COMPARISON OF RESOURCE ESTIMATES WITH PREVIOUS ASSESSMENTS

Several past assessments of the undiscovered oil and gas resources of the United States addressed resources of the Pacific OCS Region. Comparisons of resource estimates from different assessments are meaningful only if comparable areas, hydrocarbon commodities (e.g., oil vs. gas), and resource categories (e.g., conventionally recoverable vs. economically recoverable) have been assessed, and comparable types of estimates (e.g., conditional vs. risked and percentile vs. mean) are compared. Such comparisons demonstrate the degree to which resource estimates have changed and may provide insight regarding the factors that contributed to the change.

A comparison of select resource estimates from this and two previous MMS assessments[19] of the Pacific OCS Region is presented here. The 1987 assessment, which was conducted concurrently with the USGS and assessed resources as of January 1, 1987, is documented in Mast and others (1989) and Cooke and Dellagiarino (1990). Some of the results of the 1990 assessment, which assessed resources as of January 1990, are documented in Cooke (1991); other results have not been previously published but are presented here.

UNDISCOVERED CONVENTIONALLY RECOVERABLE RESOURCES

The commodities and category of hydrocarbon resources referred to as "undiscovered conventionally recoverable resources" for this assessment are comparable to those resources referred to and assessed as the "undiscovered resource base" for the 1987 and 1990 assessments. Comparable estimates of the volume of these oil and gas resources in the Region and its constituent assessment provinces are listed in tables 54 and 55 and illustrated in figures 150 and 151. Estimates of the volume of undiscovered conventionally recoverable oil and gas resources in the Region from this assessment have a significantly larger magnitude and smaller (narrower) range than estimates from the previous assessments.

The mean estimated volume of undiscovered conventionally recoverable oil resources in the Region from this assessment is approximately three times that estimated from the 1990 assessment (7.12 Bbbl more than previously estimated). Mean estimates of the volume of undiscovered conventionally recoverable oil resources have increased in all assessment provinces, particularly in the Central California province (2.87 Bbbl more than previously estimated), Santa Barbara-Ventura Basin province (1.53 Bbbl more than previously estimated), and Inner Borderland province (1.34 Bbbl more than previously estimated).

The mean estimated volume of undiscovered conventionally recoverable gas resources in the Region from this assessment is nearly twice that estimated from the 1990 assessment (8.08 Tcf more than previously estimated). Mean estimates of the volume of undiscovered conventionally recoverable gas resources have increased in most assessment provinces, particularly in the Santa Barbara-Ventura Basin province (3.71 Tcf more than previously estimated), Central California province (2.08 Tcf more than previously estimated), and Inner Borderland province (1.29 Tcf more than previously estimated). The mean estimated volume of undiscovered conventionally recoverable gas resources in the Pacific Northwest province decreased slightly.

The increased magnitude of the estimated volume of undiscovered conventionally recoverable oil and gas resources in the Region and most assessment provinces is attributed to the use of significantly different methodology and some additional data for this assessment. The more comprehensive petroleum geological analysis that was performed for this assessment led to the recognition of additional petroleum source rocks and reservoir rocks in many areas and to the definition of additional plays. Rock compositional data that were newly acquired for the analysis indicated that the volume of fractured siliceous "Monterey" reservoir rocks (which have high hydrocarbon potential) in some basins offshore California is larger than previously believed. Additionally, the recognition and applied use of the concept of lognormality in the analysis of plays (i.e., that pools within a play have sizes and volumetric properties that are lognormally distributed) are believed to have led to the consideration of additional and possibly larger pools in many plays.

[19] An assessment of undiscovered economically recoverable resources in the Pacific OCS Region as of July 1984 was conducted by MMS and is documented in Cooke (1985); however, the resource estimates from the 1984 assessment are not comparable to those from the 1987, 1990, and 1995 assessments and are not included in this discussion.

Table 54. *Comparable estimates of undiscovered conventionally recoverable oil and gas resources*[1] *in the Pacific OCS Region, by assessment. All estimates are risked values. The low, mean, and high estimates correspond to the 95th-percentile, mean, and 5th-percentile values of a probability distribution, respectively. N/R denotes an estimate not reported.*

Assessment	Oil (Bbbl)			Gas (Tcf)			BOE (Bbbl)		
	Low	Mean	High	Low	Mean	High	Low	Mean	High
MMS 1987	0.81	3.51	8.92	3.50	8.01	15.07	N/R	4.94	N/R
MMS 1990	1.37	3.59	7.26	6.38	10.86	16.94	N/R	5.52	N/R
MMS 1995	8.99	10.71	12.62	15.21	18.94	23.19	11.82	14.08	16.60

[1] Estimates of undiscovered conventionally recoverable resources from the 1995 assessment are comparable to estimates of the undiscovered resource base from the 1987 and 1990 assessments.

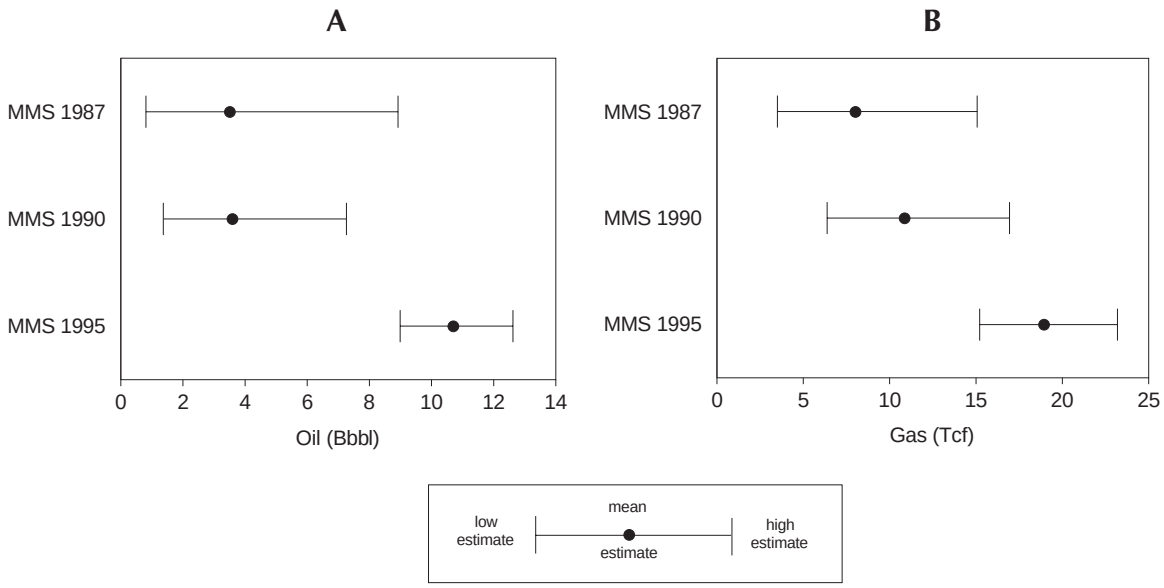

Figure 150. *Comparison of estimates of undiscovered conventionally recoverable oil (A) and gas (B) resources in the Pacific OCS Region, by assessment. The estimates correspond to those listed in table 54.*

UNDISCOVERED ECONOMICALLY RECOVERABLE RESOURCES

The commodities and category of hydrocarbon resources referred to as "undiscovered economically recoverable resources" for this and the previous assessments are conceptually comparable; however, estimates of the volume of these oil and gas resources reflect different economic assumptions (i.e., prices, costs, and timing) and are, therefore, not completely comparable. The "$18-per-barrel economic scenario" of this assessment is similar to the "primary case economic scenario" of the 1987 and 1990 assessments; therefore, the estimates of undiscovered economically recoverable resources for these scenarios are closely (but not completely) comparable. These comparable estimates of the undiscovered economically recoverable oil and gas resources in the Region and its constituent assessment provinces are listed in tables 55 and 56, and illustrated in figures 151 and 152. Mean estimates of the volume of undiscovered economically recoverable oil and gas resources in the Region and most assessment provinces have increased; however, the proportion of undiscovered conventionally recoverable resources that are estimated to be economically recoverable in the Region and most assessment provinces has decreased.

Table 55. *Comparable estimates of undiscovered conventionally recoverable and economically recoverable oil and gas resources in assessment provinces of the Pacific OCS Region, by assessment. All estimates are risked mean values.*

Assessment	Undiscovered Conventionally Recoverable Resources[1]			Undiscovered Economically Recoverable Resources[2]		
	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Pacific Northwest Province[3]						
MMS 1987	0.19	2.18	0.58	0.08	1.15	0.28
MMS 1990	0.40	4.34	1.16	0.08	1.01	0.26
MMS 1995	0.41	3.91	1.11	0.10	0.93	0.27
Central California Province[4]						
MMS 1987	2.14	2.47	2.58	1.00	1.30	1.23
MMS 1990	2.08	3.15	2.64	1.28	2.17	1.67
MMS 1995	4.95	5.23	5.88	2.59	2.77	3.08
Santa Barbara-Ventura Basin Province[5]						
MMS 1987	0.32	0.90	0.48	0.29	0.79	0.43
MMS 1995	1.85	4.61	2.67	1.17	2.91	1.68
Los Angeles Basin Province[6]						
MMS 1987	0.09	0.13	0.12	0.09	0.13	0.12
MMS 1995	0.31	0.32	0.37	0.21	0.21	0.25
Inner Borderland Province[7]						
MMS 1987	0.45	0.78	0.59	0.40	0.69	0.52
MMS 1995	1.79	2.07	2.16	1.19	1.37	1.43
Outer Borderland Province[8]						
MMS 1987	0.33	1.55	0.61	0.23	1.11	0.43
MMS 1995	1.40	2.79	1.89	0.06	0.10	0.08

[1] Estimates of undiscovered conventionally recoverable resources from the 1995 assessment are comparable to estimates of the undiscovered resource base from the 1987 and 1990 assessments.

[2] Estimates of undiscovered economically recoverable resources from the 1987, 1990, and 1995 assessments are closely (but not completely) comparable, as follows:

Estimates from the 1987 and 1990 assessments are for the primary case economic scenario and are based on variable prices starting at $18.00 per bbl of oil and $1.80 per Mcf of gas.

Estimates from the 1995 assessment are for the $18-per-barrel economic scenario and are based on fixed prices of $18.00 per bbl of oil and $2.11 per Mcf of gas.

[3] Formerly referred to and assessed as the Washington-Oregon and Northern California-Southern Oregon provinces.

[4] Formerly referred to and assessed as the Central California and Santa Maria provinces.

[5] Formerly referred to and assessed as the Santa Barbara province.

[6] Formerly referred to and assessed as the Los Angeles Basin province.

[7] Formerly referred to and assessed as the Inner Banks province.

[8] Formerly referred to and assessed as the Outer Banks province.

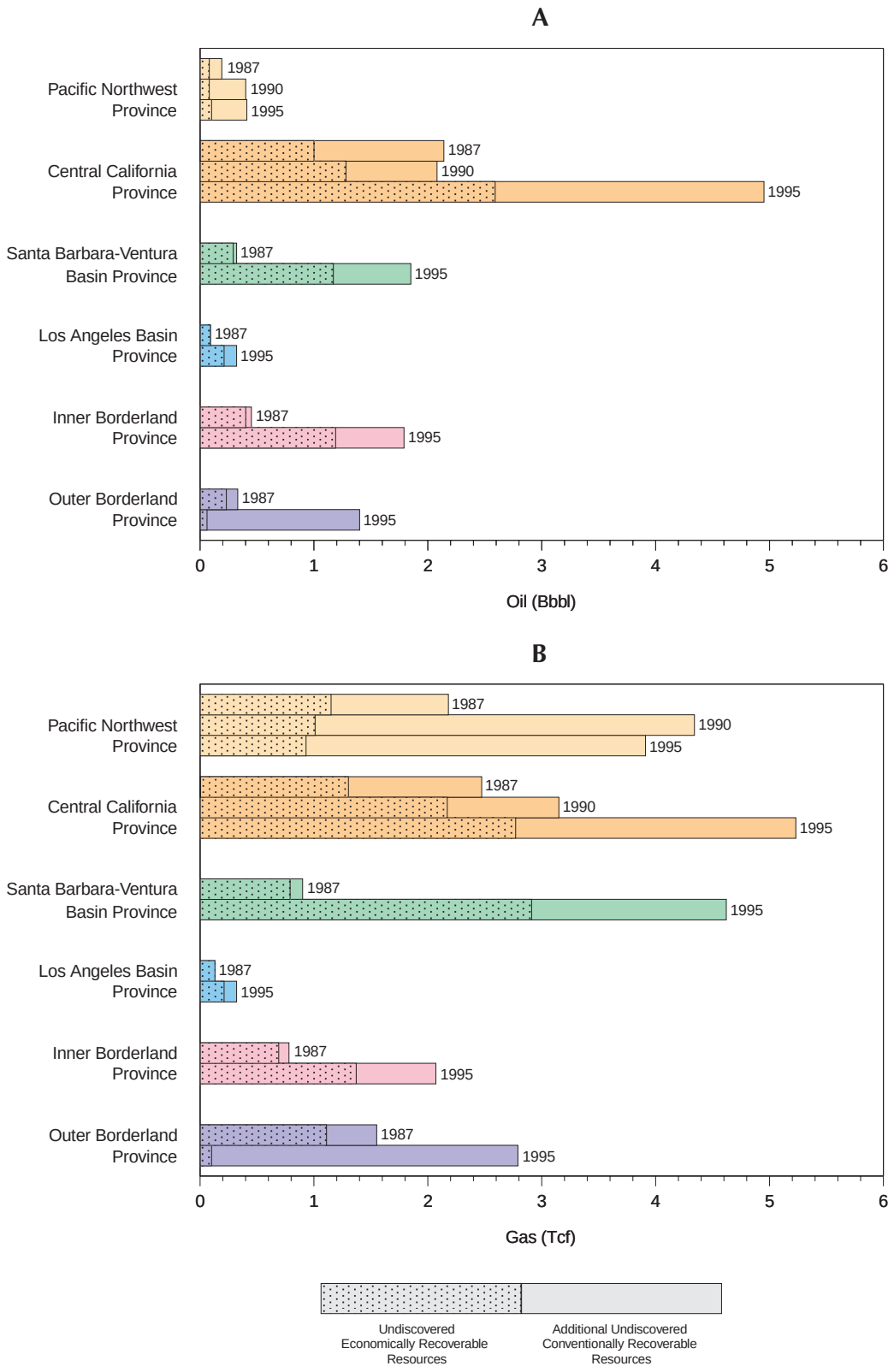

Figure 151. *Comparison of estimates of undiscovered conventionally recoverable and economically recoverable oil (A) and gas (B) resources in assessment provinces of the Pacific OCS Region, by assessment. The estimates correspond to those listed in table 55.*

Table 56. *Comparable estimates of undiscovered economically recoverable oil and gas resources[1] in the Pacific OCS Region, by assessment. All estimates are risked values. The low, mean, and high estimates correspond to the 95th-percentile, mean, and 5th-percentile values of a probability distribution, respectively. N/R denotes an estimate not reported.*

Assessment	Oil (Bbbl)			Gas (Tcf)			BOE (Bbbl)		
	Low	Mean	High	Low	Mean	High	Low	Mean	High
MMS 1987	0.34	2.10	6.02	1.78	5.17	11.04	N/R	3.02	N/R
MMS 1990	0.63	2.49	6.12	2.46	6.15	12.14	N/R	3.58	N/R
MMS 1995	N/R	5.31	N/R	N/R	8.30	N/R	N/R	6.79	N/R

[1] Estimates of undiscovered economically recoverable resources from the 1987, 1990, and 1995 assessments are closely (but not completely) comparable, as follows:

Estimates from the 1987 and 1990 assessments are for the primary case economic scenario and are based on variable prices starting at $18.00 per bbl of oil and $1.80 per Mcf of gas.

Estimates from the 1995 assessment are for the $18-per-barrel economic scenario and are based on fixed prices of $18.00 per bbl of oil and $2.11 per Mcf of gas.

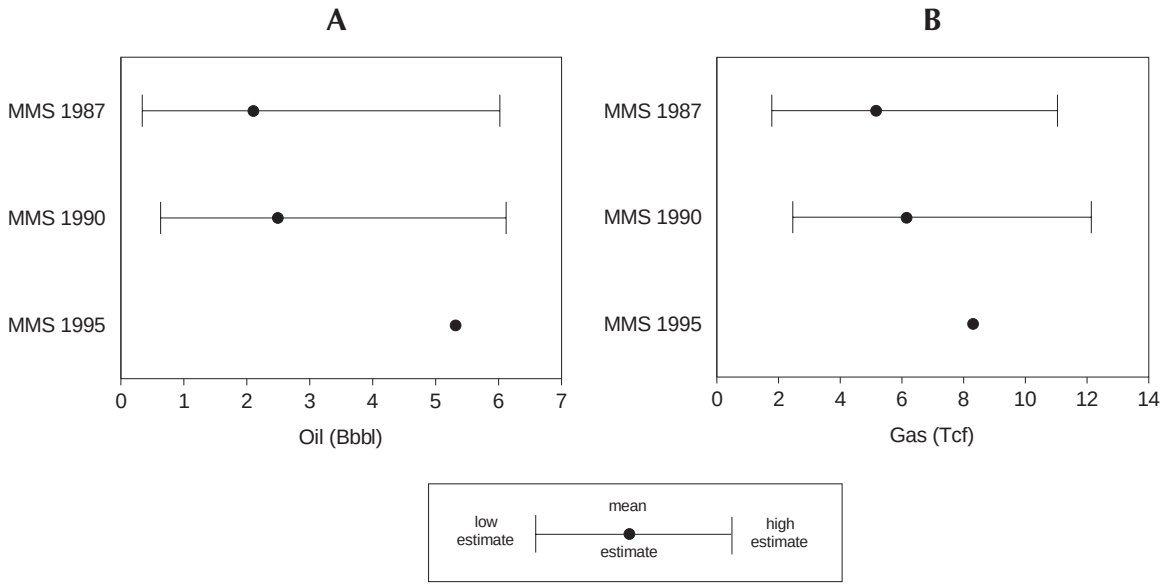

Figure 152. *Comparison of estimates of undiscovered economically recoverable oil (A) and gas (B) resources in the Pacific OCS Region, by assessment. The estimates correspond to those listed in table 56.*

The mean estimated volume of undiscovered economically recoverable oil resources in the Region from this assessment is approximately twice that estimated from the 1990 assessment (2.82 Bbbl more than previously estimated). Mean estimates of the volume of undiscovered economically recoverable oil resources have increased in most assessment provinces, particularly in the Central California province (1.31 Bbbl more than previously estimated), Santa Barbara-Ventura Basin province (0.88 Bbbl more than previously estimated), and Inner Borderland province (0.79 Bbbl more than previously estimated). The mean estimated volume of undiscovered economically recoverable oil resources in the Outer Borderland province decreased markedly.

The mean estimated volume of undiscovered economically recoverable gas resources in the Region from this assessment is nearly one and one-half times that estimated from the 1990 assessment (2.15 Tcf more than previously estimated). Mean estimates of the volume of undiscovered economically recoverable gas resources have increased in

many assessment provinces, particularly in the Santa Barbara-Ventura Basin province (2.12 Tcf more than previously estimated), Inner Borderland province (0.68 Tcf more than previously estimated), and Central California province (0.60 Tcf more than previously estimated). The mean estimated volume of undiscovered economically recoverable gas resources in the Outer Borderland province decreased significantly (1.01 Tcf less than previously estimated) and in the Pacific Northwest province decreased slightly.

The increased magnitude of the estimated volume of undiscovered economically recoverable oil and gas resources in the Region and most assessment provinces is primarily attributed to the increased magnitude of the estimated volume of undiscovered conventionally recoverable oil and gas resources. The decreased magnitude of the estimated volume of undiscovered economically recoverable oil and gas resources in the Outer Borderland province is attributed to the recognition that most potential fields exist at greater water depths than previously believed.