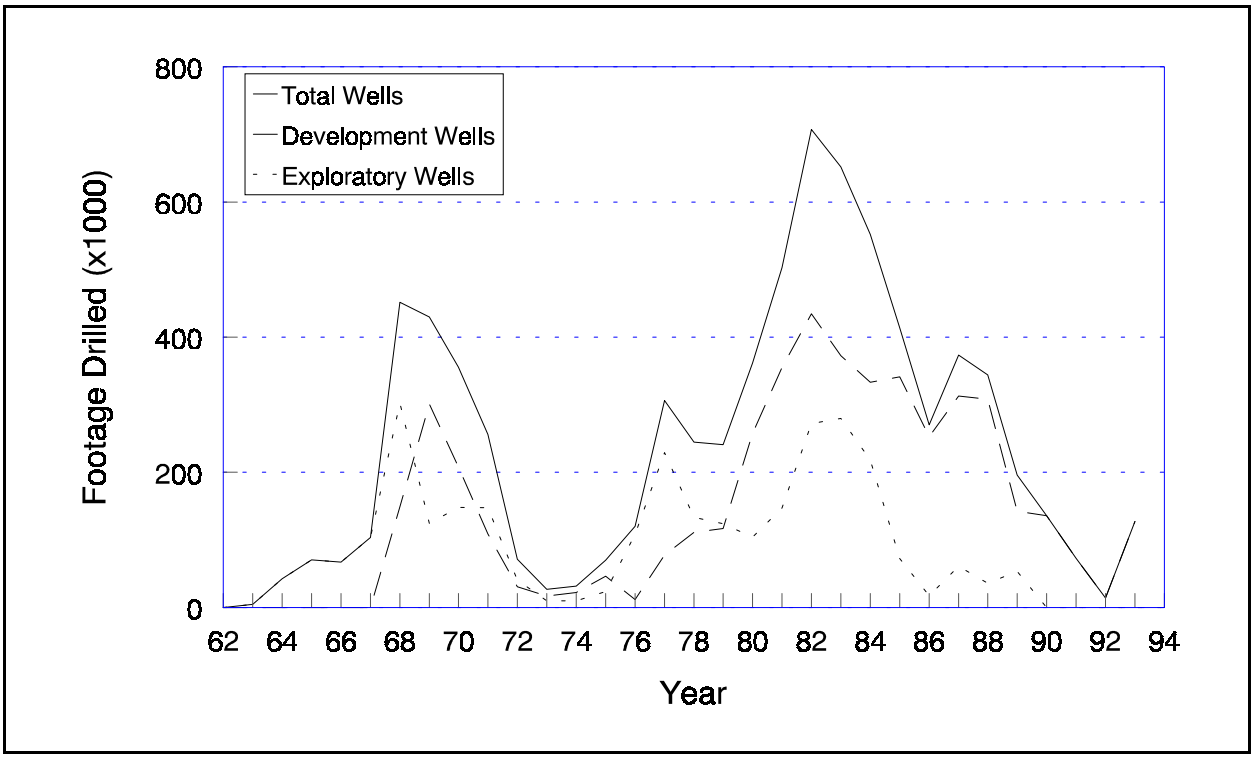

Figure 11. Annual drilled footage for wells in the Pacific OCS.

Oil and Gas Sales Prices, Volumes, and Gravities

During 1993, eleven of the 38 fields in the Pacific OCS produced oil and gas. Sales volumes of oil and gas produced from these fields totaled 49.25 MMbbl and 38.96 Bcf, respectively. The weighted average sales prices of oil and natural gas during 1993 were $9.64 per barrel and $2.81 per thousand cubic feet, respectively.

Total sales of crude oil from each field during 1993 are shown in table 7. Point Arguello Field is the largest field in the Pacific OCS in terms of oil sales volumes. Point Arguello and Hondo fields account for almost two-thirds of all Pacific OCS crude oil sold. This percentage is likely to increase as production rates increase at both fields.

Total sales of natural gas from each field during 1993 are shown in table 8. Pitas Point Field is the only producing gas field in the Pacific OCS, and produced over one-quarter of all Pacific OCS natural gas sold. Hondo Field produces more natural gas than any other single field in the region. Together the two fields account for over one-half of all Pacific OCS natural gas sold. Differences between sales volumes and produced gas volumes are due to lease use, flaring, injection, byproducts, etc.

Oil sales gravities range from 12° to 32° API. Oil produced from some reservoirs also contains substantial quantities of sulfur and metals. These factors have produced average prices for Pacific OCS crudes that are generally lower than the national average (figure 12).

Table 7. 1993 Oil sales for the Pacific OCS.

Field	Oil Sales Volume (MMbbl)	Percent of Total Sales
Point Arguello	25.83	52.45
Hondo	6.91	14.03
Point Pedernales	4.26	8.65
Beta	3.78	7.68
Dos Cuadras	3.58	7.27
Sockeye	1.76	3.57
Santa Clara	1.68	3.41
Carpinteria Offshore	1.01	2.05
Hueneme	0.44	0.89
Pescado *	0.00	0.00
Total	**49.25**	**100.00**

* production started 12/18/93

Table 8. 1993 Natural gas sales for the Pacific OCS.

Field	Natural Gas Sales Volume (Bcf)	Percent of Total Sales
Hondo	10.87	27.90
Pitas Point	10.41	26.72
Point Arguello	7.22	18.53
Sockeye	4.68	12.01
Dos Cuadras	2.58	6.62
Santa Clara	1.33	3.42
Point Pedernales	0.96	2.47
Carpinteria Offshore	0.48	1.23
Hueneme	0.22	0.56
Beta	0.21	0.54
Pescado *	0.00	0.00
Total	**38.96**	**100.00**

* production started 12/18/93

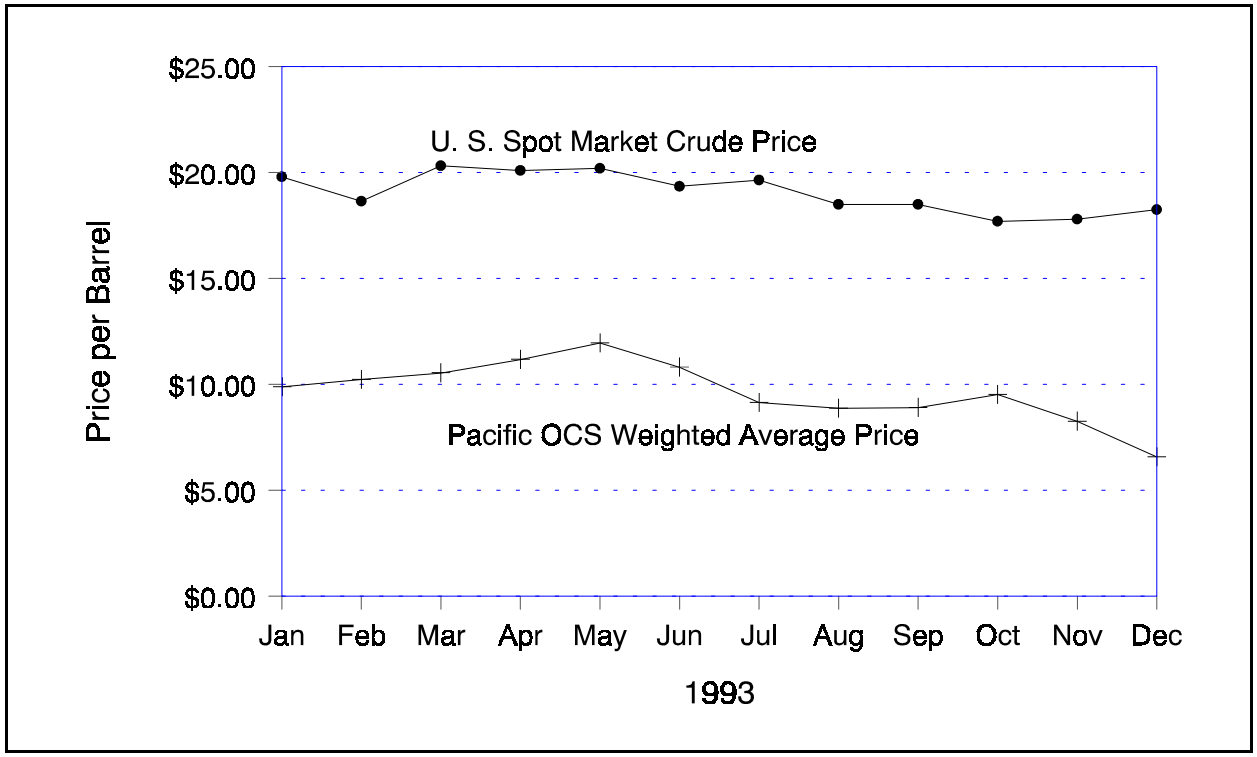

Figure 12. Average monthly crude oil price for Pacific OCS and Standard West Texas Crude (U.S. Spot Market).

Conclusions

As of December 31, 1993, the total original recoverable reserves in 38 fields in the Pacific OCS, offshore California, are estimated to be 2,050 MMbbl of oil and 3,129 Bcf of gas. The remaining proved reserves in 13 oil and gas fields are estimated to be 860 MMbbl of oil and 1,697 Bcf of gas. Unproved reserves in 25 oil and gas fields in the Pacific OCS are estimated to be 570 MMbbl of oil and 745 Bcf of gas. Total remaining reserves have decreased by 57 MMbbl of oil and 44 Bcf of gas, as compared with previously published estimates.

Oil and gas were being produced from 23 platforms in 11 fields at yearend. Original recoverable gas reserves for the single producing gas field are estimated to be 239 Bcf, and remaining reserves are estimated to be 63 Bcf of gas. Estimated original recoverable reserves for the other 10 producing fields total 1,335 MMbbl of oil and 1,906 Bcf of gas. Estimated remaining reserves for these 10 fields are 716 MMbbl of oil and 1,395 Bcf of gas. Over one-half of the remaining reserves in the Pacific OCS are contained within producing fields, and approximately three-fourths of the remaining oil and gas reserves are attributed to reservoirs in the Monterey Formation.

Pacific OCS oil production reached a new peak during 1993, when approximately 51 MMbbl of oil was produced. Annual gas production decreased slightly to 52 Bcf. Over three-fourths of the gas produced during the year was associated gas produced from oil reservoirs. Over one-half of the natural gas produced came from oil reservoirs in the Monterey Formation. Cumulative production from fields in the Pacific OCS has reached 619 MMbbl of oil and 687 Bcf of gas since production began in 1968.

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Appendices: Reserves, Production, and Development Summaries

The following appendices provide information on estimated oil and gas reserves, oil and gas production volumes and rates, and annual development activities in the Pacific OCS. Past reports have included compilations of information from each of the producing fields in the region. Pescado Field began producing oil and gas in December 1993, and similar information has been compiled for Pescado Field and included as an appendix to this report.

The information in the appendices has been obtained primarily from MMS interpretations of geophysical, geological, and other data provided by lessees. Such interpretations form the basis of MMS oil and gas reserves estimates for each of the fields in the Pacific OCS.

Appendices

Appendix A - Annual Estimates of Oil and Gas Reserves

The first oil field extending into Federal waters in the Pacific OCS was discovered in 1965. Estimates of original recoverable oil and gas reserves in the region have increased since that time, largely due to the discovery of new oil and gas fields, and often due to the reevaluation of known fields. Estimates of remaining reserves have generally increased as well, for the same reasons. The continued production of oil and gas, following the cessation of leasing and exploratory drilling, will tend to offset increases in estimates of remaining reserves.

Estimates of Original Recoverable Reserves

Since the discovery of Carpinteria Offshore Field in 1965, estimates of original recoverable oil and gas reserves in the Pacific OCS have increased substantially (figure A-1 and table A-1). The primary cause for this increase has been the discovery of additional oil and gas fields, many of which are of significant size. Other factors that can increase estimates of original recoverable reserves are the analysis of new data from known fields and the reevaluation of old data in combination with new technology. Past reevaluations of known fields have caused significant increases in estimates of original recoverable reserves.

It should be noted, however, that such studies may result in decreased reserves estimates as well. Some annual estimates of original recoverable oil and gas reserves in the Pacific OCS have decreased, as compared with estimates published in previous years (figure A-1). All such reductions in estimated original recoverable reserves have resulted from new studies of known fields. The cessation of leasing and exploratory drilling in the Pacific OCS have made the reevaluation of known fields the only factor that continues to cause changes in estimates of original recoverable oil and gas reserves.

Estimates of Remaining Reserves

Six of the 38 known fields in the region have been ranked among the top 100 U.S. oil fields in terms of remaining proved reserves; four of the six have been ranked among the top 50 fields, and three of the six are in the top 20 (table A-2). One of these three is also ranked among the 50 largest U.S. gas fields. These six fields contain almost one-half of the remaining oil and gas reserves in the region. Analyses of new data from other fields may increase reserves estimates sufficiently to include other Pacific OCS fields in the Nation's top 100.

The average volumes of oil and gas produced annually in the Pacific OCS have been about 1 percent of current estimated original recoverable oil and gas reserves. Such production rates have not caused extreme annual variations between estimated original recoverable reserves and remaining reserves. As a result, annual estimates of remaining oil and gas reserves have generally increased or decreased in step with the annual estimates of original recoverable reserves (figures A-1 and A-2). Future reserves estimates can be expected to reflect this relationship as well, although the divergence between original recoverable reserves and remaining reserves will increase as production from the Pacific OCS continues to increase.

Table A-1. Annual estimates of original recoverable reserves with source publication numbers.

Original Recoverable Reserves			
Year	Publication	Oil (MMbbl)	Gas (Bcf)
1976	OFR 78-384	829	1,530
1977	OFR 79-345	843	1,546
1978	OFR 80-477	875	1,665
1979	OFR 80-1042	920	1,845
1980	OFR 81-623	988	1,853
1981	OFR 82-37	1,082	1,847
1982	OFR 83-559	1,217	1,983
1983	MMS 84-0024	1,433	2,298
1984	MMS 85-0041	1,515	2,400
1985	MMS 86-0066	1,599	2,334
1986	MMS 87-0045	1,670	2,461
1987	MMS 88-0047	1,727	2,501
1988	MMS 89-0085	1,729	2,467
1989	MMS 90-0086	1,987	2,723
1990	MMS 91-0087	1,988	2,684
1991	MMS 92-0073	1,990	2,762
1992	MMS 94-0008	2,055	3,121
1993	MMS 94-0059	2,050	3,129

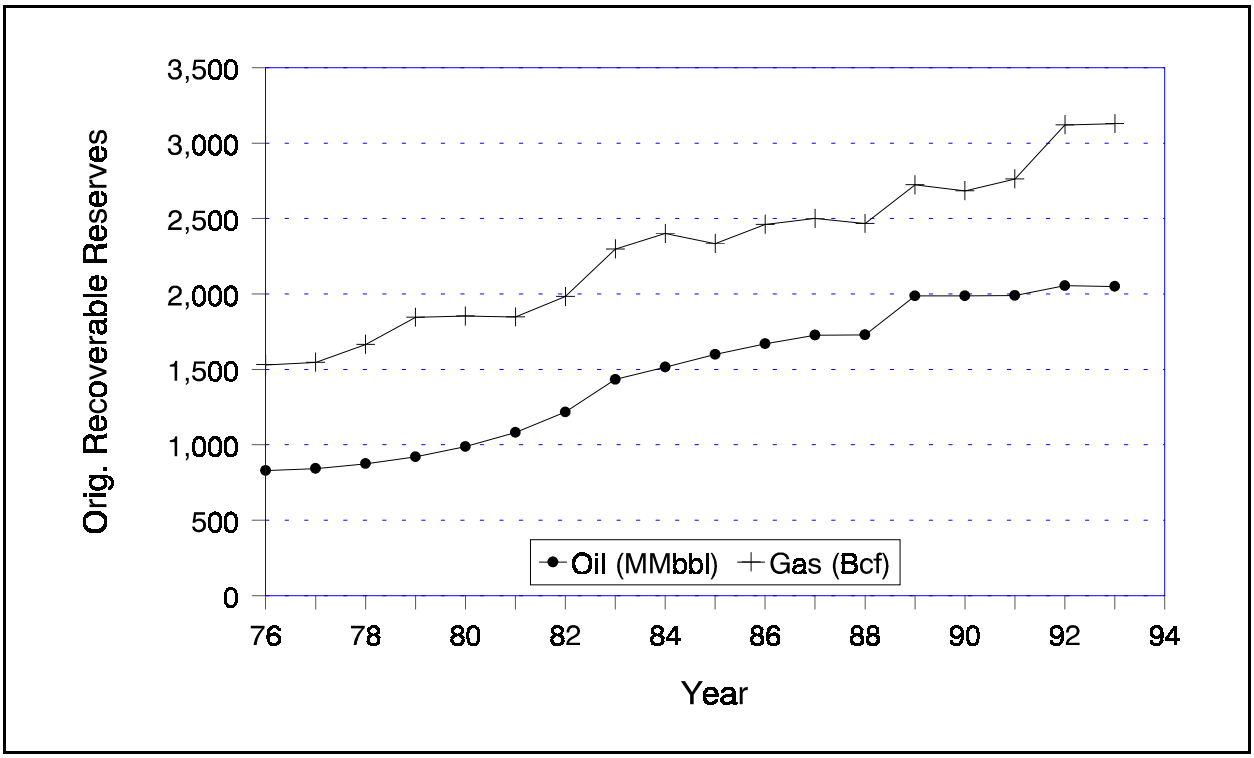

Figure A-1. Annual estimates of original recoverable reserves from known fields.

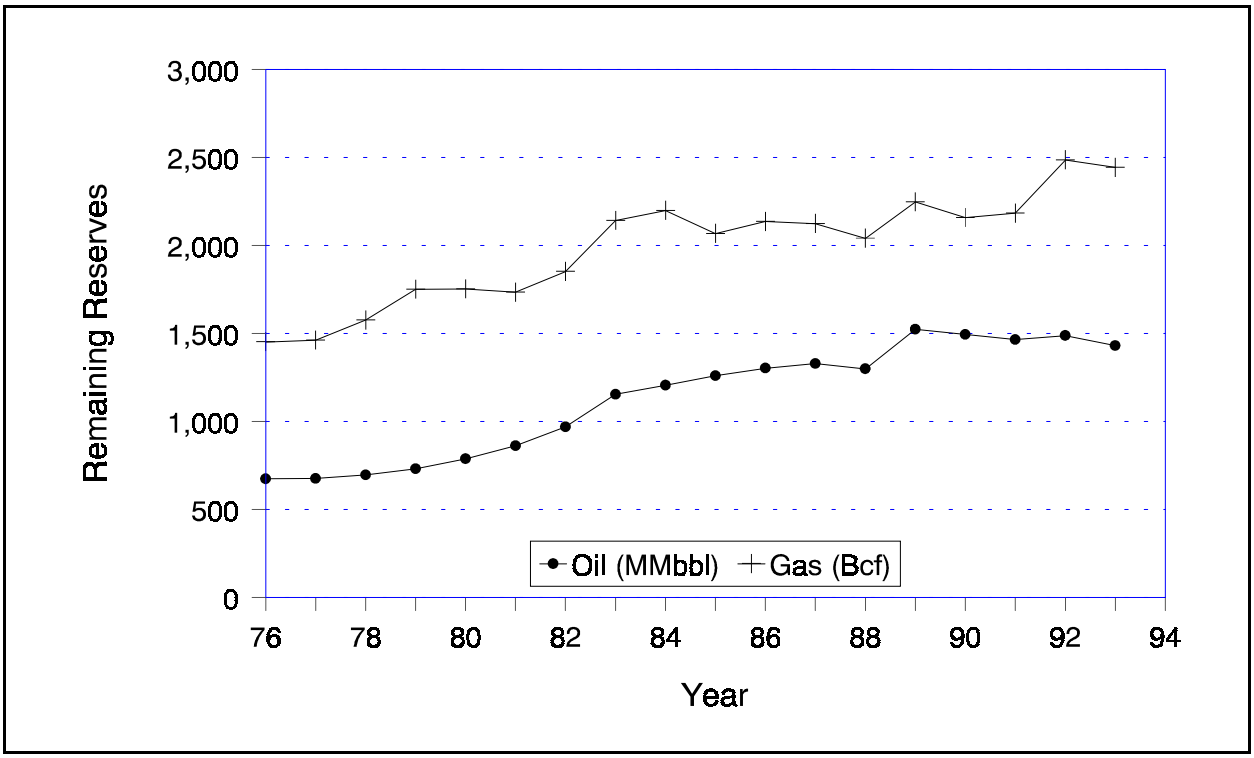

Figure A-2. Annual estimates of remaining recoverable reserves from known fields.

Table A-2. Pacific OCS fields among top 100 producing U.S. oil and gas fields.

Field	Orig. Rec. Oil (MMbbl)	Orig. Rec. Gas (Bcf)	Energy Information Adminstration Ranking (1991)	
			Oil	Gas
Hondo	278.9	834.0	Top 20	Top 50
Point Arguello	283.9	336.8	Top 20	
Pescado	109.0	218.6	Top 20	
Beta	116.5	32.3	Top 50	
Dos Cuadras	256.8	137.6	Top 100	
Point Pedernales	77.3	17.0	Top 100	

Appendix B - Pescado Field

Summary

Pescado Field is located in the western Santa Barbara Basin approximately 12 miles southeast of Point Conception. The field covers portions of Leases OCS-P 0182, 0183, and 0329, all of which are within the Santa Ynez Unit. Water depths over the field exceed 1,000 feet. Platform Heritage is set near the center of the field in Lease OCS-P 0182 in 1,075 feet of water.

Oil and gas production from Pescado Field began in December 1993. Only two development wells have been drilled from the 60-slot platform to date, both late in 1993. All produced oil is from fractured reservoirs in the Miocene Monterey Formation. Miocene, Oligocene, and Eocene sandstone reservoirs are present within the field, but are not currently producing.

Production during 1993 totaled only 35,991 barrels of oil and 11,154 Mcf of gas, from a single producing oil well. Oil gravity averaged 17^{o} API. Estimated remaining oil and gas reserves for the field are 109.0 MMbbl and 218.6 Bcf, respectively.

Geology

The geologic structures of the Pescado Field area exhibit the general east-west trend of the Transverse Ranges physiographic province. The anticline that provides structural closure for most of the field follows this trend, as do the principal faults (figures B-1 and B-2). These faults form part of a system defining the northern margin of the basin that contains the Santa Barbara Channel.

The oldest strata penetrated within Pescado Field are Late Paleocene(?) to Early Eocene marine sedimentary rocks. The sandstones and shales in this section have been assigned to the Anita Formation (also referred to by some authors as the Juncal or Camino Cielo formations). In one exploration well, over 2,000 feet of Anita Formation rocks were penetrated. Overlying the Anita Formation are the predominantly coarse-clastic sedimentary rocks of the Matilija Formation. These strata date from the Ulatisian stage and average over 700 feet in thickness in Pescado Field. The bathyal shales of the Narizian Cozy Dell Formation conformably overlie the Matilija Formation and vary in thickness between 400 and 600 feet in the exploratory wells. Above this shale unit are the upper to middle bathyal sandstones of the Narizian Sacate Formation. These sandstones are predominantly fine-grained, angular, and quartz-rich and are interbedded with siltstone. The average thickness of the Sacate Formation is 700 feet.

The Gaviota Formation was deposited during the Refugian stage, which spans the Eocene-Oligocene boundary. This formation includes bathyal to neritic shales, siltstones, and prominent sandstones, which conformably overlie the older Eocene strata. The Gaviota Formation varies in thickness from about 1,100 to 1,500 feet. Above the Gaviota Formation are the sandstones and shales of the Early Zemorrian Alegria Formation. This formation is dominated by shallow marine sandstones, and total formation thickness averages only 150 feet. To date, no nonmarine Sespe Formation rocks have been penetrated within the field. The Eocene and Oligocene rocks at Pescado Field are analogous to rocks of the Great Valley Sequence in the San Joaquin Valley.

The basal transgressive Vaqueros Sandstone marks the onset of Neogene deposition in the Santa Barbara Basin. This shallow marine sand varies in thickness from 0 to 150 feet within the field and was deposited unconformably on top of the Alegria Formation. Conformably overlying the Vaqueros Sandstone is the lower Miocene Rincon Formation, which consists of a deepening-upwards sequence of outer neritic to upper bathyal shales. The average thickness of the formation exceeds 500 feet. A bentonite bed that has been arbitrarily picked as the top of the Rincon Formation marks the Saucesian-Relizian boundary and may be coeval with the Tranquillon Volcanics identified in the Santa Ynez Mountains.

Directly above the Rincon Formation is the middle to upper Miocene Monterey Formation. At Pescado Field this formation is informally subdivided into a lower sandstone/shale zone and an upper biogenic silica/carbonate zone. The lower zone is composed of Relizian-aged deep sea fan sediments, which average 600 feet in thickness. These rocks have been assigned by some authors to the Rincon Formation. The upper zone is a complex of fractured deep-water sedimentary rocks that include laminated chert, phosphatic shales, siltstone, and carbonates. The upper zone has been further subdivided into calcareous and massive chert units below a zone that is predominantly shale, and an upper siliceous unit and transitional unit. The upper zone averages 2,000 feet in thickness.

The top of the Monterey Formation is gradational with the base of the late Miocene to early Pliocene Sisquoc Formation. The amount of biogenic silica decreases within the Sisquoc Formation, which contains more terrigenous material. This formation varies in thickness from 400 to 1,100 feet within the field, and the formation top appears to be unconformable. The Sisquoc Formation is overlain by the Pico and "Repetto" (lower Pico) formations, which consist of a generally shallowing upwards sequence of bathyal sandstones, siltstones, and mudstones. Paleontological evidence suggests that the Repettian-aged section may be abbreviated. The Pico and "Repetto" formations exceed 3,500 feet in thickness. A 500- to 700-foot-thick veneer of semiconsolidated Quaternary sediments overlies the Pliocene section. A type log for Pescado Field is shown in figure B-3.

Hydrocarbon reservoirs are apparently present throughout the stratigraphic section. Gas and oil reservoirs have been found in the Matilija, Gaviota, Alegria, and Vaqueros formations. Fractured reservoirs within the Monterey Formation have begun to produce heavy oil. The lower Pliocene was tested in one well, but produced only a trace of oil. Reservoir characteristics are summarized in table B-1.

Exploration and Development

The three blocks containing Pescado Field were leased during two OCS lease sales. Leases OCS-P 0182 and 0183 were leased during OCS Sale P4, in February 1968. Humble Oil & Refining Company and Standard Oil Company of California obtained Lease OCS-P 0182 with a bonus bid of $2,062,771. Humble acquired Lease OCS-P 0183 with a high bid of $11,600,640. Lease OCS-P 0329 was leased 11 years later, in June 1979, in OCS Sale No. 48. Exxon Corporation (formerly Humble Oil & Refining Company) became the sole interest holder in the lease with a bonus bid of $17,115,000. Exxon was designated operator of each lease.

The Pescado Field discovery well, OCS-P 0182 No. 1, was spudded by Exxon in February 1970. The well was drilled from the *Bluewater II* semisubmersible in 1,046 feet of water, to a total depth of 14,358 feet. The Matilija Formation tested gas and 50° API condensate at rates of 4,100 Mcfpd and 460 bpd, respectively. Drill stem tests of the Gaviota, Alegria, and Vaqueros formations flowed 33° to 38° API oil at a combined rate of 3,030 bpd, with 3,410 Mcfpd of gas. The Monterey Formation was also tested, and produced 960 bpd of 15° to 16° API oil. The well was suspended in May 1970.

Within a year, the operator had spudded another well on the structure, down-dip to the west. This second well, OCS-P 0183 No. 1, was also drilled from the *Bluewater II*, to a total depth of 12,760 feet. Subsequent testing showed the Matilija Formation to be wet, although the Monterey Formation flowed 16° API oil at a rate of 250 bpd. Over the next 10 years, the operator drilled four more expendable wells in the two leases. Three of these wells produced oil from the Monterey Formation, but no producible hydrocarbons were found in any of the sandstones penetrated. All of the exploratory wells were plugged and abandoned by November 1982.

The discoveries in the northwestern Santa Barbara Basin prompted the creation of the Santa Ynez Unit in November 1970. The unit initially contained 18 leases, including Leases OCS-P 0182 and 0183. Exxon was designated as unit operator. Lease OCS-P 0329 was added to the Santa Ynez Unit in November 1982.

Exxon installed Platform Heritage on Lease OCS-P 0182 in October 1989. The platform is located near the center of Pescado Field in 1,075 feet of water. In September 1993 the first development well, OCS-P 0182 HE-1, was spudded from the 60-slot platform. The well was completed as an oil well and began producing in December. The operator began drilling a second well, OCS-P 0182 HE-2, in November and completed it as a gas injection well one month later. By December 31, 1993, only two wells had been completed, although the drilling of a third well was in progress.

In October 1993, the interest in Lease OCS-P 0182 held by Chevron U.S.A. Inc. (formerly Standard Oil Company of California) was assigned to Burdette A. Ogle. Exxon continues as unit and field operator and remains the sole interest holder in the other two Pescado Field leases.

Production and Reserves

The production of oil and gas from Pescado Field began in December 1993. All of the production to date has been from fractured Monterey Formation reservoirs. Oil and gas reservoirs are also present in the older Vaqueros, Alegria, Gaviota, and Matilija formations. All oil produced from the field is transported onshore by pipeline to Exxon's Las Flores Canyon facility.

Volumetric analyses were used to calculate recoverable hydrocarbon reserves for Pescado Field. Original recoverable reserves of oil and gas are estimated to be 109.0 MMbbl and 218.6 Bcf, respectively. Cumulative production as of December 1993 amounted to only 35,991 bbl of oil and 11,154 Mcf of gas from a single producing oil well. Estimated remaining oil and gas reserves for the field are, therefore, approximately equal to original recoverable reserves.

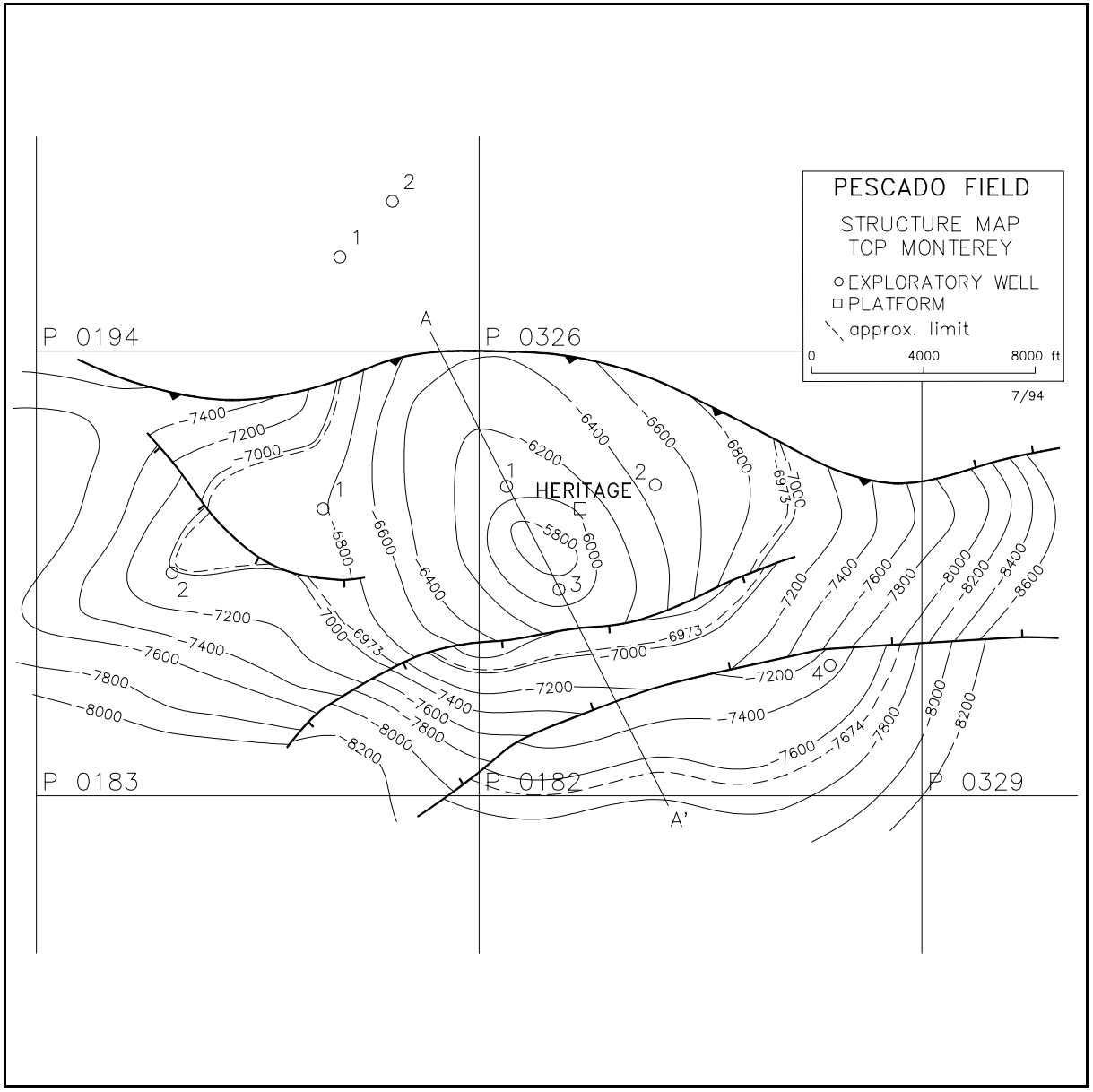

Figure B-1. Structure map of Pescado Field.

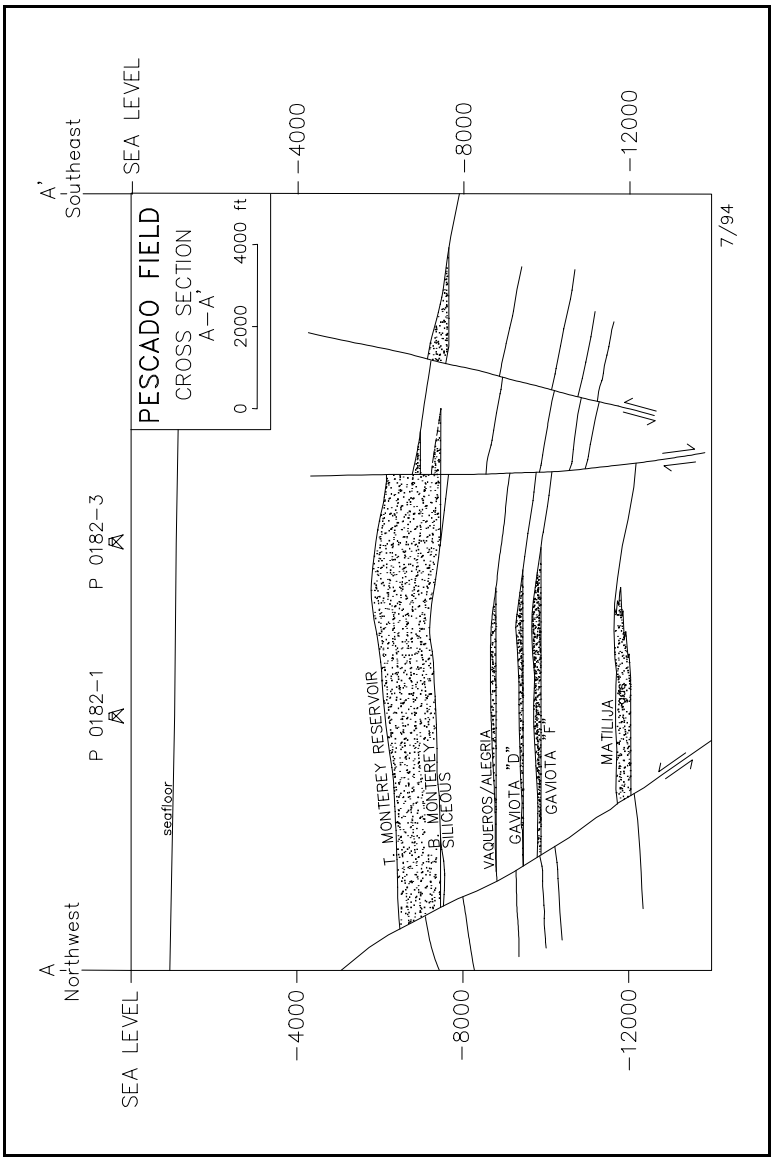

Figure B-2. Cross section through Pescado Field.

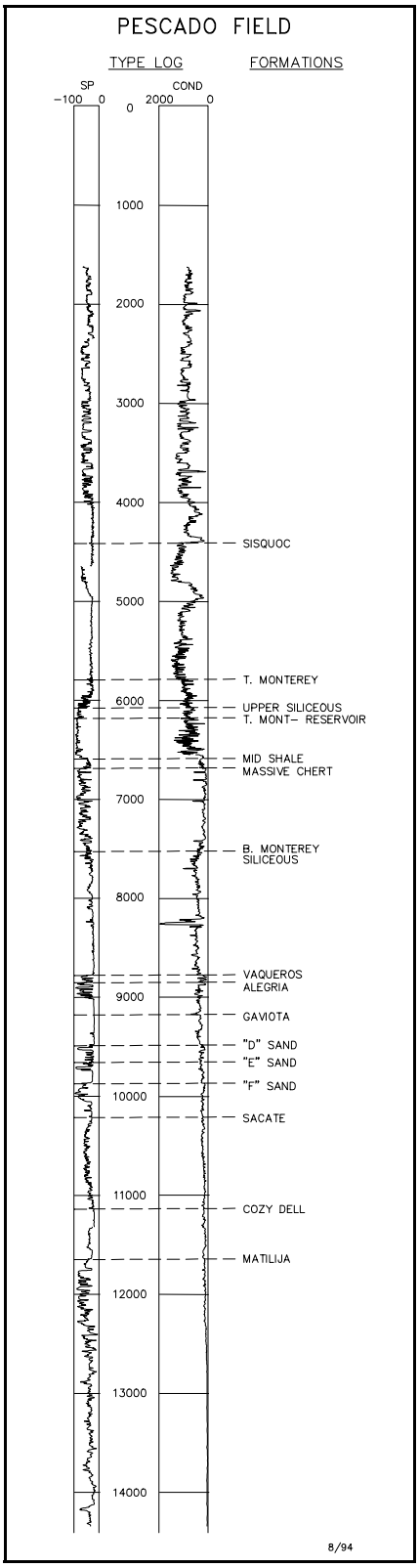

Figure B-3. Pescado Field type log.

Table B-1. Pescado Field reservoir characteristics.

Pescado Field Monterey Reservoir Characteristics	
Average Depth	6,712 feet
Porosity	2-30%
Permeability	0.1-1,700 md
Reservoir Temperature	200° F
Original Reservoir Pressure	3,050 psig
Connate Water Saturation	10-55%
Gross Pay Thickness	1,200 feet
Net Pay Thickness	35-675 feet
Productive Area	4,954 acres
Gas Specific Gravity	0.73

Table B-2. Pescado Field fluid characteristics.

Pescado Field Monterey Reservoir Fluid Characteristics	
Average Oil Gravity	17° API
Saturation Pressure	2,500 psig
Viscosity	7.0 cp
Initial Producing GOR	300 SCF/STB
Initial Oil Formation Volume Factor	1.20 RB/STB

Appendix C - Annual Development Activities

Development activities in the Pacific OCS increased markedly during 1993. Although only three wells or redrills were drilled in the region during 1992, five redrills and 16 new wells were drilled to total depth by the end of 1993 (Tables C-1 and C-2). This marks a seven-fold increase in just one year. Twenty-eight wells were completed or recompleted by yearend. Other work was also completed at each of the 11 producing fields.

Field Activities

Beta Field

Beta Field is the only producing Pacific OCS field in the Los Angeles Basin. Two new development wells were drilled in the field during 1993, both from Platform Eureka in Lease OCS-P 0301. Two other Platform Eureka wells were converted from electric submersible pumps to hydraulic pumps. Three Platform Ellen wells in Lease OCS-P 0300 received similar workovers. One Platform Edith well in Lease OCS-P 0296 was converted to a water injection well, and two others were acidized. There were 24 electric submersible pump changes at Beta Field during 1993. Waterflood operations continued in Leases OCS-P 0300 and 0301. Maximum oil production for the year was 11,198 bpd in February; gas production peaked at 2,722 Mcfpd in June.

Carpinteria Offshore Field

There were no new development wells drilled at Carpinteria Offshore Field during 1993, but ten workovers were conducted by yearend. Workovers included changing three gas lift completions to rod pump, changing two rod pumps to progressive cavity pumps, and five acid stimulations. Oil production for the year peaked at 3,098 bpd in March and gas production reached a high of 2,450 Mcfpd in July. A study of the feasibility of using extended reach drilling to increase productivity and ultimate recovery is underway.

Dos Cuadras Field

Technological advances, including the completion of trilateral horizontal wells, have allowed Unocal to reverse the natural production decline at Dos Cuadras Field. Four trilateral wells were drilled in 1993. Three were drilled from Platform B in Lease OCS-P 0241, and one was drilled from Platform Hillhouse in Lease OCS-P 0240, targeting Pliocene sands at depths too shallow to fully develop by conventional drilling. Although oil production in 1991 averaged only 8,500 bpd, the completion of the trilateral wells pushed production up to 10,600 bpd by December 1993. One conventional well was also drilled from Platform B. Nine workovers were also performed, including seven acid stimulations, one recompletion, and one gravel pack.

Hondo Field The development of Hondo Field continued in 1993, with the spudding of the first three wells from newly installed Platform Harmony in Lease OCS-P 0190. The first well was spudded in July and completed as an oil well. The second well was spudded in September and completed as a gas injection well in December. Drilling began on the third well in December and continued into 1994. Production commenced from the 60-slot platform in December and totaled 28,142 bbl of oil and 11,028 Mcf of gas by yearend.

No wells were drilled from Platform Hondo in Lease OCS-P 0188 in 1993. A number of workovers were performed, however, including the addition of new perforations in three wells to increase production. A mechanical plug was set in another well to isolate watered out perforations. In addition, Exxon installed redesigned valves for high pressure gas lift in five wells, and replaced cut-out gas lift valves in another. Finally, the subsurface safety valves were replaced in three wells, and these wells were then acidized to increase production.

Hueneme Field Most of Hueneme Field is located within the Point Hueneme Unit. In March 1993, Lease OCS-P 0479 was deleted from the unit, leaving only Leases OCS-P 0202 and 0203 in the Point Hueneme Unit. No wells were drilled and no workovers were performed in 1993, although Unocal was preparing to test the Monterey Formation at yearend. Monthly oil production in 1993 peaked in December at 670 bpd, produced through electric submersible pumps in conjunction with the active water drive. Gas production peaked in January at 838 Mcfpd.

Pescado Field Pescado Field became the eleventh producing field in the Pacific OCS in December 1993. The leasing, exploration, and development history of Pescado Field are summarized in appendix B.

Pitas Point Field Pitas Point Field is the only producing gas field in the Pacific OCS. No new wells or redrills were drilled in the field during 1993. During the last quarter of the year, damaged tubing was replaced in two wells. Peak gas production for the year occurred in January, when daily production averaged 33,547 Mcfpd. Condensate production for January was only 28 bpd.

Point Arguello Field One new development well was drilled in Point Arguello Field during 1993, fromPlatform Hidalgo in Lease OCS-P 0450. One previously drilled well on Platform Hermosa in Lease OCS-P 0316 was completed. Three Platform Hidalgo wells received workovers, including packer repairs and the addition of new perforations. Other well work at Platform Hermosa included the addition of perforations, the replacement of failed packers, and acid stimulations for five wells. Nine Platform Harvest wells in Lease OCS-P 0315 received similar workovers. Oil production from Point Arguello Field reached a peak of 80,790 bpd in September 1993; peak gas production of 34,914 Mcfpd occurred two months later.

Point Pedernales Field

Three new development wells were drilled in Point Pedernales Field during the year. All three wells were drilled from Platform Irene in Lease OCS-P 0441 and use gas lift to produce oil from Monterey Formation reservoirs. A tubing repair job was also conducted on one other well. Unocal is in the process of selling its interest in the Point Pedernales project to Torch Operating Company. Oil and gas production from Point Pedernales Field during 1993 peaked at 13,527 bpd and 3,236 Mcfpd, respectively, in May 1993.

Santa Clara Field

Only one well was drilled in Santa Clara Field during 1993, a redrill from Platform Gilda in Lease OCS-P 0216. Numerous workovers were also performed during the year, including the replacement of damaged tubing. Four wells were perforated and acidized, two water injection wells were acidized, and two idle wells were converted to water injection wells. One other injector was abandoned in preparation for a redrill in 1994. Peak oil and gas production for the year occurred in January, when average rates of 5,039 bpd and 5,334 Mcfpd were attained.

Sockeye

Two wells were drilled or redrilled in Sockeye Field during 1993. These wells use gas lift to produce oil from dual completions in the Monterey and Sespe formations. A number of workovers were also conducted during 1993. One well was acidized after the tubing was replaced, another well was converted from a single completion to dual completions, and five wells were perforated. Peak oil production for the year occurred in May, when the average rate reached 8,673 bpd. Peak gas production of 25,397 Mcfpd occurred in December.

Table C-1. Summary of development well borehole status at yearend.

Platform Name	APD	ACT	DSI	COM	PA	ST	TA	**Total**
A				50		15		**65**
B				53	1	21		**75**
C				33				**33**
Edith				18		1	2	**21**
Ellen				60	4	5		**69**
Eureka				46		1		**47**
Gail				16	1			**17**
Gilda	1			61		6	1	**69**
Gina				12		2		**14**
Grace				23	2	6	3	**34**
Habitat				18	1		2	**21**
Harmony				2				**2**
Harvest				11			4	**15**
Henry				23	1	1		**25**
Heritage				2				**2**
Hermosa				12				**12**
Hidalgo				7				**7**
Hillhouse				47		4		**51**
Hogan				36	4	10		**50**
Hondo				28		9		**37**
Houchin				32	3	7	1	**43**
Irene				19	2	3	1	**25**
Total	**1**	**0**	**0**	**609**	**19**	**91**	**14**	**734**

Table C-2. Summary of development well completion status at yearend.

Platform Name	POW	GLO	PGW	OSI	GSI	GIW	WIW	WDW	WSW	**Total**
A	38			9			5			**52**
B	39			10			8			**57**
C	27			1			9			**37**
Edith	12			6						**18**
Ellen	29			3	2		22	1	3	**60**
Eureka	28			1	1		16			**46**
Gail	7	10	1	4						**22**
Gilda	35		2	4	3		20			**64**
Gina	3			4			5			**12**
Grace		13		6	4		1			**24**
Habitat			16		4					**20**
Harmony	1		1							**2**
Harvest	8			3						**11**
Henry	22			1						**23**
Heritage	1					1				**2**
Hermosa	7	5								**12**
Hidalgo	1	5		1						**7**
Hillhouse	34			12			1	1		**48**
Hogan	16			16		1		3		**36**
Hondo	12	10		3		2	1	1		**29**
Houchin	14			18						**32**
Irene	2	11		6						**19**
Total	**336**	**54**	**20**	**108**	**14**	**4**	**88**	**6**	**3**	**633**

Appendix D - Annual and Cumulative Oil and Gas Production

Oil and gas production from the Pacific OCS began in June 1968, from Carpinteria Offshore Field. By December 31, 1993, 10 additional fields were producing oil and gas. Peak gas production in the region occurred in 1985, when nearly 64 Bcf of gas was produced. The most oil produced from the Pacific OCS in a single year was just under 51 MMbbl, in 1993. To date, over 619 MMbbl of oil and 687 Bcf of gas have been produced from 11 fields. Cumulative production equals almost one-third of the original recoverable oil reserves and almost one-fourth of the original recoverable gas reserves.

Annual Production

Oil production from the Pacific OCS reached a new peak during 1993, when just under 51 MMbbl of oil were produced (table D-1, and figures D-1 and D-2). This amount, produced from only 23 platforms in 11 fields, represents almost one-fifth of the Nation's OCS oil production for the year.

Point Arguello Field produced almost 26 MMbbl of oil during 1993, which amounts to over one-half of the region's oil production and one-tenth of the Nation's OCS total. A number of wells in the field produced over 1 MMbbl of oil during 1993; one well produced over 2 MMbbl of oil and the most prolific well produced over 3 MMbbl. Eleven of the 12 most productive oil wells in the Pacific OCS are located in Point Arguello Field (table D-2). These 11 wells accounted for over one-third of the oil produced in the region during 1993.

Natural gas production from the Pacific OCS had declined slightly by yearend, to approximately 52 Bcf. This decline can be largely attributed to declining gas production from Pitas Point Field, the only producing gas field in the region. The amount of gas produced from Hondo Field also declined during 1993, while gas production from Point Arguello Field continued to increase. Production from the three fields exceeded 37 Bcf, accounting for over two-thirds of the gas produced in the Pacific OCS.

Five of the 11 wells that produced over 1 Bcf of gas during 1993 are located in Hondo Field (table D-3); three of the wells are located in Pitas Point Field, and two are located in Sockeye Field. Over one-third of the gas produced in the region during the year can be attributed to these 11 wells. The 22 most prolific producing wells (tables D-2 and D-3) accounted for almost one-half of the oil and over one-half of the gas produced in the Pacific OCS during 1993.

During 1993, over three-fourths of the oil and over one-half of the gas were produced from reservoirs in the Monterey Formation (figure D-2).

Reservoirs in younger rocks were the source of most of the remaining production. The proportion of produced oil and gas obtained from Monterey Formation reservoirs will increase as production from Point Arguello, Hondo, and Pescado fields increases, and as production from the more mature fields in the Pacific OCS continues to decline.

Cumulative Production

Cumulative production exceeded 619 MMbbl of oil and 687 Bcf of gas in 1993 (table D-1 and figure D-4). The amount of oil produced equals almost one-half of the proved original recoverable reserves, and about one-third of the total original recoverable reserves. Cumulative gas production equals almost one-third of the proved original recoverable reserves, and almost one-fourth of the total original recoverable reserves.

To date, Dos Cuadras Field has produced more oil than any other field in the Pacific OCS. Over one-third of the region's cumulative oil production can be attributed to Dos Cuadras Field. Over one-half of the cumulative oil production can be attributed to just two fields, Dos Cuadras and Hondo. Dos Cuadras, Hondo, and Beta fields are responsible for over two-thirds of the oil produced to date.

More gas has been produced from Hondo Field than from any other field in the region. Pitas Point Field, the only producing gas field in the Pacific OCS, currently ranks second in terms of cumulative gas production. The combined total gas production from the two fields amounts to over one-half of the cumulative gas production from the region. Hondo, Pitas Point, and Dos Cuadras fields have produced over two-thirds of the natural gas obtained from Pacific OCS fields.

Over one-half of the oil and gas produced to date can be attributed to post-Monterey reservoirs (figure D-5). Production from Monterey Formation reservoirs continues to increase, however, and over one-third of the oil and gas produced by December 31, 1993, has been obtained from reservoirs in the Monterey Formation.

Table D-1. Annual and cumulative production for the Pacific OCS.

Year	Annual Oil (bbl)	Cumulative Oil (bbl)	Annual Gas (Mcf)	Cumulative Gas (Mcf)
1968	2,076,160	2,076,160	1,237,180	1,237,180
1969	9,942,733	12,018,893	6,016,485	7,253,665
1970	25,035,171	37,054,064	13,757,148	21,010,813
1971	31,103,681	68,157,745	17,853,055	38,863,868
1972	22,562,566	90,720,311	12,546,915	51,410,783
1973	18,818,026	109,538,337	9,157,714	60,568,497
1974	16,784,100	126,322,437	7,234,937	67,803,434
1975	15,434,507	141,756,944	5,978,959	73,782,393
1976	13,977,436	155,734,380	5,533,258	79,315,651
1977	12,258,013	167,992,393	5,366,181	84,681,832
1978	11,979,674	179,972,067	5,193,985	89,875,817
1979	10,971,013	190,943,080	5,430,689	95,306,506
1980	10,118,614	201,061,694	5,771,792	101,078,298
1981	19,619,670	220,681,364	12,769,110	113,847,408
1982	28,471,665	249,153,029	17,814,958	131,662,366
1983	30,558,866	279,711,895	23,923,258	155,585,624
1984	30,500,506	310,212,401	45,912,435	201,498,059
1985	29,673,649	339,886,050	63,523,094	265,021,153
1986	28,779,936	368,665,986	57,989,035	323,010,188
1987	31,284,618	399,950,604	54,874,298	377,884,486
1988	31,529,776	431,480,380	49,132,759	427,017,245
1989	33,067,789	464,548,169	50,872,623	477,889,868
1990	29,885,271	494,310,184	49,950,216	527,796,524
1991	31,623,014	525,896,641	52,390,640	580,197,225
1992	42,711,426	568,610,886	55,268,116	635,258,278
1993	50,656,382	619,321,164	51,832,124	687,459,521

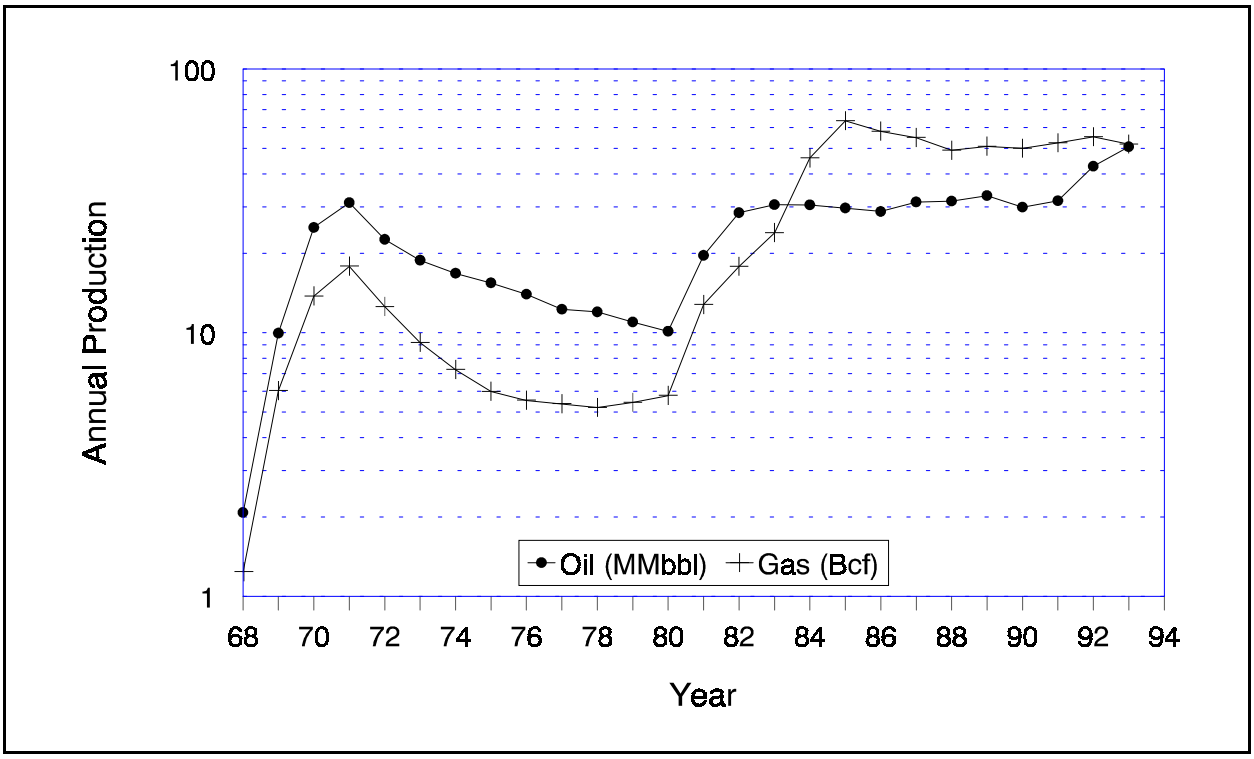

Figure D-1. Annual production for the Pacific OCS.

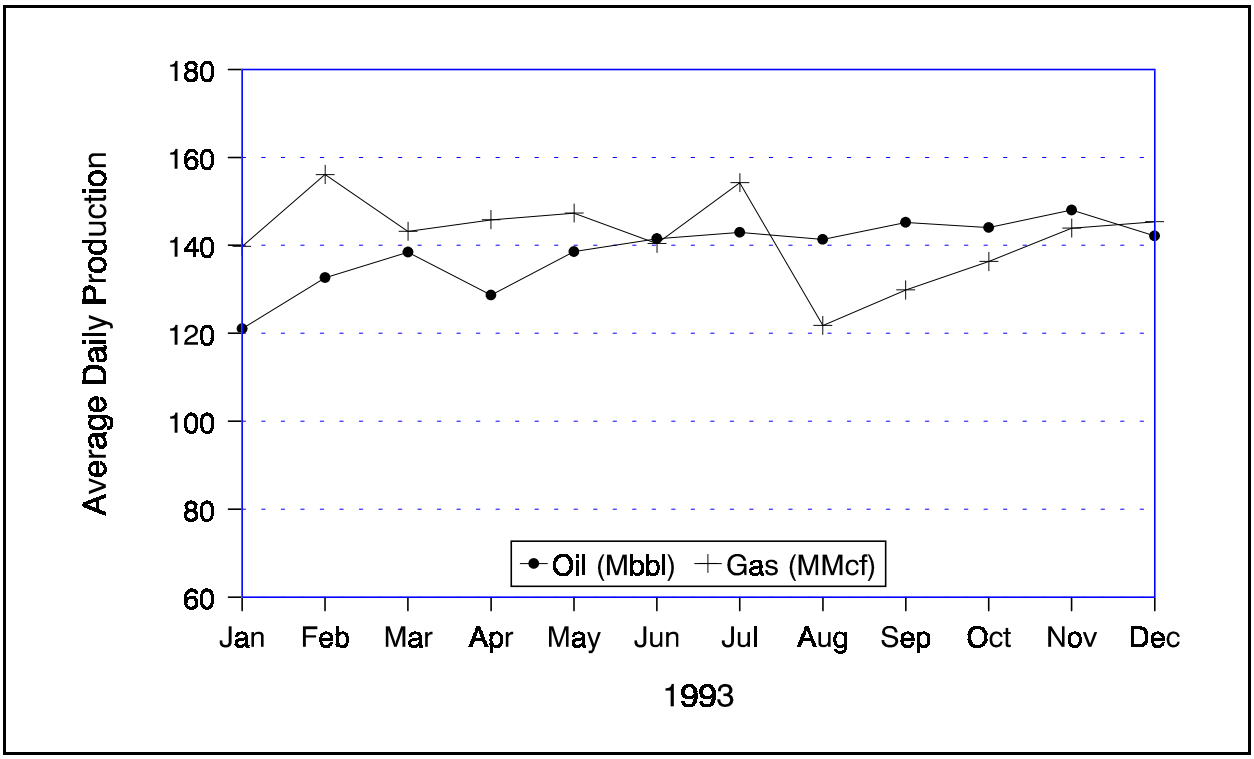

Figure D-2. Average daily production for the Pacific OCS.

Table D-2. Wells producing over 1 MMbbl of oil, Pacific OCS.

1993 Annual Production						
Field	Lease	Well	Oil (bbl)	Gas (Mcf)	Water (bbl)	Days Produced
PTARGL	P 0315	A-3	3,007,617	1,299,497	90,273	359
PTARGL	P 0316	B-3	2,123,824	931,655	5,629	363
PTARGL	P 0316	B-11	1,996,379	874,321	13,842	362
PTARGL	P 0316	B-2	1,993,086	869,913	0	363
PTARGL	P 0315	A-6	1,746,622	665,883	3,757	359
PTARGL	P 0315	A-13	1,657,843	667,785	21,983	219
PTARGL	P 0316	B-6	1,643,582	820,215	142	363
HONDO	P 0190	H-3	1,562,343	833,827	89,325	351
PTARGL	P 0315	A-7	1,407,735	554,568	11,358	359
PTARGL	P 0316	B-1	1,367,874	627,595	1,710	363
PTARGL	P 0315	A-4	1,295,669	598,821	6,412	347
PTARGL	P 0450	C-1	1,115,971	388,329	259,528	361

Table D-3. Wells producing over 1 Bcf of gas, Pacific OCS.

1993 Annual Production						
Field	Lease	Well	Oil (bbl)	Gas (Mcf)	Water (bbl)	Days Produced
HONDO	P 0188	H-23	76,071	3,526,238	67,539	314
HONDO	P 0188	H-9	841,857	2,833,057	99,452	331
PITSPT	P 0234	A-19	1,386	2,398,739	4,196	365
HONDO	P 0188	H-7	338,505	1,642,478	276,328	352
SOCKEY	P 0205	E-1	170,855	1,501,755	74,961	360
PTARGL	P 0315	A-3	3,007,617	1,299,497	90,273	359
SOCKEY	P 0205	E-4	224,543	1,168,550	186,196	279
HONDO	P 0190	H-29	737,562	1,080,761	103,389	356
HONDO	P 0188	H-12	78,005	1,070,494	18,538	350
PITSPT	P 0234	A-8	618	1,055,195	14,957	365
PITSPT	P 0234	A-1	301	1,025,526	8,015	365

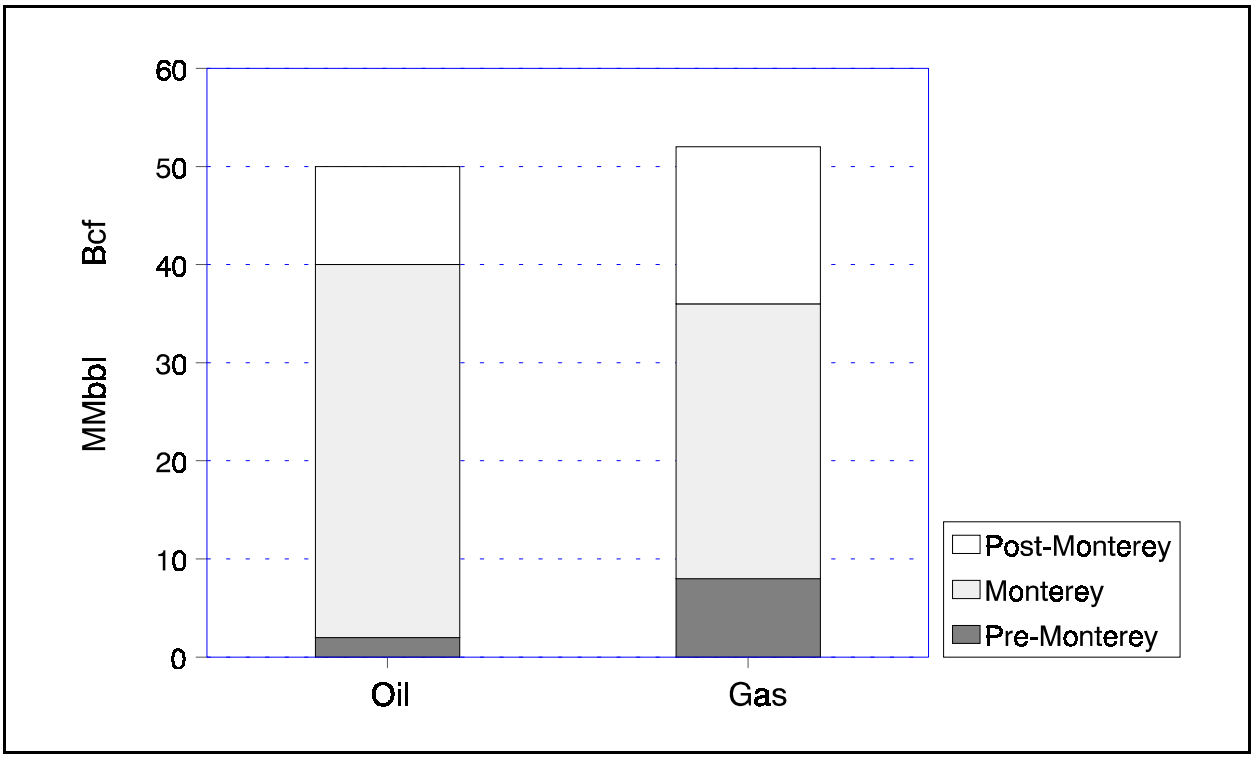

Figure D-3. Annual production of oil and gas by reservoir age group, Pacific OCS, Dec. 31, 1993.

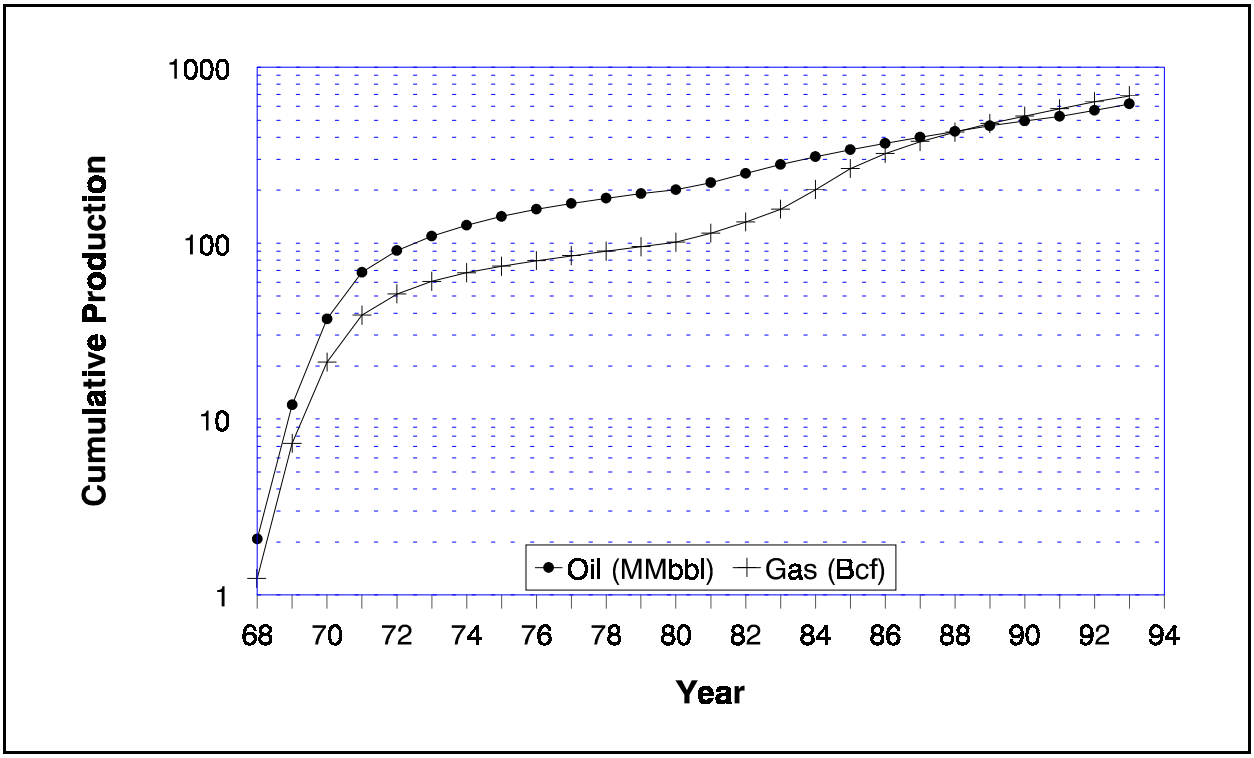

Figure D-4. Cumulative production for the Pacific OCS.

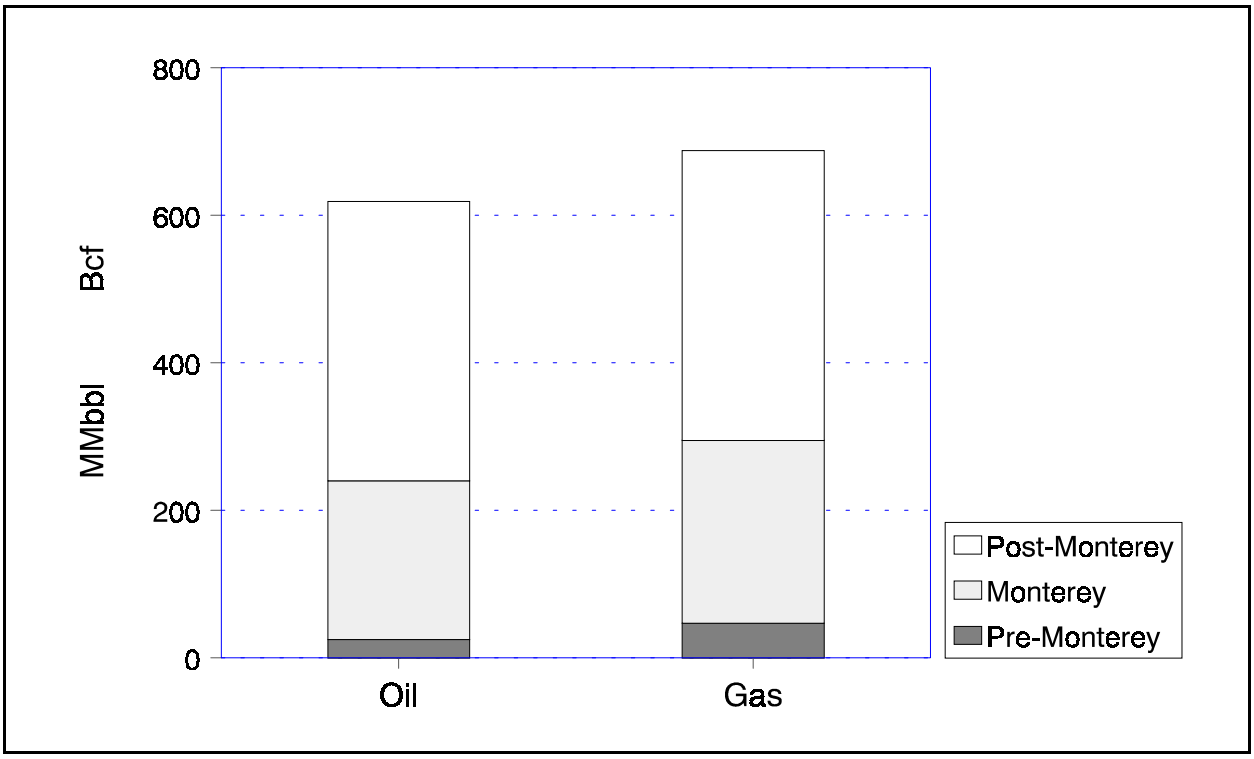

Figure D-5. Cumulative production of oil and gas by reservoir age group, Pacific OCS, Dec. 31, 1993.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

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

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

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