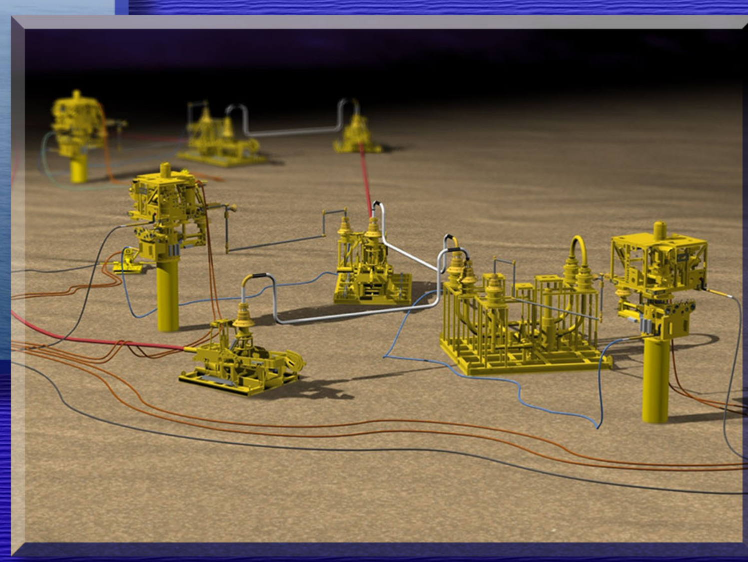
OCS Report
MMS 2004-021

Deepwater Gulf of Mexico 2004: America's Expanding Frontier



MMS U. S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

ERRATA

Figure 1

P. 4, The colored areas marked as "Royalty Relief Zones" are water-depth zones that correspond with Deep Water Royalty Relief Act (DWRRA) water depths. Not all leases within a colored area are eligible for royalty relief due to the different vintage leases included in the area. In addition, please note that the colored areas extend past the official royalty relief area authorized by the DWRRA and that leases east of 87 degrees, 30 minutes West longitude in the Eastern Planning Area are not eligible for royalty relief.

P. 112, last line, "51%" should read "48%."

Appendix B

P. 125, line 2, clarification: the Pardner project may appear to be the first deepwater discovery because it was combined with a field discovered in water depths less than 1,000 ft. The shallow-water portion of the WD152 field was indeed discovered in 1968, but the deepwater portion of the field (the Pardner project) was not drilled until 2002.

Appendix H

P. 150, line 12, column 5: "2.7" should read "12.7."
P. 150, line 13, column 5: "3.4" should read "13.4."
P. 150, line 14, column 5: "2.8" should read "12.8."

ON COVER – The cover features four images of the deepwater frontier (top to bottom). Transocean's deepwater drillship *Discoverer Deep Seas*, which set a world record drilling in 10,011 ft of water at ChevronTexaco's Toledo prospect (photo courtesy of Transocean). A sperm whale surfaces near BP's Horn Mountain spar and Heerema's construction vessel *Balder* (photo courtesy of Christopher Richter). The Na Kika semisubmersible, installed by Shell and operated by BP, which will gather production from six subsea projects by the end of 2004 (photo courtesy of Shell International Exploration and Production Inc. and BP). An artist's rendering of subsea equipment installed at a deepwater location (image courtesy of Shell International Exploration and Production Inc.).

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Deepwater Gulf of Mexico 2004: America's Expanding Frontier

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PREFACE

The Gulf of Mexico is now in its ninth year of sustained expansion of the deepwater frontier. Deepwater oil and gas exploration and development in the Gulf of Mexico OCS has succeeded probably beyond the most optimistic dreams of most of us and shows no sign of diminishment. This is the fourth report issued by MMS chronicling the beginning and unfolding of this frontier.

Since those first steps taken by industry in 1995-1996, we have entered into a sustained, robust expansion of activity that promises to continue for many years to come. As 2004 begins, we have 90 hydrocarbon production projects on line. Production from the deepwater frontier grew to an estimated 959 thousand barrels of oil per day and 3.6 billion cubic feet of natural gas per day by the end of 2002. This was a rise of 535 percent and 620 percent for oil and gas, respectively, since 1995.

About 750 exploration wells have been drilled in the deepwater Gulf since 1995. At least 100 deepwater discoveries have been announced since then. Significantly, in the last three years, there have been 11 industry-announced discoveries in water depths greater than 7,000 ft (2,134 m), and these ultra-deep discoveries have the promise of opening up entirely new geologic frontiers.

Of critical note, the new technology that has been developed and deployed to produce the Gulf of Mexico deepwater resources is the marvel of the world. Never-before-heard-of production from spars has now accelerated so that eight spars were in production by the end of 2003 with three more spars scheduled to begin production in 2004. These spars range from classic spars and truss spars to the first-ever cell spar, scheduled by Kerr McGee for installation in 2004. Similarly, a few years ago, there were no mini-tension leg platforms and now the SeaStar and the MOSES have arrived. Subsea production has expanded from a water depth of 1,462 ft (446 m) with Placid Oil Company's Green Canyon Block 29 project in 1988 to 5,318 ft (1,621 m) with Shell's Mensa in 1997, and to 7,216 ft (2,199 m) with Marathon's Camden Hills in 2002. Shell and BP's Coulomb/Na Kika project, scheduled this year, will establish subsea production in 7,591 ft (2,314 m) of water.

The role played by the MMS in this major energy expansion has been critical — from ensuring the receipt of fair market value for the sale of the leases to the evaluation and approval of new technology, and to facing new challenges in drilling and new environmental questions. The MMS's development of new environmental review procedures to ensure timely but thorough review and protection of environmental values has been innovative and critical to keep project timelines minimized.

Chris C. Oynes

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Regional Director
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INTRODUCTION

The deepwater Gulf of Mexico (GOM) is an important oil and gas province and an integral part of the Nation's oil and gas supply. A major milestone was reached early in 2000 when more oil was produced from the deepwater GOM than from the shallow-water GOM. Deepwater oil production continues to increase and is rapidly approaching the all-time shallow-water GOM record set in 1971. In addition, deepwater drilling reached record levels in 2001. The average sizes of deepwater GOM field discoveries are several times larger than the average shallow-water field discoveries. In fact, since the last version of this report (Baud et al., 2002) some of the largest hydrocarbon accumulations ever discovered in the GOM were found in the deepwater area. The deepwater fields are some of the most prolific producers in the GOM.

This report is divided into five sections.

The **Background** section discusses

- highlights of current deepwater GOM activity,
- new discoveries and geologic plays,
- environmental issues,
- technology concerns, and
- the existing deepwater infrastructure.

The **Leasing** section discusses

- historical water-depth and bidding trends in deepwater leasing,
- leaseholdings of major oil companies compared with those of nonmajor oil companies, and
- future deepwater lease activity.

The **Drilling and Development** section discusses

- deepwater rig activity,
- historical drilling statistics,
- the transition to deeper wells and deeper water,
- the complexity of deepwater development systems, and
- the progress of deepwater infrastructure development.

The **Reserves and Production** section discusses

- historical deepwater reserve additions;
- large future reserve additions associated with recently announced discoveries;
- discoveries in new, lightly tested plays with large potential;
- potential for numerous, large future deepwater field discoveries;
- historical trends in deepwater production;
- deepwater production from various companies; and
- high deepwater production rates.

The **Summary and Conclusions** section discusses

- increasing deepwater oil and gas production and anticipated new fields;
- expected increases in deepwater discoveries (these expectations are based on drilling of the large deepwater lease inventory);
- lags between leasing, drilling, and initial production;
- difficulties evaluating deepwater leases before their terms expire; and
- significant changes since the 2002 report.

BACKGROUND

DEFINITIONS

The GOM Outer Continental Shelf (OCS) is divided into the Western, Central, and Eastern Planning Areas (figure 1). Many of the data presented in this report are subdivided according to water depth. These divisions (1,000, 1,500, 5,000, and 7,500 ft) are illustrated in figure 1, along with Deep Water Royalty Relief (DWRR) zones (200, 400, 800, and 1,600 m) for reference.

There are a variety of criteria that can be used to define deepwater. The threshold separating shallow- and deepwater can range from 656-ft (200-m) to 1,500-ft (457-m) water depth. For purposes of this report, deepwater is defined as water depths greater than or equal to 1,000 ft (305 m). Similarly, ultra-deepwater is difficult to define precisely. For purposes of this report, ultra-deepwater is defined as water depths greater than or equal to 5,000 ft (1,524 m).

A few other definitions are useful at this point:

- *Proved Reserves* are those quantities of hydrocarbons that can be estimated with reasonable certainty to be commercially recoverable from known reservoirs. These reserves have been drilled and evaluated and are generally in a producing or soon-to-be producing field.
- *Unproved Reserves* can be estimated with some certainty (drilled and evaluated) to be potentially recoverable, but there is as yet no commitment to develop the field.
- *Known Resources* in this report refer to discovered resources (hydrocarbons whose location and quantity are known or estimated from specific geologic evidence) that have less geologic certainty and a lower probability of production than the Unproved Reserves category.
- *Industry-Announced Discoveries* refer to oil and gas accumulations that were announced by a company or otherwise listed in industry publications. These discoveries have not been evaluated by MMS and the reliability of estimates can vary widely.
- *Field* is defined as an area consisting of a single reservoir or multiple reservoirs all grouped on, or related to, the same general geologic structural feature and/or stratigraphic trapping condition. There may be two or more reservoirs in a field that are separated vertically by intervening impervious strata or laterally by local geologic barriers, or by both.

More detailed definitions may be found in the annual *Estimated Oil and Gas Reserves, Gulf of Mexico Outer Continental Shelf, December 31, 2000* report (Crawford et al., 2003).

This report refers to deepwater developments as both fields (as defined above) and by operator-designated project names. A field name is assigned to a lease or a group of leases so that natural gas and oil resources, reserves, and production can be allocated on the basis of the unique geologic feature that contains the hydrocarbon accumulation. Appendices A and B provide locations, operators, and additional information regarding these fields and projects. The field's identifying block number corresponds to the first lease qualified by MMS as capable of production or the block where the primary structure is located. Note that the term "oil" refers to both oil and condensate throughout this report and "gas" includes both associated and nonassociated gas. All production volumes and rates reflect data through December 2002 (the most recent, complete data available at the time of this publication).

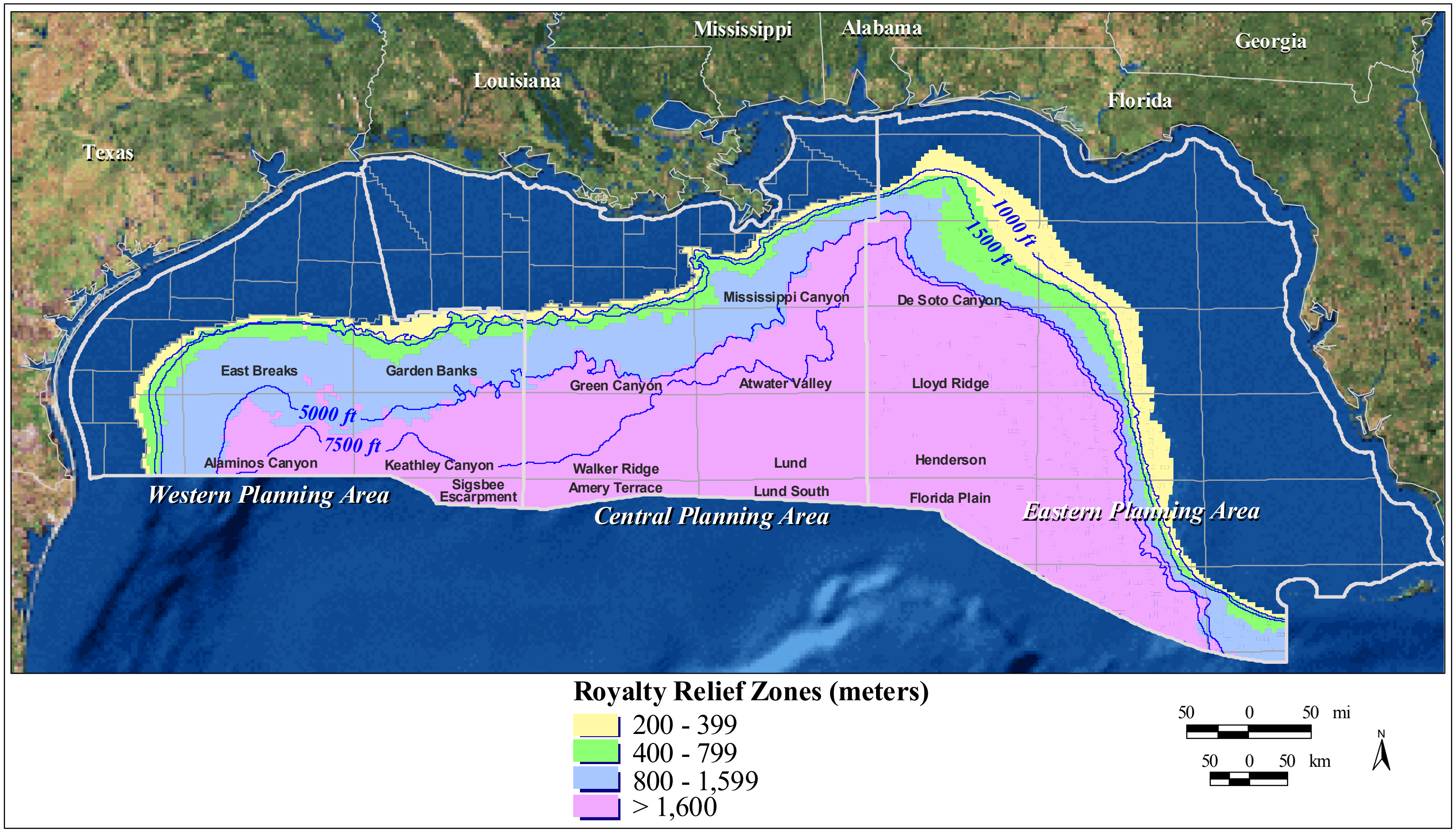


Figure 1. The Gulf of Mexico OCS is divided into Western, Central, and Eastern Planning Areas. Water-depth categories used in this report are shown in addition to shaded Deep Water Royalty Relief Act zones.

EXPANDING FRONTIER

When the original version of this report (Cranswick and Regg, 1997) was published in February 1997, a new era for the GOM had just begun with intense interest in the oil and gas potential of the deepwater areas. There were favorable economics, recent deepwater discoveries, and significant leasing at that time. In February 1997, there were 17 producing deepwater projects, up from only 6 at the end of 1992. Since then, industry has been rapidly advancing into deepwater and, indeed, many of the anticipated fields have begun production since the 1997 report. The previous version of this report (Baud et al., 2002)highlighted dramatic advancements from 1997 through 2001. Significant advances have continued and are described in this report.

At the end of 2003, there were 86 producing projects in the deepwater GOM, up 51 percent in the two years since Baud et al. (2002). Deepwater production rates have risen by well over 100,000 barrels of oil per day (BOPD) and 400 million cubic ft of gas per day (MMCFPD), respectively, each year since 1997.

The dramatic shift toward high activity levels in the deepwater GOM occurred during the last few years, although it had been developing for over two decades. Deepwater production began in 1979 with Shell's Cognac field, but it took another five years before the next deepwater field (ExxonMobil's Lena field) came online. Both developments relied on extending the limits of platform technology used to develop the GOM shallow-water areas. Deepwater exploration and production grew with tremendous advances in technology since those early days. This report focuses on changes during the last 12 years, 1992-2003.

Over the last 12 years, there has been an overall expansion in all phases of deepwater activity. There are approximately 7,800 active leases in the Gulf of Mexico OCS, 54 percent of which are in deepwater. (Note that lease statuses may change daily, so the current number of active leases is an approximation.) Contrast this to approximately 5,600 active Gulf of Mexico leases in 1992, only 27 percent of which were in deepwater. On average, there were 29 rigs drilling in deepwater in 2003, compared with only 3 rigs in 1992. Likewise, deepwater oil production rose over 840 percent and deepwater gas production increased about 1,600 percent from 1992 to 2002.

Although deepwater production and the number of discoveries have increased substantially, some measures of deepwater activity have declined since the last report. There have been decreases in the average bid amount per block, average number of rigs operating, the number of wells drilled, and the number of deepwater plans submitted.

All phases of exploration and development moved steadily into deeper waters over the past 12 years. This trend is observable in seismic activity, leasing, exploratory drilling, field discoveries, and production. Major oil companies dominated deepwater leasing activity until 1996, when the activity of nonmajor companies increased. Major oil companies continue to dominate deepwater oil and gas production. Production from major oil companies has continued to increase steadily, but production from nonmajor companies has remained flat.

The OCS Deep Water Royalty Relief Act (DWRRA; 43 U.S.C. §1337) has had a significant impact on deepwater GOM activities. This legislation provides economic incentives for operators to develop fields in water depths greater than 200 m (656 ft). These incentives include the suspension of Federal royalty payments (for new leases issued 1996-2000) on the initial 17.5 million barrels of oil equivalent (MMBOE) produced from a field in 200-400 m (656-1,312 ft) of water, 52.5 MMBOE for a field in 400-800 m (1,312-2,624 ft) of water, and 87.5 MMBOE for a field in greater than 800 m (2,624 ft) of water.[1]

[1] Whether leases issued under the DWRRA (November 28, 1995 through November 28, 2000) are entitled to incentives on a field or a lease basis is currently under litigation.

Reduction of royalty payments is also available through an application process for some deepwater fields that were leased prior to the DWRRA but had not yet gone on production. The fixed suspension volume provision of the DWRRA (for new leases issued 1996-2000) expired on November 28, 2000. Leases acquired between November 28, 1995, and November 28, 2000, will retain the incentives until their expiration. Exploration and production incentives have continued since 2000 for leases in water depths greater than 400 m (1,312 ft). Royalty relief volumes range from 5 MMBOE in water depths of 400-799 m (1,312-2,621 ft) to 12 MMBOE of relief in depths greater than 1,600 m (5,249 ft). Royalty relief is granted to individual leases, not fields[1] as in the DWRRA. Post-DWRRA provisions are subject to change for each lease sale.

SEISMIC ACTIVITY

A combination of factors including the DWRRA, several key deepwater discoveries, the recognition of high deepwater production rates, and the evolution of deepwater development technologies, spurred a variety of deepwater activities. One of the first impacts was a dramatic increase in the acquisition of 3-D seismic data (figure 2). (Note that figures 2 and 3 illustrate areas permitted for seismic acquisition. The actual coverage available may be slightly different than that permitted.) Three-dimensional seismic data are huge volumes of digital energy recordings resulting from the transmission and reflection of sound waves through the earth. These large "data cubes" can be interpreted to reveal likely oil and gas accumulations. The dense volume of recent, high-quality data may reduce the inherent risks of traditional hydrocarbon exploration and allow imaging of previously hidden prospects. Figure 2 illustrates the surge of seismic activity in the deepwater GOM during the last 12 years. Seismic acquisition has stepped into progressively deeper waters since 1992. Figure 3 shows the abundance of 3-D data now available. These data blanket most of the deepwater GOM, even beyond the Sigsbee Escarpment (a geologic and bathymetric feature in ultra-deep water). Note that many active deepwater leases were purchased before these 3-D surveys were completed (only the more sparsely populated 2-D datasets were available).

The seismic permitting coverage shown in figure 3 does not tell the whole story of geophysical activity in the deepwater GOM. Pre-stack depth migration (PrSDM) of seismic data has greatly enhanced the interpretation capabilities in the deepwater GOM, particularly for areas hidden below salt canopies. While PrSDM was once used sparingly, the availability of large speculative PrSDM surveys allows the widespread use of this technology in the early phases of exploration. Subsalt discoveries like Mad Dog, Thunder Horse, North Thunder Horse, Atlantis, and Tahiti demonstrate the importance of subsalt exploration. Figure 4 provides a partial inventory of speculative PrSDM coverage. This figure was assembled from publicly available sources and provides a good indication of the current widespread coverage of PrSDM processing.

Time-lapse seismic surveys (also known as 4-D) will likely be the next significant seismic technology to be applied routinely in the deepwater GOM. The technique can be applied to characterize reservoir properties, monitor production efficiency, and estimate volumetrics from inception through the life of the field (Shirley, 2001). The high cost of drilling deepwater wells and challenges associated with reentry of deepwater wells may promote the use of 4-D technology in the deepwater GOM.

EXPLORATION ACTIVITY

Modern seismic data often generate new ideas leading to surges in leasing and drilling activities. Exploration drilling in the deepwater GOM in 2002 and 2003 has found over 2 billion BOE. Traditional deepwater mini-basin plays are still providing many exploration opportunities (consider the Thunder Horse and North Thunder Horse discoveries in southern Mississippi Canyon), but recent discoveries in new deepwater plays continue to expand the exploration potential of the deepwater GOM. Figure 5 illustrates the fact that 99 percent of total GOM production is from Neogene-age reservoirs (Pleistocene, Pliocene, and Miocene); however, several recently announced deepwater discoveries encountered large potential reservoirs in sands of Paleogene age (Oligocene, Eocene, and Paleocene). This older portion of the geologic section has been very lightly tested in the GOM and the discovery of reservoirs of this geologic age may open wide areas of the GOM to further drilling. Figure 6 illustrates two frontier

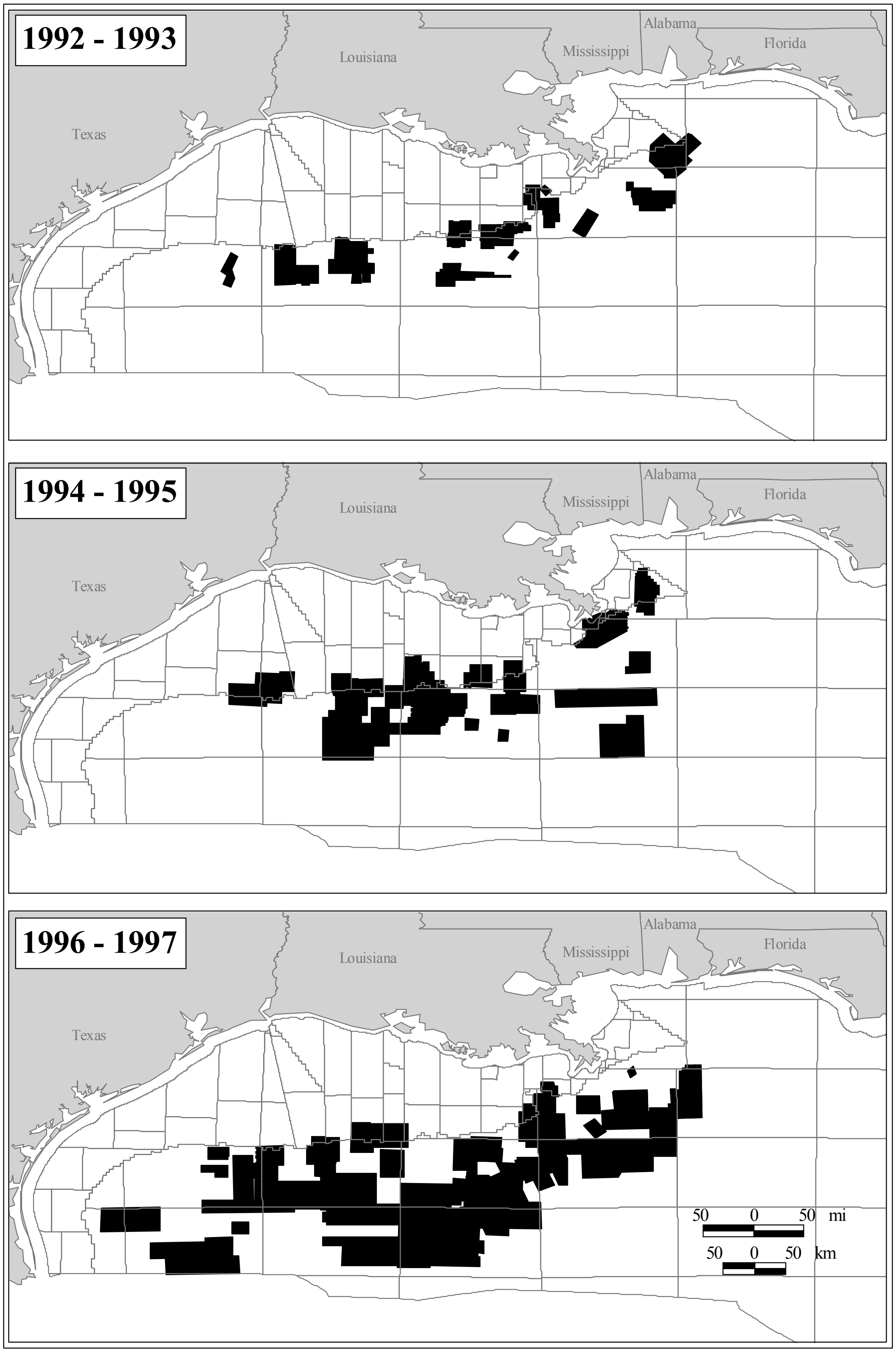


Figure 2. Progressive deepwater 3-D seismic permit coverage.

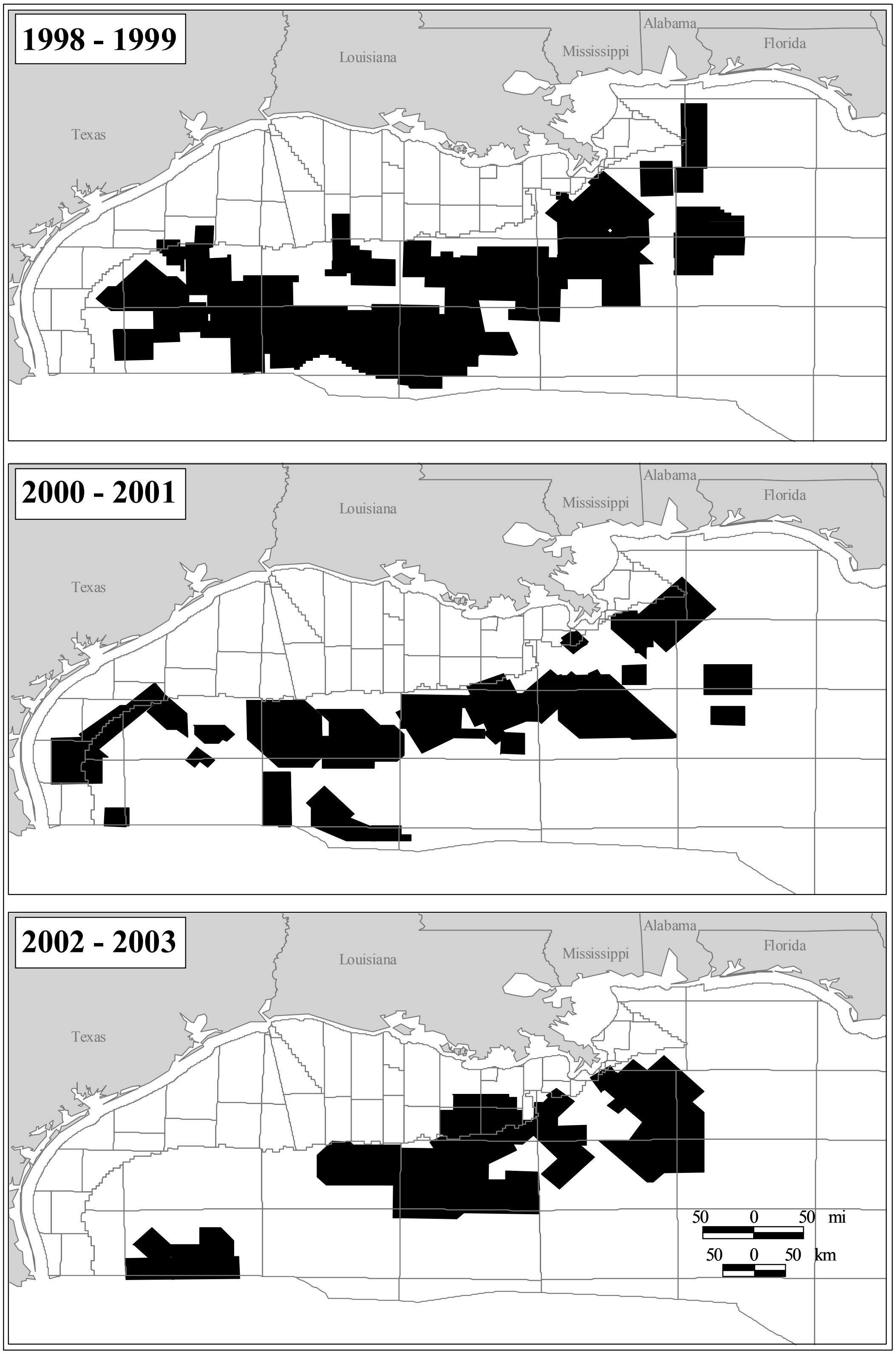


Figure 2. Progressive deepwater 3-D seismic permit coverage (continued).

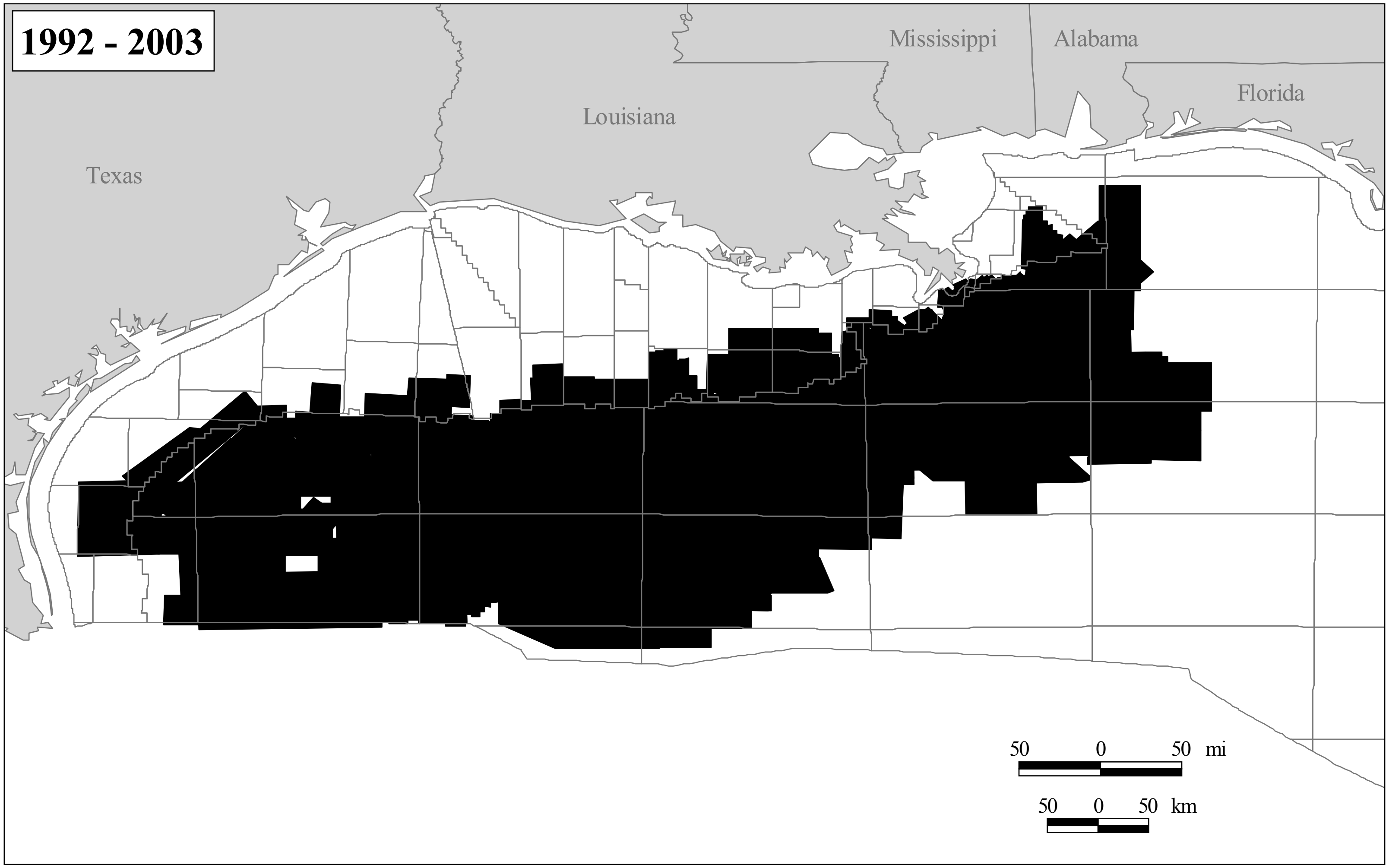


Figure 3. Deepwater Gulf of Mexico 3-D seismic permit coverage from 1992 to 2003.

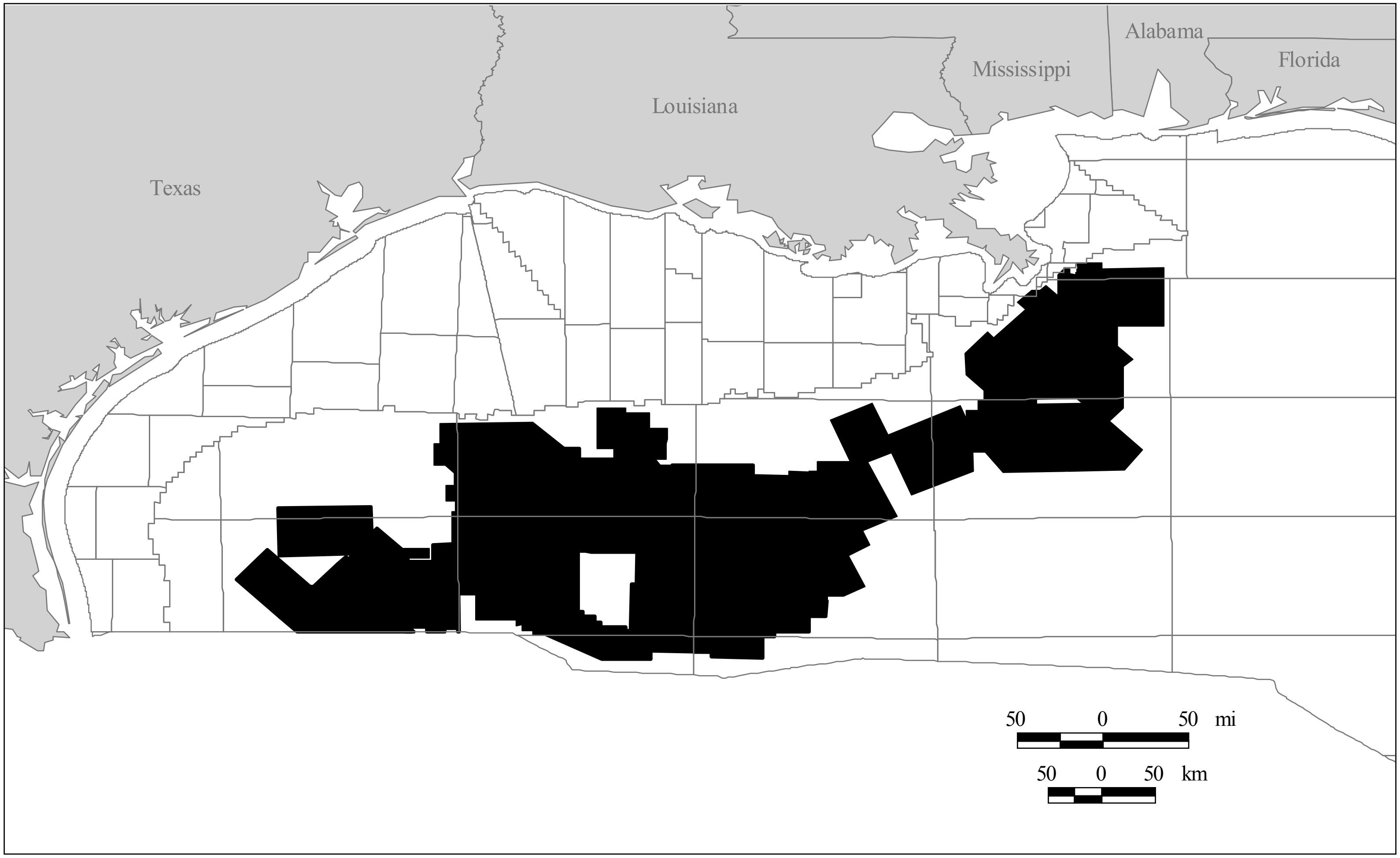


Figure 4. Pre-stack depth migration coverage from various industry sources.

Quaternary 0 mya – 1.8 mya		**Pleistocene**	***99% GOM proved reserves***	• Large discoveries in Mississippi Fan Fold Belt. • Large subsalt discoveries – fold belts and turtle structures. • Projection of deepwater plays updip into shallower waters. Deep drilling required.
Tertiary 24 mya	**Neogene**	**Pliocene** **Miocene**		
Tertiary 65 mya	**Paleogene**	**Oligocene** **Eocene** **Paleocene**		• Newly announced discoveries in the deepwater open a large play area for exploration.
Cretaceous 144 mya			***1% GOM proved reserves***	• Mesozoic potential extends into the Eastern GOM Sale areas.
Jurassic				

mya=million years ago

Figure 5. Stratigraphic chart highlighting new play potential.

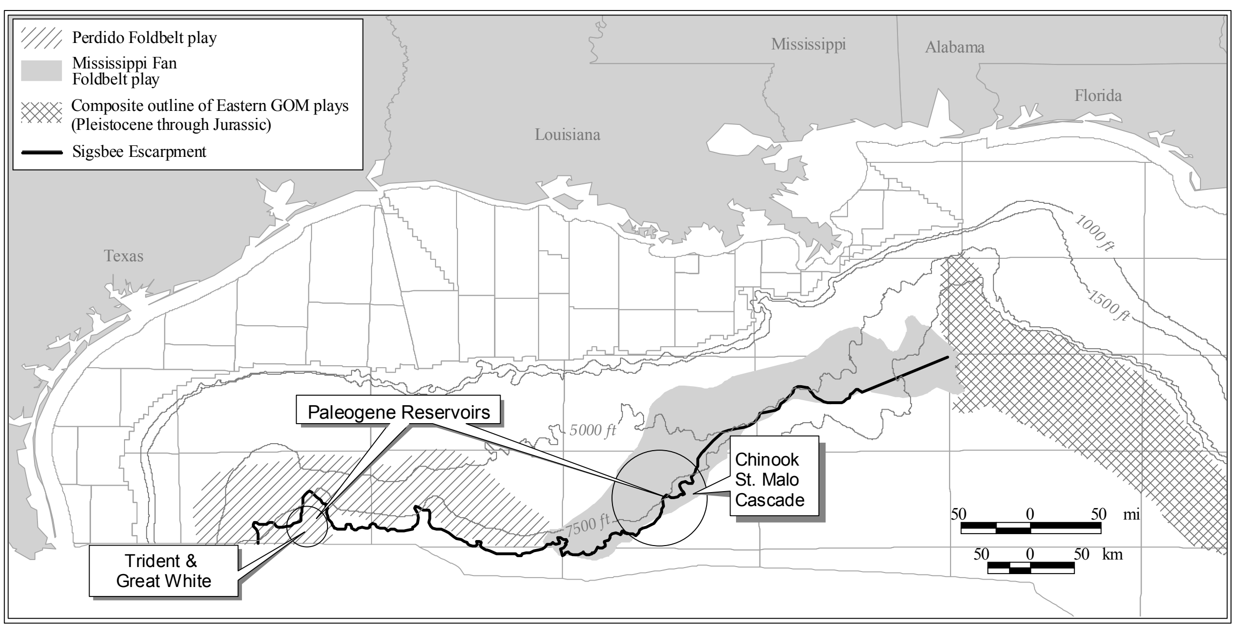


Figure 6. Frontier plays in the deepwater GOM.

deepwater plays in the GOM, the Mississippi Fan Foldbelt and the Perdido Foldbelt, which include reservoirs of Paleogene age. Announced discoveries in the Alaminos Canyon area (Trident and Great White) and in the Walker Ridge area (St. Malo, Cascade, and Chinook) provide evidence of productive Paleogene reservoirs in a wide area of the deepwater GOM. However, many important questions remain concerning the extent and producibility of these older reservoirs.

Figure 6 also shows a composite outline of numerous plays in the Eastern GOM; these range in age from Pleistocene through Jurassic. Successful exploration has occurred in the Eastern GOM with announced discoveries in DeSoto Canyon (Spiderman/Amazon), in Lloyd Ridge (Atlas), and in Atwater Valley (Jubilee).

Although not a geologic play, the ultra-deepwater areas of the GOM can also be considered "frontier territory." During the last three years there have been 11 industry-announced discoveries in water depths greater than 7,000 ft (2,134 m) (table 1). Announced volumes for these discoveries are more than 1.75 billion BOE.

Table 1
List of Deepwater Discoveries in Water Depths Greater than 7,000 ft (2,134 m)

Project Name	Area/Block	Water Depth (ft)	Discovery Year
Aconcagua	MC 305	7,379	1999
Camden Hills	MC 348	7,530	1999
Blind Faith	MC 696	7,116	2001
Merganser	AT 37	8,064	2001
St. Malo	WR 678	7,326	2001
Trident	AC 903	9,816	2001
Cascade	WR 206	8,143	2002
Great White	AC 857	7,425	2002
Vortex	AT 261	8,422	2002
Atlas	LL 50	9,180	2003
Chinook	WR 469	9,104	2003
Jubilee	AT 349	8,891	2003
Spiderman/Amazon	DC 621	8,100	2003

AC = Alaminos Canyon
AT = Atwater Valley
DC = DeSoto Canyon
LL = Lloyd Ridge
MC = Mississippi Canyon
WR = Walker Ridge

In summary, the presence of pre-Miocene reservoirs, successes in the Eastern GOM sale area, and significant discoveries in the ultra-deepwater demonstrate the continuing exploration potential in the deepwater GOM. These new plays are large in areal extent, have multiple opportunities, and contain potentially huge traps with the possibility of billions of barrels of hydrocarbons.

In addition to the traditional oil and gas plays in the deepwater GOM, there may be significant resources in gas hydrates (figure 7). These resources may be 30 to 300 times greater than conventional oil and gas reserves. A gas hydrate is a cage-like lattice of ice that traps molecules of natural gas, primarily methane. Hydrates are formed near the seafloor under conditions of low temperature, high pressure, and in the presence of natural gas. In the GOM, hydrates occur in water depths greater than 1,450 ft (442 m). Each cubic foot of hydrate yields approximately 160 ft^3 of gas at standard temperature and pressure.

Piston cores have sampled about 100 sites that contain both thermogenic and biogenic gas hydrates. Thermogenic gas hydrates are known only in the GOM, whereas biogenic gas hydrates are found in other marine settings around the world. Thermogenic gas hydrates are derived from deeply buried, organic-rich sediments or existing gas reservoirs and contain a mixture of complex hydrocarbon gases. Biogenic gas hydrates are generated at shallow depths by bacterial decomposition of organic matter, yielding primarily methane gas. Gas-hydrate mounds (figure 8) and associated chemosynthetic communities, commonly at the edges of deepwater mini-basins, have been sampled and observed by research submersibles at many sites in the GOM.

There are many unanswered questions about the distribution, concentration, reservoir properties, and stability of hydrates. Conventional drilling operations do not allow sampling of the upper 3,000 ft (914 m) of sediment (where hydrates occur). Although conventional 3-D exploration and high-resolution seismic data are not specifically designed to detect hydrate deposits, interpretive techniques have been used to delineate possible hydrates. To gather hydrate data, a joint effort by MMS, Department of Energy (DOE), and seven oil and service companies will begin in 2004. Approximately eight 1,000- to 2,000-ft (305- to 610-m) deep wells will be drilled, logged, and cored through bedded hydrates near seafloor hydrate mounds in Atwater Valley and Keathley Canyon. This project will allow the first calibration of geophysical data for characterizing buried gas hydrates in the GOM. The MMS is developing a gas-hydrate assessment model and will complete an initial inventory of the amount of recoverable hydrates in 2005.

LEASING ACTIVITY

The DWRRA encouraged extensive leasing in the deepwater GOM. Figure 9 shows the recent history of deepwater leasing. Activity slowly increased from 1992 through 1995, but immediately after the DWRRA was enacted, deepwater leasing activity exploded. Other factors also contributed to this activity, including improved 3-D seismic data coverage, several key deepwater discoveries, the recognition of high deepwater production rates, and the evolution of deepwater development technologies.

The GOM leasing status is shown in figure 10. There are about 3,600 active leases in water depths less than 1,000 ft (305 m), about 150 active leases in 1,000-1,499 ft (305-457 m) of water, about 1,800 active leases in 1,500-4,999 ft (457-1,524 m) of water, about 1,500 active leases in 5,000-7,499 ft (1,524-2,286 m) of water, and about 750 active leases in water depths of 7,500 ft (2,286 m) and greater. The limited number of active leases in the eastern GOM is related to leasing restrictions. In 2001 and 2003, sales were held offshore of Alabama, approximately 100 miles from the coastline, which added 109 active leases. Appendix C provides a chronological listing of all Gulf of Mexico lease offerings arranged by sale number, location, and date.

Figure 11 shows the historic total active leasing trends by water-depth range. Notice the dramatic increase in active deepwater leases from 1995 through 1998. In 1999, the number of active deepwater leases surpassed that of shallow-water leases.

Operators contend with numerous obstacles when venturing into the deepwater arena. Figure 12 illustrates natural features and manmade zones that require special considerations for oil and gas activities. Although the topographic features are located primarily along the shelf break, they may be obstacles to pipelines from deepwater developments to the shelf infrastructure.

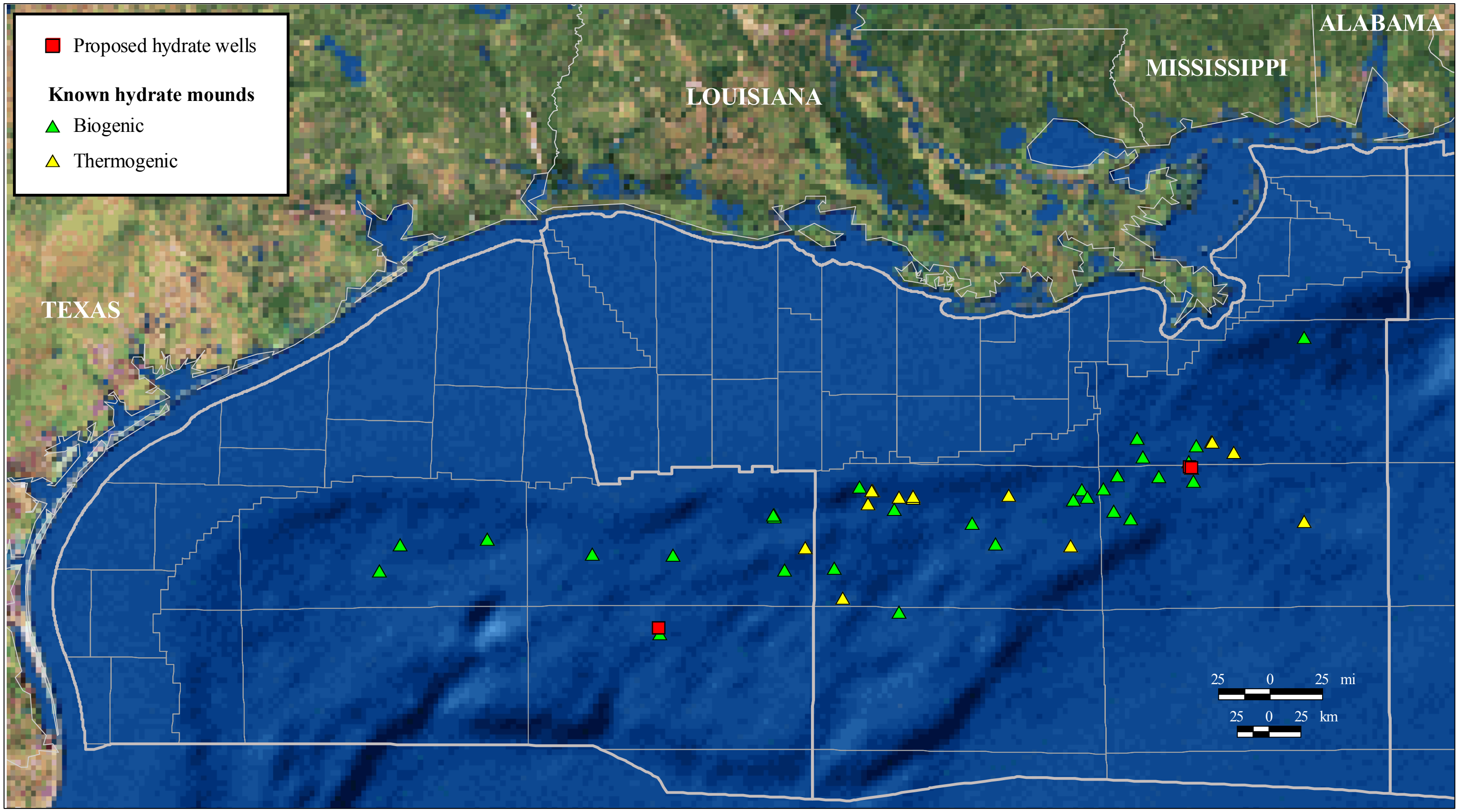


Figure 7. Location of known gas hydrates in the Gulf of Mexico.

Figure 8. Gas hydrates on the seafloor in Green Canyon Block 185 (photo courtesy of GERG/Texas A&M University).

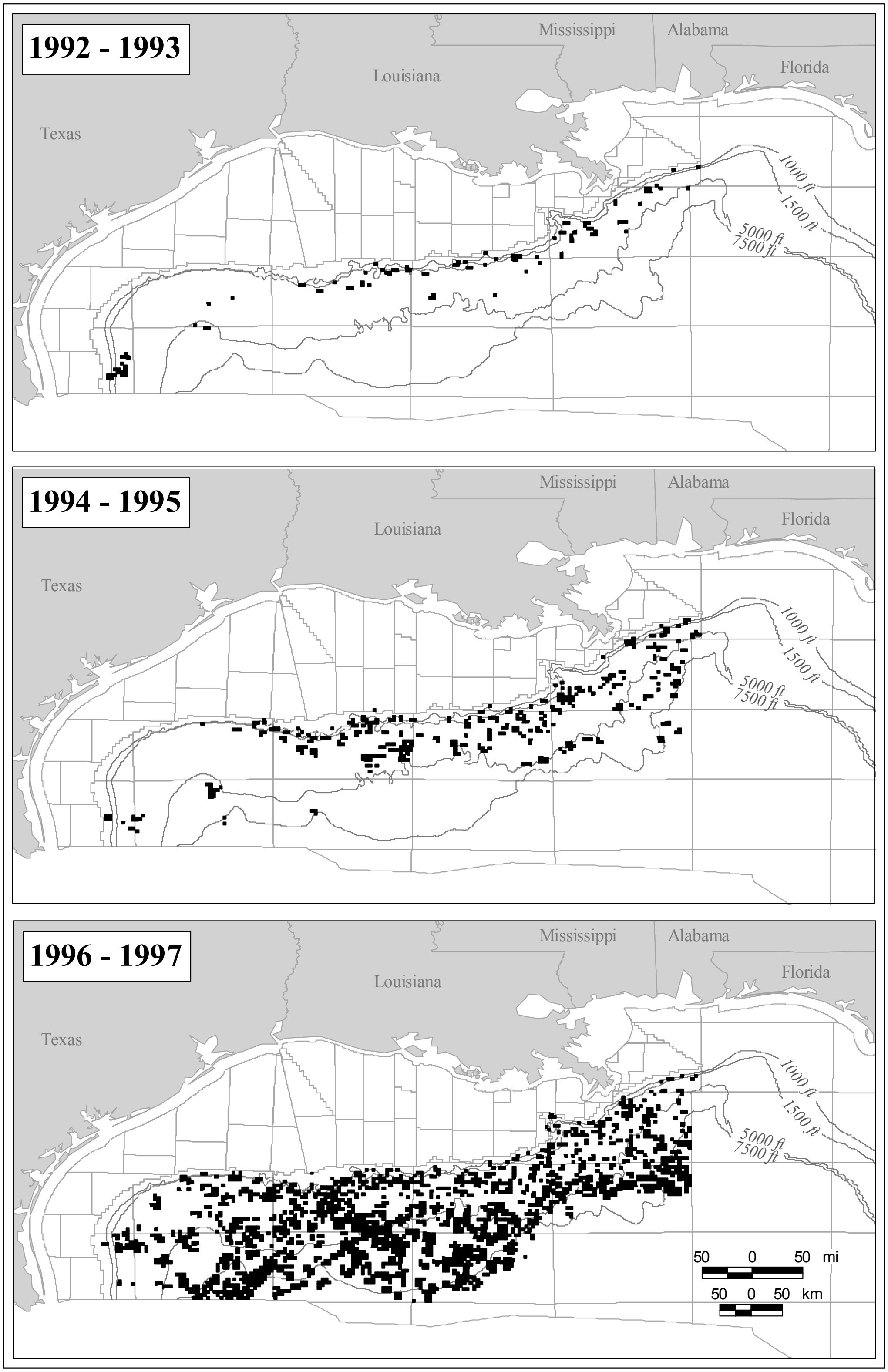


Figure 9. Deepwater leases issued in the Gulf of Mexico.

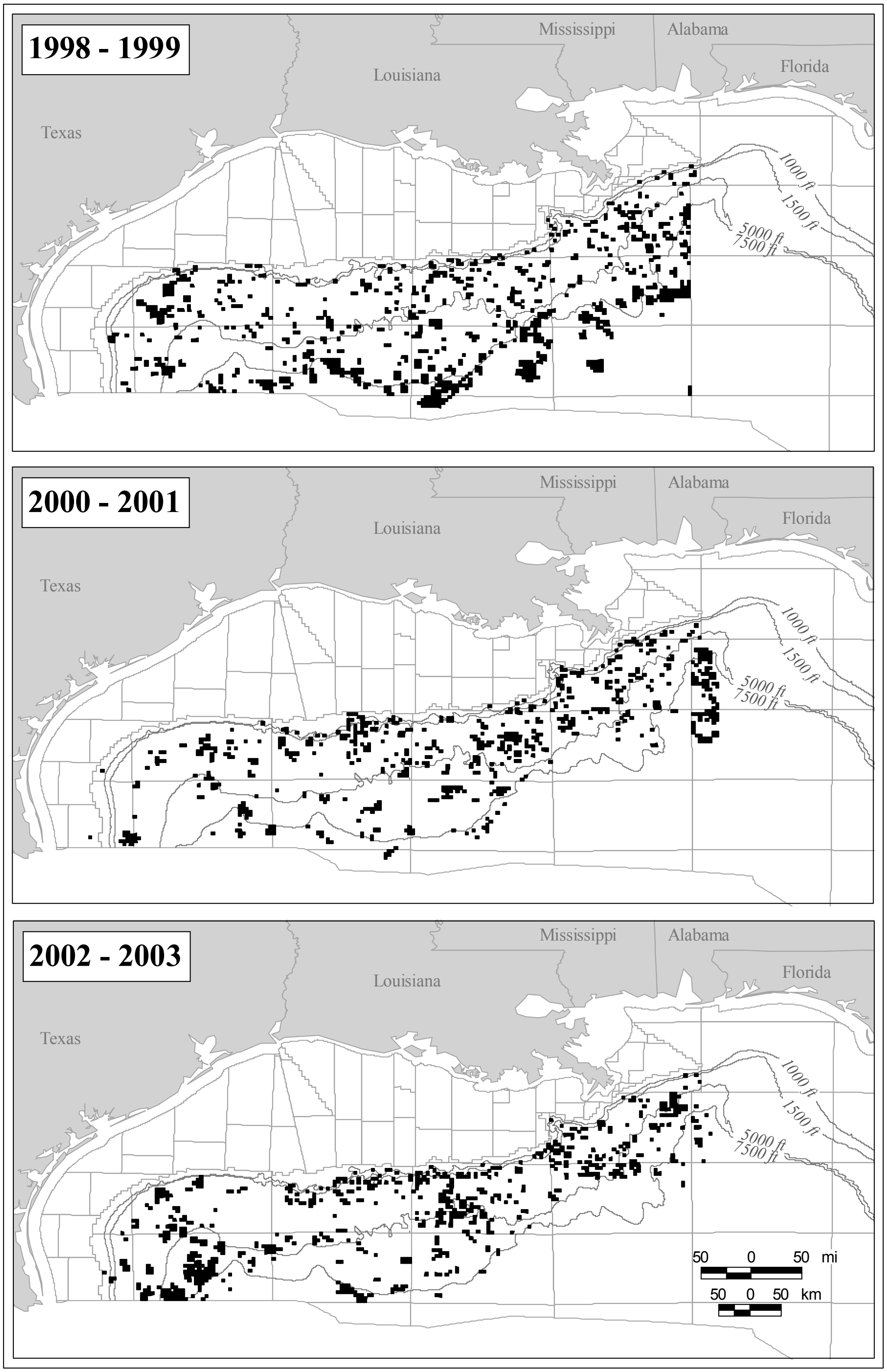


Figure 9. Deepwater leases issued in the Gulf of Mexico (continued).

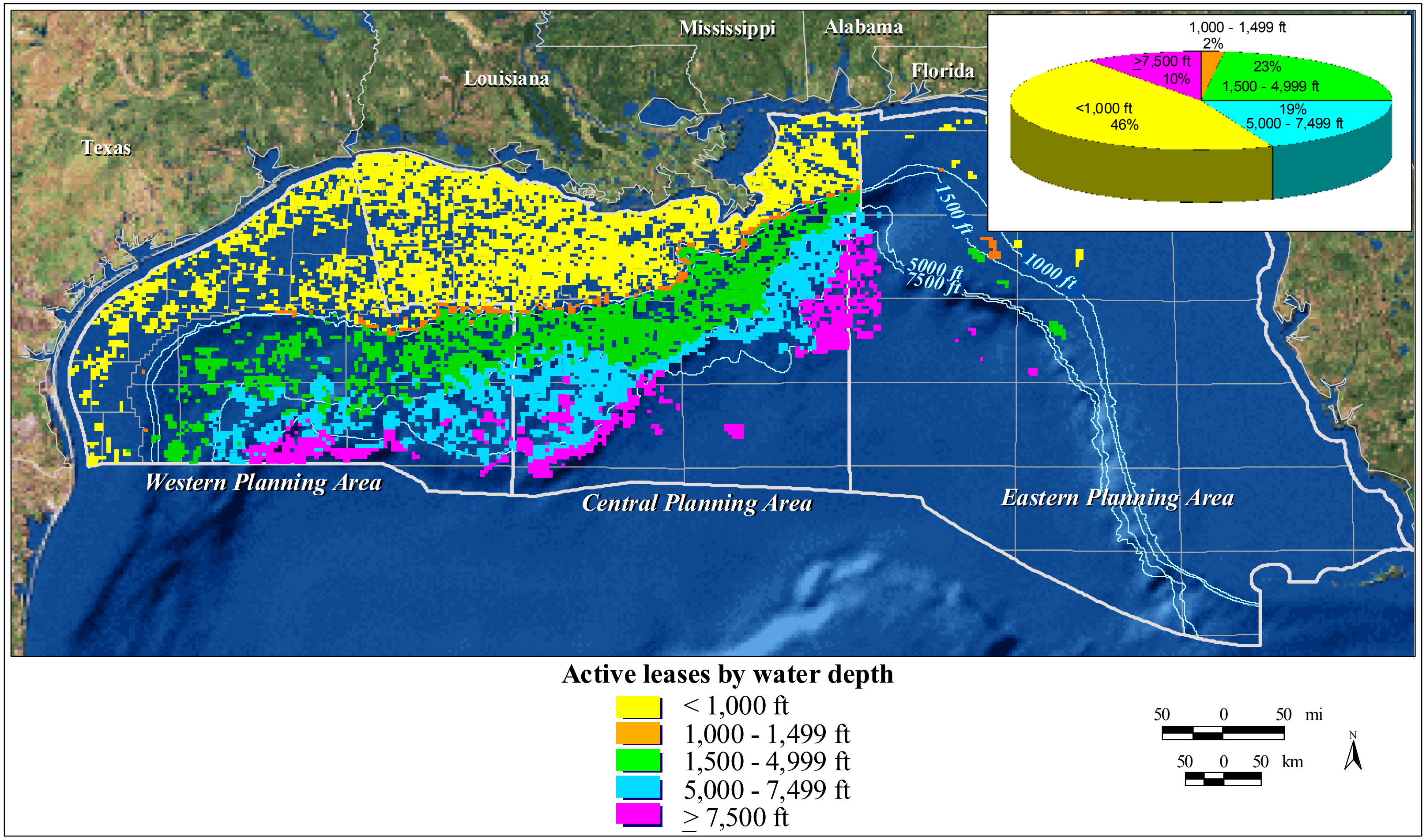
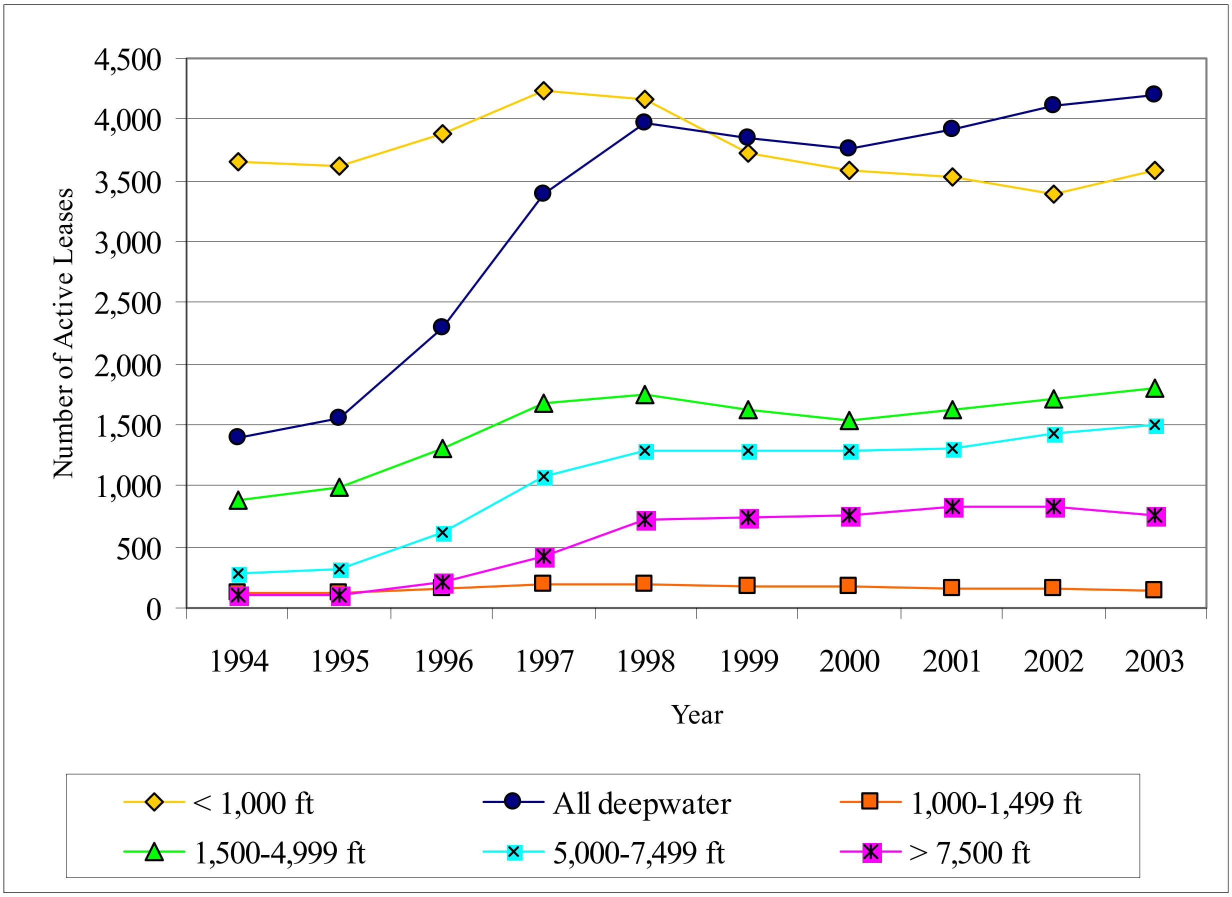


Figure 10. Active leases in the Gulf of Mexico.



Water Depth (ft)	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
< 1,000 ft	3,645	3,613	3,886	4,228	4,162	3,716	3,588	3,531	3,382	3,585
1,000-1,499 ft	121	129	166	189	199	185	179	162	153	150
1,500-4,999 ft	886	988	1,300	1,683	1,753	1,632	1,537	1,627	1,703	1,793
5,000-7,499 ft	278	323	614	1,084	1,293	1,289	1,283	1,314	1,432	1,506
> 7,500 ft	102	109	214	429	727	744	761	822	821	757
Total Number Leases	5,032	5,162	6,180	7,613	8,134	7,566	7,348	7,456	7,491	7,791

Figure 11. Total active leases by water depth.

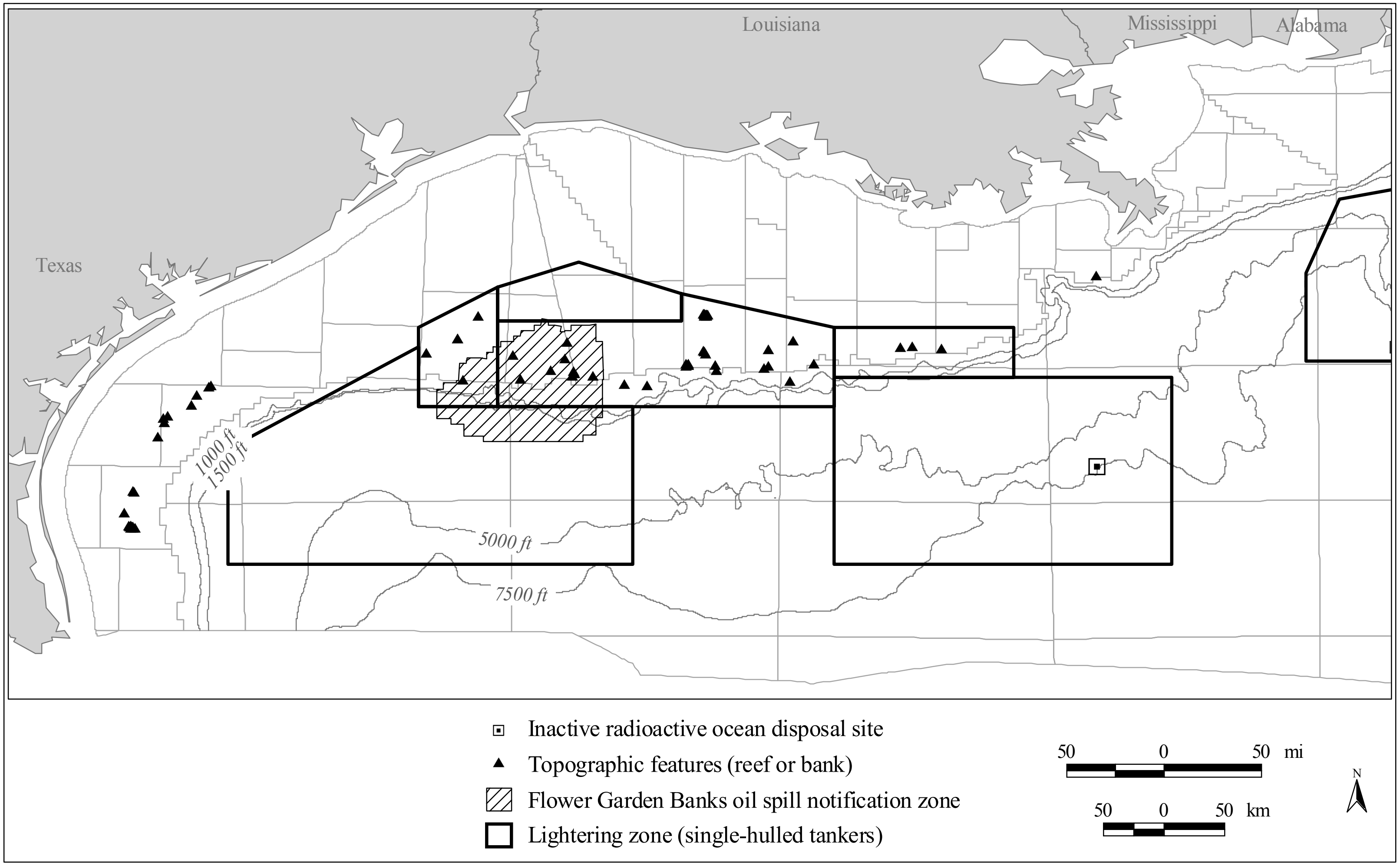


Figure 12. Environmental and deepwater administrative features.

ENVIRONMENTAL ACTIVITY

The extensive activity in the deepwater GOM requires thorough scientific knowledge and careful environmental considerations. The Environmental Studies Program (ESP), initiated in 1973, gathers and synthesizes environmental, social, and economic information concerning offshore oil and gas activities. The ESP expanded its focus to address particular issues as industry moved into deepwater. For example, studies were begun to evaluate the sensitivity of chemosynthetic ecosystems. Refer to Appendix D for a listing of selected deepwater environmental studies.

A biologically based grid system was developed as part of a comprehensive strategy to address deepwater issues. The grid system divided the Gulf into 18 areas or "grids" of biological similarity (figure 13). Under this strategy, the MMS will prepare a programmatic environmental assessment (PEA) to address a proposed development project within each of the grids. These grid PEA's are comprehensive in terms of the impact-producing factors and in terms of the environmental and socioeconomic resources described and analyzed for the entire grid. Other information on publicly announced projects within the grid is discussed, as well as any potential effects expected from their future developmental activities. Projects selected for the grid PEA's are representative of the types of development expected for the grid. For example, a good candidate for a grid PEA would be a proposed development of a new surface structure that might serve as a "hub" for future development within the grid.

Once a grid PEA has been completed, it will serve as a reference document to implement the "tiering" concept detailed in the National Environmental Policy Act's (NEPA's) implementing regulations. Future environmental evaluations may reference appropriate sections from the PEA to reduce duplication of issues and effects addressed in the grid NEPA document. This will allow the subsequent environmental analyses to focus on specific issues and effects related to the proposals.

Table 2 below shows the status of the grid PEA's.

Table 2
Completed Grid PEA's Within the Central and Western Planning Areas of the Gulf of Mexico

Grid	Project Name	Company	Plan	Area and Blocks
3	Gunnison	Kerr-McGee	N-7625	GB 667, 668, & 669
4	Nansen	Kerr-McGee	N-7045	EB 602 & 646
7	Magnolia	Conoco	N-7506	GB 783 & 784
10	Holstein	BP	N-7216	GC 644 & 645
12	Medusa	Murphy	N-7269	MC 538 & 582
13	Marco Polo	Anadarko	N-7753	GC 608
15	Matterhorn	TotalFinaElf	N-7249	MC 243
16	Thunder Horse	BP	N-7469	MC 775-778 & 819-822

EB = East Breaks
GB = Garden Banks
GC = Green Canyon
MC = Mississippi Canyon

To continue implementation of its deepwater strategy, MMS issued Notice to Lessees and Operators (NTL) No. 2003-G03, "Remotely Operated Vehicle Surveys in Deepwater," with an effective date of January 23, 2003. The NTL requirements apply to activities in water depths greater than 400 m (1,312 ft) in the Central and Western Planning Areas of the GOM.

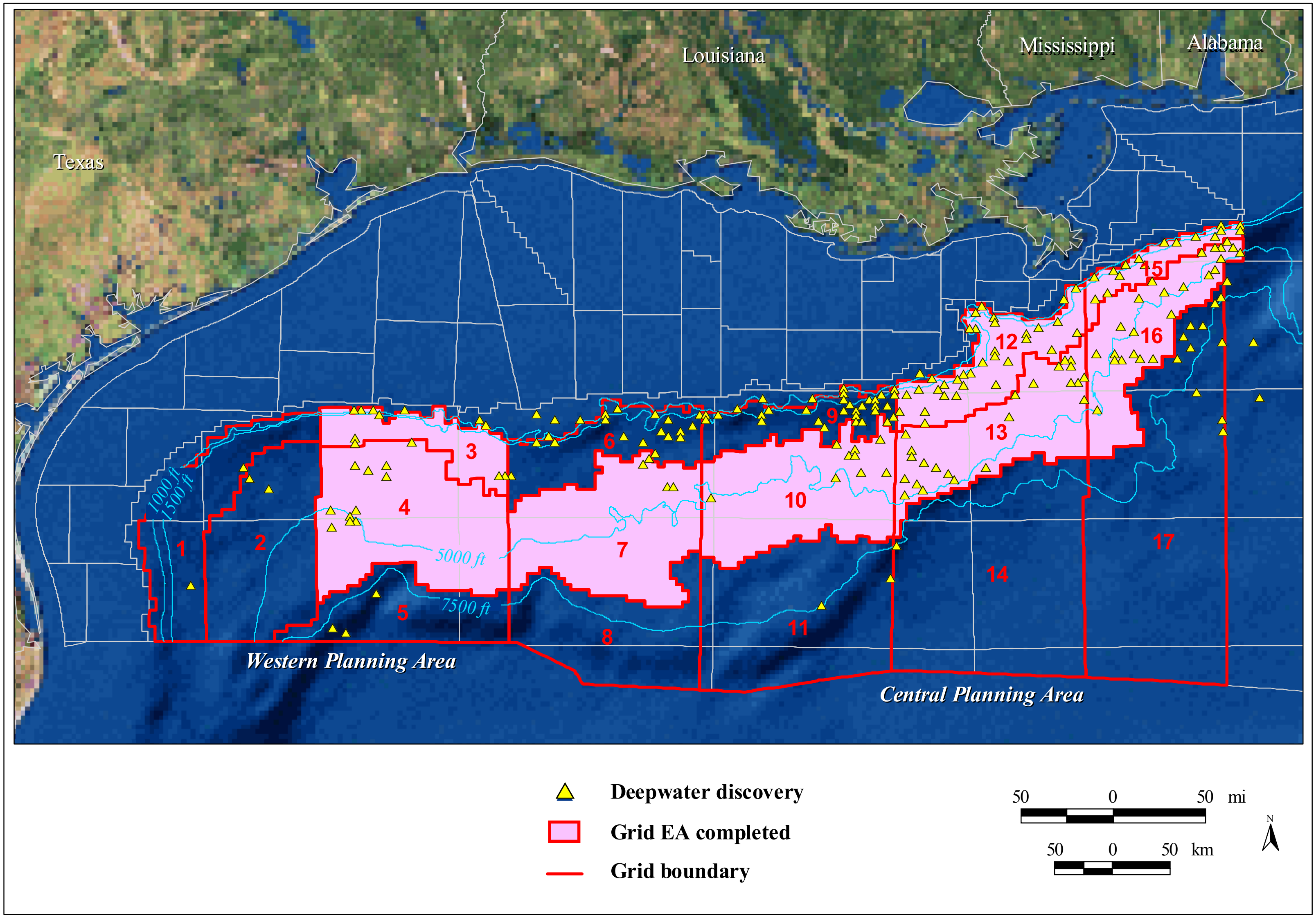


Figure 13.Grid EA status.

Operators submit a remotely operated vehicle (ROV) survey plan as an integral part of an Exploration Plan (EP) or a Development Operations Coordination Document (DOCD) that has a surface structure in one of the 18 grid areas. The MMS will notify an operator in the EP or DOCD approval letter if the operator needs to conduct the ROV survey. The decision to require the survey is based on whether or not the grid area that contains the proposed activities has already received adequate ROV-survey coverage. Figure 14 shows the location of existing ROV surveys.

Exploration and development activities in deepwater may have localized impact on benthic communities. A description of these potential impacts is available in *Gulf of Mexico Deepwater Operations and Activities: Environmental Assessment* (USDOI, MMS, 2000). The MMS believes that sensitive benthic communities such as chemosynthetic communities are protected by the existing review process, relying on NTL's and mitigative measures that require avoidance of sensitive communities.

The ROV-monitoring surveys are intended to verify the effectiveness of mitigative measures and to ensure that previously unknown, high-value benthic communities do not exist in the vicinity of proposed activities. New information could lead to changes in the review process and in the mitigative measures required.

The deepwater GOM has an amazing diversity of about 20 species of whales and dolphins (cetaceans), including the endangered sperm whale. Sperm whales are the deepest diving cetacean, routinely engaging in 45-to-60-minute dives while chasing prey (predominately large squid) in 2,300-3,300 ft (701-1,006 m) of water. Approximately 1,000 sperm whales can be found in the northern GOM. They are rarely seen in less than 2,300 ft (701 m) of water, and most likely are found at about 3,300-ft (1,006-m) water depths. Although the whales move throughout the deeper Gulf, one preferred area is off the Mississippi River delta – an area with considerable oil and gas activity.

Sperm whales, like the majority of cetaceans, depend more on hearing than on vision to navigate, communicate, and find food. They have complex sound-producing organs and equally complex sound-reception and sound-processing capabilities. Since airguns create intense sound waves, there is concern that seismic surveys could damage whales' hearing or interfere with their communications and biological sonar. To date, there are no definitive data demonstrating the effect that airguns have on sperm whales and other cetaceans. However, preliminary findings from ongoing studies suggest that sperm whales do not react to moderate levels of airgun exposure.

To mitigate potential impacts, MMS has engaged in a precautionary approach to regulating seismic operations. New rules require seismic vessels to

- start airgun operations during daylight hours only,
- ramp up airguns slowly when operations begin,
- visually monitor for sperm whales within a 1,640-ft (500-m) radius, and
- halt airgun operations if sperm whales are seen within a 1,640-ft (500-m) radius.

Ocean Current Monitoring

The most energetic currents in the Gulf of Mexico are created by the Loop Current, which moves from the Caribbean Sea into the eastern part of the Gulf and exits between southern Florida and Cuba (figure 15). It affects the ocean from the surface to approximately 3,000-ft (914-m) water depth with varying speeds. Currents as high as 4 knots (kn) have been observed from the surface to 1,000-ft (305-m) water depths. These upper currents then taper off between 1,000- and 3,000-ft (305- and 914-m) depths. The Loop Current path may vary by hundreds of miles while the flow direction generally remains constant. Once it reaches its most northward position, a portion may break off and form an eddy current, a mass of clockwise-rotating water that traverses westward until it dissipates off the western coast of the Gulf.

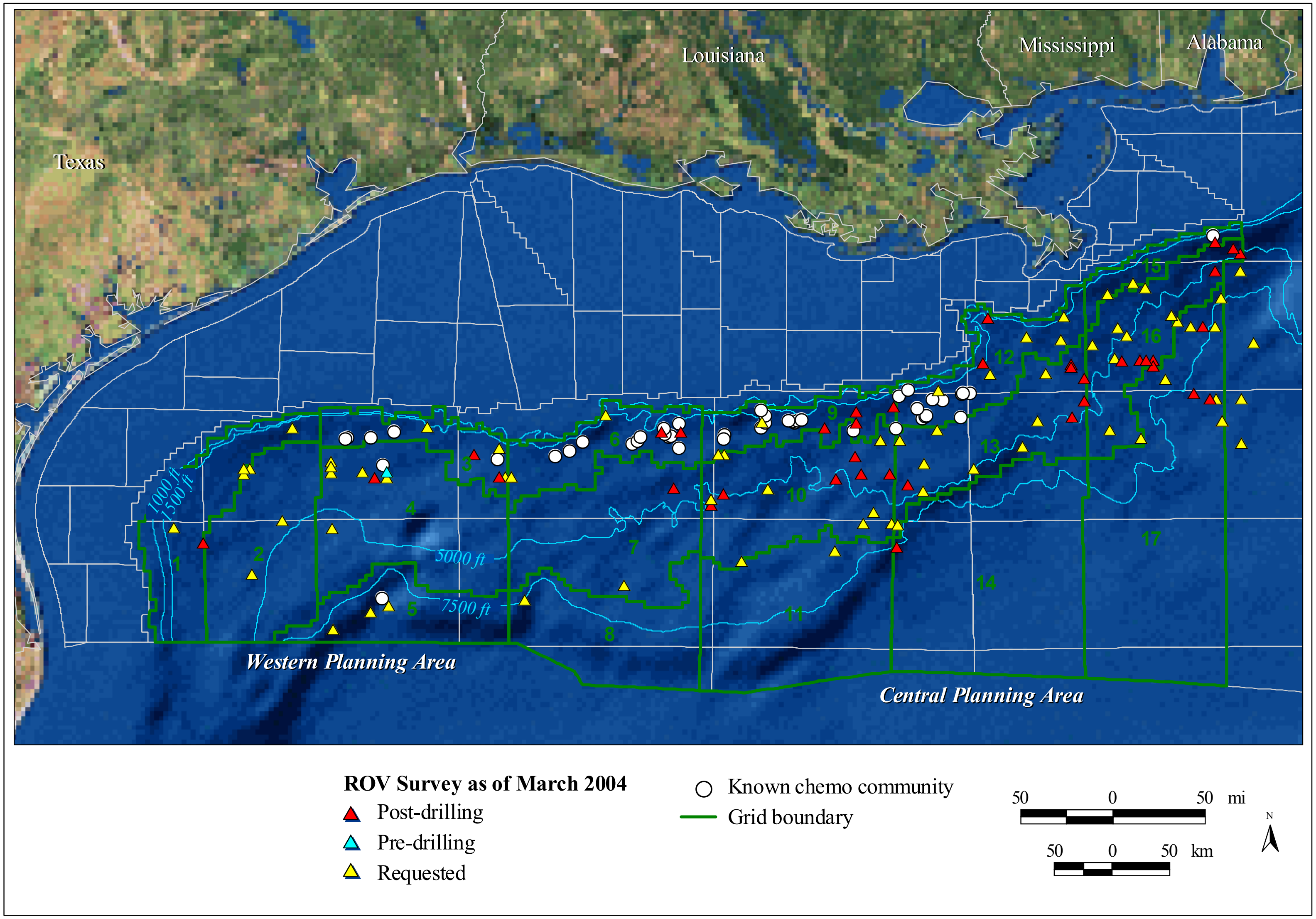


Figure 14. ROV surveys including known chemosynthetic communities.

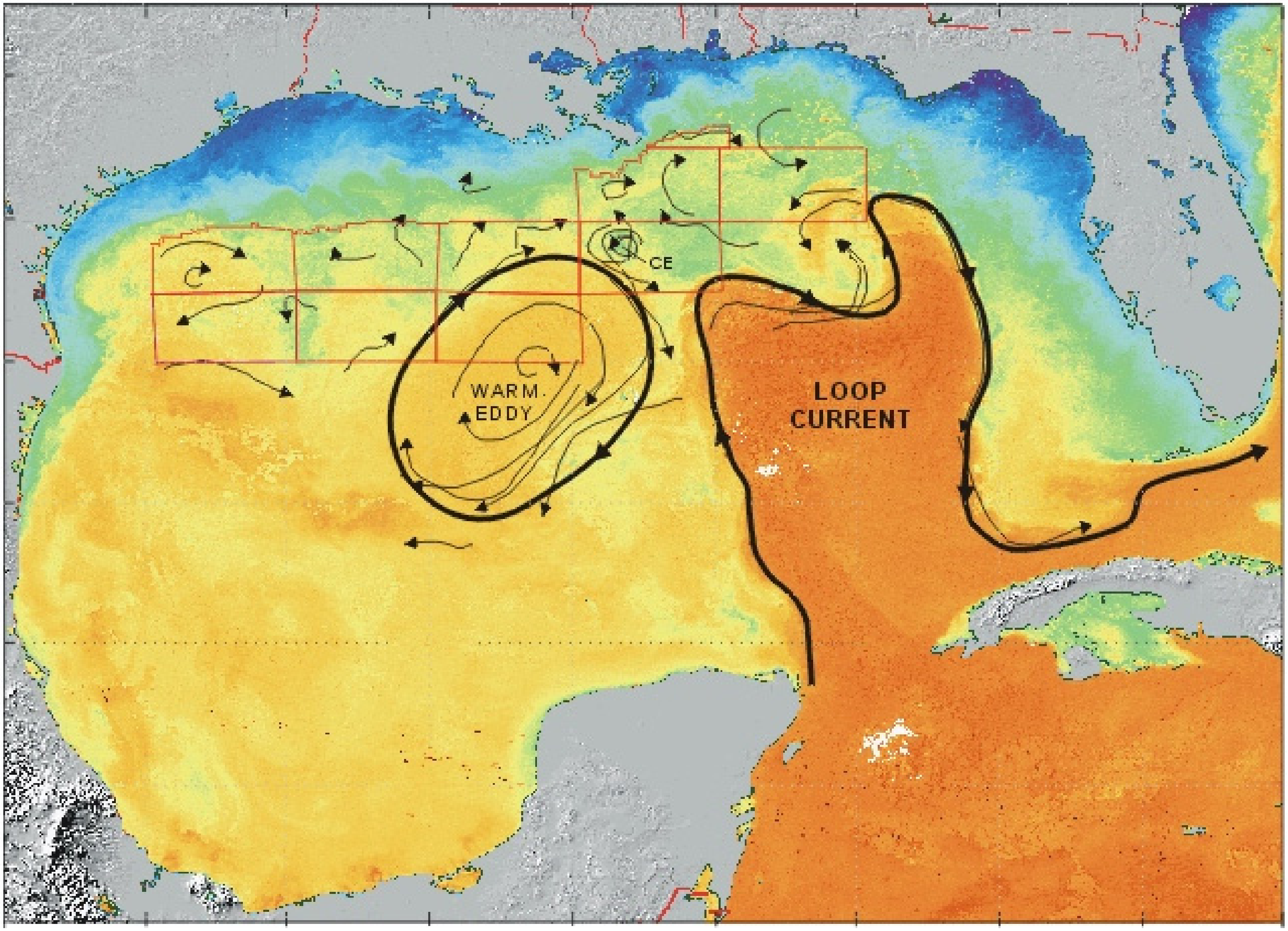


Figure 15. Loop and eddy currents in the Gulf of Mexico (image courtesy of Horizon Marine, Inc.).

Beneath the 3,000-ft (914-m) water depth, other currents migrate around the deep waters of the GOM. Until recently, these deep currents were thought to be minimal and were not a major consideration in most structure designs. In 1999, industry reported significant currents on the OCS below 3,000 ft (914 m). This information led to a Safety Alert and subsequent study of deep currents by MMS (Hamilton et al., 2003). This study revealed significant deep currents of up to 2 kn at some locations. The effects of all currents must be considered in the design of deepwater floating production facilities, drilling rigs, and their ancillary equipment, such as steel catenary risers and mooring systems.

Recent incidents have revealed the need for more accurate data in hind-casting and forecasting events and in daily operations. As a result, MMS is proposing to issue an NTL titled "Ocean Current Monitoring on Floating Facilities." This NTL could establish and implement a program where operators of deepwater offshore production facilities and mobile offshore drilling units (MODU's) collect data on ocean currents and submit them for publication on an industry-sponsored Internet website. Data collected on currents will improve fatigue forecast models and establish responsible design criteria, resulting in increased reliability of deepwater structures, thereby reducing risk to human lives, offshore facilities, and the ocean environment.

CHALLENGES AND REWARDS

Significant challenges exist in deepwater in addition to environmental considerations. Deepwater operations are very expensive and often require significant amounts of time between the initial exploration and first production. Despite these challenges, deepwater operators often reap great rewards. Figure 16 shows the history of discoveries in the deepwater GOM. There was a shift toward deeper water over time, and the number of deepwater discoveries continues at a steady pace. Note that the last frame of this figure only represents a 3-year span and that several recent discoveries are not shown in this frame because they have not been assigned a discovery date yet. (The Reserves and Production section of this report explains how discovery dates are assigned.)

Figure 17 shows how major and nonmajor oil and gas companies compare in terms of deepwater project discoveries. (Appendix E lists those companies defined as majors.) In the past, major companies were responsible for the majority of discoveries and led the way into the deepest waters. However, the number of discoveries by nonmajor companies has surpassed that by major companies. In addition, nonmajor companies have made numerous recent discoveries in the deepest waters of the frontier.

In addition to the significant number of deepwater discoveries, the flow rates of deepwater wells and the field sizes of deepwater discoveries are often quite large. These factors are critical to the economic success of deepwater development. Figure 18 illustrates the estimated sizes and distributions of 80 proved deepwater fields. In addition to their large sizes, deepwater fields have a wide geographic distribution and range in geologic age from Pleistocene through Paleocene. Note that only recently have reservoirs older than Miocene been encountered.

The growing number of large deepwater fields on production requires increasing support from onshore service bases. Most producing deepwater fields have service bases in southeast Louisiana (figure 19). Pending exploration plans (EP's) and development operations coordination documents (DOCD's) filed with MMS indicate that support from southeastern Louisiana will continue to grow and that additional support will come from southwest Louisiana, Mississippi, and the Texas coast (figure 20). Although expanding along the Gulf Coast, shore-based support for deepwater operations is likely to remain concentrated in southeastern Louisiana.

Figure 21 illustrates existing and potential hubs for deepwater production. For purposes of this report, deepwater hubs are defined as surface structures that host production from one or more subsea projects. These hubs represent the first location where subsea production surfaces and the connection point to the existing pipeline infrastructure. Note that potential hubs are moving into deeper waters, expanding the infrastructure, and facilitating additional development in the ultra-deepwater frontier.

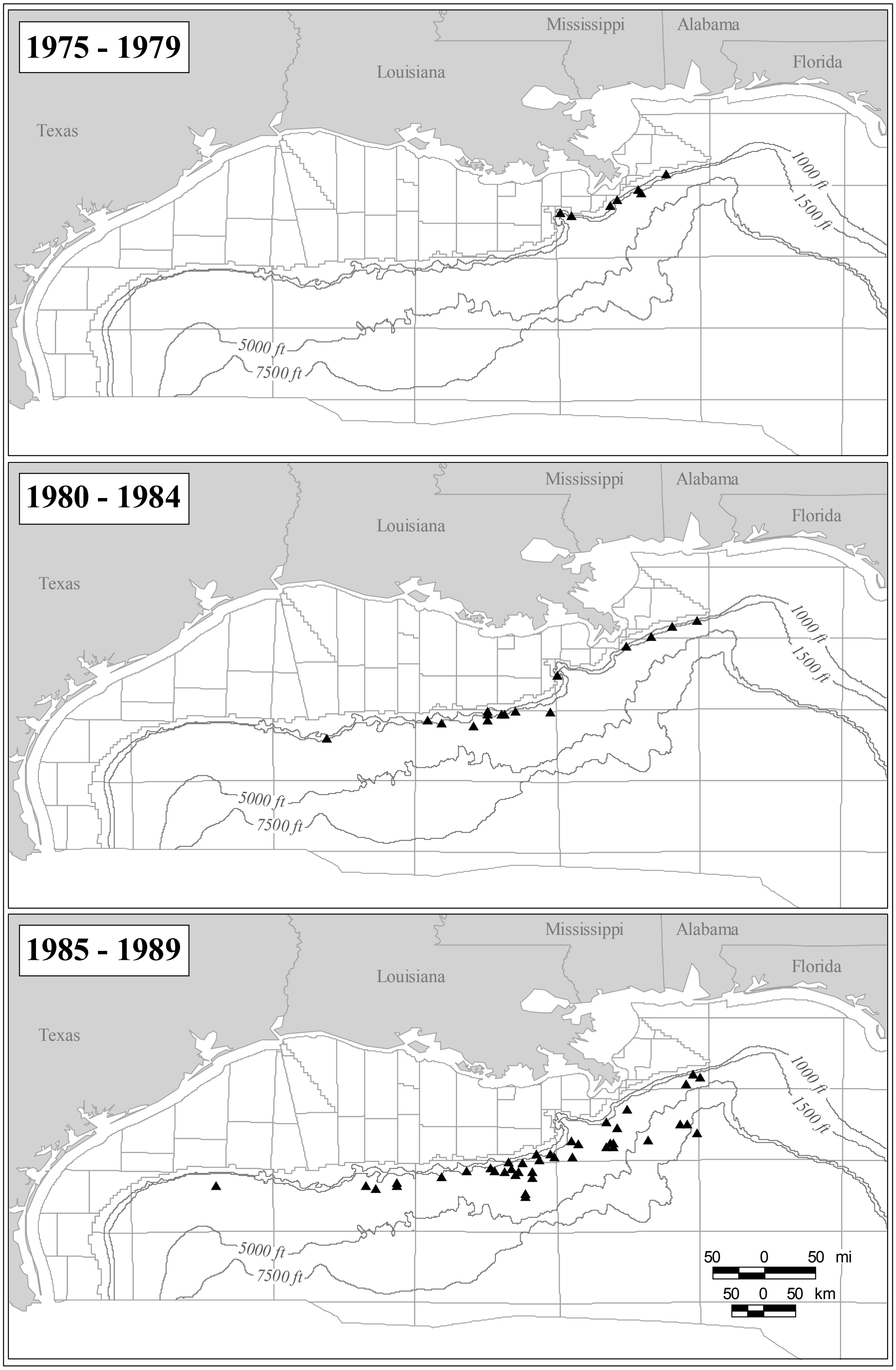


Figure 16. Deepwater discoveries in the Gulf of Mexico.

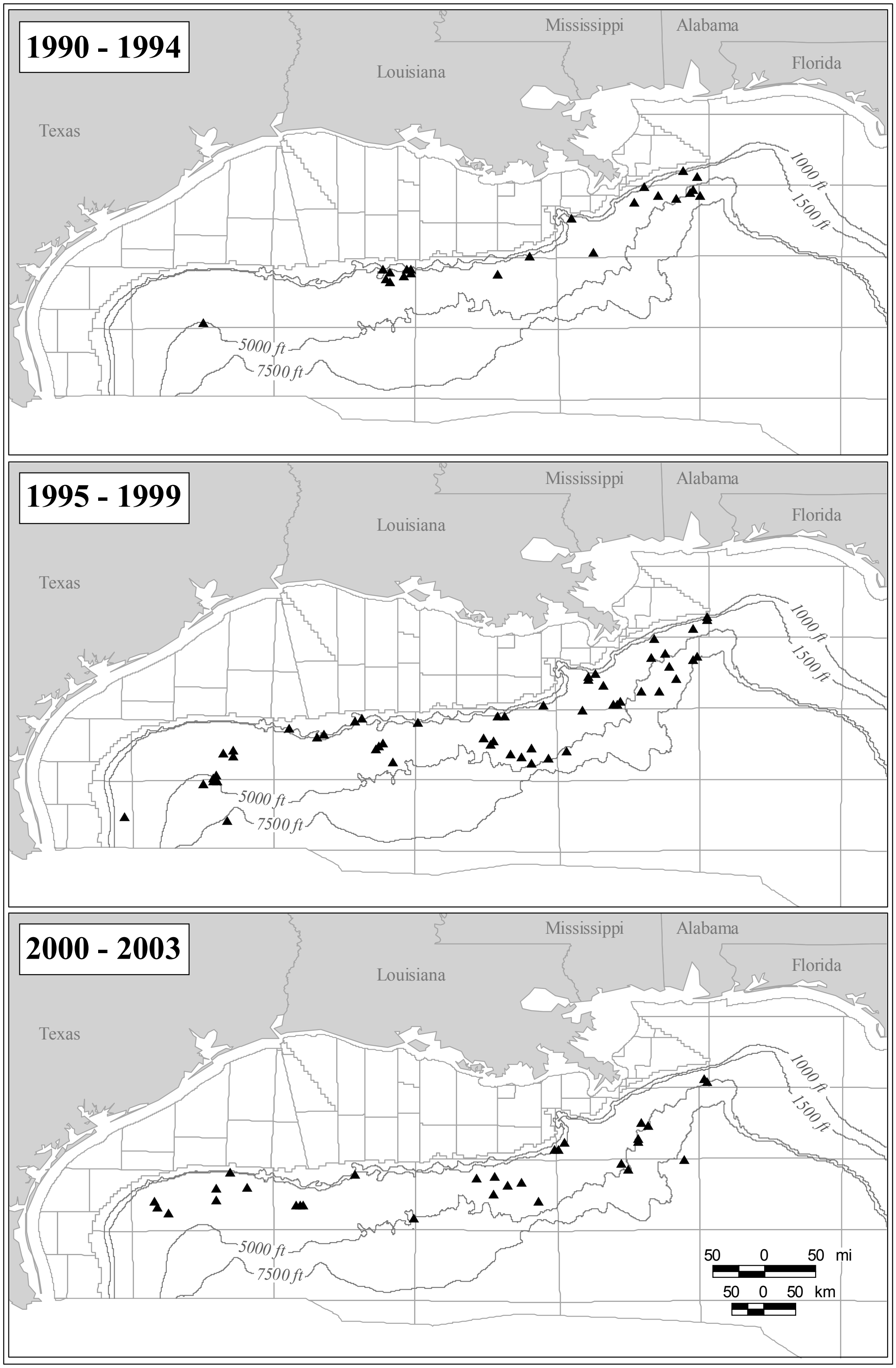


Figure 16. Deepwater discoveries in the Gulf of Mexico (continued).

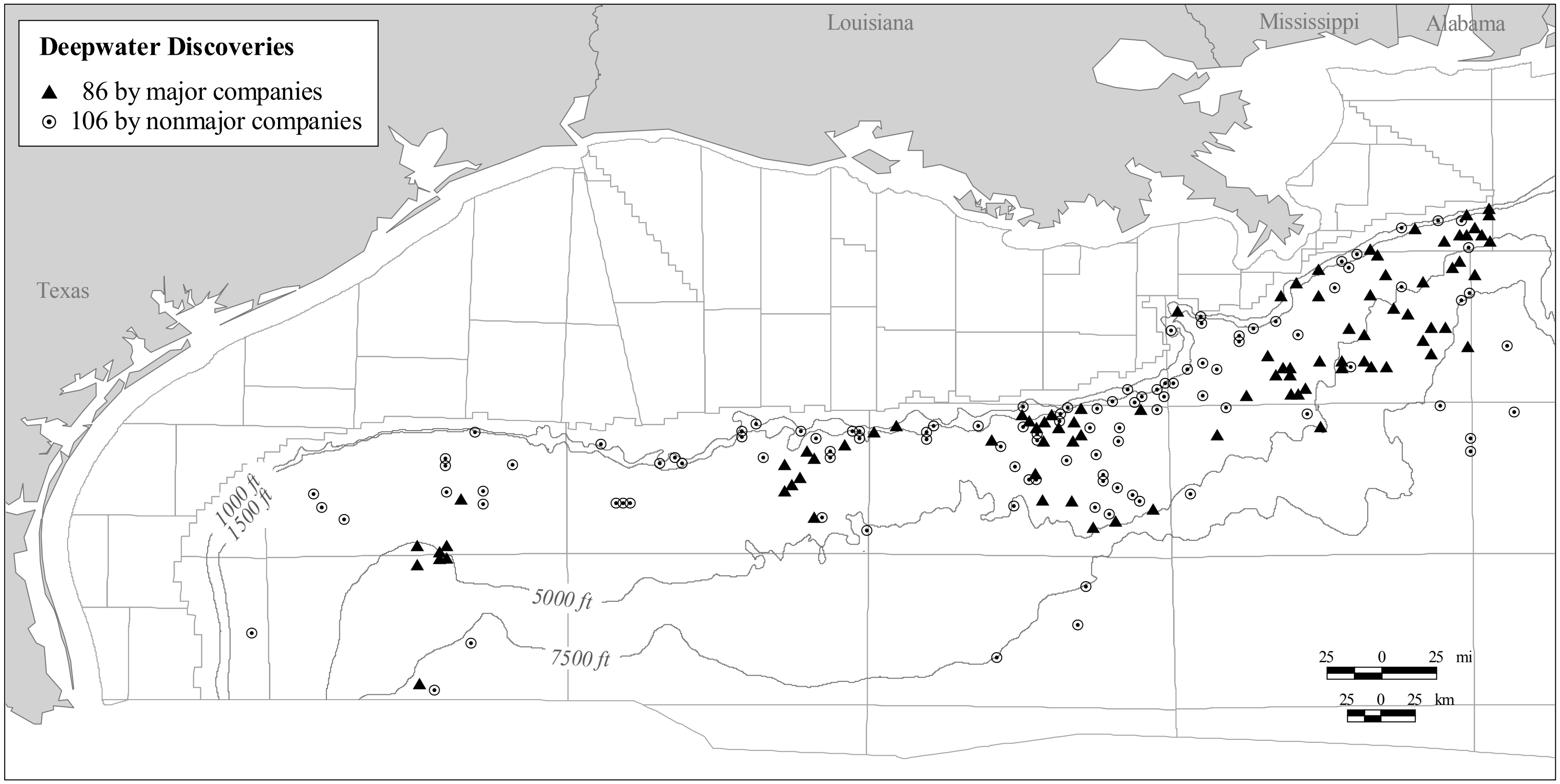


Figure 17. Ownership of deepwater discoveries (includes industry-announced discoveries).

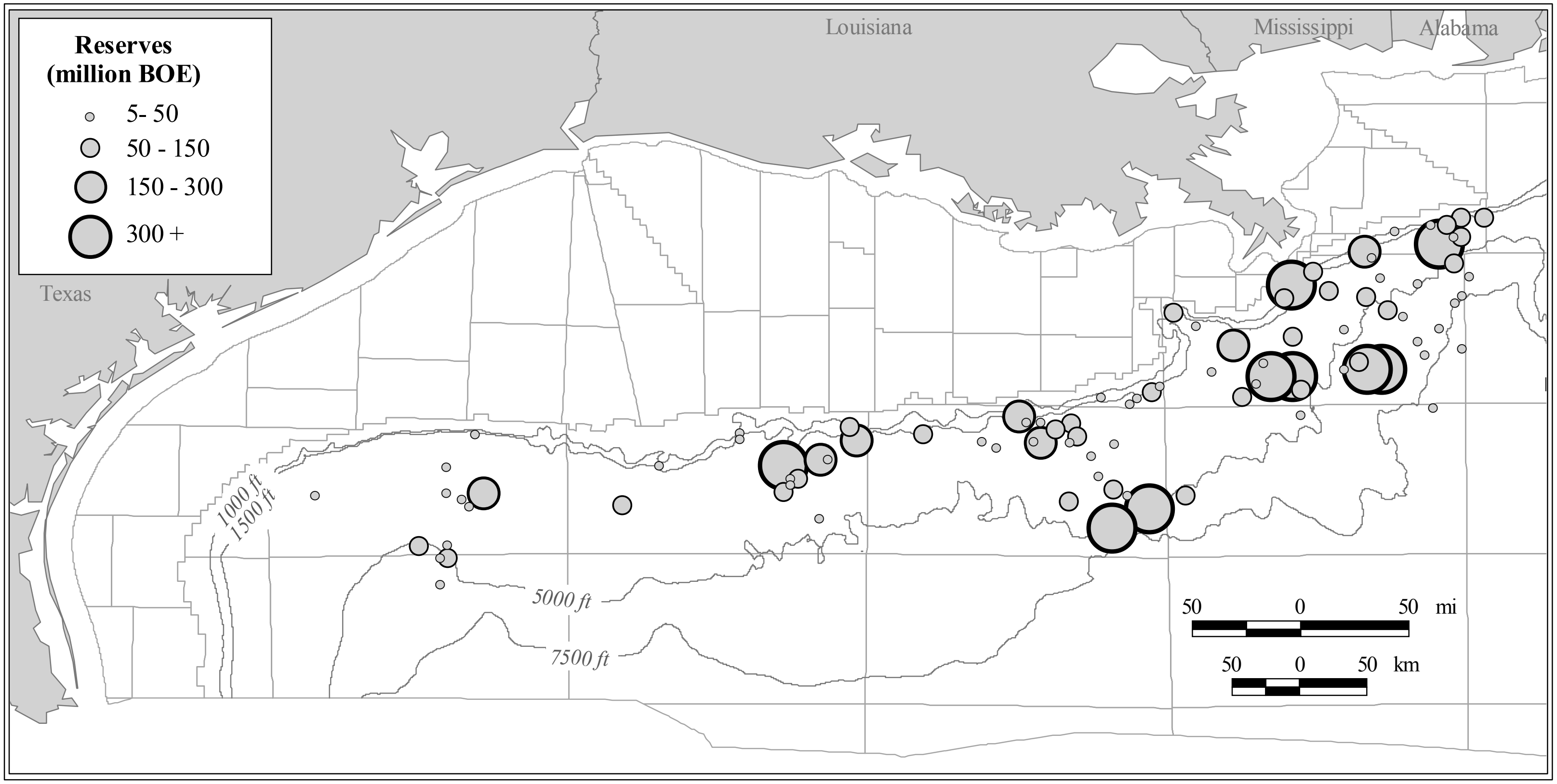


Figure 18. Estimated volumes of 80 proved deepwater fields.

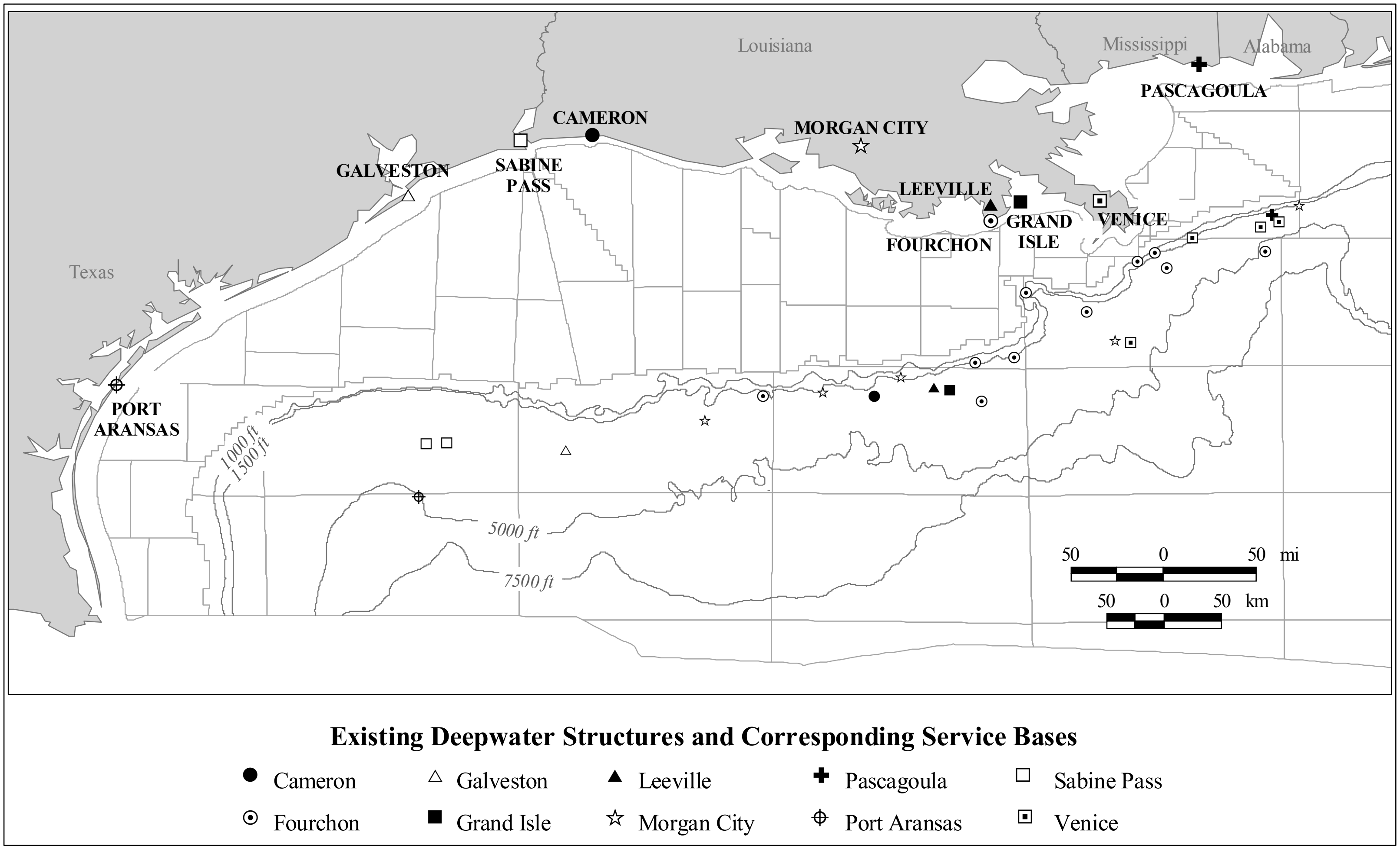


Figure 19. Onshore service bases for existing deepwater structures.

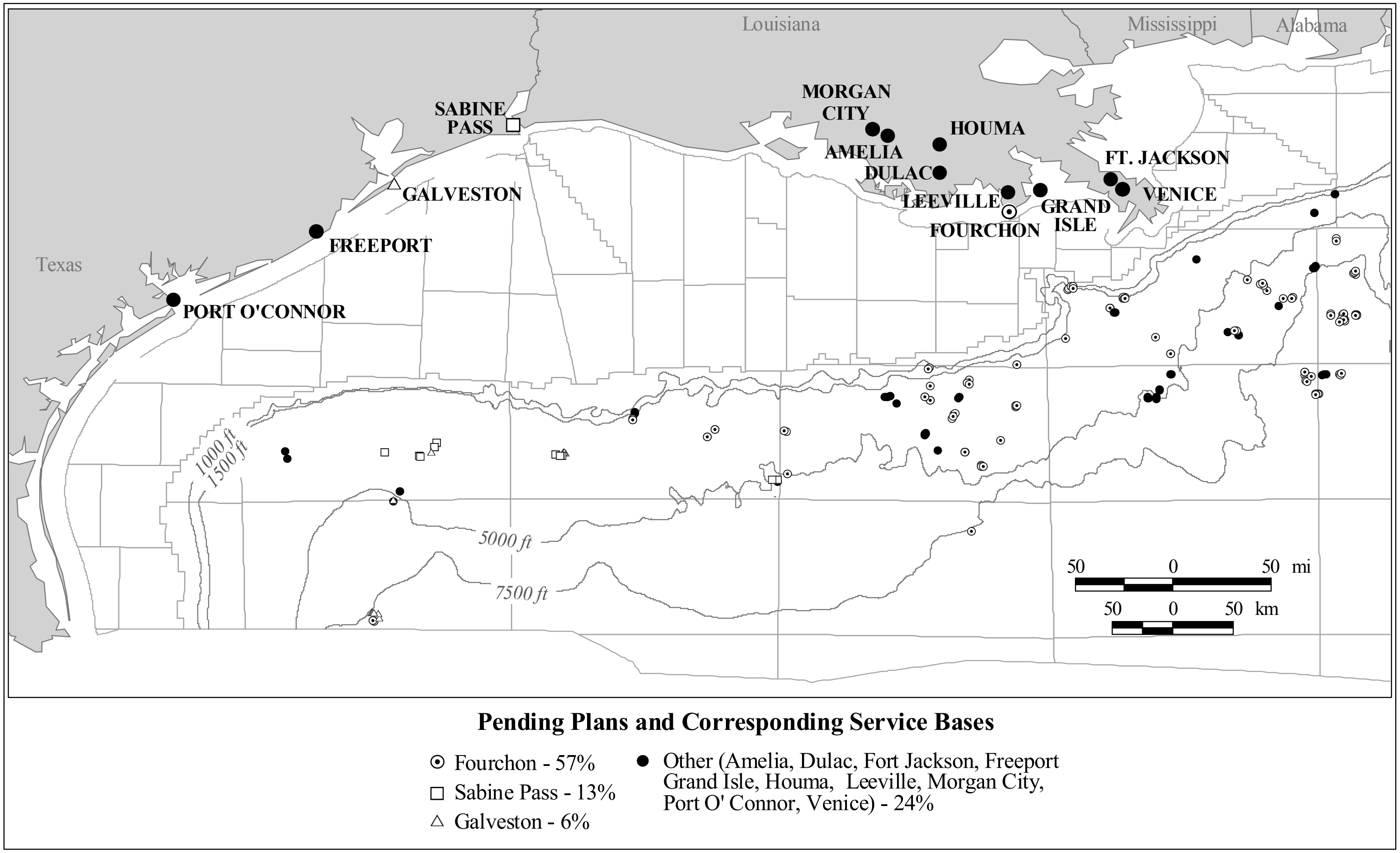


Figure 20. Onshore service bases for pending deepwater plans.

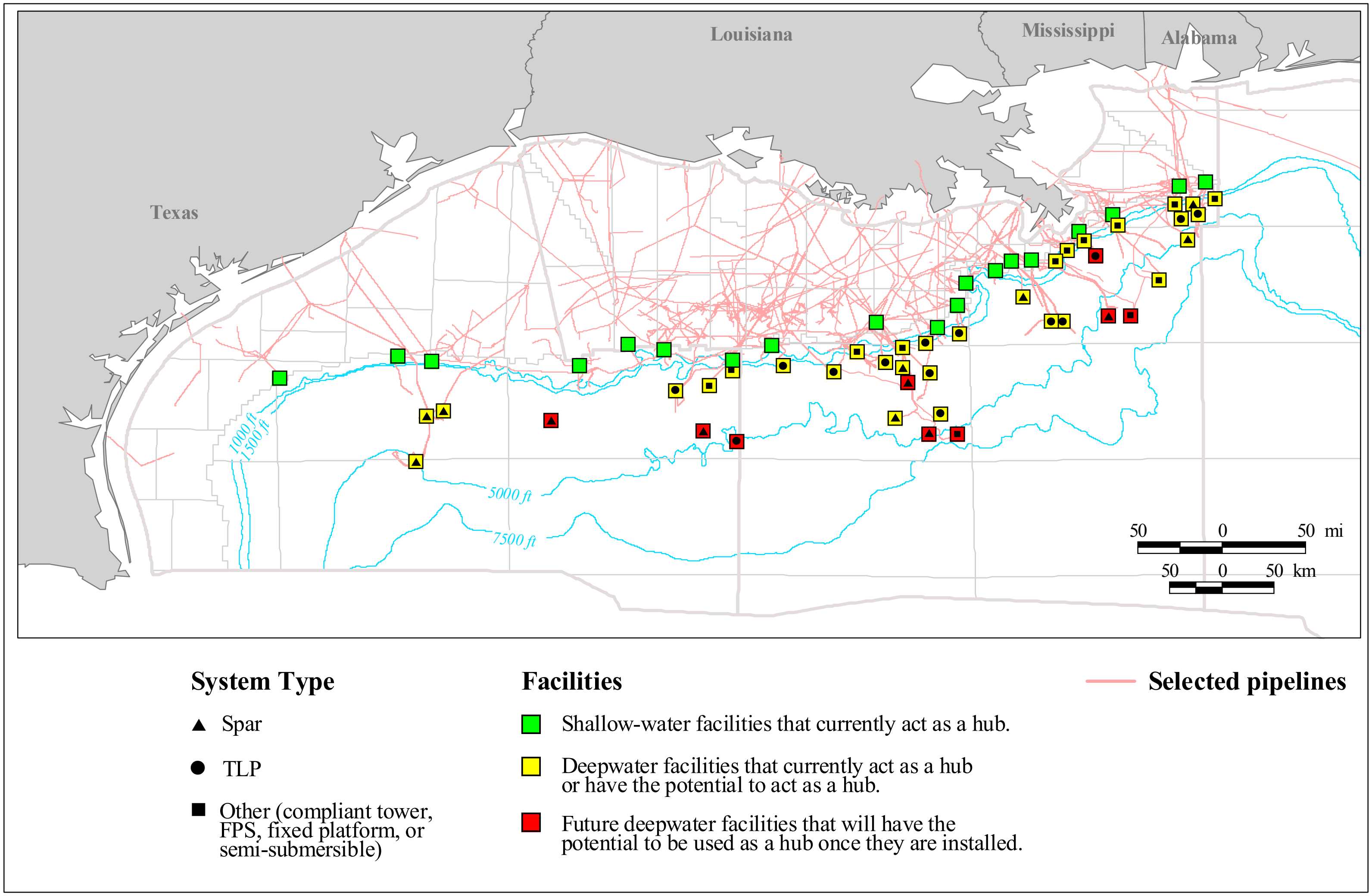


Figure 21. Current, potential, and future hub facilities in the Gulf of Mexico.

The infrastructure needed to bring deepwater production online continues to develop over time. Figure 22 shows the framework of major oil and gas pipelines in the GOM. Figure 23 illustrates the existing network of deepwater pipelines. These figures highlight new and proposed pipelines since the last report.

Offshore liquefied natural gas (LNG) terminals may bring significant additional gas into the GOM and may vie for pipeline capacity with future deepwater developments. Table 3 shows proposed LNG terminals in the GOM.

Table 3
LNG Projects Proposed in the Gulf of Mexico

Project Name	Company	Area and Block	Facility Type
Port Pelican	Port Pelican LLC (ChevronTexaco)	Vermilion 140	Concrete Gravity Base Structures
Energy Bridge	El Paso Energy Bridge GOM, LLC (El Paso)	West Cameron 603	Submerged Turret Loading Buoy
Gulf Landing	Gulf Landing, LLC (Shell)	West Cameron 213	Gravity Base Structures
Main Pass Energy Hub	Freeport-McMoRan Energy, LLC (Freeport-McMoRan)	Main Pass 299	Incorporates Existing Platforms

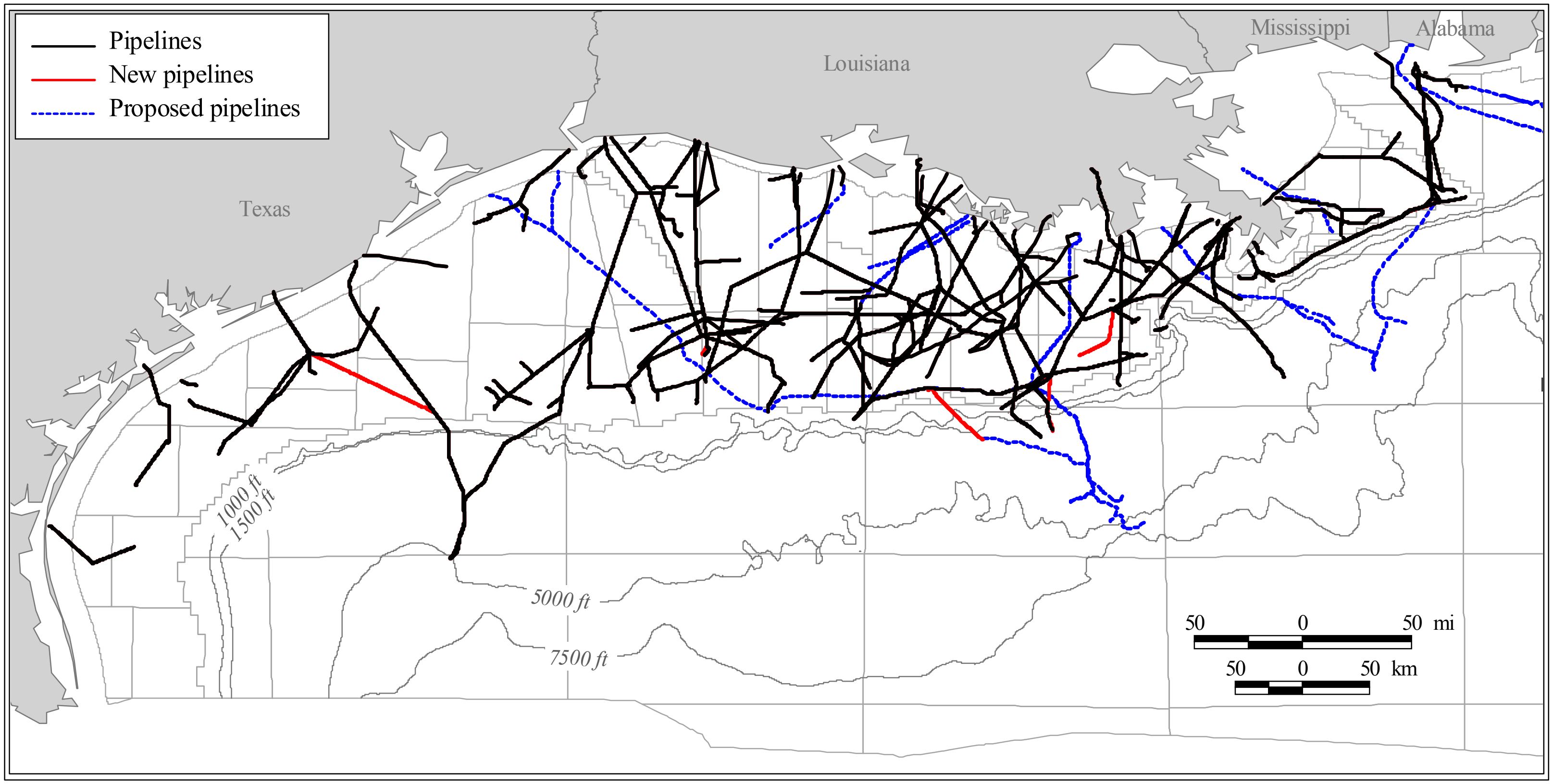


Figure 22. Oil and gas pipelines with diameters greater than or equal to 20 inches.

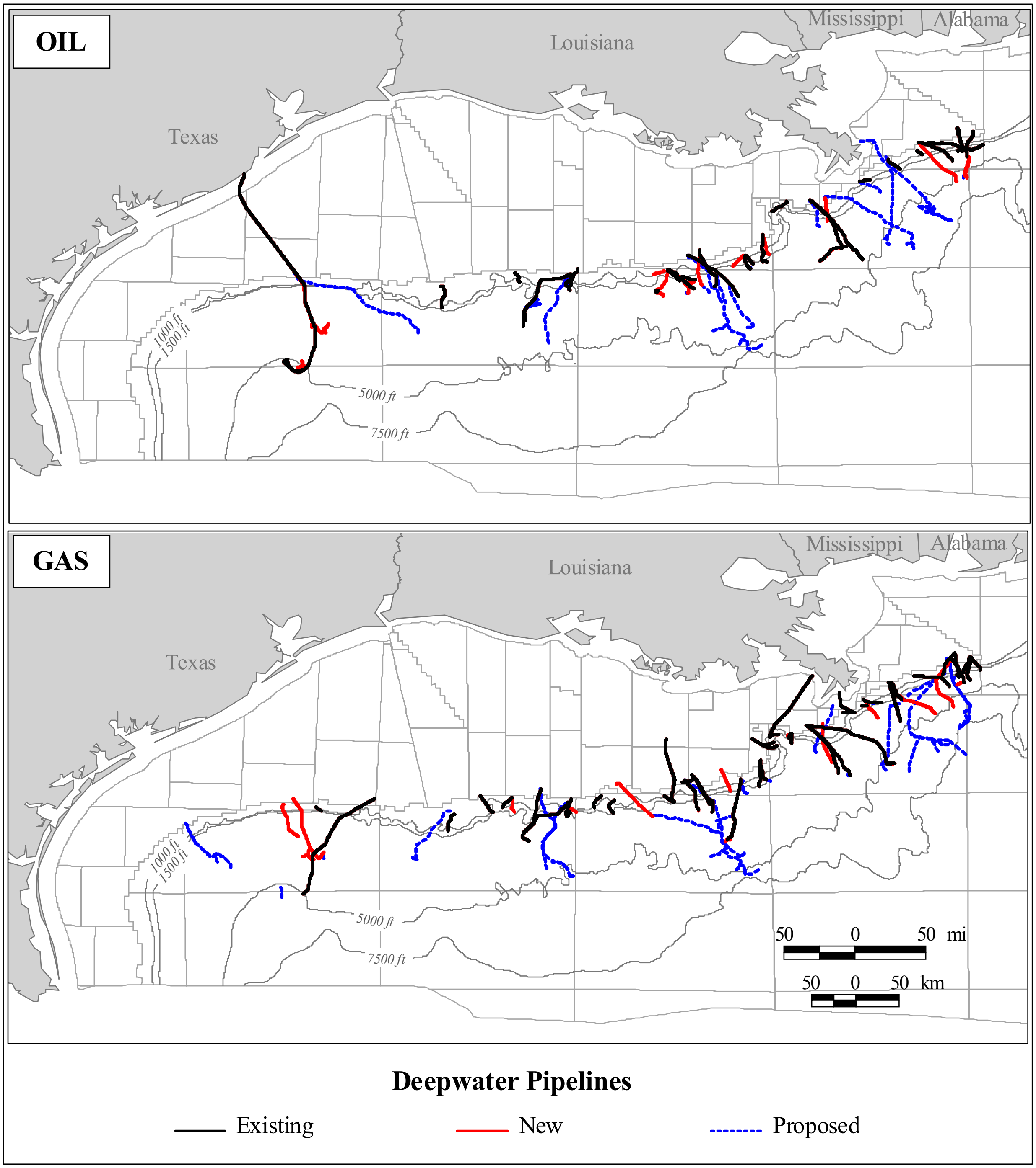


Figure 23. Deepwater oil and gas pipelines in the Gulf of Mexico.

LEASING

Until the mid-1990's, leasing activities in the Gulf of Mexico were focused on shallow-water blocks located on the continental shelf (water depths of approximately 650 ft [200 m] or less). For example, in 1992 there were 176 leases issued in water depths less than approximately 650 ft (200 m), compared with only 28 leases issued in water depths greater than that depth.

In 1995, the DWRRA established incentives for royalty relief based on water-depth intervals defined in meters. The water-depth categories depicted in figure 24 reflect the divisions used in the DWRRA. This figure shows the magnitude of the DWRRA impact, with tremendous deepwater leasing activity from 1996 through 1998 in water depths greater than 800 m (2,625 ft), where the greatest royalty relief was available. In 1992, for example, leases in water depths greater than 800 m (2,625 ft) only accounted for 3 percent of leases issued. By the end of 1998, however, this had grown to almost 70 percent.

While interest in deepwater blocks increased during the mid-1990's, interest in shallow-water blocks faded during that period. For example, shelf leases accounted for 86 percent of all leases issued in 1992, but this dropped to 23 percent by the end of 1998.

BIDDING AND LEASING TRENDS

The Gulf experienced a lull in leasing activities in 1999 — about a four-fold decrease compared with the 1998 levels. However, interest is rekindling in blocks in the 200-m (650-ft) or less range and in the greater than 800-m (2,625-ft) range, evidenced by increased leasing activities in the 1999-2003 interval. Note that shelf leasing has once again outpaced leasing in water depths greater than 800 m (2,625 ft). Some of the resurgent interest in the shelf area may be the result of the MMS's recent royalty suspension program for new deep-gas development in water depths less than 200 m (650 ft). Data in figure 24 include 95 leases awarded in Sale 181 (2001) and 14 leases in Sale 198 (2003), both Eastern GOM sales. All of the leases in these Eastern GOM sales are located in water depths of 1,600 m (5,250 ft) or greater.

Figure 25a was derived from the data in figure 24 but displays the deepwater categories used elsewhere in this report (shallow-water data are excluded from figure 25a). These deepwater data show the rapid increase in leasing activity that began in 1995. Although GOM leasing activity plummeted in 1999, there has since been a steady increase in leases awarded in the 1,500-4,999 ft (457-1,524 m) and the 5,000-7,499 ft (1,524- 2,286 m) intervals since that time.

Figure 25b shows the total amount of money spent annually for leases in each water-depth range. Large financial investments were made by the oil and gas industry from 1996 through 1998. Bid amounts were depressed in 1999, moderately increased to 2001, and slightly decreased since that time.

Most important for lease trend analysis is the average bid amount per lease as depicted in figure 25c. Overall, the average bid price for all deepwater leases steadily increased from 1992 through 2001. Beginning in 2002, there was a downturn in average bid amount per deepwater block. The high average bid amounts for 2001 reflect the fact that the industry bid large amounts per block for leases in the Eastern GOM. This was the first opportunity in 16 years for companies to bid in an area immediately adjacent to discoveries in the Central GOM area.

As the value of deepwater leases increased throughout the 1990's, MMS rejected an increasing number of deepwater high bids that it viewed as insufficient. Figure 26 shows that tracts with rejected bids moved into increasingly deeper waters over time. The rejection trend reflects the fact that, as more deepwater fields began production, they provided analogs (with high production rates, thick reservoir sections, and production infrastructure) and thus reduced the risk on similar deepwater blocks, leading to an increase in the estimated net present worth of the unleased deepwater blocks.

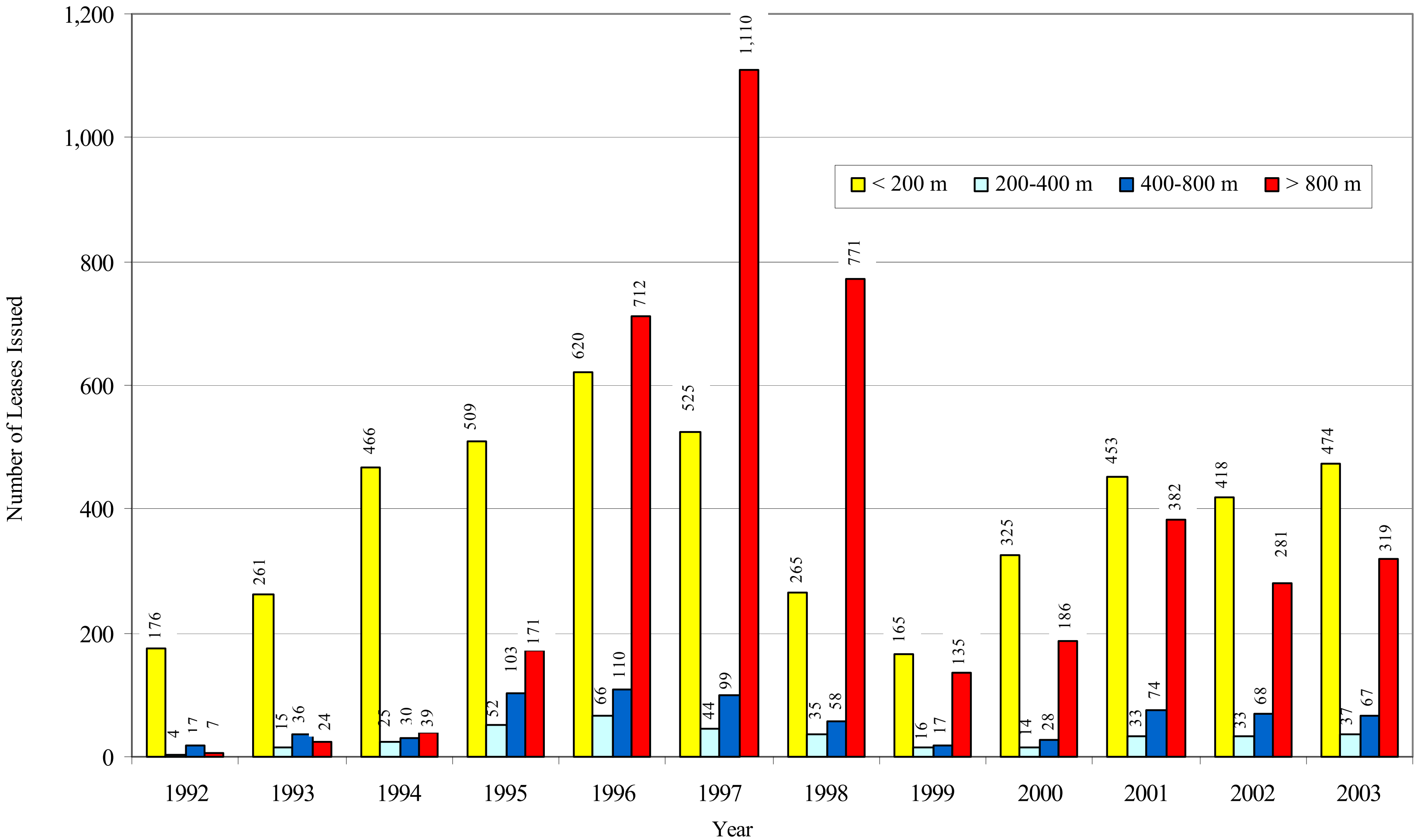


Figure 24. Number of leases issued each year, subdivided by DWRRA water-depth categories.

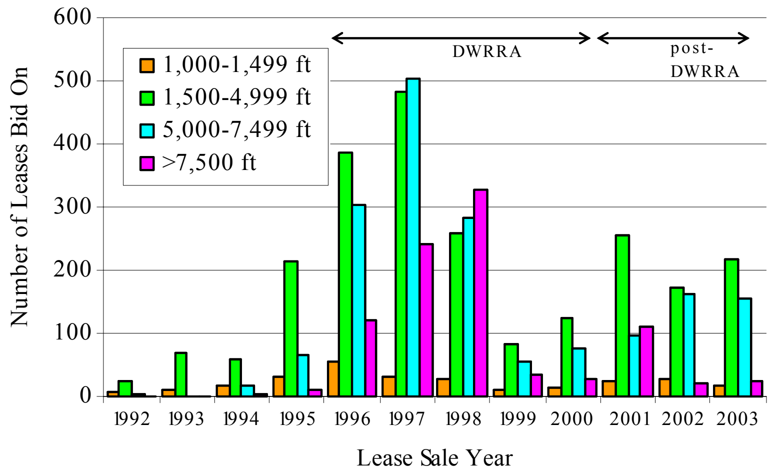


Figure 25a. Number of leases bid on for each deepwater interval.

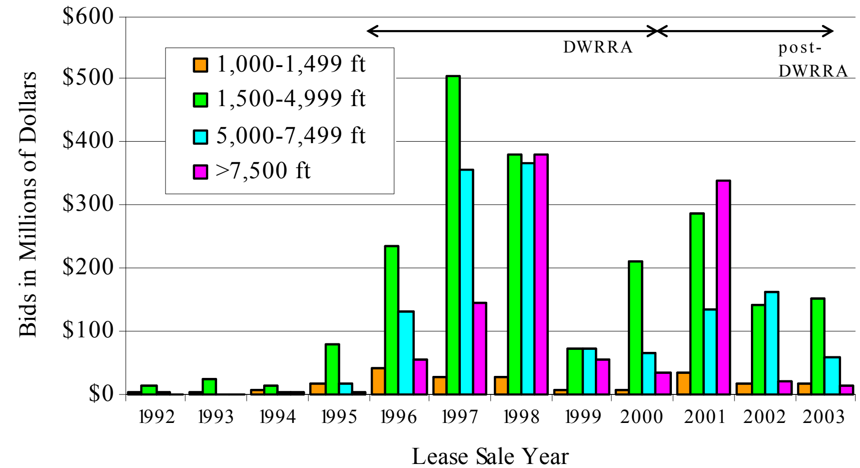


Figure 25b. Total bid amounts in deepwater intervals.

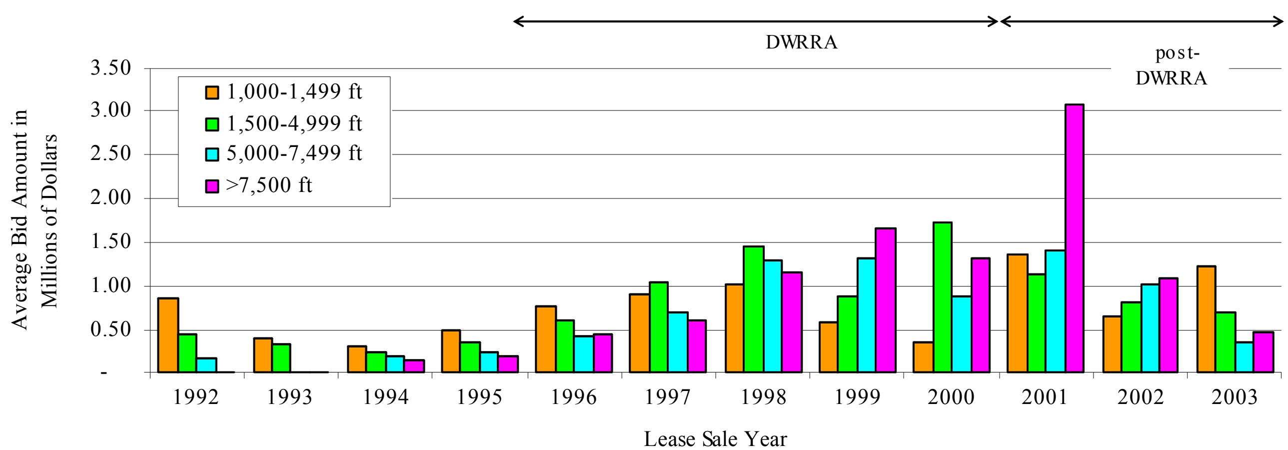


Figure 25c. Average bid amount per block in deepwater intervals.

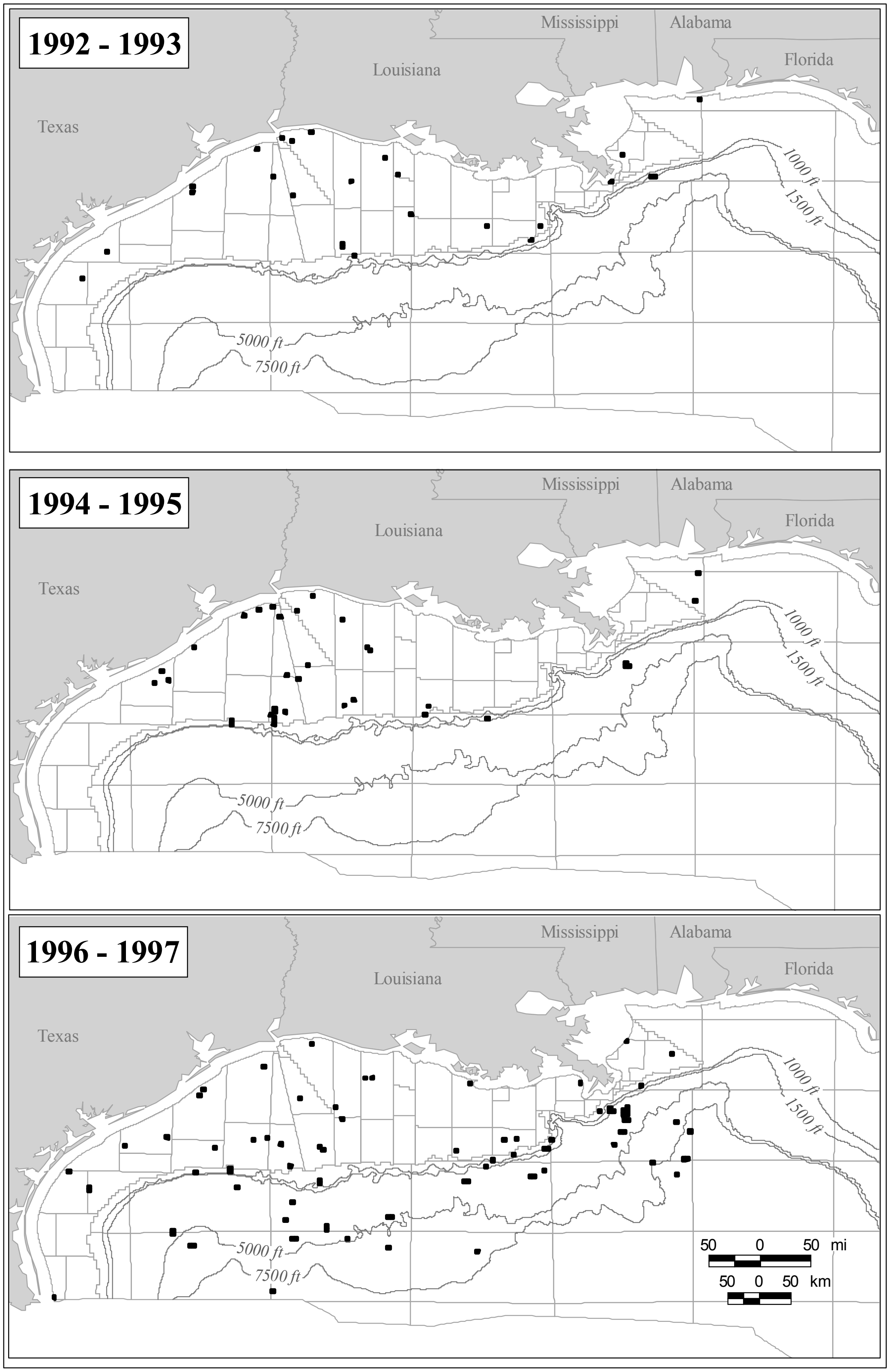


Figure 26. Rejected shallow- and deepwater Gulf of Mexico bids.

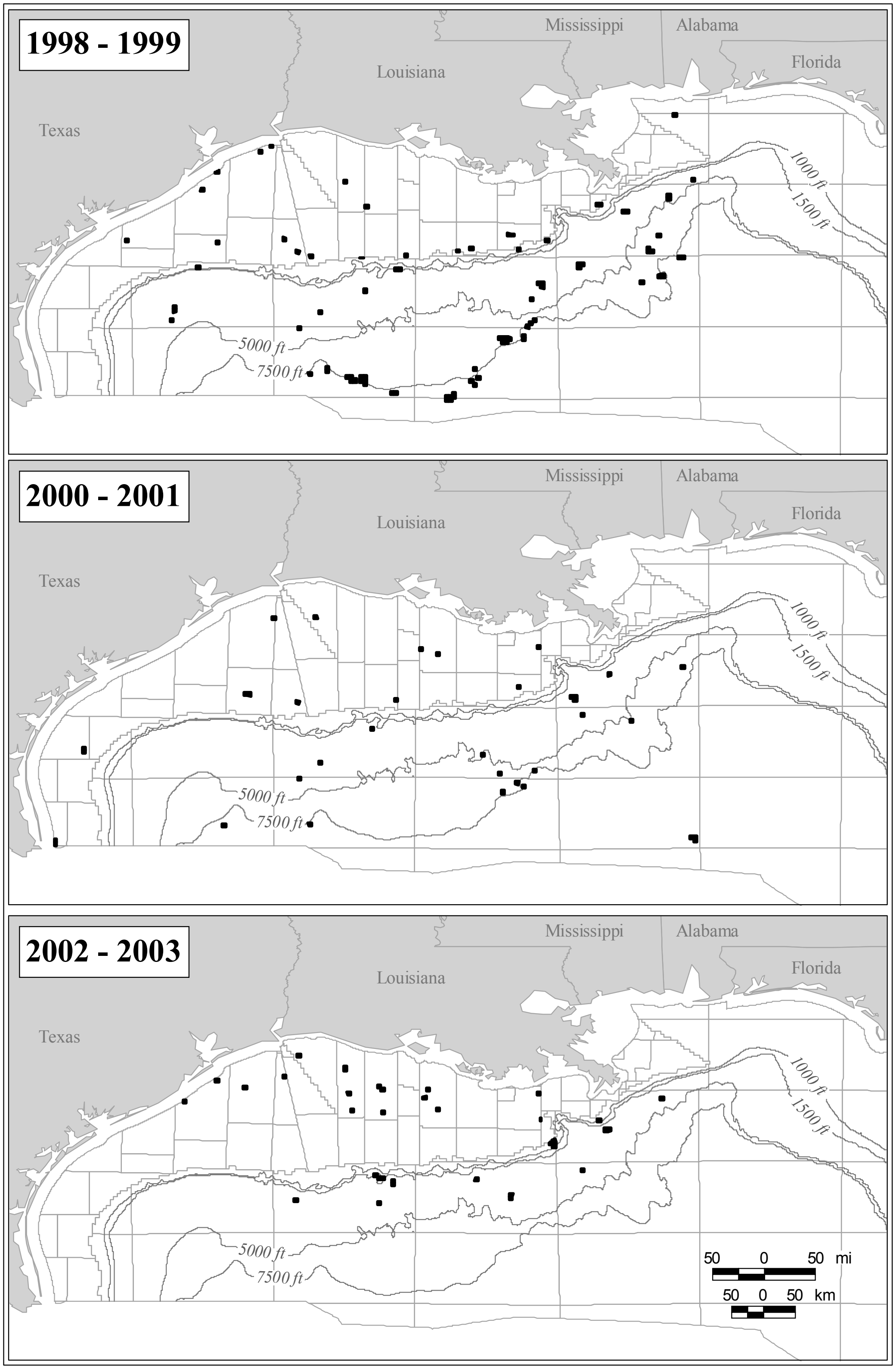


Figure 26. Rejected shallow- and deepwater Gulf of Mexico bids (continued).

LEASE OWNERSHIP

A handful of major oil and gas companies blazed the trail into deepwater in the 1980's and early 1990's. In this report, we define major companies to include BP, ChevronTexaco, ExxonMobil, and Shell. Appendix E shows the companies and subsidiaries that form these majors. (Grouping of these four entities does not indicate a regulatory conclusion or an analysis of production size. It is merely a convenient category for the purpose of comparison.) Figure 27 illustrates the relative leaseholding positions of majors versus nonmajors. (Figure 27 reflects the most recent lease ownerships at the end of each 2-year period.) Note that majors dominated deepwater leasing in 1992-1993. In 1996, nonmajors began acquiring significant leaseholdings, a trend that continued through 2003. Nonmajor companies are poised to play a leading role in the future of the deepwater Gulf.

The type of companies active in deepwater clearly changed with the increased presence of nonmajor oil and gas companies. Another change in deepwater lease ownership came with the wave of company mega-mergers. The industry mergers increased the diversity of leaseholdings for the merged companies. For example, while some companies were heavily focused on the deepwater GOM prior to the mergers, their merger partners may have been focused primarily on shallow-water prospects. The combination of these entities yielded a larger leasehold position in all water depths and frequently a broader geographic range across the GOM.

FUTURE LEASE ACTIVITY

Since the deepwater arena is already heavily leased, the number of leases that are relinquished or expire will influence activity in future lease sales. Given the fact that most companies can only drill a small percentage of their active leases, it is likely that many high-quality leases will expire without being tested. The impending turnover of these leases often results in "farm-outs" to nonmajors, opportunities for different companies to gain a lease position and, potentially, a more rapid exploration and development of the acreage. Ultimately, an untested and undeveloped lease will expire and possibly be leased again.

Figure 28 shows leases that will expire in the coming years, assuming each lease expires at the end of its primary lease term (without a lease-term extension). Note that lease terms vary according to water depth. Primary lease terms are five years for blocks in less than 400 m (1,312 ft), eight years for blocks in 400-799 m (1,312-2,622 ft), and ten years for blocks in 800 m (2,625 ft) or greater. Therefore, in the absence of primary lease-term extensions, all active shallow-water leases will expire before 2010 (explaining the absence of expiring shallow-water leases in certain frames of figure 28). The 2003 and 2004 lease sales will offer a limited number of expired deepwater leases because of moderate leasing activity in 1993 and 1994. The availability of previously leased blocks is expected to increase dramatically in 2006 as a result of the leasing boom that began in 1996 and continued through 1998. The lease expiration projections will pressure leaseholders to drill and evaluate their holdings and will provide opportunities for other companies to enter an active play by acquiring leases as they expire or by obtaining "farm-outs" from companies with untested acreage.

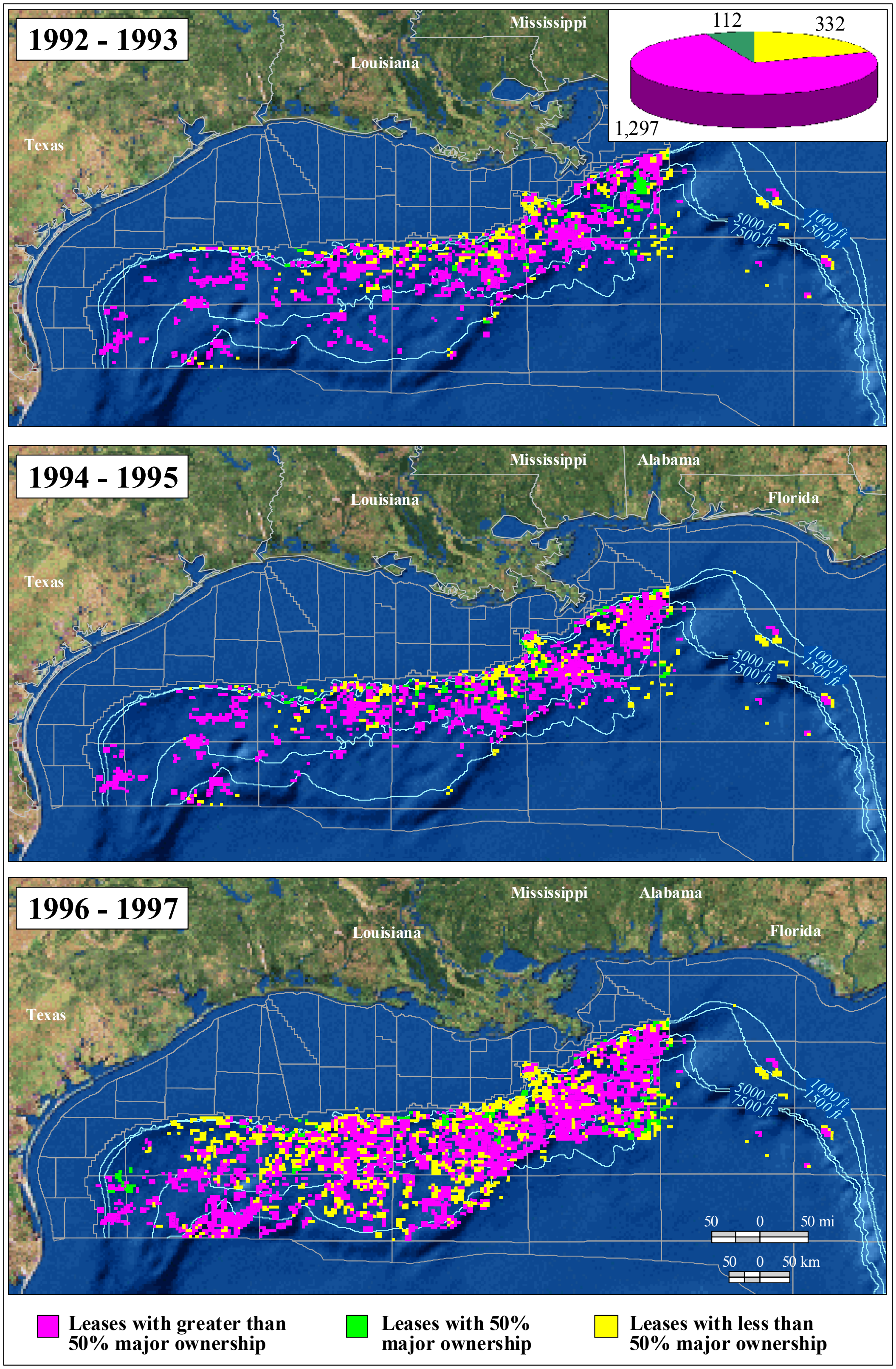


Figure 27. Ownership of deepwater leases.

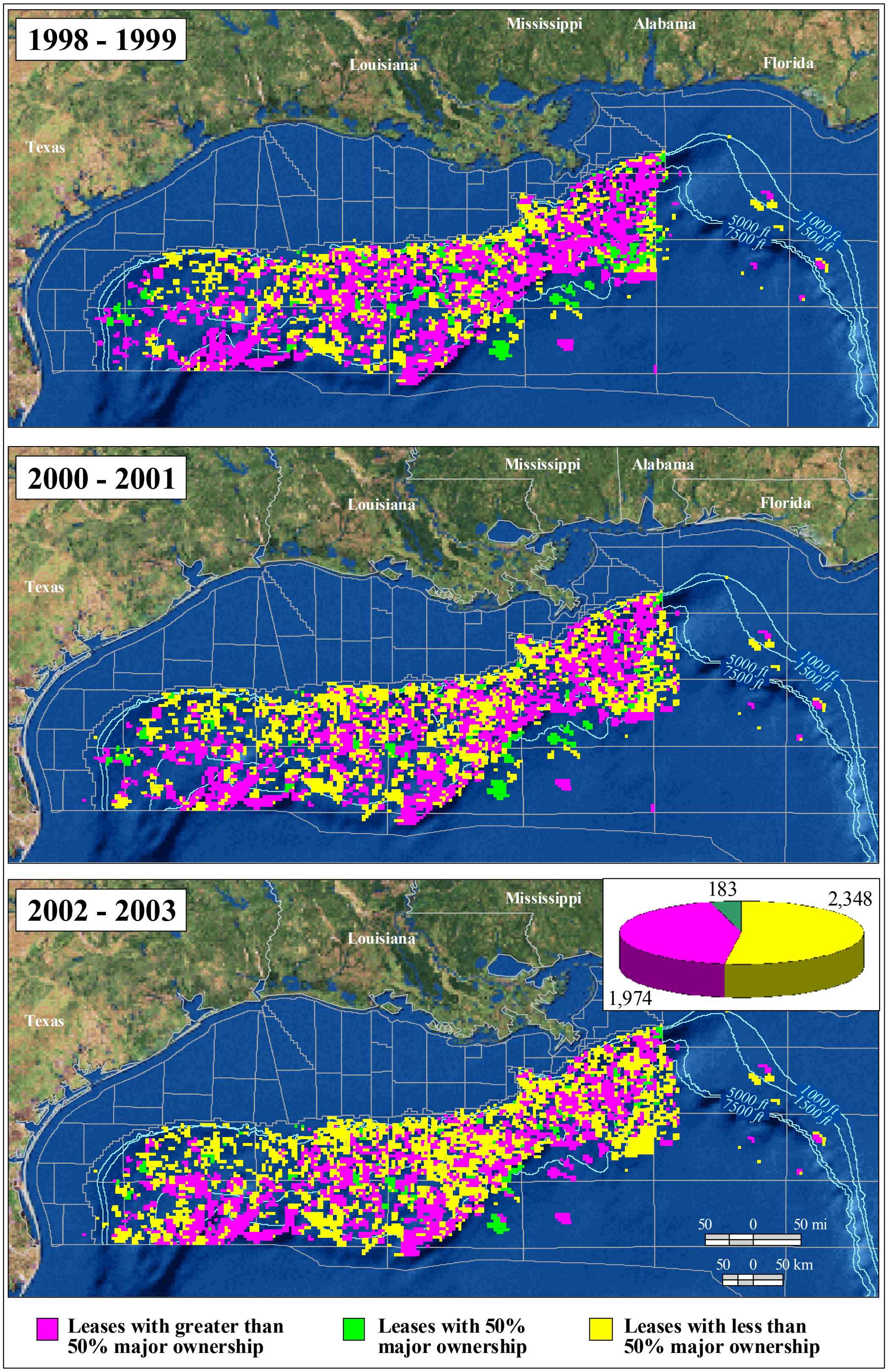


Figure 27. Ownership of deepwater leases (continued).

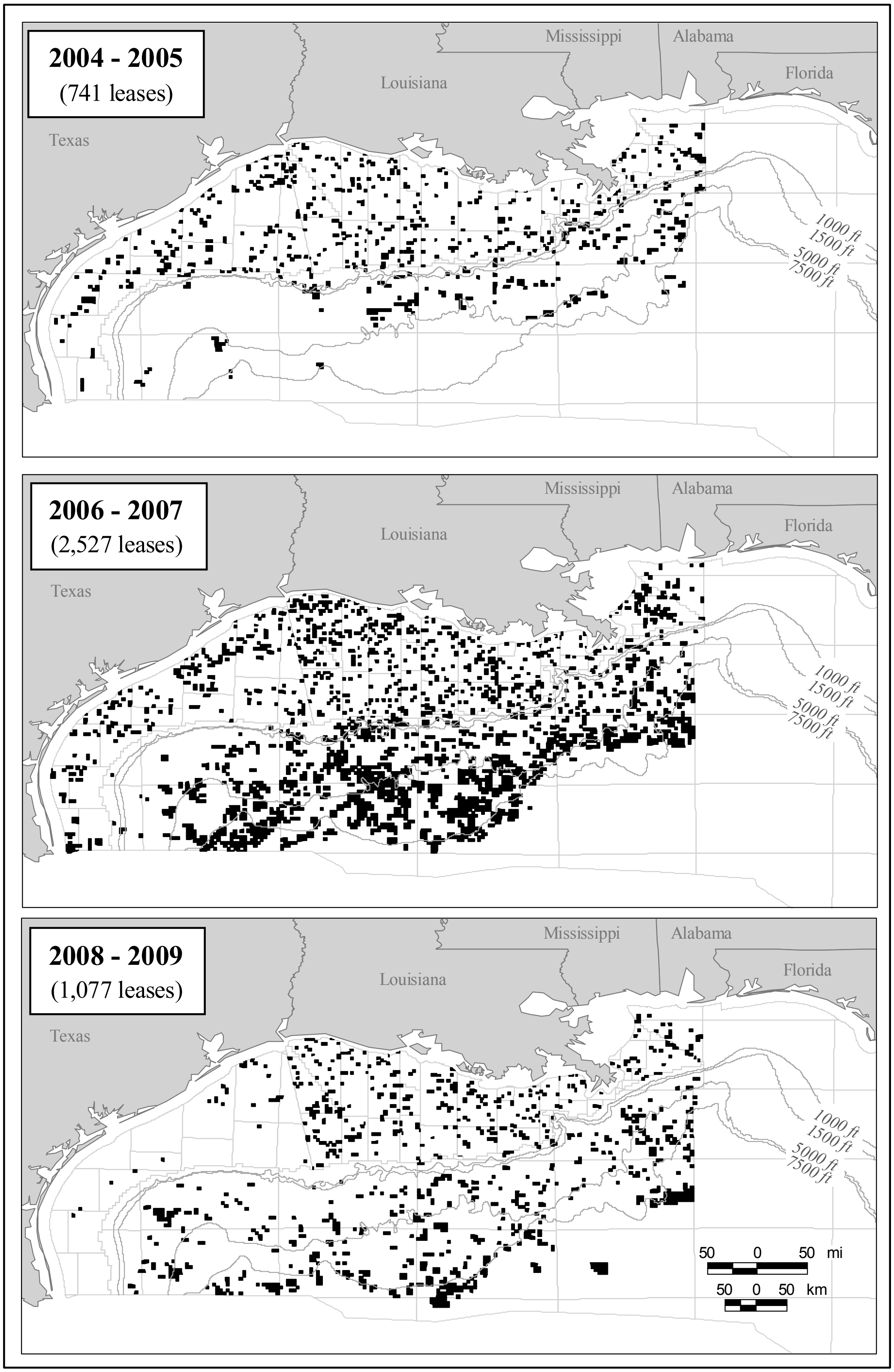


Figure 28. Anticipated lease expirations in the Gulf of Mexico.

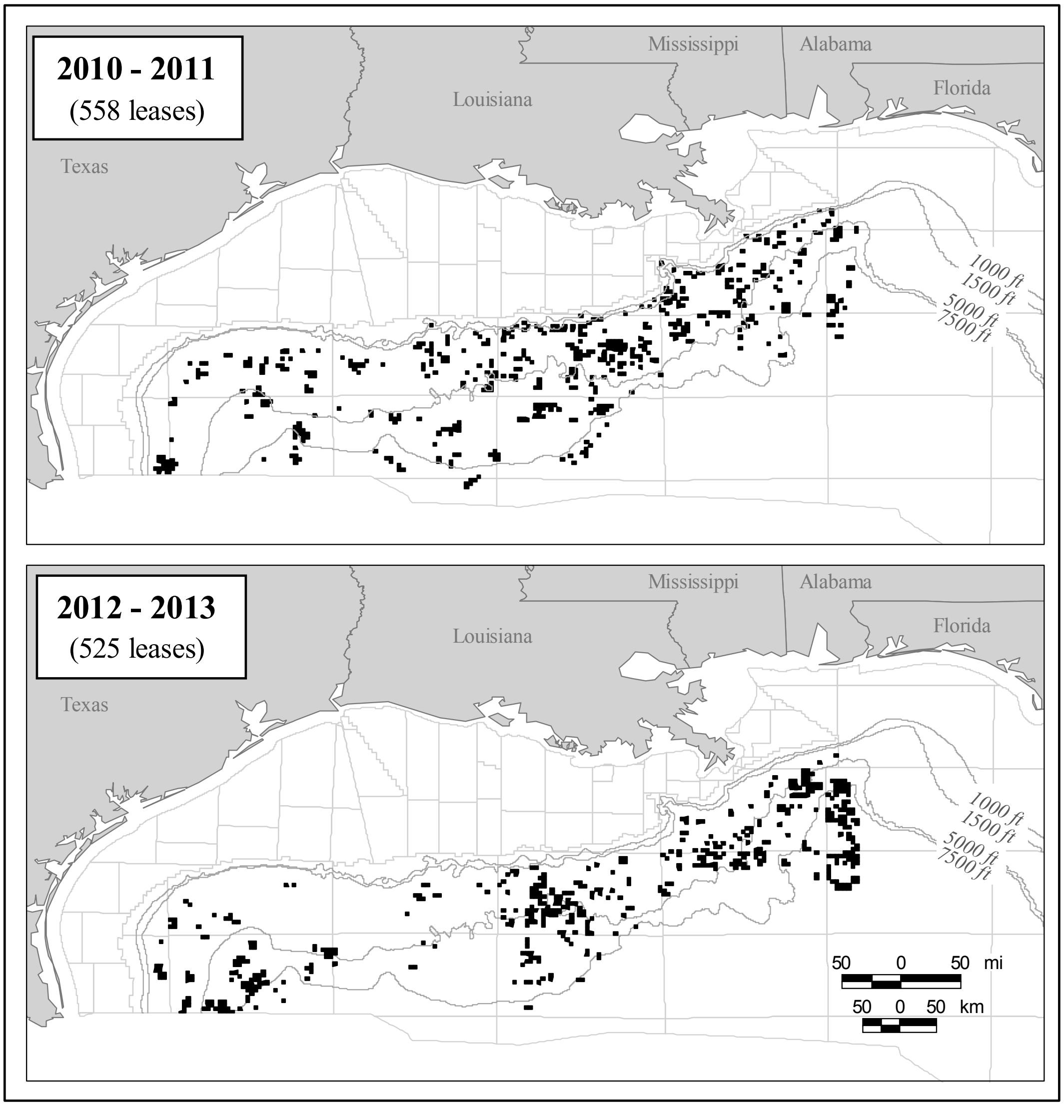


Figure 28. Anticipated lease expirations in the Gulf of Mexico (continued).

DRILLING AND DEVELOPMENT

Deepwater drilling occurs from mobile offshore drilling units (MODU's), such as semisubmersible units or drillships (figures 29 and 30), and from platform rigs. There are numerous deepwater prospects waiting to be drilled, and there will be many that remain undrilled before the primary lease terms expire because of the limited number of rigs available for deepwater drilling in the GOM. Figure 31 depicts deepwater rigs operating in the GOM from 1992 through 2003.[1] There was a steady increase in the average number of rigs operating from 1992 to a peak in 2001. However, in the past two years, the number of rigs operating has decreased 29 percent. Figure 32 shows the number of deepwater MODU's by water-depth categories in the GOM and worldwide. Approximately 28 percent of the world's fleet of deepwater drilling rigs is committed to GOM service (Harding and Albaugh, 2003). The pie chart within figure 32 shows the distribution of deepwater rigs by major operating area. Most, if not all, of the deepwater-capable drilling rigs are under long-term contractual arrangements. The reader is cautioned not to draw any conclusions from the rig count differences between figures 31 and 32. As mentioned above, figure 31 includes platform rigs in addition to MODU's; figure 32 addresses MODU's only. Further, not all MODU's in figure 32 are operating at any given time and upgrades to MODU's that increase their water-depth capability will alter the rig counts shown, so year-to-year comparisons may not be valid.

DRILLING ACTIVITY

The number of deepwater wells drilled generally increased from 1992 through 2001; however, the activity has declined in the last two years. Only original boreholes and sidetracks are included in the well counts used in this report. Wells defined as "by-passes" are specifically excluded. A "by-pass" is a section of well that does not seek a new objective; it is intended to drill around a section of the wellbore made unusable by stuck pipe or equipment left in the wellbore. Figure 33 shows that most of the drilling has occurred in the 1,500- to 4,999-ft (457- to 1,524-m) water-depth range. Despite an overall decline in recent years, considerable drilling activity occurred in water depths greater than 7,500 ft (2,286 m). It is interesting to note that, in November 2003, the first well began drilling in over 10,000 ft (3,050 m) of water and more are anticipated.

Figures 34 and 35 further break down the deepwater well counts into exploratory and development wells, respectively. This report uses the designation of exploratory and development wells provided by the operators. The data reflect the variations among operators in classifying wells as either development or exploratory. In the past two years, there has been a decrease in the number of exploratory wells drilled. This is best illustrated by looking at the number of wells drilled in the 1,500- to 4,999-ft (457- to 1,524-m) water-depth range. While exploratory drilling at this depth is decreasing, drilling in the 5,000- to 7,499-ft (1,524- to 2,286-m) and the >7,500 ft (2,286 m) water-depth ranges is increasing. There has also been a decrease in the number of development wells drilled in the last year. Possible reasons for the recent decrease may be the method by which wells are categorized in this report (exploratory versus development), the retention of exploratory wells for production purposes, and the lag from exploration to first production. The complexity of the deepest water developments may also be a factor, requiring operators to spend more time in planning and design. Most development drilling was in the 1,500- to 4,999-ft (457- to 1,524-m) water-depth range; there are no development wells in water depths exceeding 7,500 ft (2,286 m).

Figure 36 illustrates the geographic distribution of deepwater exploratory wells. Note the progression into the western GOM and into deeper water through time. Figure 37 depicts the locations of deepwater development wells. Once again, the data reveal a general increase in activity as well as a trend toward increasing water depth with time.

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[1] It is important to note that the rig count includes platform rigs operating on deepwater production facilities in addition to the MODU's. About one-third of all rigs are platform rigs. The numbers do not distinguish between rigs drilling and those in service for completion and workover operations.

Figure 29. The *Deepwater Horizon,* a dynamically positioned, semisubmersible drilling unit (photo courtesy of Transocean).

Figure 30. The *Discoverer Deep Seas*, a Class 1A1, double-hulled, dynamically positioned drillship (photo courtesy of Transocean).

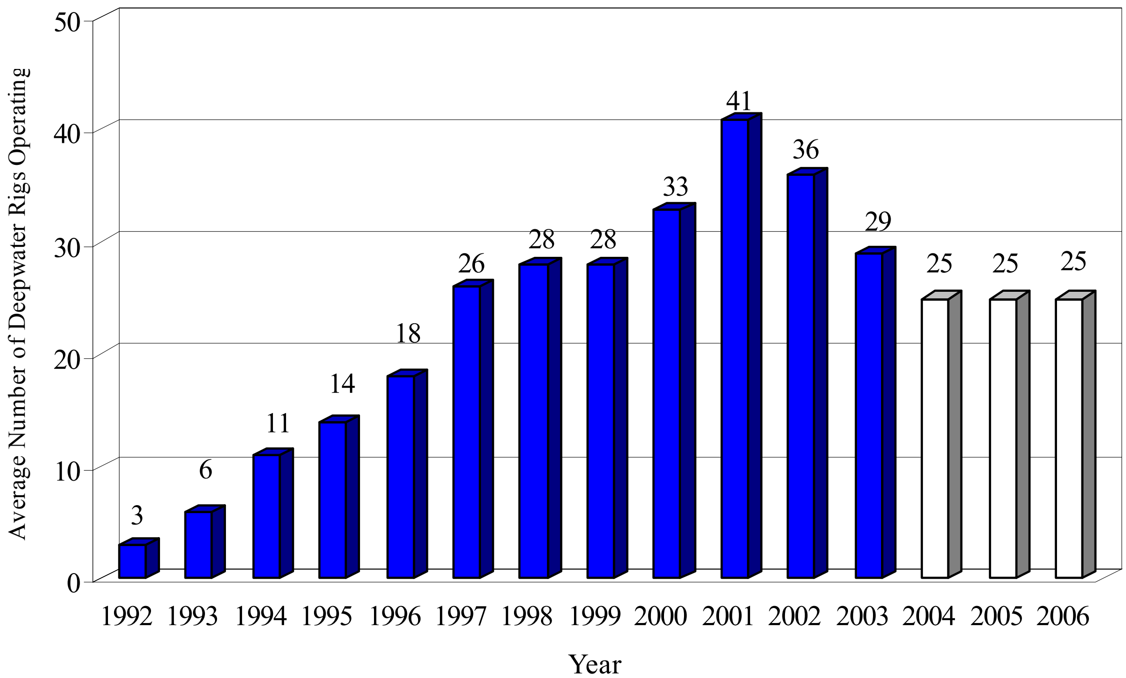


Figure 31. Average number of rigs operating in the deepwater GOM. (White bars are estimates.)

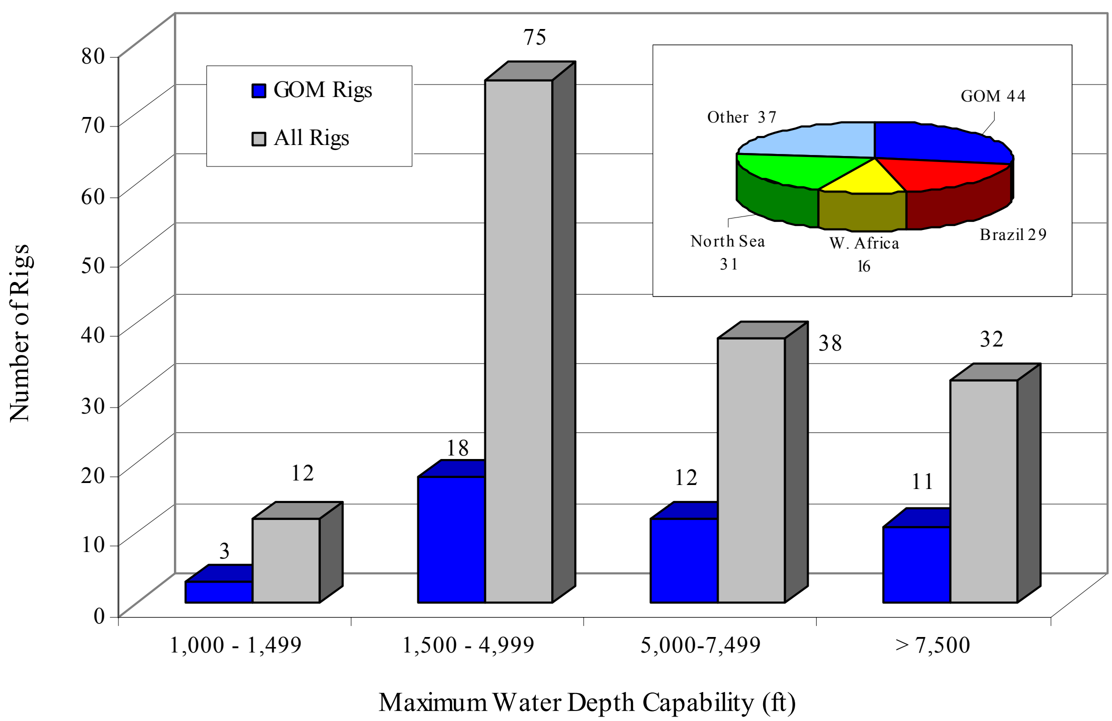


Figure 32. Approximate number of deepwater rigs (GOM and worldwide) subdivided according to their maximum water-depth capabilities. Inset shows the number of deepwater rigs in various locations.

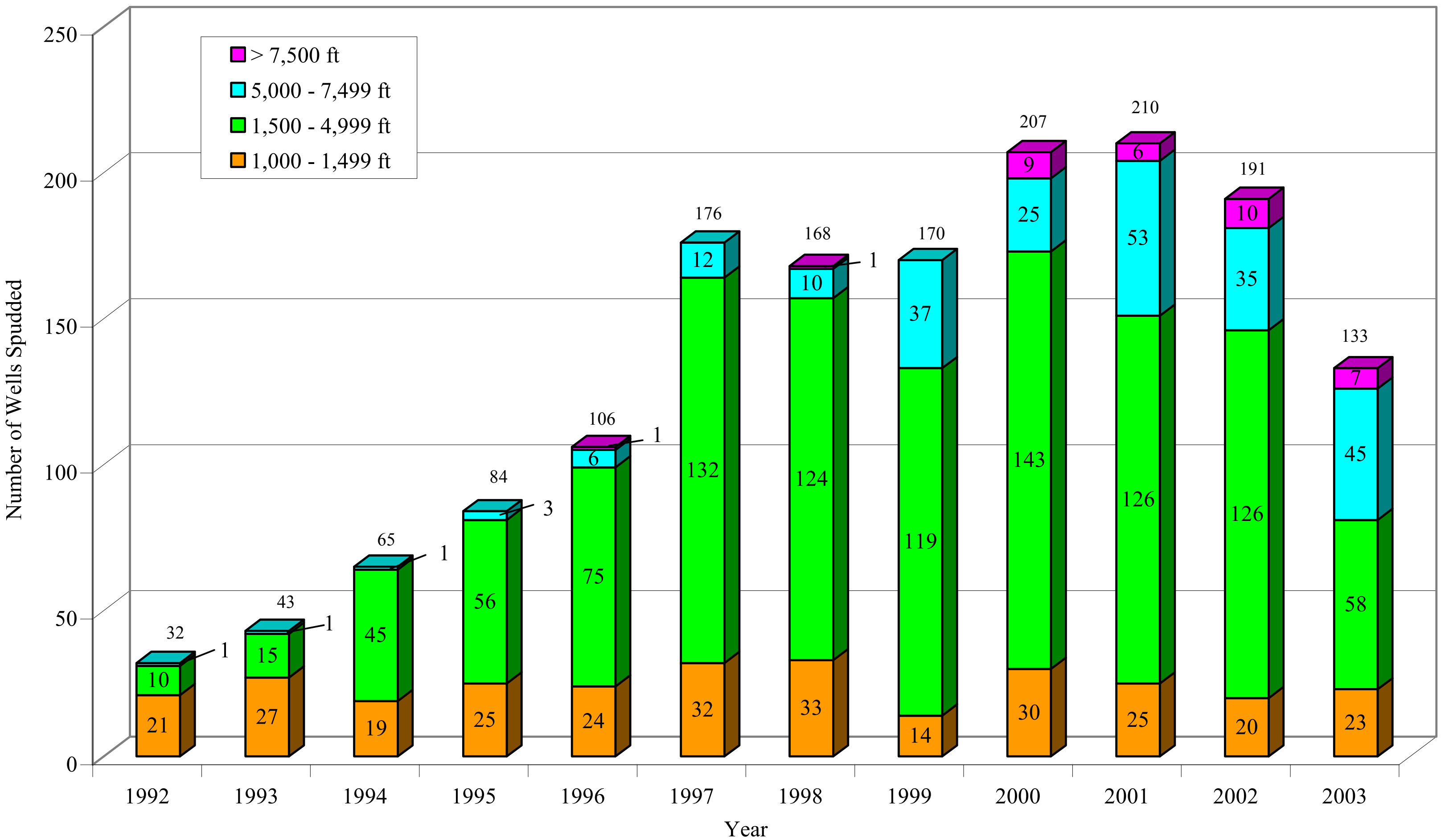


Figure 33. All deepwater wells drilled in the Gulf of Mexico, subdivided by water depth.

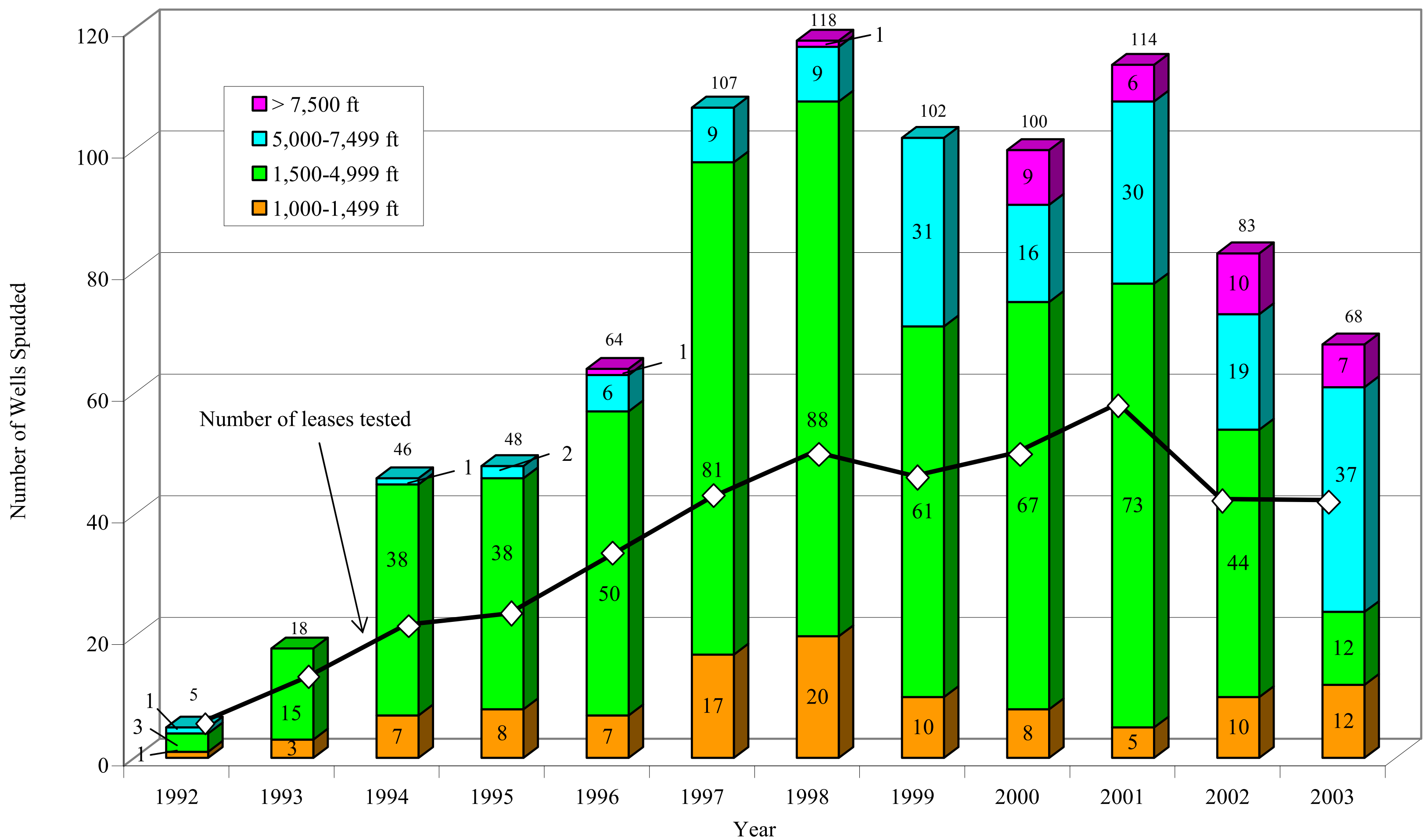


Figure 34. All deepwater exploratory wells drilled in the Gulf of Mexico by water depth.

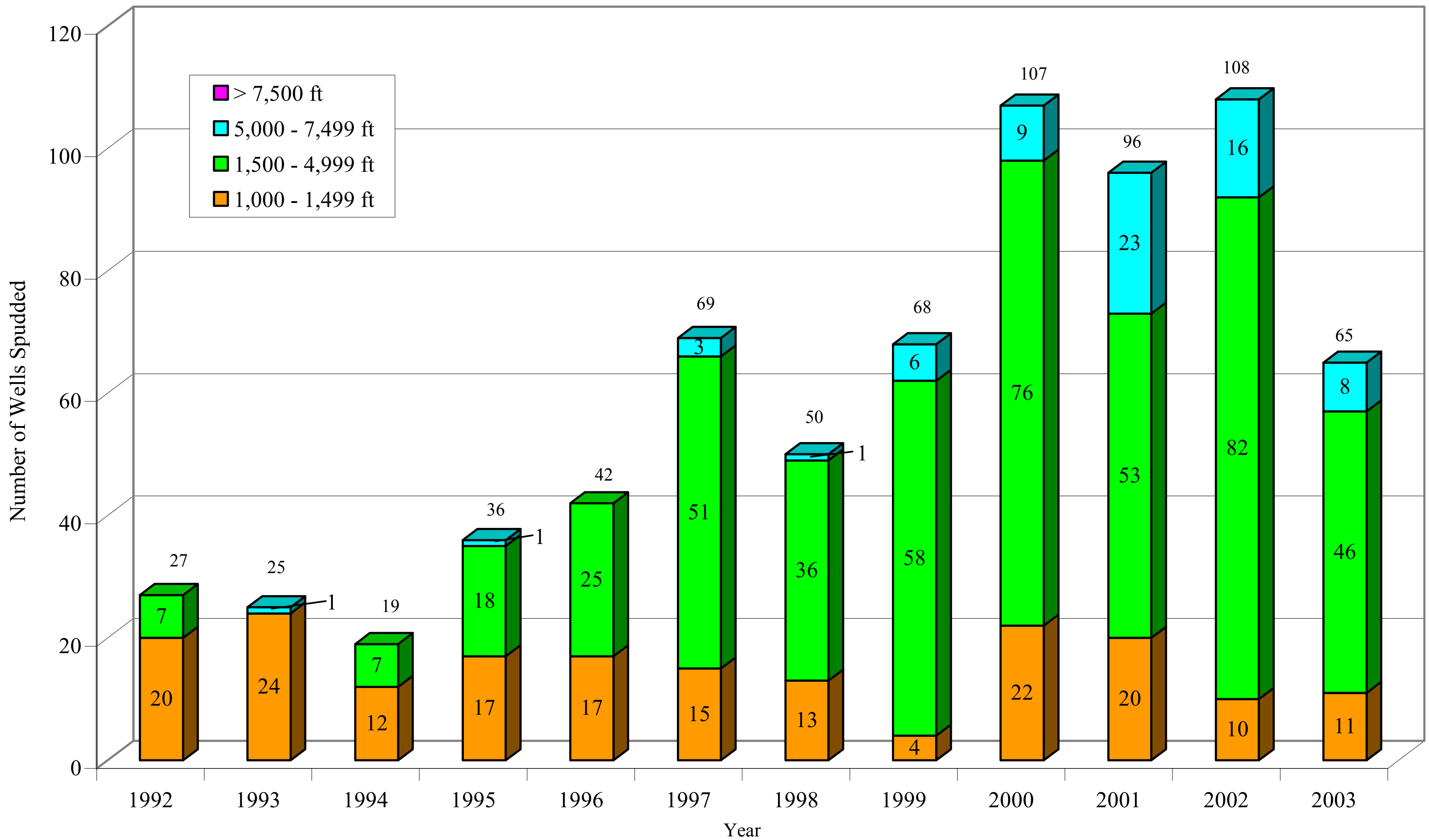


Figure 35. Deepwater development wells drilled in the Gulf of Mexico, divided by water depth.

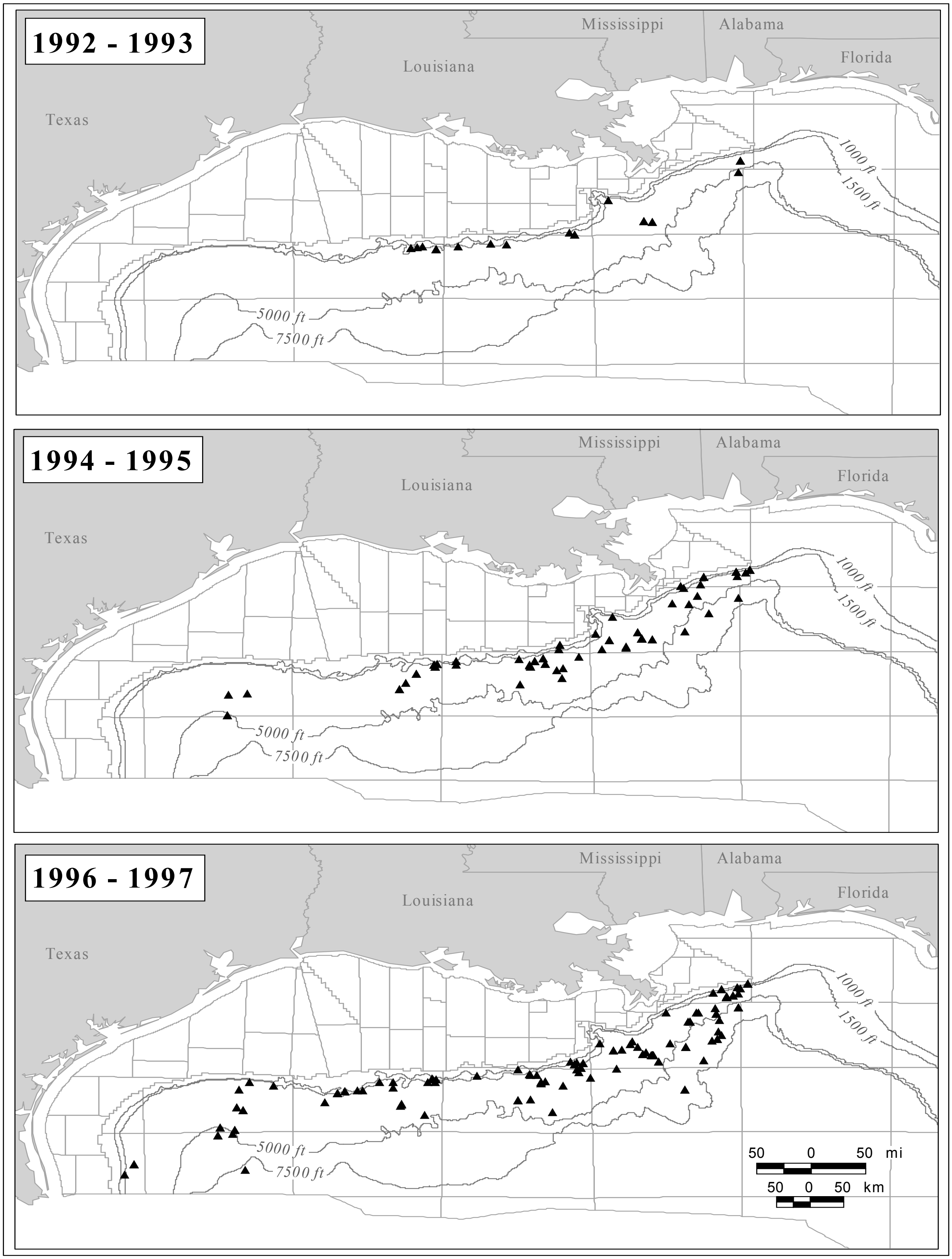


Figure 36. Deepwater exploratory wells drilled in the Gulf of Mexico.

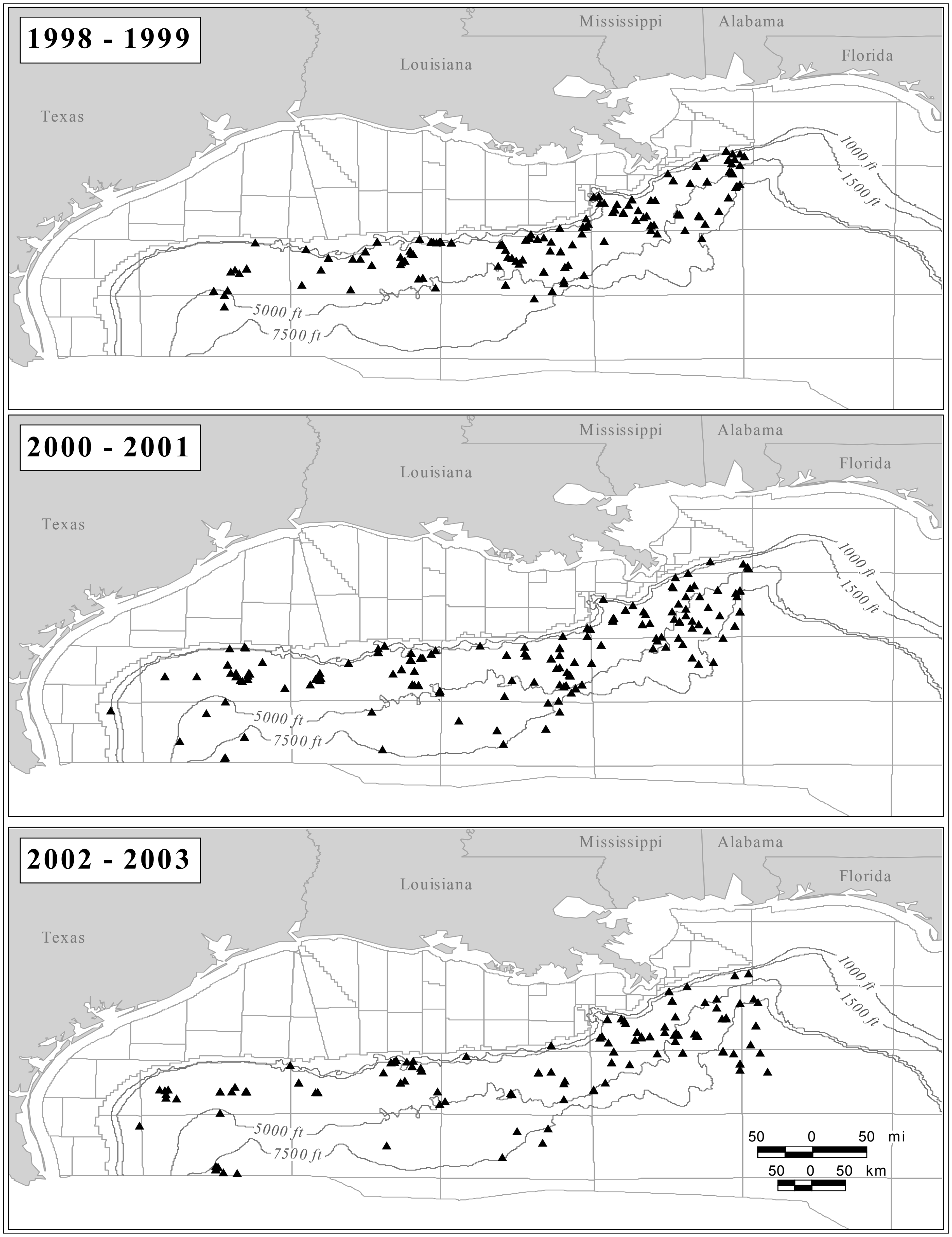


Figure 36. Deepwater exploratory wells drilled in the Gulf of Mexico (continued).

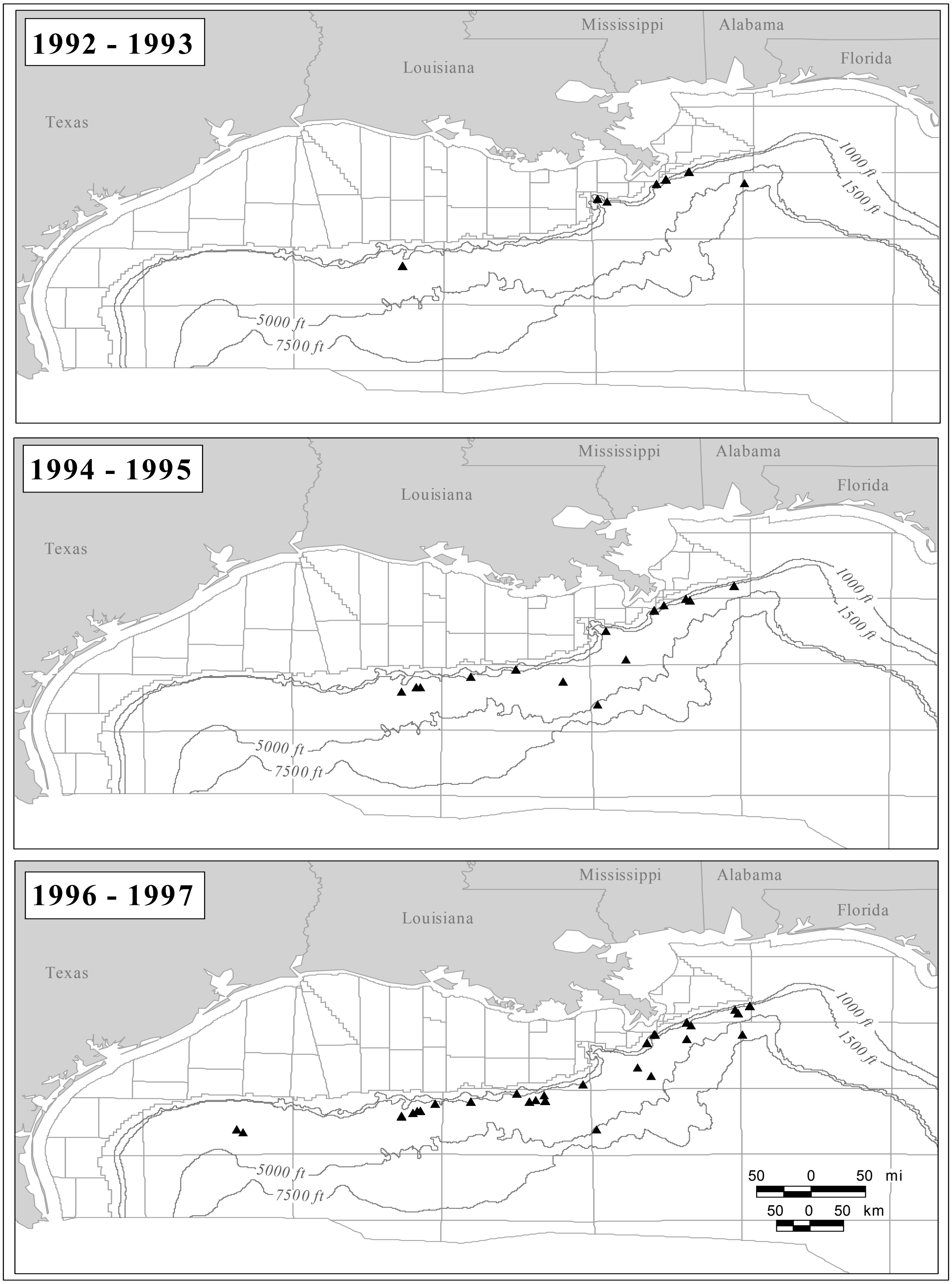


Figure 37. Deepwater development wells drilled in the Gulf of Mexico.

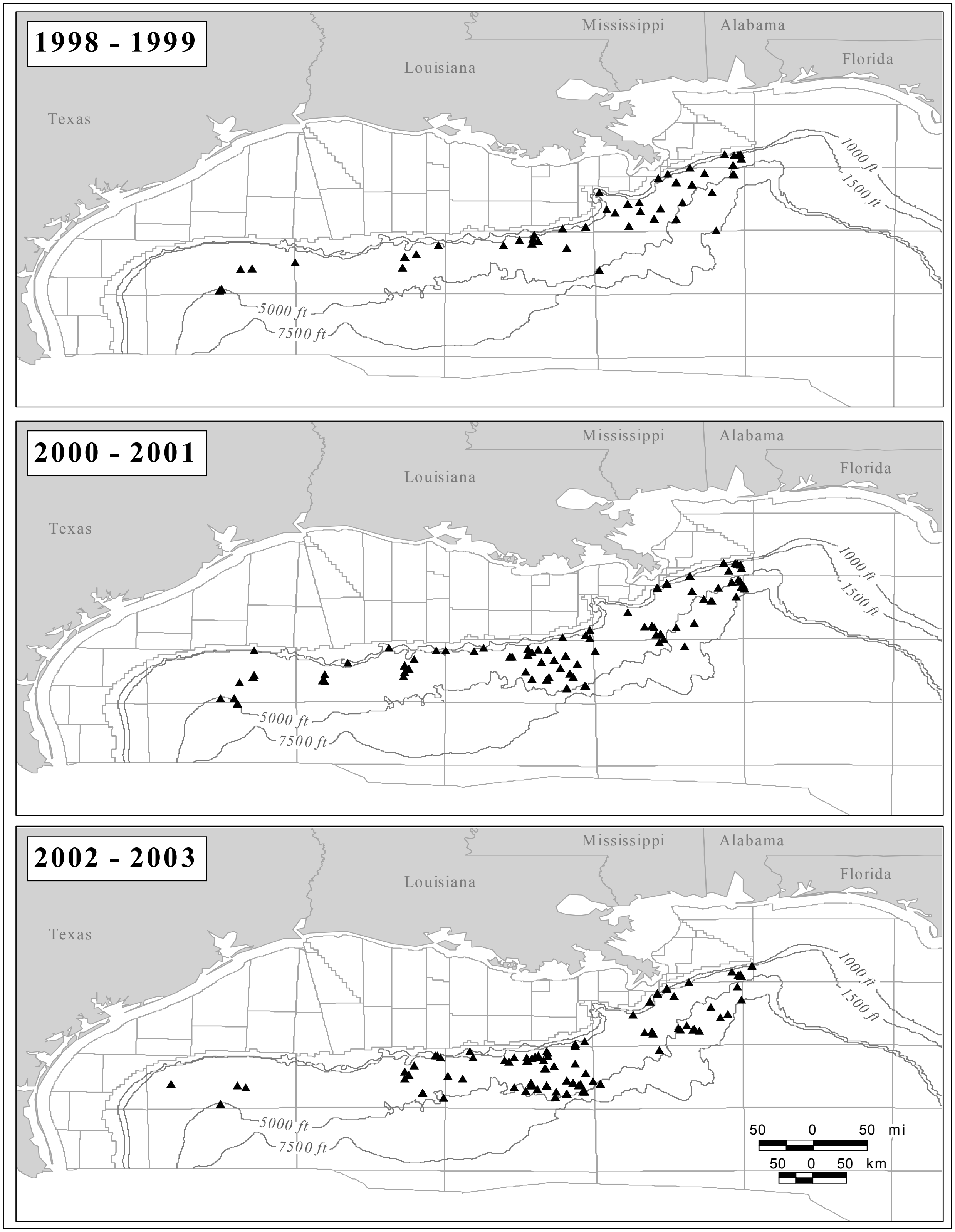


Figure 37. Deepwater development wells drilled in the Gulf of Mexico (continued).

One indicator that MMS has found useful in projecting activity levels is the number of plans received. Although the order of plan submission and drilling activities can vary with projects, operators generally proceed as follows:

- file an Exploration Plan (EP),
- drill exploratory wells,
- file a Conceptual Deep Water Operations Plan (DWOP),
- file a Development Operations Coordination Document (DOCD),
- file a Preliminary DWOP,
- drill development wells, then
- begin production.

Figure 38 shows the number of deepwater EP's, deepwater DOCD's, and DWOP's received each year since 1992 (DWOP's were not required until 1995). The count of EP's and DOCD's includes initial, supplemental, and revised plans; only the initial submittals (Conceptual Part) of the DWOP's are shown. Some shallow-water activities are included in the DWOP data because DWOP's must be filed and approved for developments in greater than 1,000-ft (305 m) water depths and for all subsea developments regardless of water depth. The discussion of subsea wells later in this report will address the significance of shallow-water subsea tiebacks—the effective use of deepwater technologies in shallow-water marginal developments.

There was a marked increase in EP's, DOCD's, and DWOP's beginning in 1996. In recent years, however, there has been a moderate decrease in these plans.

Until recently there had been a gradual increase of drilling depth (as measured in true vertical depth [TVD]). Since 1996 the maximum drilling depth has increased rapidly, reaching depths below 30,000 ft (9,144 m) in 2002. Figure 39 shows the maximum TVD of wells drilled each year since 1965. The maximum TVD increased gradually from 17,500 ft (5,334 m) in 1965 to 26,978 ft (8,223 m) in 1998. The recent dramatic increase in TVD to a record 31,824 ft (9,700 m), reached in 2003, may be attributed to several factors, including enhanced rig capabilities, deeper exploration targets, and the general trend toward greater water depths.

Figure 40 shows the maximum water depth drilled in the entire GOM each year since 1965. The progression into greater water depths has been very rapid. Deepwater drilling began in 1975; significant water depth records occurred in 1976 (1,986 ft or 605 m), 1983 (3,530 ft or 1,076 m), and 1987 (7,500 ft or 2,286 m). In November 2003, ChevronTexaco set a world record – drilling in 10,011 ft (3,051 m) of water at its Toledo prospect in Alaminos Canyon Block 951.

DEVELOPMENT SYSTEMS

Development strategies vary for deepwater depending on reserve size, proximity to infrastructure, operating considerations (such as well interventions), economic considerations, and an operator's interest in establishing a production hub for the area. Figure 41 shows the different systems that can be used to develop deepwater discoveries. Table 4 lists the systems that have begun production. In contrast to the MMS field designations used in the 2002 report, table 4 now lists operator-designated project names. Fixed platforms (e.g., Bullwinkle) have economic water-depth limits of about 1,400 ft (427 m). Compliant towers (e.g., Petronius) may be considered for water depths of approximately 1,000-3,000 ft (305-914 m). Tension-leg platforms (TLP's) (e.g., Brutus and Typhoon) are frequently used in 1,000- to 5,000-ft (305- to 1,524-m) water depths. Spars (e.g., Genesis), semisubmersible production units (e.g., Na Kika), and floating production, storage, and offloading (FPSO) systems (none in GOM) may be used in water depths ranging up to and beyond 10,000 ft (3,048 m). Figure 42 shows three of these development systems: a TLP, a spar, and a semisubmersible.

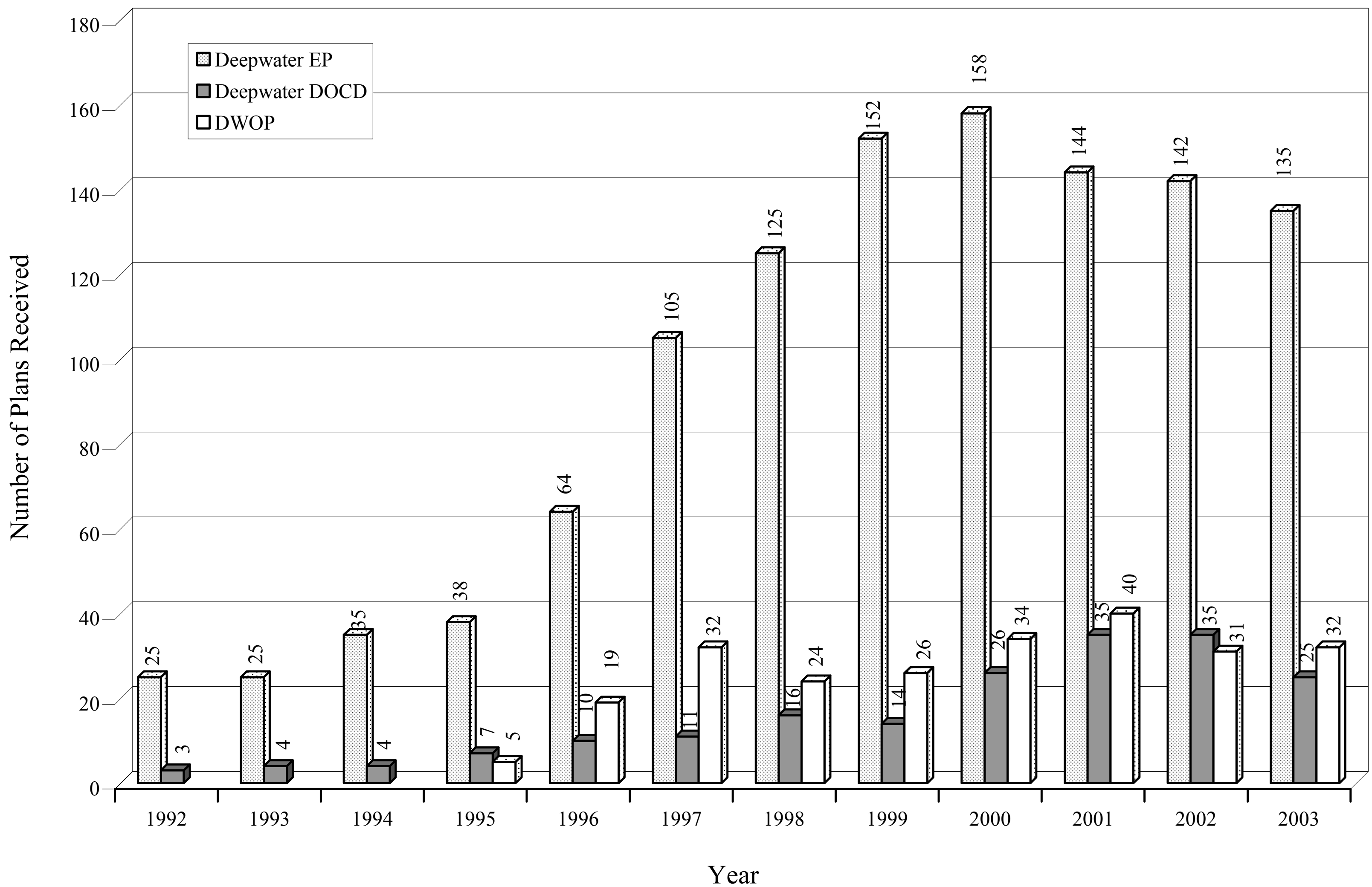


Figure 38. Deepwater EP's, DOCD's, and DWOP's received in the Gulf of Mexico since 1992.

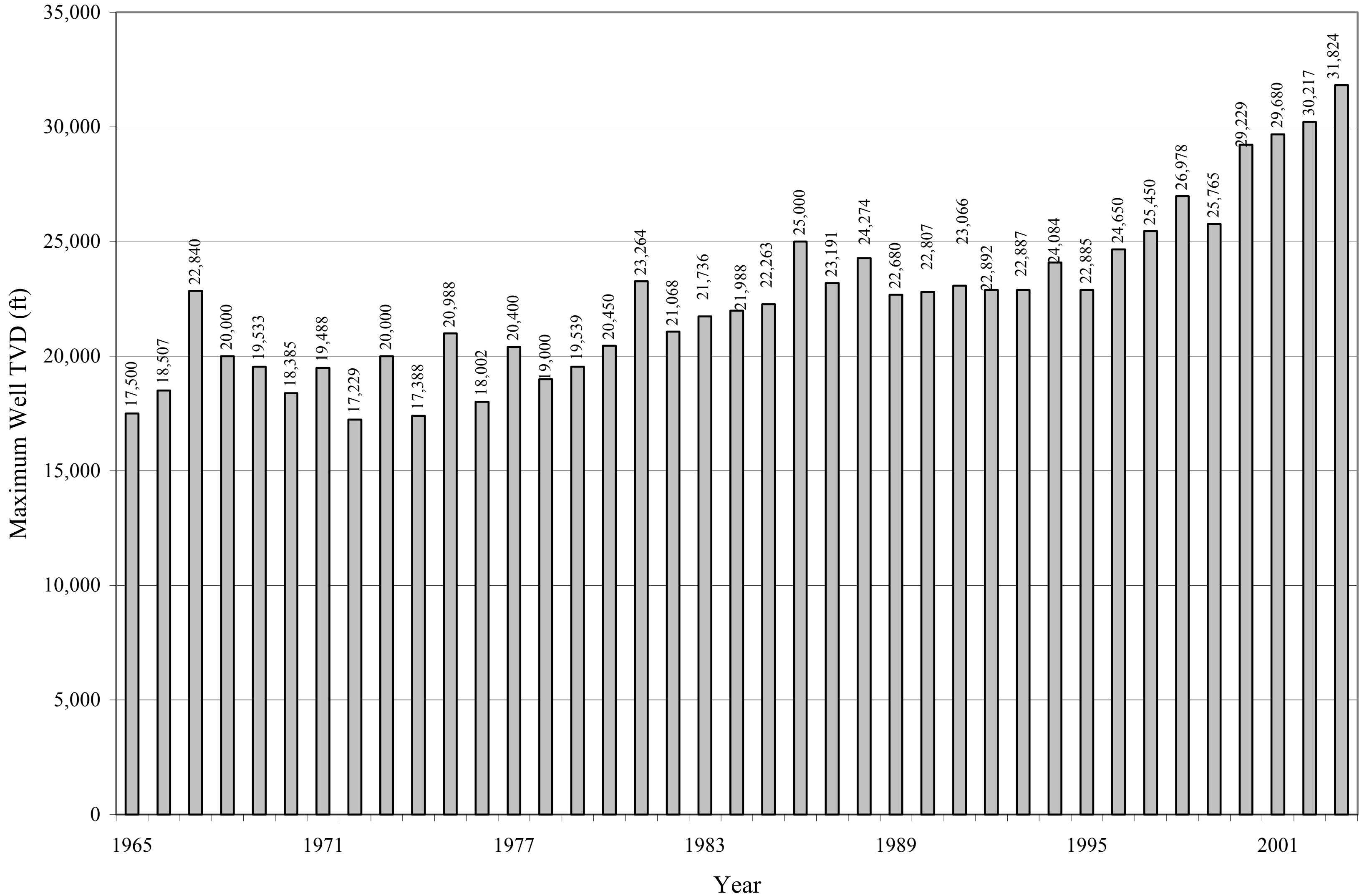


Figure 39. Maximum wellbore true vertical depth (TVD) drilled in the total Gulf of Mexico each year.

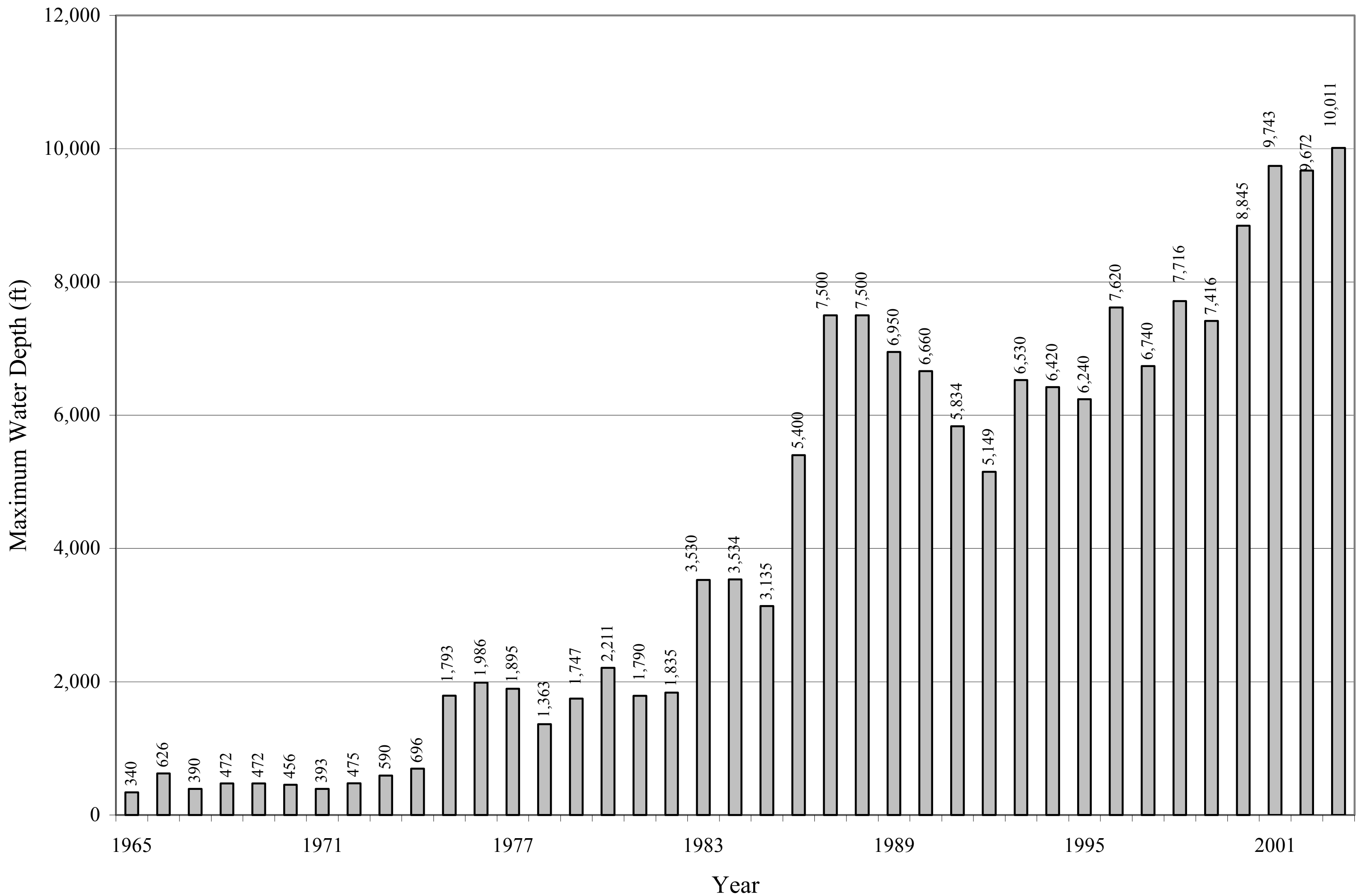


Figure 40. Maximum water depth drilled each year.

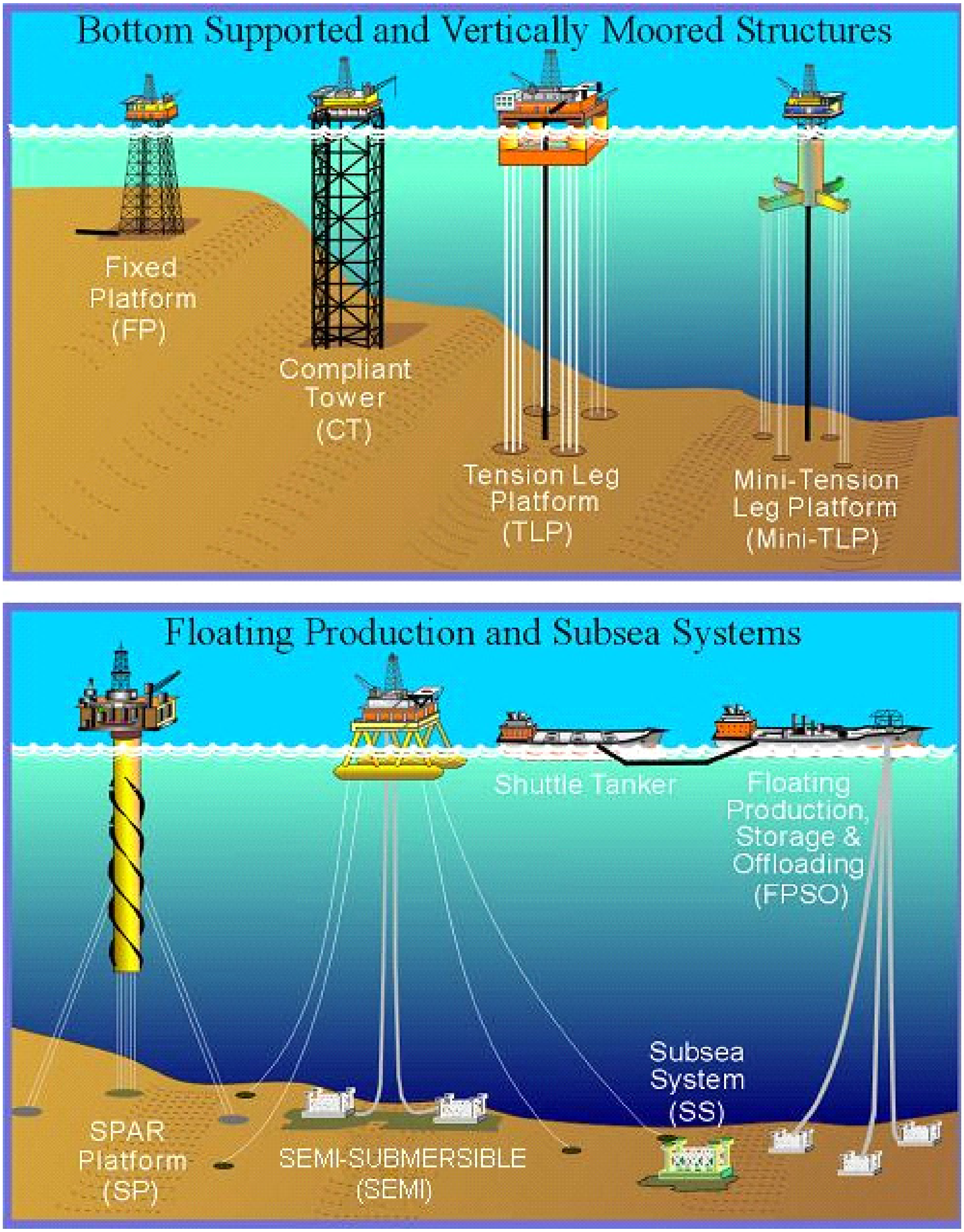


Figure 41. Deepwater development systems.

Table 4
Development Systems of Productive Deepwater GOM Projects

Year of First Production	Project Name[2]	Operator	Block	Water Depth (ft)	System Type	DWRR[3]
1979	Cognac	Shell	MC 194	1,023	Fixed Platform	
1984	Lena	ExxonMobil	MC 280	1,000	Compliant Tower	
1988[1]	GC 29	Placid	GC 29	1,554	Semisubmersible/ Subsea	
1988[1]	GC 31	Placid	GC 31	2,243	Subsea	
1989	Bullwinkle	Shell	GC 65	1,353	Fixed Platform	
1989	Jolliet	ConocoPhillips	GC 184	1,760	TLP	
1991	Amberjack	BP	MC 109	1,100	Fixed Platform	
1992	Alabaster	ExxonMobil	MC 485	1,438	Subsea	
1993[1]	Diamond	Kerr McGee	MC 445	2,095	Subsea	
1993	Zinc	ExxonMobil	MC 354	1,478	Subsea	
1994	Auger	Shell	GB 426	2,860	TLP	
1994	Pompano/ Pompano II	BP	VK 989	1,290	Fixed Platform/ Subsea	
1994	Tahoe/SE Tahoe	Shell	VK 783	1,500	Subsea	
1995[1]	Cooper	Newfield	GB 388	2,600	Semisubmersible	
1995	Shasta	ChevronTexaco	GC 136	1,048	Subsea	
1995	VK 862	Walter	VK 862	1,043	Subsea	
1996	Mars	Shell	MC 807	2,933	TLP/Subsea	
1996	Popeye	Shell	GC 116	2,000	Subsea	
1996	Rocky	Shell	GC 110	1,785	Subsea	
1997	Mensa	Shell	MC 731	5,318	Subsea	
1997	Neptune	Kerr McGee	VK 826	1,930	Spar/Subsea	
1997	Ram-Powell	Shell	VK 956	3,216	TLP	
1997	Troika	BP	GC 200	2,721	Subsea	
1998	Arnold	Marathon	EW 963	1,800	Subsea	
1998	Baldpate	Amerada Hess	GB 260	1,648	Compliant Tower	
1998	Morpeth	Eni	EW 921	1,696	TLP/Subsea	
1998	Oyster	Marathon	EW 917	1,195	Subsea	
1999	Allegheny	Eni	GC 254	3,294	TLP	
1999	Angus	Shell	GC 113	2,045	Subsea	
1999	Dulcimer	Mariner	GB 367	1,120	Subsea	Yes
1999	EW 1006	Walter	EW 1006	1,884	Subsea	
1999	Gemini	ChevronTexaco	MC 292	3,393	Subsea	
1999	Genesis	ChevronTexaco	GC 205	2,590	Spar	
1999	Macaroni	Shell	GB 602	3,600	Subsea	
1999	Penn State	Amerada Hess	GB 216	1,450	Subsea	
1999	Pluto	Mariner	MC 674	2,828	Subsea	Yes

Table 4
Development Systems of Productive Deepwater GOM Projects

Year of First Production	Project Name[2]	Operator	Block	Water Depth (ft)	System Type	DWRR[3]
1999	Ursa	Shell	MC 809	3,800	TLP	
1999	Virgo	TotalFinaElf	VK 823	1,130	Fixed Platform	Yes
2000	Black Widow	Mariner	EW 966	1,850	Subsea	Yes
2000	Conger	Amerada Hess	GB 215	1,500	Subsea	
2000	Diana	ExxonMobil	EB 945	4,500	Subsea	
2000	Europa	Shell	MC 935	3,870	Subsea	
2000	Hoover	ExxonMobil	AC 25	4,825	Spar	
2000	King	Shell	MC 764	3,250	Subsea	
2000	Marlin	BP	VK 915	3,236	TLP	
2000	Northwestern	Amerada Hess	GB 200	1,736	Subsea	Yes
2000	Petronius	ChevronTexaco	VK 786	1,753	Compliant Tower	
2001	Brutus	Shell	GC 158	3,300	TLP	
2001	Crosby	Shell	MC 899	4,400	Subsea	
2001	Einset	Shell	VK 872	3,500	Subsea	Yes
2001	EW 878	Walter	EW 878	1,585	Subsea	Yes
2001	Ladybug	ATP	GB 409	1,355	Subsea	
2001	Marshall	ExxonMobil	EB 949	4,376	Subsea	
2001	MC 68	Walter	MC 68	1,360	Subsea	
2001	Mica	ExxonMobil	MC 211	4,580	Subsea	
2001	Nile	BP	VK 914	3,535	Subsea	
2001	Oregano	Shell	GB 559	3,400	Subsea	
2001	Pilsner	Unocal	EB 205	1,108	Subsea	Yes
2001	Prince	El Paso	EW 1003	1,500	TLP	Yes
2001	Serrano	Shell	GB 516	3,153	Subsea	
2001	Typhoon	ChevronTexaco	GC 237	2,679	TLP	Yes
2002	Aconcagua	TotalFinaElf	MC 305	7,100	Subsea	Yes
2002	Aspen	BP	GC 243	3,065	Subsea	Yes
2002	Boomvang	Kerr McGee	EB 643	3,650	Spar	Yes
2002	Camden Hills	Marathon	MC 348	7,216	Subsea	Yes
2002	Horn Mountain	BP	MC 127	5,400	Spar	Yes
2002	King	BP	MC 84	5,000	Subsea	
2002	King Kong	Mariner	GC 472	3,980	Subsea	Yes
2002	King's Peak	BP	DC 133	6,845	Subsea	Yes
2002	Lost Ark	Samedan	EB 421	2,960	Subsea	Yes
2002	Madison	ExxonMobil	AC 24	4,856	Subsea	
2002	Manatee	Shell	GC 155	1,939	Subsea	Yes
2002	Nansen	Kerr McGee	EB 602	3,675	Spar	Yes
2002	Navajo	Kerr McGee	EB 690	4,210	Subsea	Yes

Table 4
Development Systems of Productive Deepwater GOM Projects

Year of First Production	Project Name[2]	Operator	Block	Water Depth (ft)	System Type	DWRR[3]
2002	Princess	Shell	MC 765	3,600	Subsea	
2002	Sangria	Spinnaker	GC 177	1,487	Subsea	Yes
2002	Tulane	Amerada Hess	GB 158	1,054	Subsea	Yes
2002	Yosemite	Mariner	GC 516	4,150	Subsea	Yes
2003	Boris	BHP	GC 282	2,378	Subsea	Yes
2003	East Anstey/ Na Kika	Shell	MC 607	6,590	FPS/Subsea[4]	
2003	Falcon	Pioneer	EB 579	3,638	Subsea	Yes
2003	Fourier/ Na Kika	Shell	MC 522	6,950	FPS/Subsea[4]	
2003	Goose	Spinnaker	MC 751	1,624	Subsea	
2003	Gunnison	Kerr McGee	GB 668	3,100	Spar	Yes
2003	Habanero	Shell	GB 341	2,015	Subsea	
2003	Herschel/ Na Kika	Shell	MC 520	6,739	FPS/Subsea[4]	
2003	Matterhorn	TotalFinaElf	MC 243	2,850	TLP	Yes
2003	Medusa	Murphy	MC 582	2,223	Spar	Yes
2003	Pardner	Anadarko	MC 401	1,139	Subsea	
2003	Zia	Devon	MC 496	1,804	Subsea	

[1] Indicates projects that are no longer on production.

[2] The previous edition of this report listed deepwater fields, whereas this version lists deepwater projects. The Definitions section of this report explains the difference between a field and project.

[3] Indicates projects with one or more leases approved to receive DWRR.

[4] Na Kika FPS is located in Mississippi Canyon Block 474 in 6,340 ft (1,932 m) of water.

AC = Alaminos Canyon
DC = DeSoto Canyon
EB = East Breaks
EW = Ewing Bank
GB = Garden Banks
GC = Green Canyon
MC = Mississippi Canyon
VK = Viosca Knoll

Figure 42. Three different development systems (left to right): a SeaStar TLP installed at ChevronTexaco's Typhoon field, a spar installed at ChevronTexaco's Genesis Field, and a semisubmersible at Shell/BP's Na Kika Field (images courtesy of ChevronTexaco, Shell International Exploration and Production Inc., and BP).

A predominant workhorse of the GOM is the spar. A spar is a vessel with a circular cross-section that sits vertically in the water and is supported by buoyancy chambers (hard tanks) at the top, a flooded mid-section structure hanging from the hard tanks, and a stabilizing keel section at the bottom. Some unique features of a spar include

- favorable motion characteristics compared with other floating systems,
- stability (the center of buoyancy is above the center of gravity),
- cost insensitivity to water depth, and
- water-depth capability up to 10,000 ft (3,048 m) and beyond.

A spar is held in place by a catenary mooring system, providing lateral stability. Currently, there are three competing versions of spars used in the GOM: classic spar, truss spar, and cell spar (figure 43).

The first generation of spar design is the classic spar. It is made up of one cylindrical hull that extends to the bottom of the structure and surrounds a center opening. This opening allows the wellhead to be on the platform and permits both drilling and production operations. Approximately 90 percent of the classic spar's hull is underwater. The first classic spar was installed in 1996 in 1,935 ft (590 m) of water in the Neptune field. Other examples of a classic spar are Genesis and Hoover.

The second generation of spar design is the truss spar. In this design, a truss structure (similar to the space frames used in conventional fixed platforms) replaces the lower portion of the cylindrical hull used in the classic spar. The truss section is lighter than the equivalent cylindrical section of the classic design, providing the following advantages:

- construction costs are lower than a classic spar of similar size,
- width of the center opening can be increased to accommodate additional wells, and
- topside equipment can be expanded to handle additional production.

In 2001, the first truss spar was installed over the Nansen field in 3,680 ft (1,122 m) of water. Other examples of the truss spar are Boomvang, Horn Mountain, and Devil's Tower. Once installed, Devil's Tower will be the deepest spar, operating at a water depth of 5,610 ft (1,710m).

The third generation of spar design is the cell spar. The cell spar's hull is made up of several identically sized cylinders surrounding a center cylinder. The main advantages of the cell spar design are reduced fabrication and transportation costs. The tank of a classic or truss spar requires specialized shipyard fabrication (large-diameter, steel-plate rolling machines are required). To date, all classic and truss spars have been constructed in European and Far East shipyards and require transport to the GOM. In contrast, each cylinder of the cell spar, being of a smaller diameter, can be fabricated using rolling machines that are readily available in most U.S. shipyards. Once fabricated, the cylinders are then lined up and welded together. This entire process can be done in the United States, increasing the number of contractors available for bidding purposes and reducing transportation costs. The main disadvantage is that the cell spar has no center opening for surface wellheads so only subsea well production is possible. The first cell spar will be installed in the Red Hawk field in 5,300 ft (1,615 m) of water in late 2004.

Figure 44 shows the different types of production systems installed each year. Data values can be found in Appendix F. At least eight deepwater production facilities (primarily truss spars) are under construction or pending installation at this time.

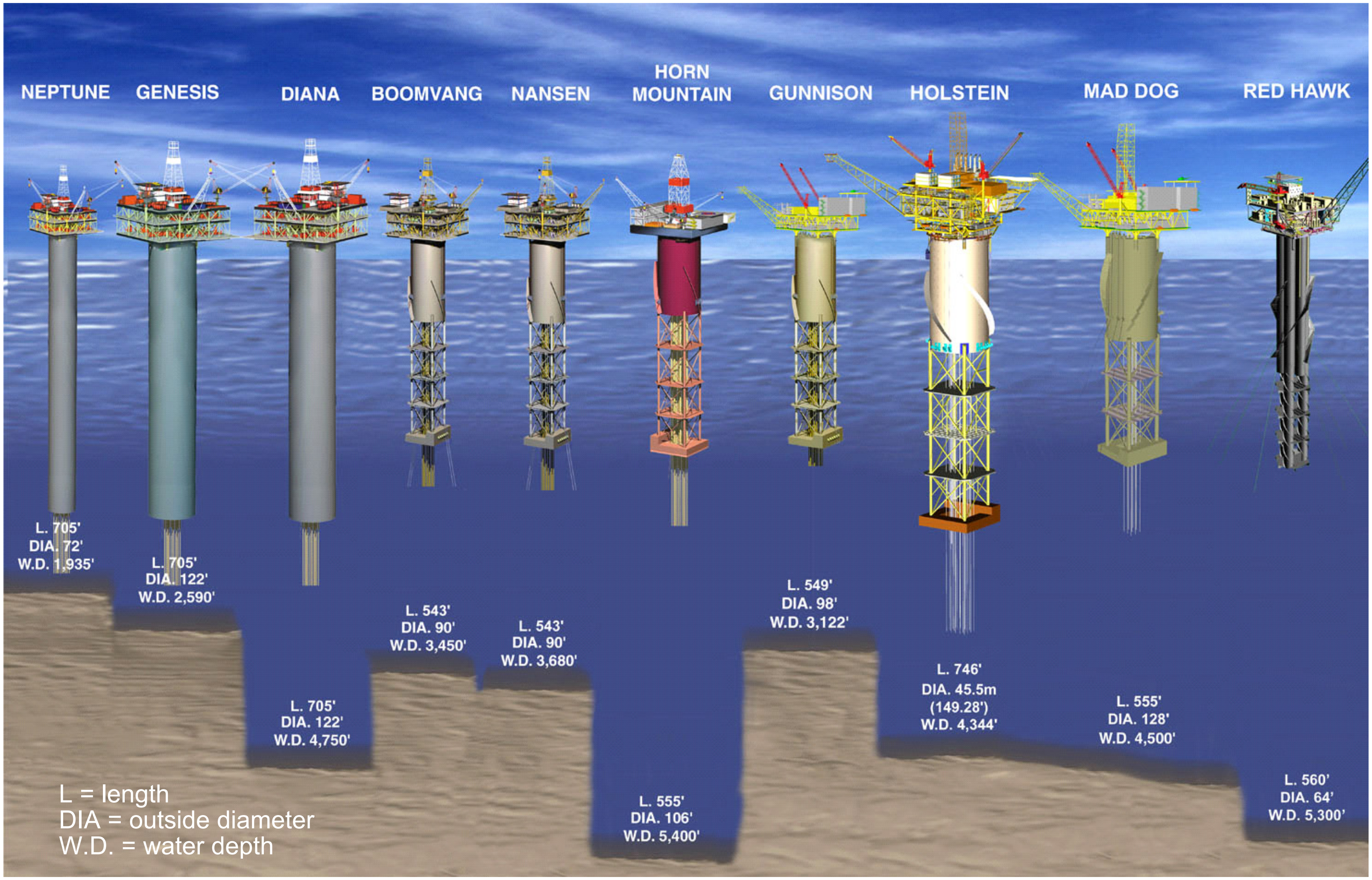


Figure 43. Progression of spar deepwater development systems (image courtesy of Technip-Coflexip).

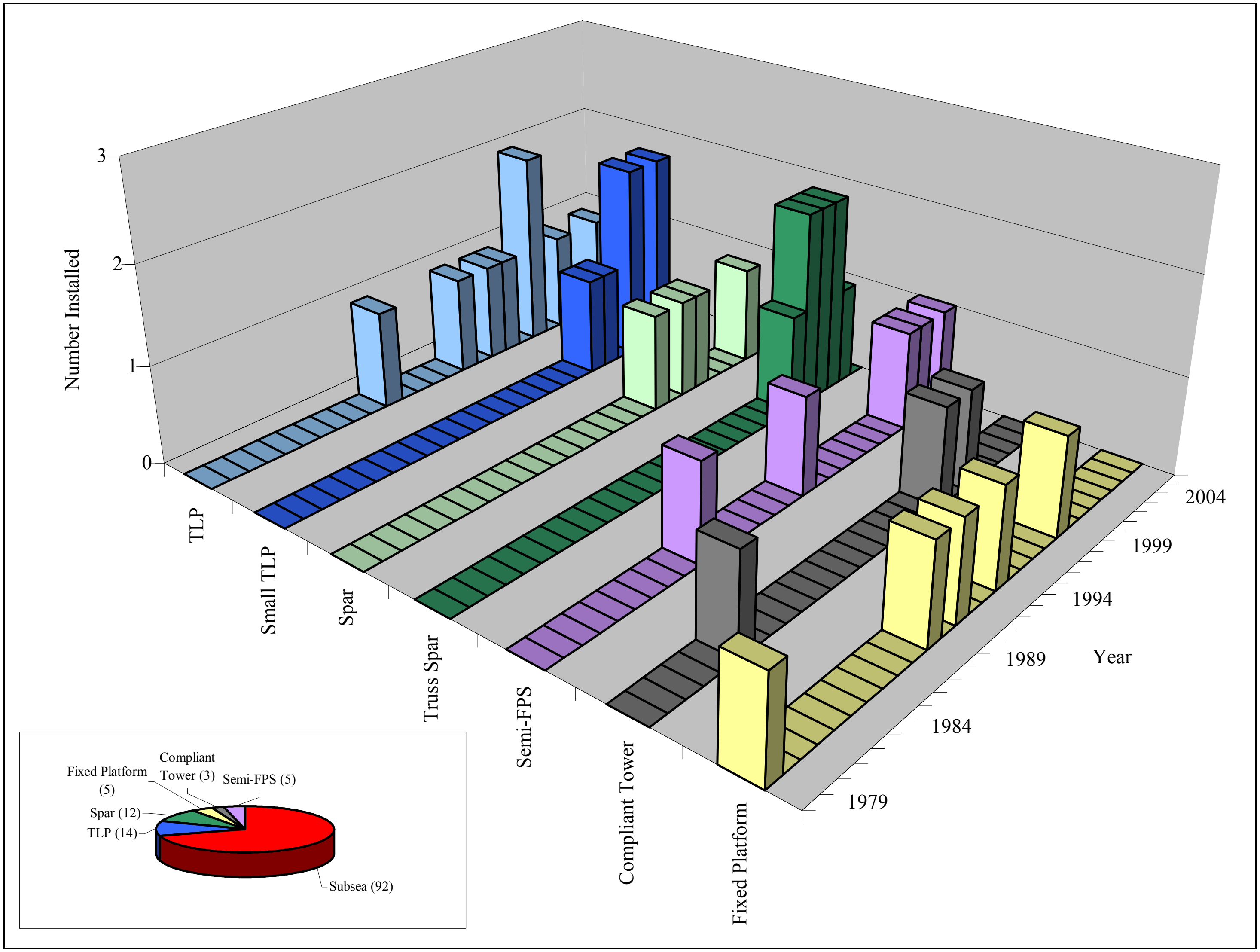


Figure 44. GOM deepwater production facilities installed each year (including plans through 2006). Inset shows production systems for currently producing fields (including subsea systems).

Subsea systems, as shown in figure 45, are capable of producing hydrocarbons from reservoirs covering the entire range of water depths that industry is exploring. Subsea systems continue to be a key component in the success in deepwater to date. These systems are generally multi-component seafloor facilities that allow for the production of hydrocarbons in water depths that would normally preclude installing conventional fixed or bottom-founded platforms. The subsea system can be divided into two major components: the seafloor equipment and the surface equipment. The seafloor equipment will include some or all of the following: one or more subsea wells, manifolds, control umbilicals, and flowlines. The surface component of the subsea system includes the control system and other production equipment located on a host platform that could be located many miles from the actual wells.

SUBSEA TRENDS

Figure 46 shows the number of subsea completions each year since 1955 (only productive wells were counted). There were fewer than ten subsea completions per year until 1993. This number increased dramatically throughout the 1990's. The pie chart within figure 46 shows that shallow-water subsea wells are a significant contribution to the subsea well population in the GOM. Shallow-water subsea wells accounted for 131 of the 295 total subsea wells in the GOM by yearend 2003. Operators have found subsea tiebacks to be valuable for shallow-water marginal fields because of the extensive infrastructure of platforms and pipelines. Nonmajor companies have installed nearly all of these shallow-water subsea wells, led by Walter Oil and Gas Corporation with 35 wells. Figure 46 demonstrates the increasing reliance of industry on subsea technology to develop both shallow-water and deepwater fields, beginning in the late 1980's.

The technology required to implement subsea production systems in deepwater evolved significantly in the last decade. This evolution is apparent in figure 47, which shows the deepest subsea completion was in 350 ft (107 m) of water until 1988, when the water depth record (GOM) jumped to 2,243 ft or 684 m (Green Canyon 31 project). In 1996 another record was reached with a subsea completion in 2,956 ft (901 m) of water (Mars project), followed by a 1997 subsea completion in 5,295 ft (1,614 m) of water (Mensa project). Camden Hills has the deepest production in the GOM to date, in a water depth of 7,216 ft (2,199 m). A listing of productive subsea completions on the GOM Outer Continental Shelf can be found in Appendix G.

Figure 48 further breaks down the subsea completion count into specific water depth ranges. This figure shows that 70 percent of the subsea completions are in water depths less than 2,500 ft (762 m).

NEW PIPELINES

The pipeline infrastructure to bring deepwater oil and gas onshore also expanded during the 1990's. The pipeline from a subsea completion to the host platform is commonly referred to as the tieback. The tieback length varies considerably, as shown in figure 49. Most subsea wells are within 10 mi (16 km) of the host platform, with the Mensa field remaining the current world record holder for a subsea tieback length of 62 mi (100 km) from the host platform. The second longest subsea tieback in the world (55 mi or 88 km) is Canyon Express, linking Aconcagua, Camden Hills, and King's Peak projects to their host platform.

Deepwater pipelines approved for installation are shown in figures 50a and 50b. The data include the total length of all pipelines originating at a deepwater development, including any shallow-water segments (control umbilicals are excluded). Figure 50a shows deepwater pipelines that are less than or equal to 12 inches (30.5 cm) in diameter. The dominance of gas pipeline miles approved in deepwater is surprising — 58 percent of the total since 1990. The large increase in 2001 in both oil and gas pipeline miles reflects approvals for Canyon Express (Aconcagua, Camden Hills, and King's Peak fields), Horn Mountain, and the Boomvang-Nansen projects. Installation of large pipelines (greater than 12 inches [30.5 cm] in diameter) dramatically increased in 2002 after a brief downturn in activity in 2000 and 2001 (figure 50b). The peak in 2002 was driven by the approval of the Mardi Gras system.

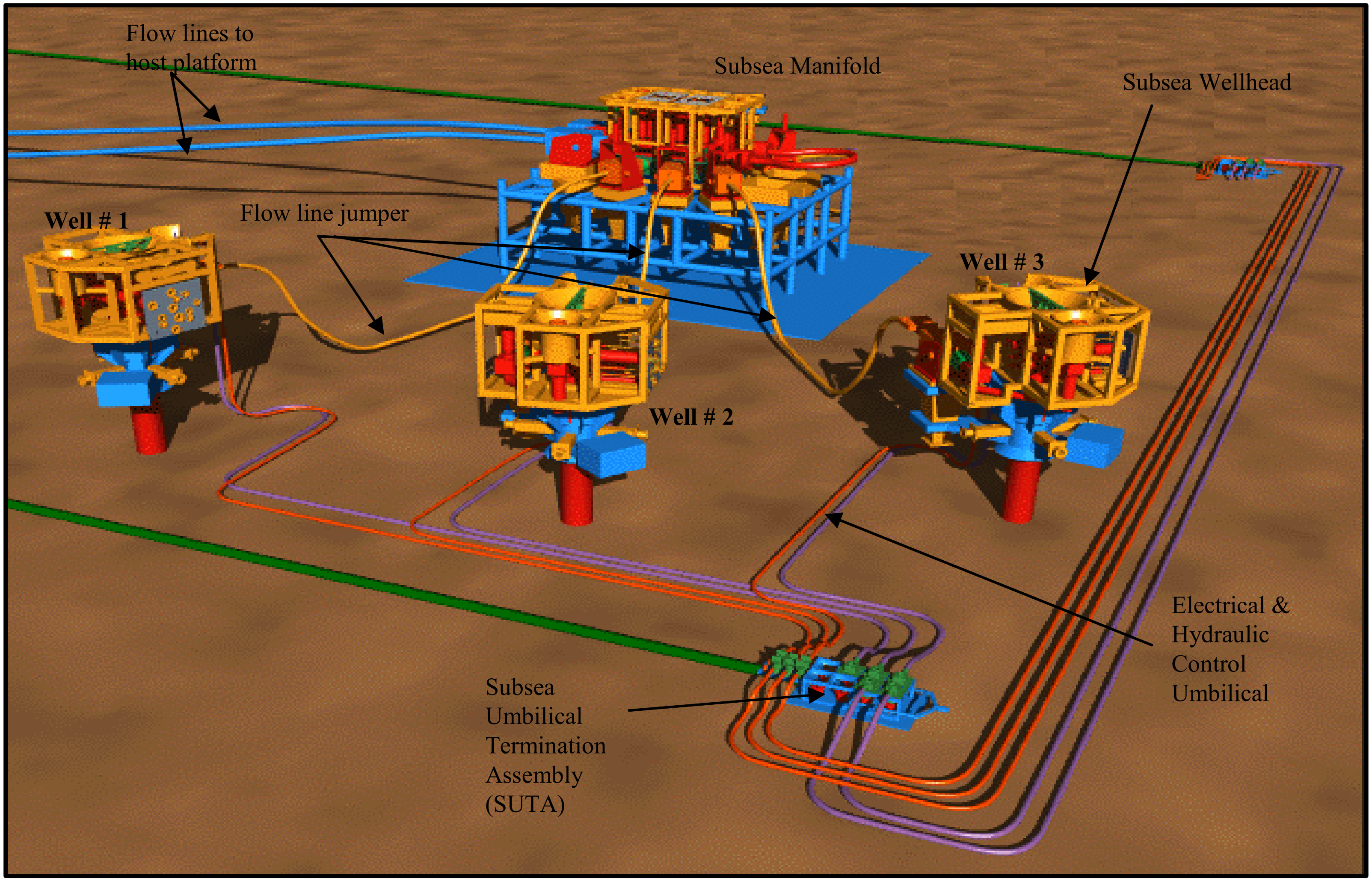


Figure 45. Crosby Project (MC 899) subsea equipment layout (image courtesy of Shell International Exploration and Production Inc.).

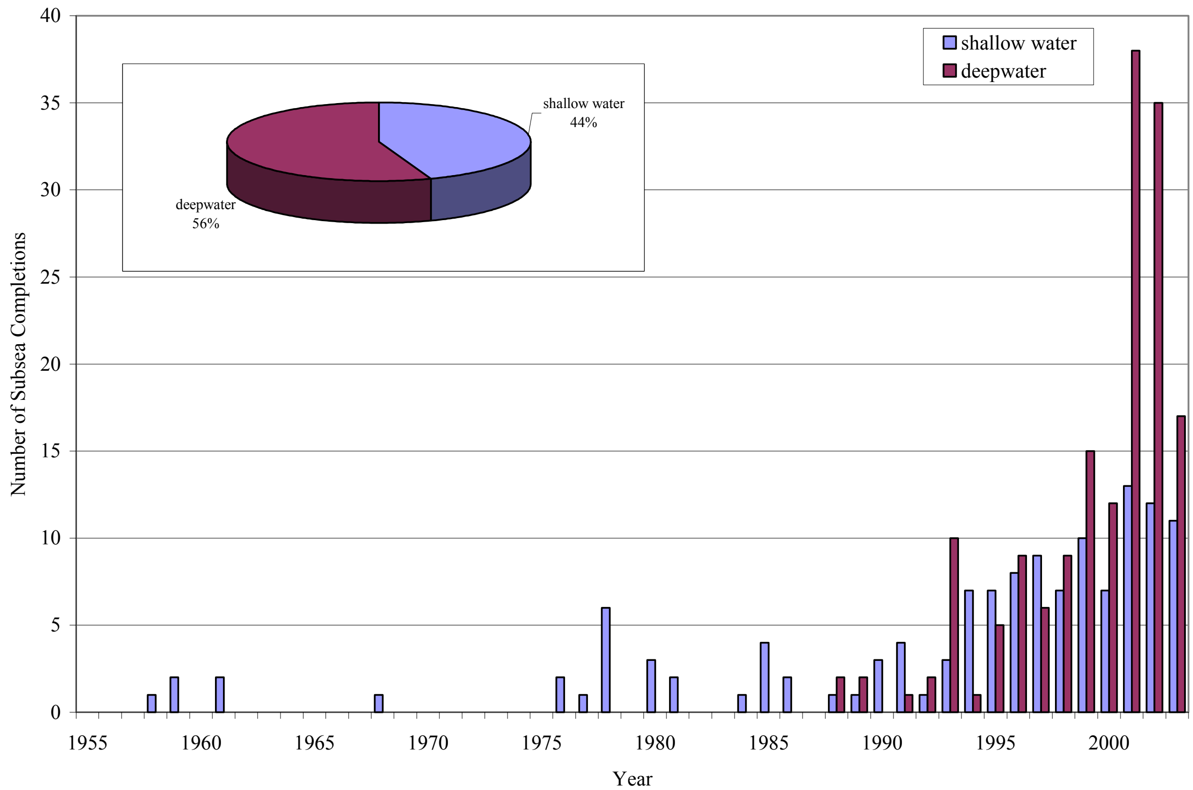


Figure 46. Number of shallow- and deepwater subsea completions each year.

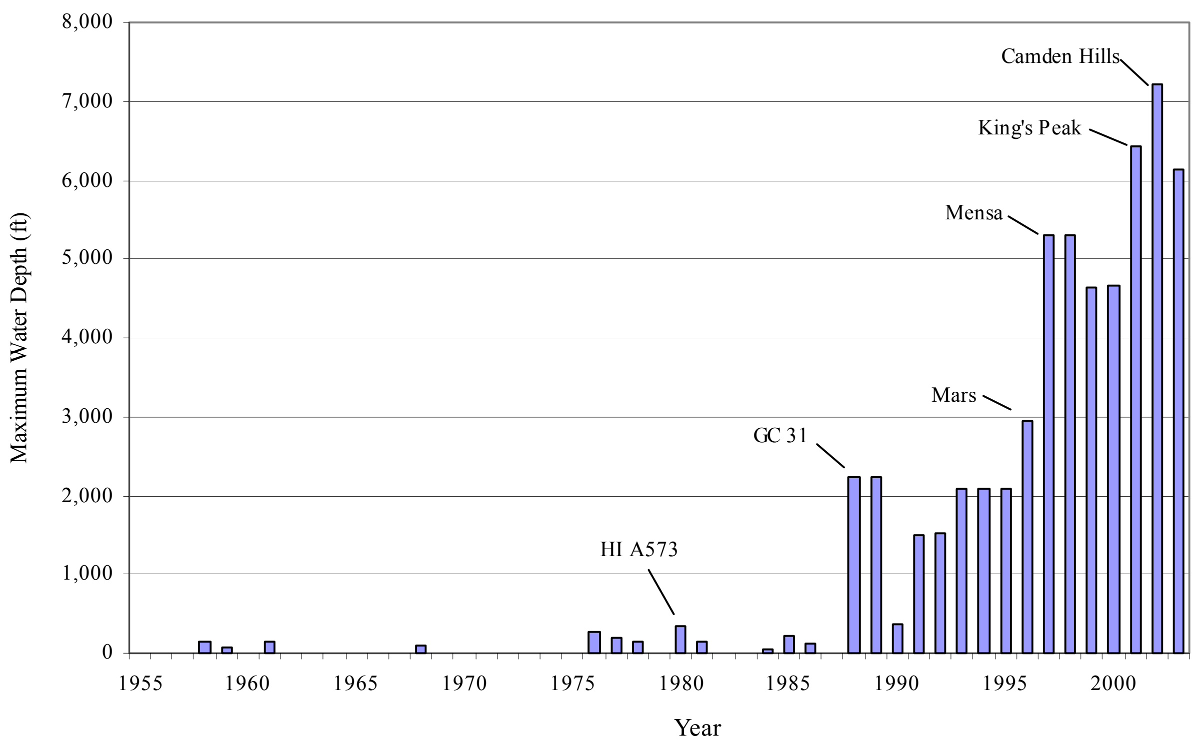


Figure 47. Maximum water depth of subsea completions each year.

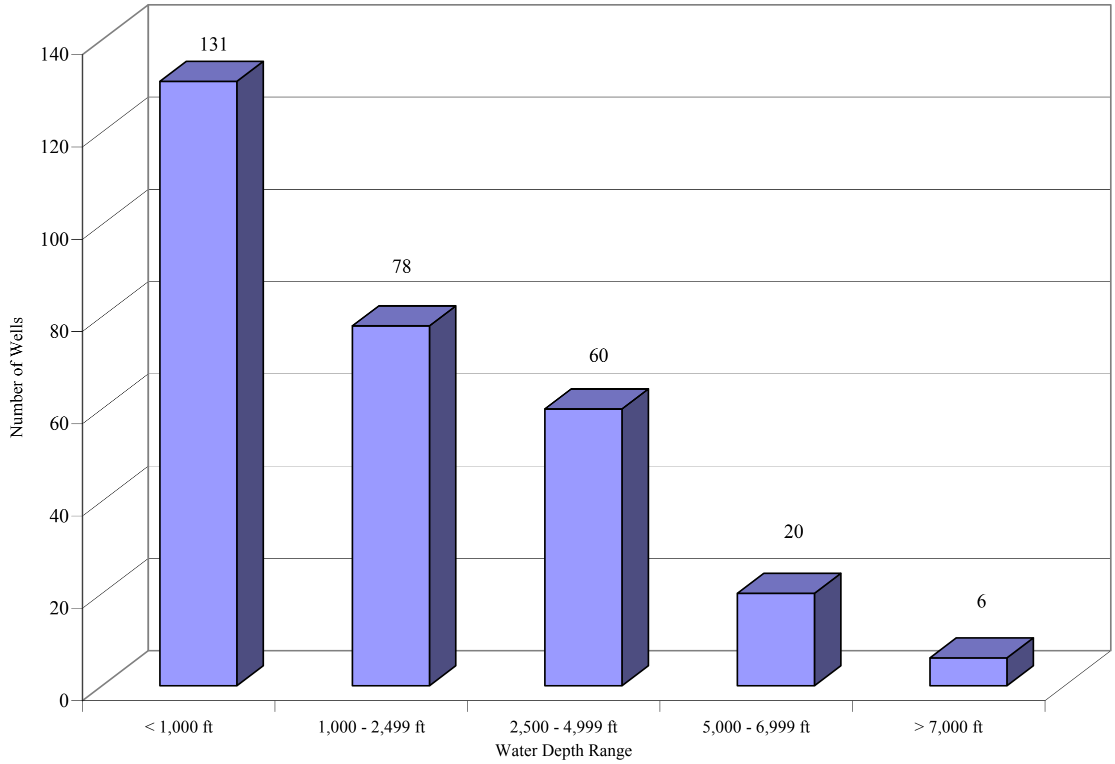


Figure 48. Water depth of subsea completions.

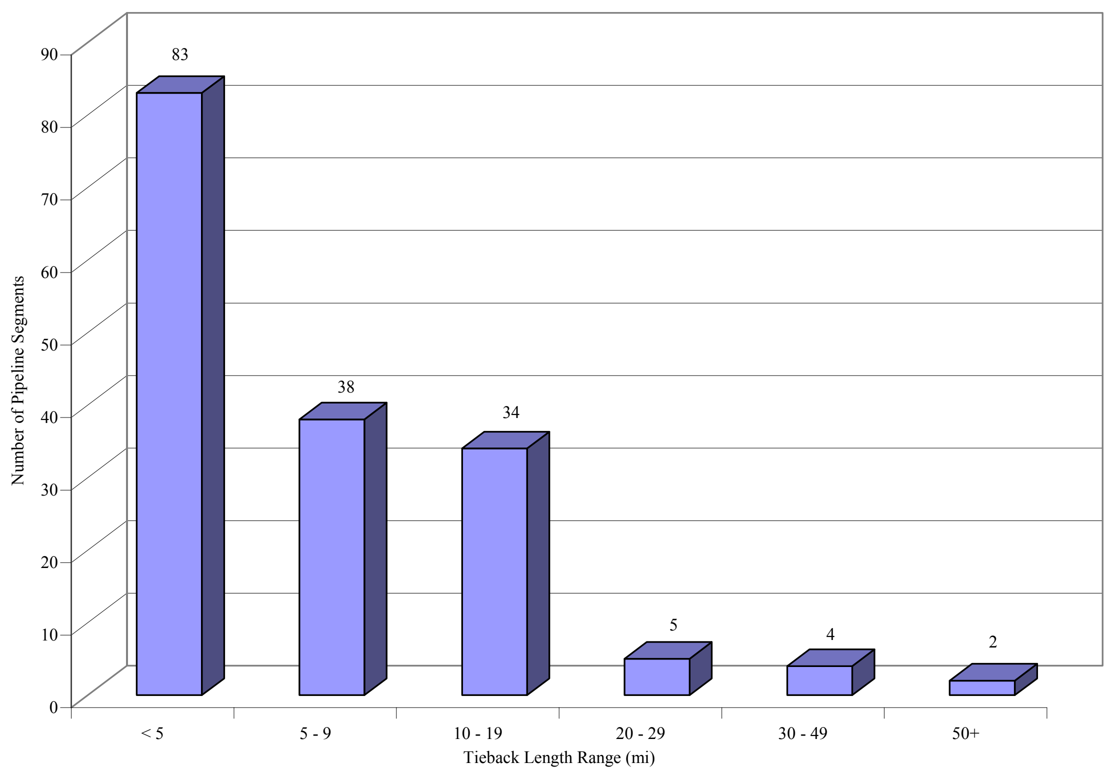


Figure 49. Length of subsea tiebacks.

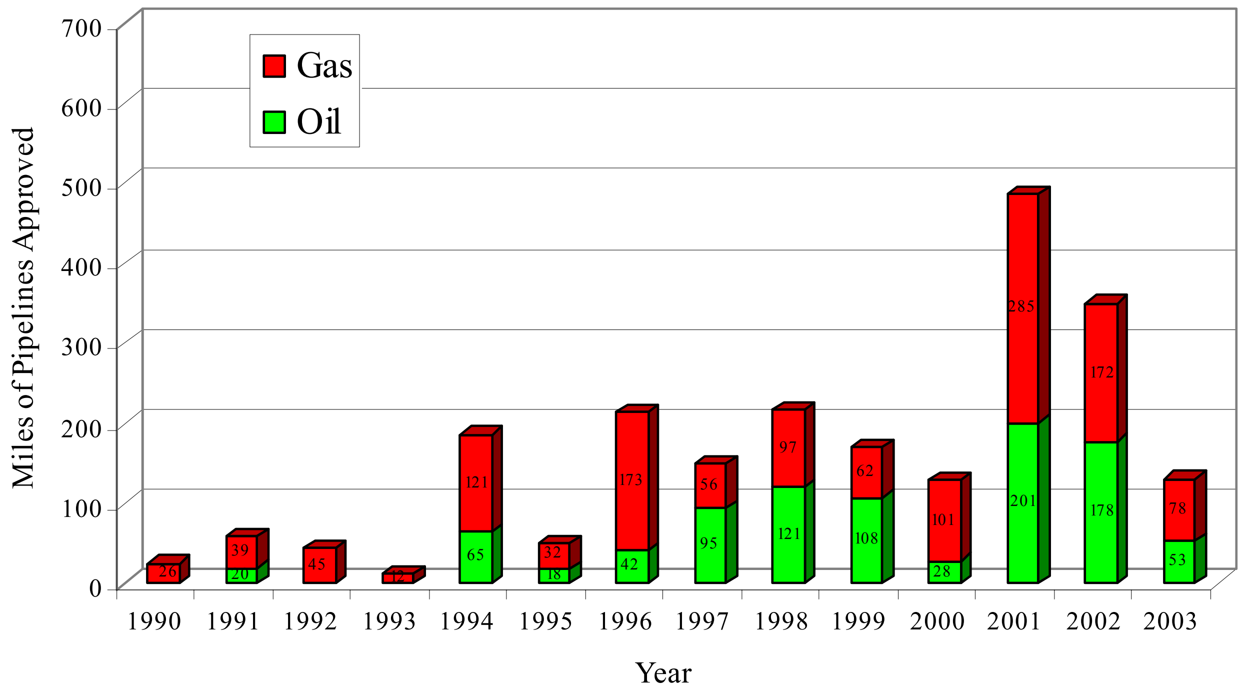


Figure 50a. Approved deepwater oil and gas pipelines less than or equal to 12 inches in diameter.

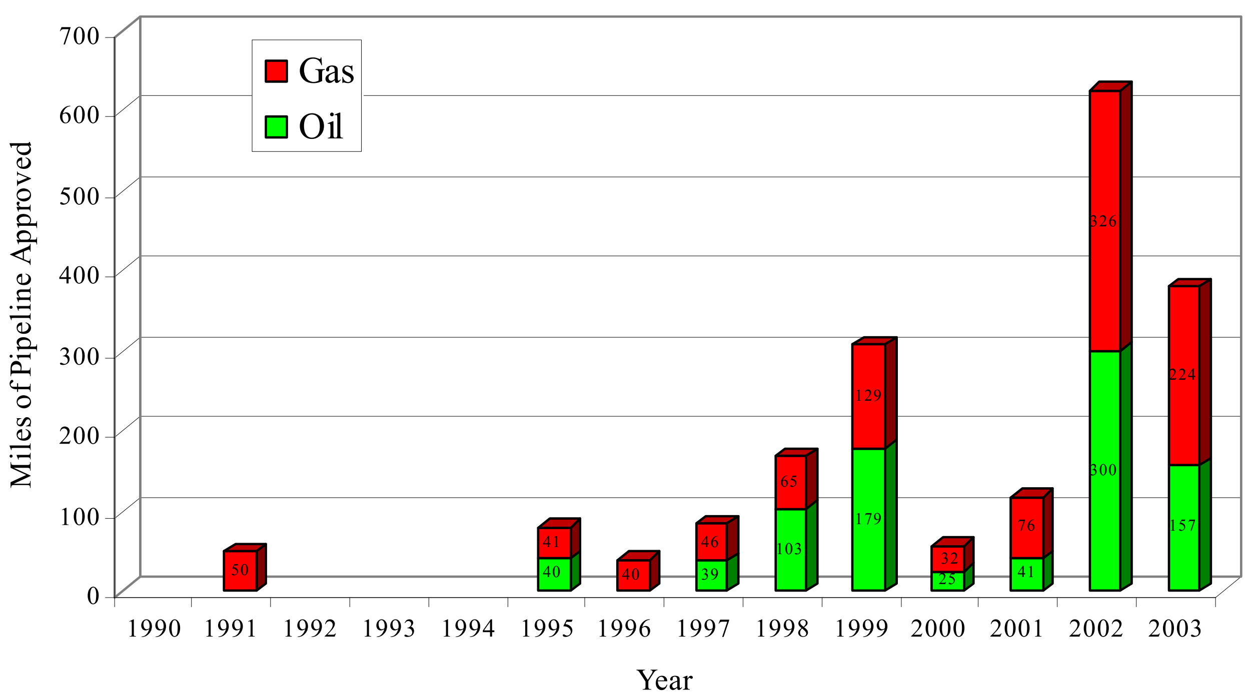


Figure 50b. Approved deepwater oil and gas pipelines greater than 12 inches in diameter.

RESERVES AND PRODUCTION

The deepwater GOM has contributed major additions to the total reserves in the GOM. Figure 51 shows the proved reserves added each year by water-depth category. Additions from the shallow waters of the GOM declined in recent years but, beginning in 1975, the deepwater area started contributing significant new reserves. Between 1975 and 1983, the majority of these additions were from discoveries in slightly more than 1,000 ft (305 m) of water. It was not until 1984 that major additions came from water depths greater than 1,500 ft (457 m).

There is often a significant lag between a successful exploratory well and its hydrocarbons being produced. The success of an exploratory well may remain concealed from the public for several years until the operator requests a "Determination of Well Producibility" from MMS. A successful MMS determination then "qualifies" the lease as producible and the discovery is placed in a field. The discovery date of that field is then defined as the TD (total depth) date of the field's first well that encountered significant hydrocarbons. Hydrocarbon reserves are still considered unproved until it is clear that the field will go on production. Then the reserves move into MMS's proved category. Figure 52 includes both proved and unproved reserves for each water-depth category. This figure shows declining reserve additions in shallow water, similar to figure 51, but reveals significantly more deepwater reserve additions and large significant unproved reserve additions in water depths greater than 5,000 ft (1,524 m) beginning in 1998.

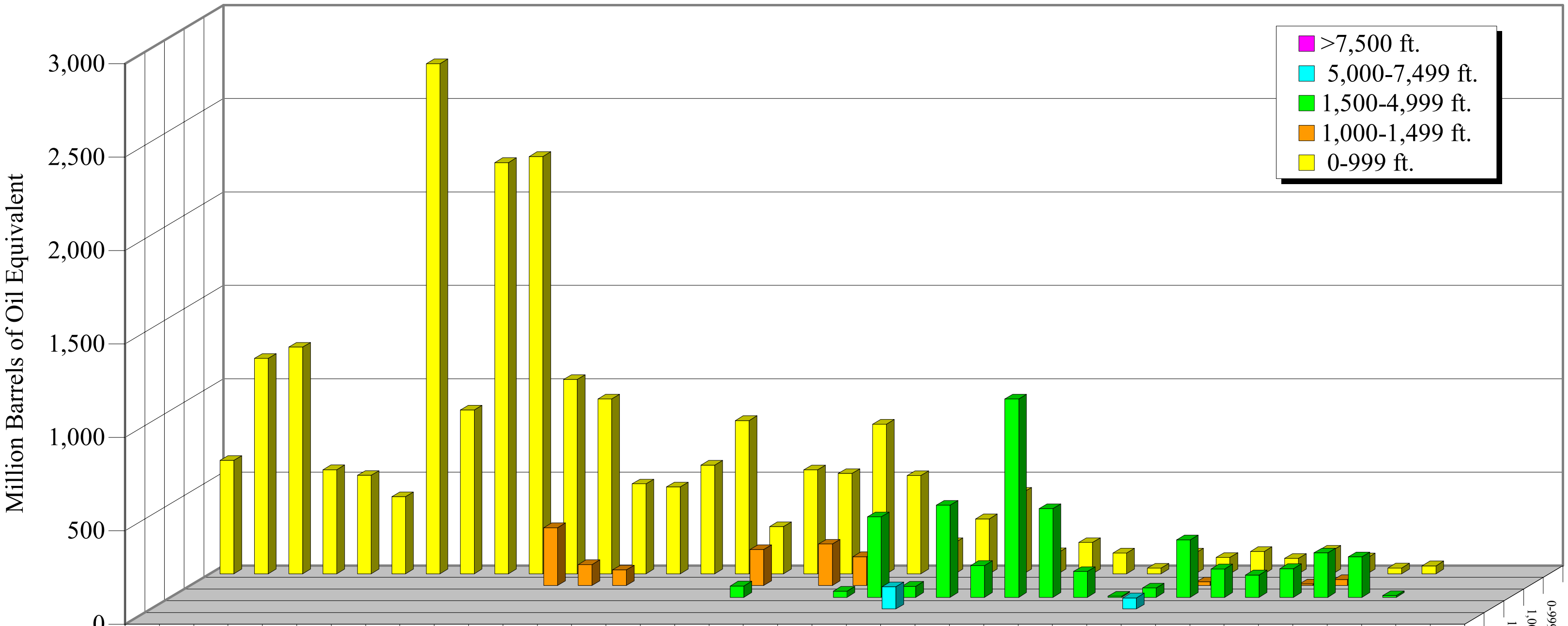
Figure 53 illustrates the most important feature of the deepwater field discoveries, that their average size is many times larger than the average size of shallow-water fields. During the last 10 years, the average shallow-water field added approximately 5 MMBOE of proved and unproved reserves. In contrast, the average deepwater field added over 86 MMBOE of proved and unproved reserves.

DISCOVERIES

Figure 54 shows the number of deepwater fields discovered each year, according to MMS criteria, since 1975. (See appendices A and B for listings of deepwater projects and discoveries.) The number of field discoveries for any given year is usually greater than the number of fields that actually go on production. The difference between the number of field discoveries and the number of those that actually produce increased in the late 1990's, since these recent field discoveries have had little time to reach production. Because of this lag between exploratory drilling and first production, the true impact of recent, large deepwater exploratory successes is not yet reflected in MMS proved and unproved reserve estimates.

In an attempt to capture the impact of these deepwater exploratory successes, figure 55 adds MMS-known resource estimates and industry-announced discoveries to the proved and unproved reserve volumes. The industry-announced discovery volumes contain considerable uncertainty, are based on limited drilling, include numerous assumptions, and have not been confirmed by independent MMS analyses. They do, however, illustrate recent activity better than using only MMS proved reserve numbers. The apparent decline of proved reserve additions in recent years is caused by the previously mentioned developmental lag.

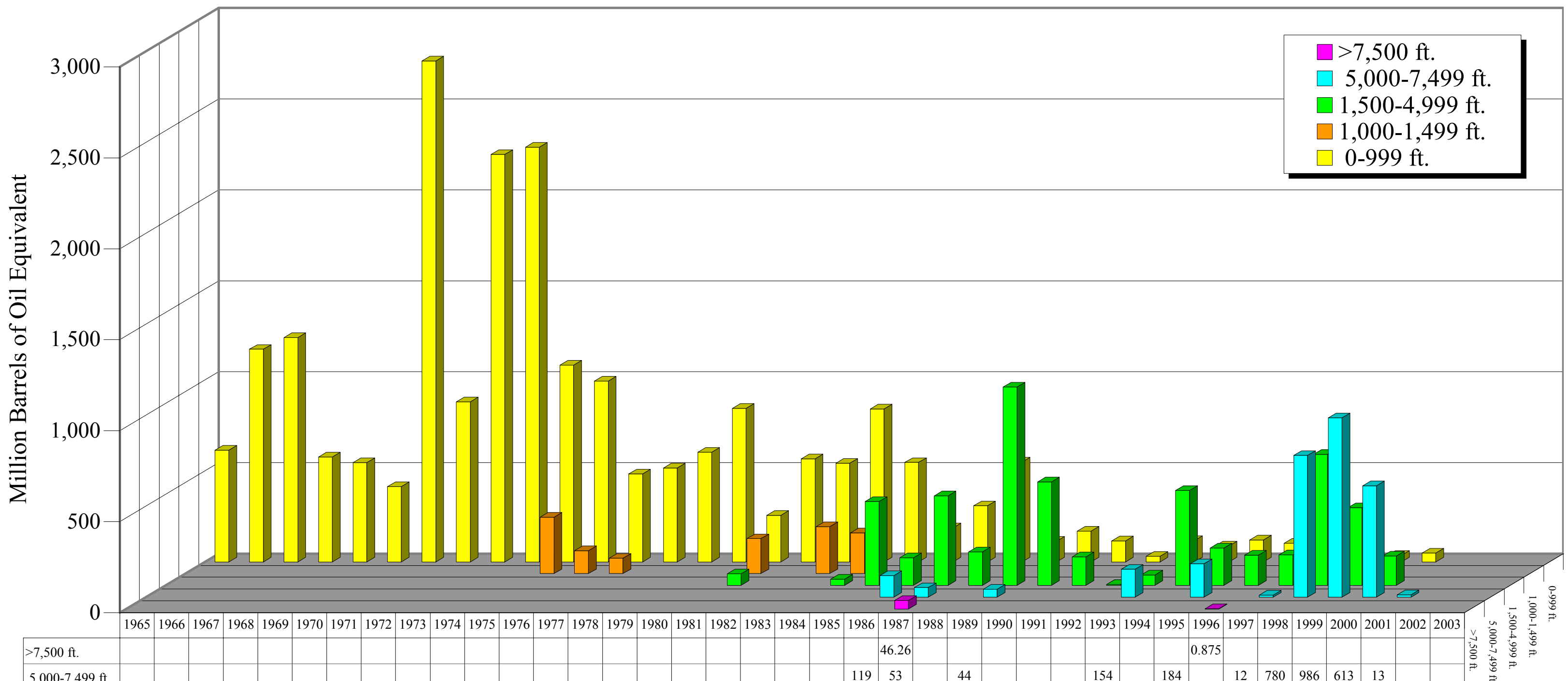
Figure 56 illustrates the distribution of recent hydrocarbon additions in the GOM, categorized by water depth. The combination of industry-announced deepwater discoveries and MMS estimates illustrates that deepwater exploration is adding significantly to the GOM hydrocarbon inventory. These large additions show the excellent potential for continued growth in deepwater activity levels.



	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
>7,500 ft.																			
5,000-7,499 ft.																			
1,500-4,999 ft.																	60.8		
1,000-1,499 ft.											310	112	83.3				192		222
0-999 ft.	607	1152	1213	557	527	412	2730	876	2201	2234	1040	936	481	465	581	820	252	556	537

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
>7,500 ft.																				
5,000-7,499 ft.			119							60.1										
1,500-4,999 ft.	32.5	430	58.6	493	170	1061	475	138	5.79	49.7	307	152	119	154	238	217	8.8			
1,000-1,499 ft.	155										19.5			8.56	31.9					
0-999 ft.	801	525	166	294	437	113	168	111	29.8	111	87.3	119	82.8	126	84.7	31	42.3			

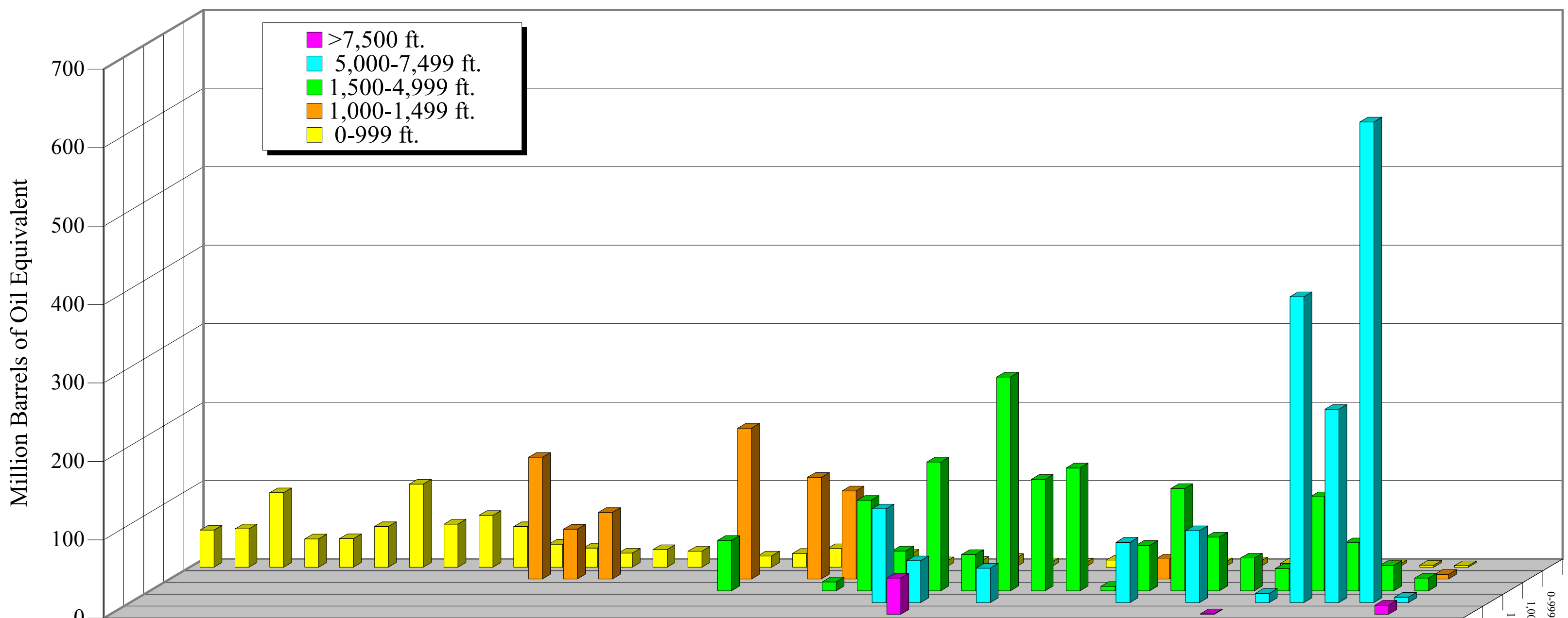
Figure 51. Proved reserve additions.



	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
>7,500 ft.																			
5,000-7,499 ft.																			
1,500-4,999 ft.																	64.45		
1,000-1,499 ft.											310.5	126.7	84.84				192.4		259
0-999 ft.	614.3	1169	1234	576.1	546.4	414.1	2754	879.2	2240	2281	1082	994.5	484.2	516.2	602.9	843.4	256.2	566.3	542.4

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
>7,500 ft.				46.26									0.875							
5,000-7,499 ft.			119	53		44				154		184		12	780	986	613	13		
1,500-4,999 ft.	34.24	461.2	152.5	492.6	184.9	1090	569.1	156.7	5.788	57.83	522.1	205.6	166.4	168.9	720.6	428.1	161.7			
1,000-1,499 ft.	224.8										24.75			8.564	31.85					
0-999 ft.	841.1	546.5	187.4	308.5	548.7	114	169.8	114.7	30.87	116.8	87.95	120.1	102.8	126	97.52	36.3	48.31			

Figure 52. Proved and unproved reserve additions.



	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
>7,500 ft.																				
5,000-7,499 ft.																				
1,500-4,999 ft.																	64.45			11.41
1,000-1,499 ft.											155.2	63.36	84.84				192.4		129.5	112.4
0-999 ft.	47.26	48.72	94.93	36.01	36.43	51.77	105.9	54.95	65.88	51.83	29.25	24.26	17.93	22.44	20.1	33.74	14.23	17.7	23.58	12.02

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
>7,500 ft.			46.26									0.875					11.67		
5,000-7,499 ft.		119.5	53.48		44.08				76.97		91.93		11.95	390.2	246.6	613.2	6.746		
1,500-4,999 ft.	115.3	50.82	164.2	46.22	272.6	142.3	156.7	5.788	57.83	130.5	68.53	41.59	28.16	120.1	61.16	32.34	16.1		
1,000-1,499 ft.		0.294							25.48	12.37			4.282	15.93	4.765		5.785		
0-999 ft.	16.56	6.94	7.524	10.97	5.43	5.305	8.824	3.858	8.984	5.497	6.674	4.893	6.3	6.501	3.025	2.543	1.773		

Figure 53. Average field size using proved and unproved reserves.

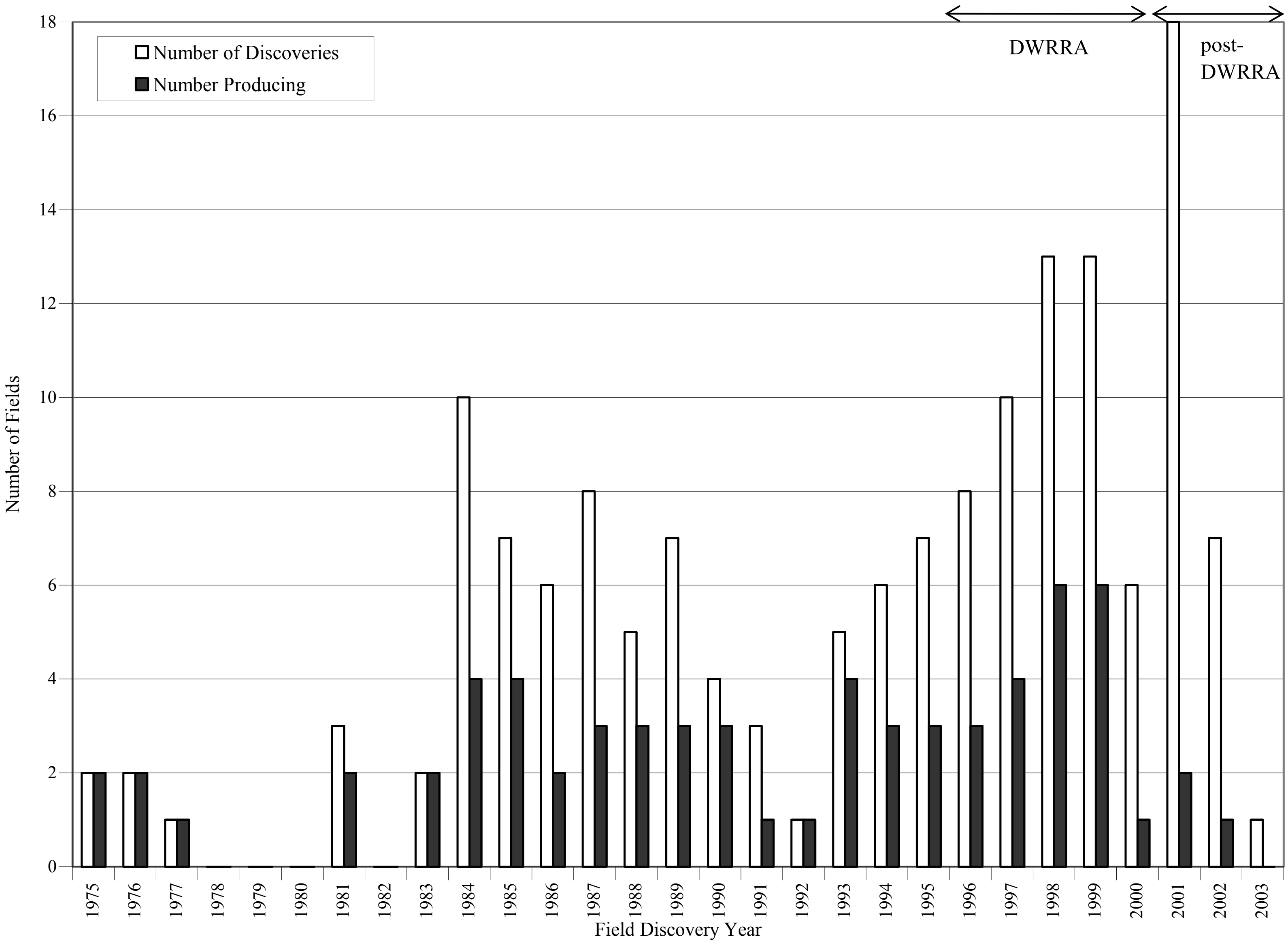


Figure 54. Number of deepwater field discoveries and resulting number of producing fields.

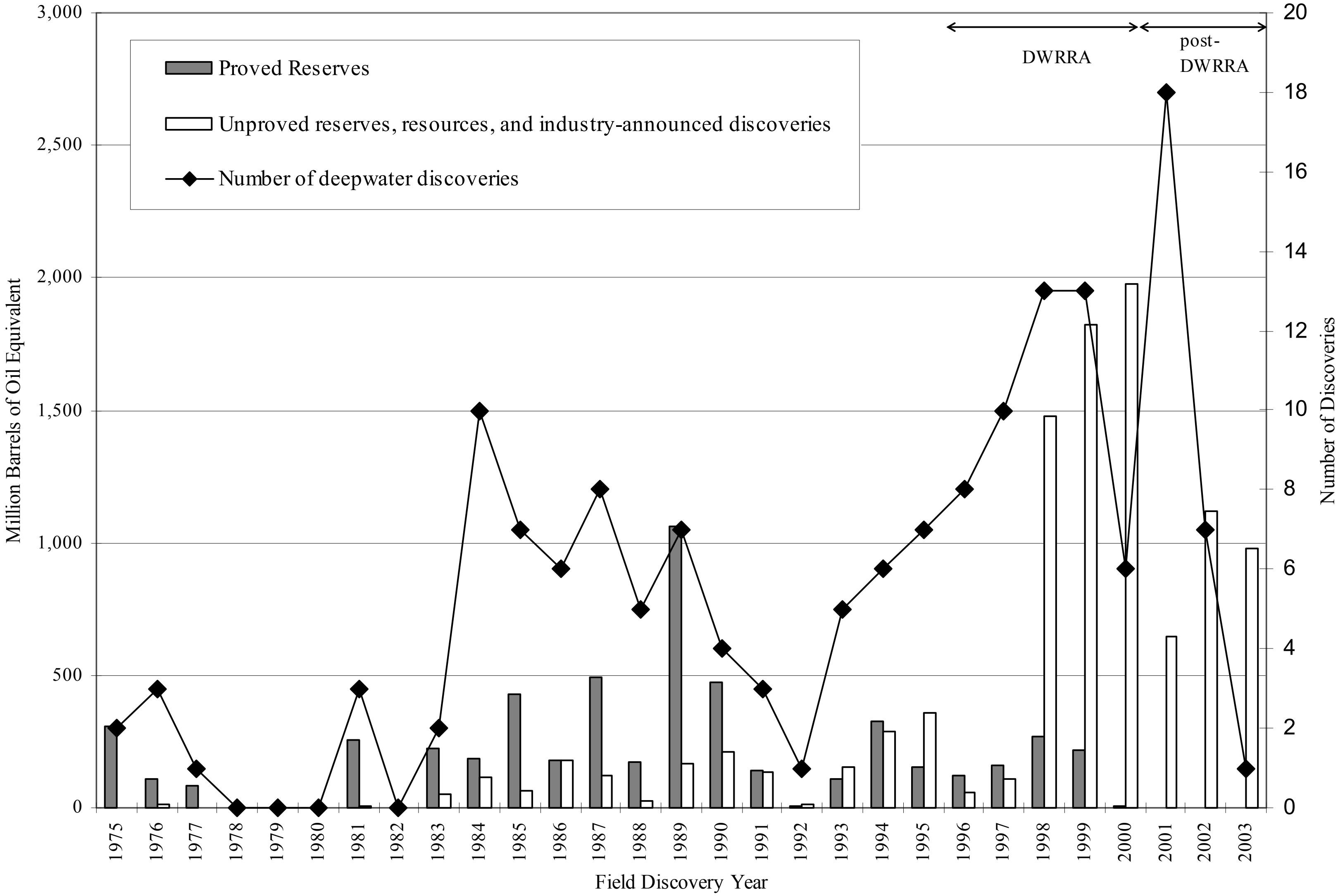
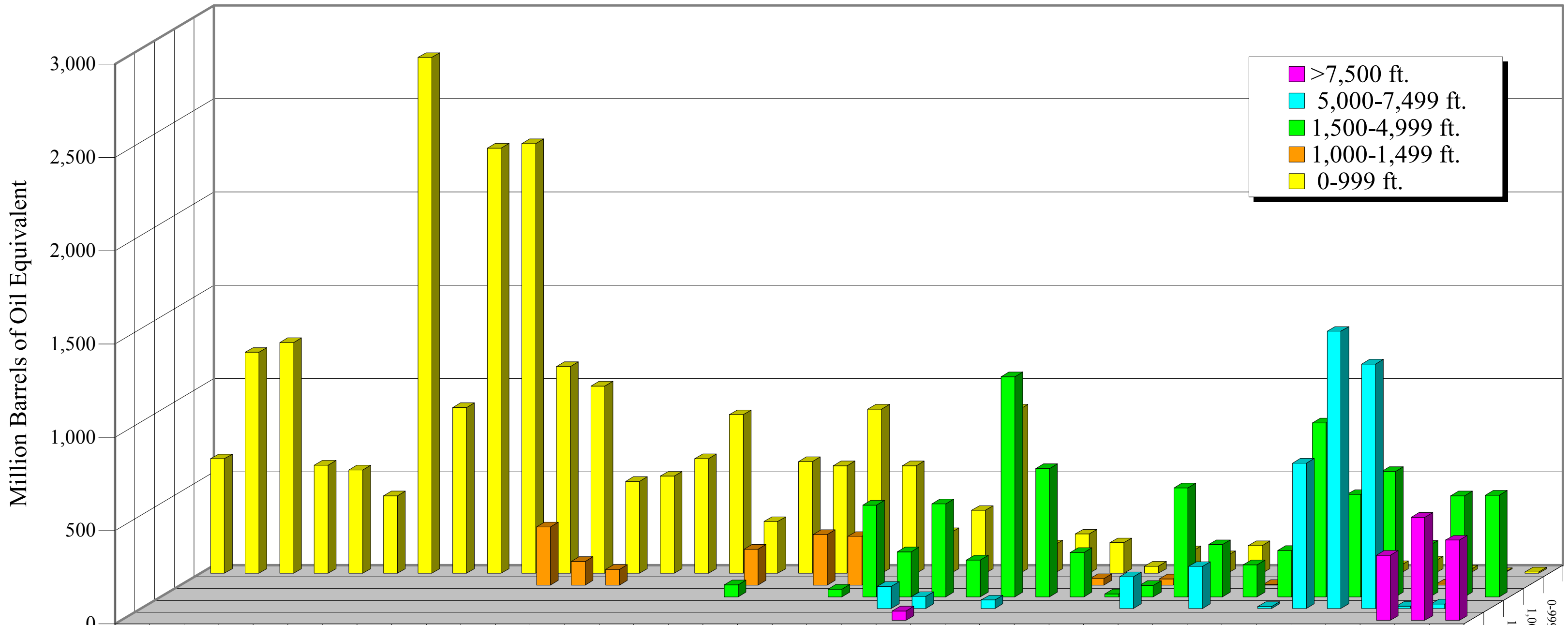


Figure 55. Number of deepwater field discoveries and new hydrocarbons found (MMS reserves, MMS resources, and industry-announced discoveries).



	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
>7,500 ft.																				
5,000-7,499 ft.																				
1,500-4,999 ft.																	64.5			41.3
1,000-1,499 ft.											311	127	84.8				192		271	261
0-999 ft.	614	1185	1238	580	554	415	2765	889	2279	2303	1109	1004	493	521	615	851	278	599	577	881

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
>7,500 ft.			50.5														349	552	431
5,000-7,499 ft.		119	65.3		46.3				171		227		12	780	1486	1311	13.5	25	
1,500-4,999 ft.	492	241	498	198	1180	688	238	16.4	61.1	584	281	173	249	933	549	672	277	542	545
1,000-1,499 ft.							35.6		33.5	32.7		2.39	10.8	31.9	4.76		5.78		
0-999 ft.	577	218	338	880	153	211	164	38	120	95	149	117	142	102	40.8	65.6	17.2	4.68	7.77

Figure 56. BOE added (reserves, known resources, and industry-announced discoveries).

RESERVE POTENTIAL

This report has examined the history of reserve growth in the GOM. Figure 56 illustrates results of the latest drilling in the GOM, suggesting very significant production volumes in the near future. Predicting future discoveries is more difficult. To address the amount of hydrocarbons yet to be discovered in the GOM, this report will briefly examine one indicator — the "creaming curve" — and one detailed study — *2000 Assessment of Conventionally Recoverable Hydrocarbon Resources of the Gulf of Mexico and Atlantic Outer Continental Shelf as of January 1, 1999* (Lore et al., 2001), commonly known as the 2000 Assessment.

This modified creaming curve (only successful tests are plotted), figure 57, shows the discovered and implies the undiscovered hydrocarbon volumes in the GOM. The creaming curve plots "cumulative number of fields by discovery date" against "cumulative discovered hydrocarbon volumes." Many such curves demonstrate that the largest fields tend to be discovered early in the exploration cycle. This phenomenon results in a curve having a steep slope during the early (immature) phase of exploration and becoming flatter in the mature phase of exploration, when smaller fields are generally discovered.

Figure 57 contains two creaming curves. The shallow-water GOM is characterized by a curve typical of a mature trend. The recent slope of the curve is very flat since, in general, smaller fields are being discovered. Unless a dramatic new exploration play is recognized, only limited reserves will be added. This prediction is supported by figures 51, 52, 53, and 56, all of which show a decline in field discovery size and added reserves from the shallow-water GOM over the last 20 years.

The deepwater creaming curve contains fewer field discoveries; however, these fields tend to be large, resulting in a curve with a steep slope. This slope indicates an area that is still in an immature exploration phase with many large fields awaiting discovery. The limited number of discoveries, steep slope of the curve, and large amount of hydrocarbon volumes already discovered support this prediction.

A more quantitative and geologic-based estimate of future discoveries in the GOM is the 2000 Assessment (Lore et al., 2001), summarized in figure 58. The deepwater is expected to have ultimate reserves of approximately 71 billion barrels of oil equivalent (BOE), of which 56.4 billion BOE remains to be discovered.[1] Compare this with the shallow-water ultimate reserves of approximately 65 billion BOE, of which 15.2 billion BOE remain to be discovered.

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[1] The forecasts were based on the MMS report *Atlas of Gulf of Mexico Gas and Oil Sands* (Bascle, 2001). Each producing field and reservoir in the GOM was assigned to a hydrocarbon play. The 2000 Assessment (Lore et al., 2001) then forecast the number of hydrocarbons remaining to be discovered in the GOM on the following factors:

- the number and size of discovered accumulations in an established play
- an estimate of the number of undiscovered accumulations in a play
- lognormal size distribution for these accumulations

The MMS then predicted the size of undiscovered accumulations in each play. Frontier or conceptual plays were modeled on similar but more mature plays. The undiscovered accumulations were then aggregated for all 92 plays in the 2000 Assessment. To compare reserve numbers from mature fields, recent field discoveries, and estimates from undiscovered fields, cumulative growth factors were used in the 2000 Assessment. It has been widely observed that a field's size "grows" throughout its lifespan. Reasons for this growth vary widely, but may include areal extension of existing reservoirs, discovery of new reservoirs, improvement in production procedures, and the natural conservatism of early estimates. A detailed discussion of reserve appreciation and cumulative growth factors may be found starting on page 49 of the 2000 Assessment. The estimated ultimate recovery volumes were then used for the forecasts in the 2000 Assessment.

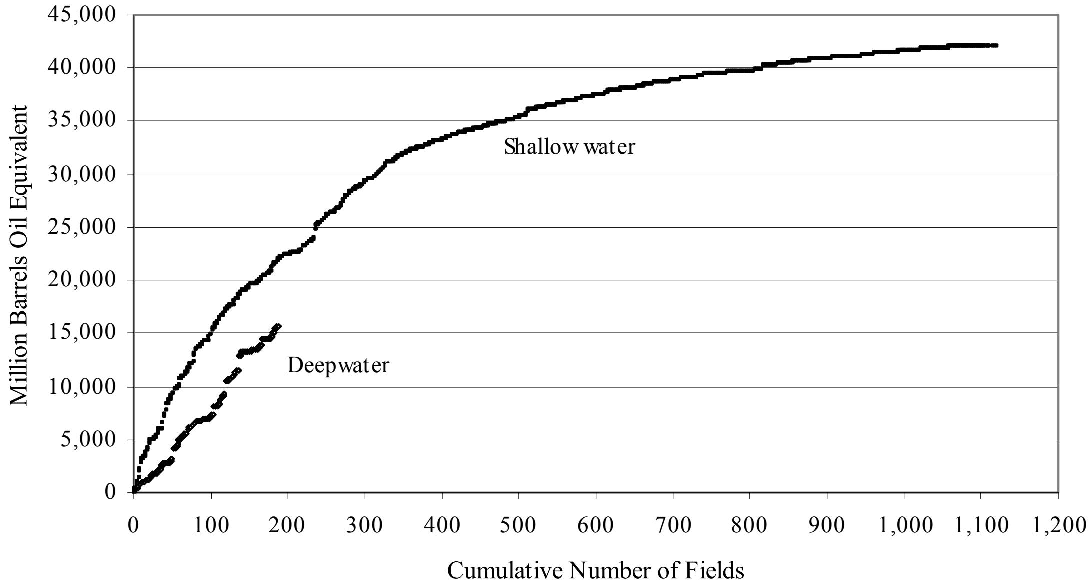

Figure 57. Modified creaming curve for shallow- and deepwater areas of the GOM (includes reserves, resources, and industry-announced discoveries).

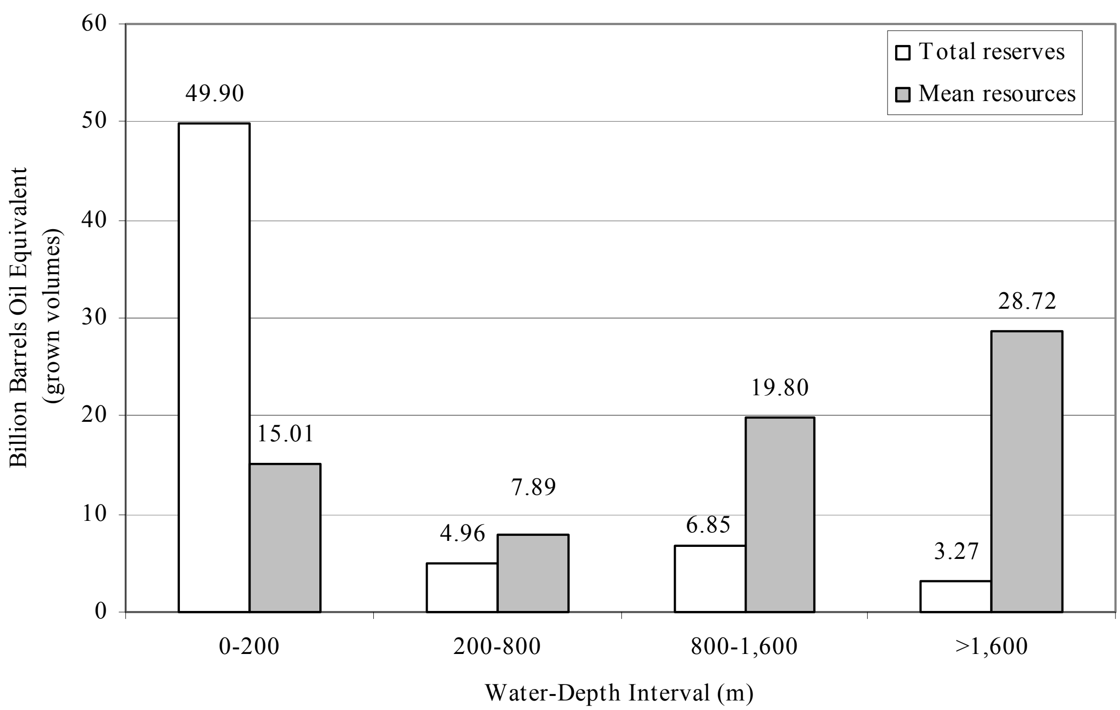

Figure 58. Reserves and future discovery volumes in the deepwater GOM.

PRODUCTION TRENDS

Seismic acquisition, leasing, bid rejects, drilling, and discoveries—all stepped into deeper waters with time. The final piece in the puzzle, production, is no exception. Figure 59 illustrates the relative volume of production from each GOM block through time. Notice the large deepwater volumes that first appear in 1996 and 1997. More recent production continues to expand over a larger area and into deeper waters. Table 5 shows that the most prolific blocks (on a BOE basis) are currently in the deepwater GOM.

Table 5
Top 20 Producing Blocks for the Years 2001—2002

Block	Project Name	Owner	Water Depth (ft)	Production (BOE)*
MC 807	Mars	Shell	2,933	136,568,699
MC 809	Ursa	Shell	3,800	93,241,872
GC 200	Troika	BP	2,679	67,655,971
GB 426	Auger	Shell	2,860	65,162,185
VK 956	Ram Powell	Shell	3,216	46,548,817
GC 205	Genesis	ChevronTexaco	2,590	46,305,567
VK 786	Petronius	ChevronTexaco	1,753	43,380,884
VK 915	Marlin	BP	3,236	40,218,070
GB 260	Baldpate	Amerada Hess	1,648	38,137,292
AC 25	Hoover	ExxonMobil	4,808	33,106,719
ST 204	Unnamed	El Paso	155	32,437,871
GB 215	Conger	Amerada Hess	1,500	28,898,766
MC 687	Mensa	Shell	5,280	27,248,719
GI 116	Unnamed	Anadarko	326	24,164,514
MC 194	Cognac	Shell	1,023	22,959,993
GC 158	Brutus	Shell	2,983	21,090,921
ST 37	Unnamed	ChevronTexaco	59	20,962,911
MI 622	Unnamed	BP	89	20,369,408
VK 989	Pompano/Pompano II	BP	1,290	19,584,629
MC 899	Crosby	Shell	4,259	17,819,211

*cumulative production from January 2001 through December 2002

Figure 60 illustrates the importance of the GOM to the Nation's energy supply. The GOM supplies approximately 28 percent of the Nation's domestic oil and 23 percent of the Nation's domestic gas production. A significant and growing portion of these volumes comes from the deepwater.

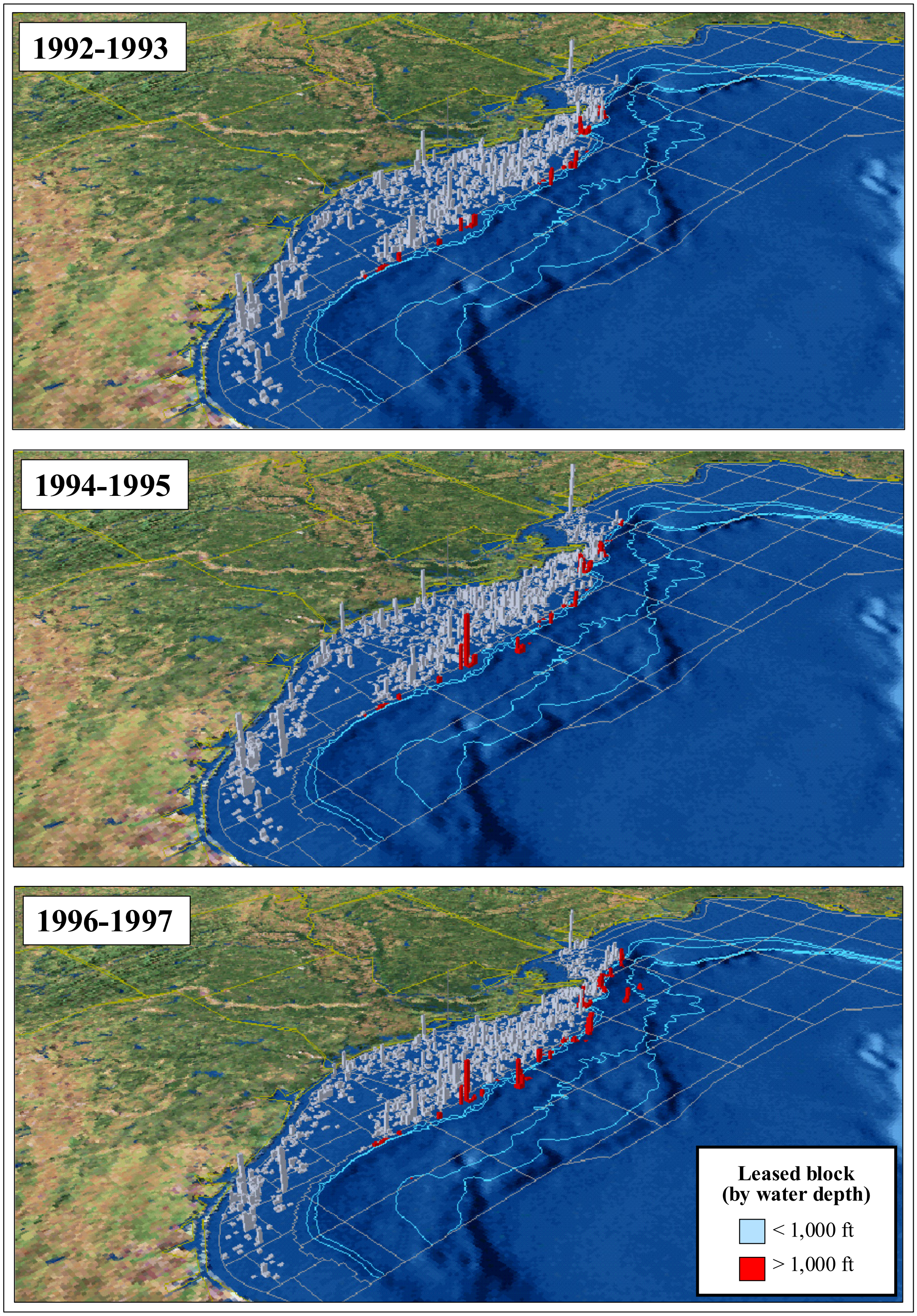

Figure 59. Relative volume of production from each GOM lease. Bar heights are proportional to total lease production (barrels of oil equivalent) during that interval.

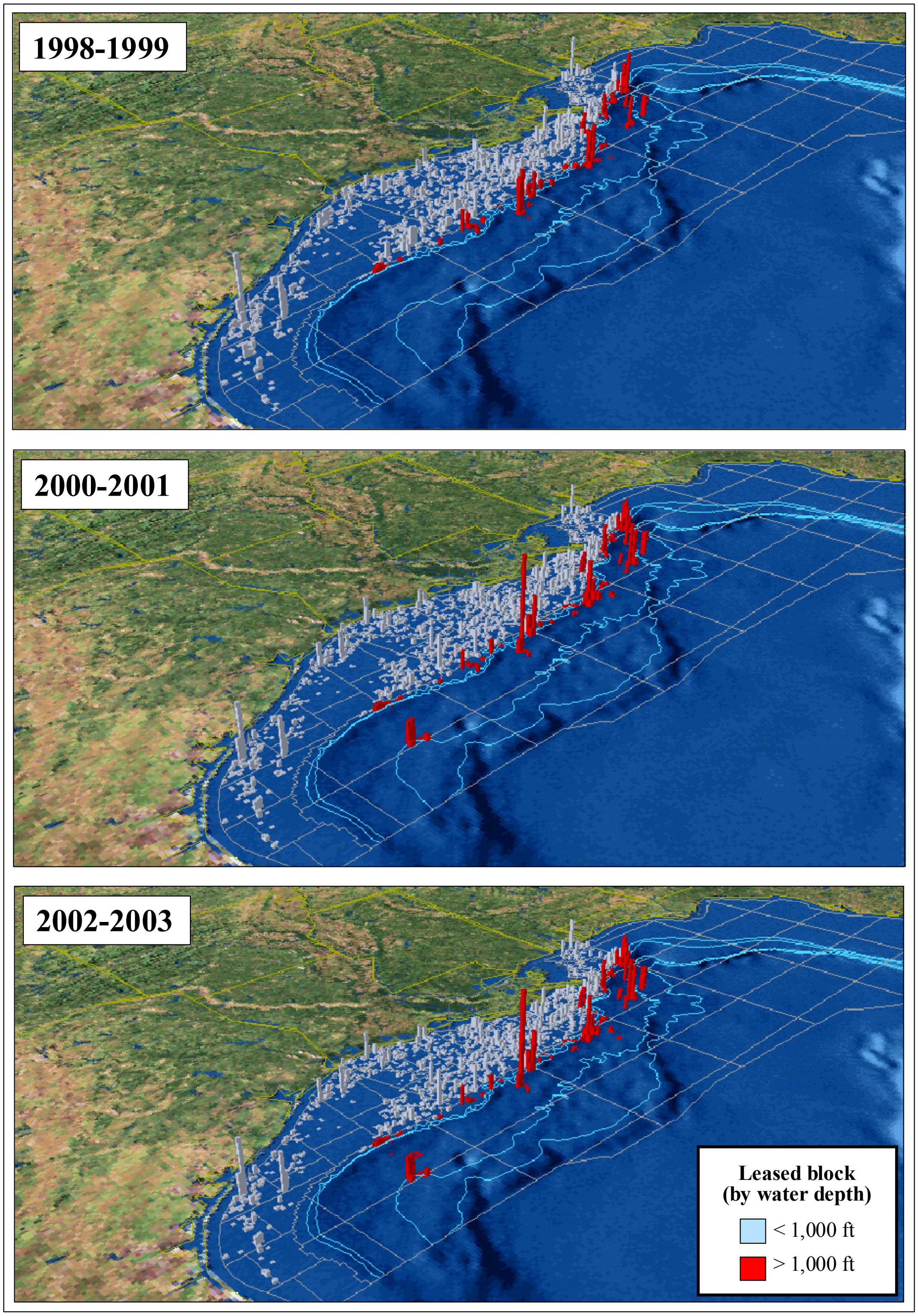

Figure 59. Relative volume of production from each GOM lease. Bar heights are proportional to total lease production (barrels of oil equivalent) during that interval (continued).

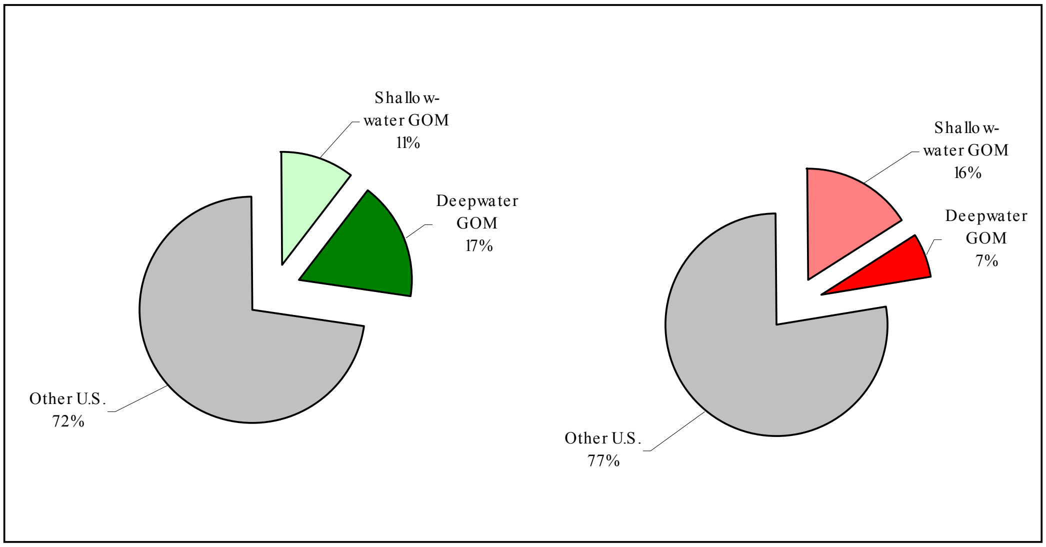

Figure 60. Estimated U.S. oil and gas production in 2002.

Figure 61a illustrates historic trends in oil production. Shallow-water oil production rose rapidly in the 1960's, peaked in 1971, and has undergone cycles of increase and decline since then. Since 1997, the shallow-water GOM oil production has steadily declined and, at the end of 2002, was at its lowest level since 1967. The deepwater GOM oil production, however, is in the midst of a dramatic increase similar to that seen in the shallow-water GOM during the 1960's. Melancon et al. (2003) predict that this production surge has not yet peaked. This strong increase in deepwater oil production more than offsets recent declines in shallow-water oil production. In 2002, deepwater oil production accounted for approximately 61 percent of GOM oil production.

Figure 61b shows similar production trends for gas. Shallow-water gas production rose sharply throughout the 1960's and 1970's, and then remained relatively stable over the next 15 years before declining steadily from 1996 through today. Although the deepwater gas production increase has not been as dramatic as with oil, the steady increase in deepwater gas production that occurred in the past few years offsets the shallow-water decline. Appendix H lists historical GOM oil and gas production rates. These trends in oil and gas production indicate that the deepwater GOM frontier continues to expand.

As discussed previously, the Deepwater Royalty Relief Act (DWRRA) had a significant effect on deepwater leasing and drilling. Numerous projects with royalty relief eligibility have come online in recent years (table 4), but the impact of the DWRRA on deepwater production is just now beginning to show. Figure 62a shows the contribution of Deepwater Royalty Relief (DWRR) oil production to total "deepwater" GOM oil production, where "deepwater" is defined as 200 m (656 ft), the minimum water depth for which DWRR incentives are offered, instead of 1,000 ft (305 m), the definition used elsewhere in this report. The amount of oil production subject to royalty suspension has hovered around 5 percent of the total "deepwater" production since mid-2001. Figure 62b displays total "deepwater" gas production along with pre-DWRRA and post-DWRRA gas production subject to royalty relief. The volume of natural gas subject to DWRR increased rapidly in 2002, reaching 14 percent of total "deepwater" production by the end of that year. Note that pre-DWRRA production refers to production from leases that have been approved to receive DWRR but were issued before November 28, 1995. Post-DWRRA production refers to DWRR production from leases that were issued after that date.

Approximately 300,000 barrels of oil and 2 billion cubic feet of gas come from deepwater subsea completions each day. Subsea completions currently account for about 30 percent of deepwater oil

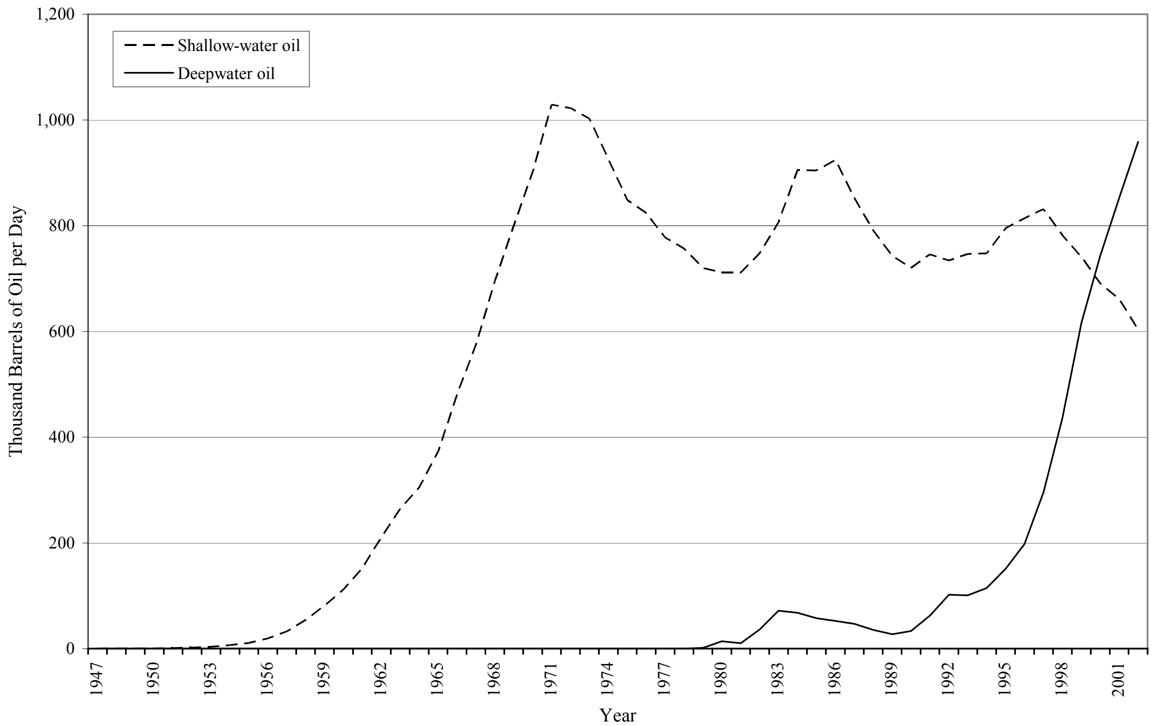

Figure 61a. Comparison of average annual shallow- and deepwater oil production.

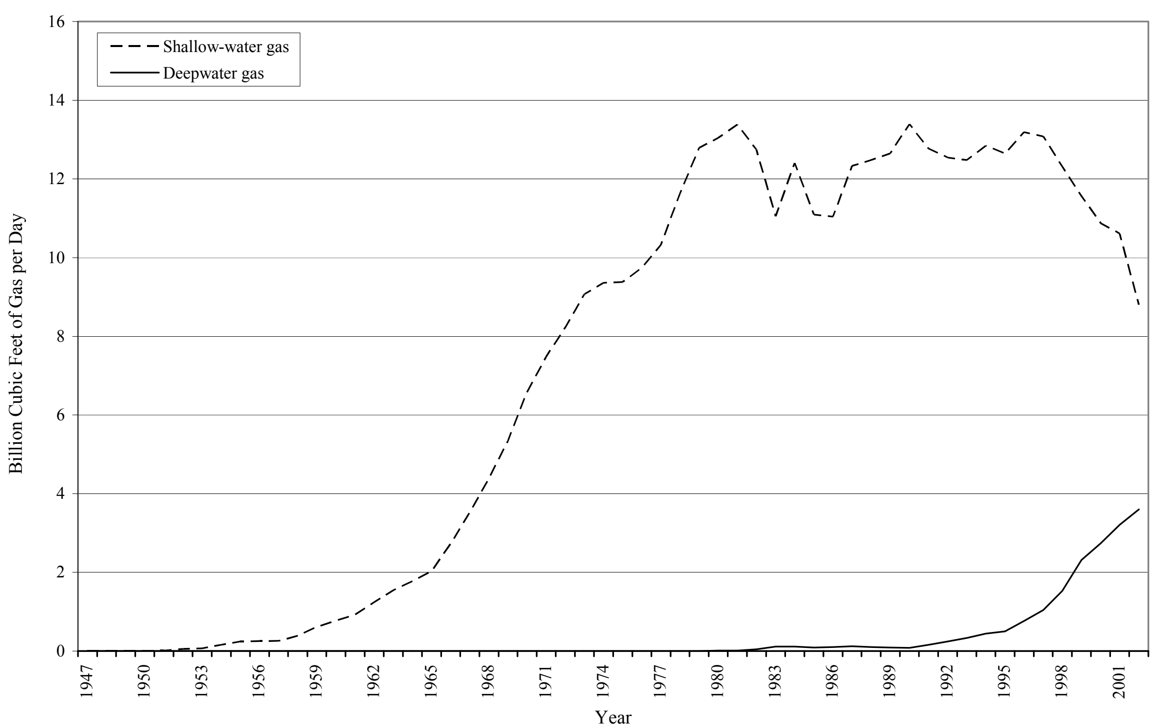

Figure 61b. Comparison of average annual shallow- and deepwater gas production.

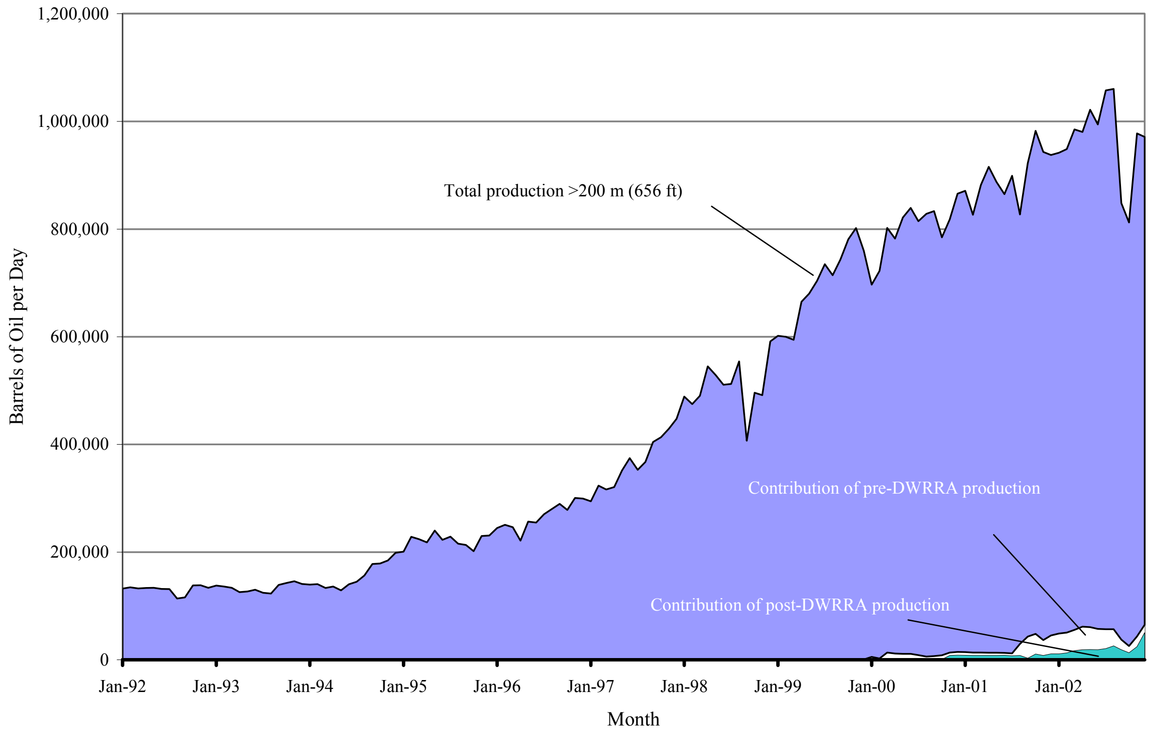

Figure 62a. Contribution of DWRRA oil production to total oil production in water depths greater than 200 m (656 ft).

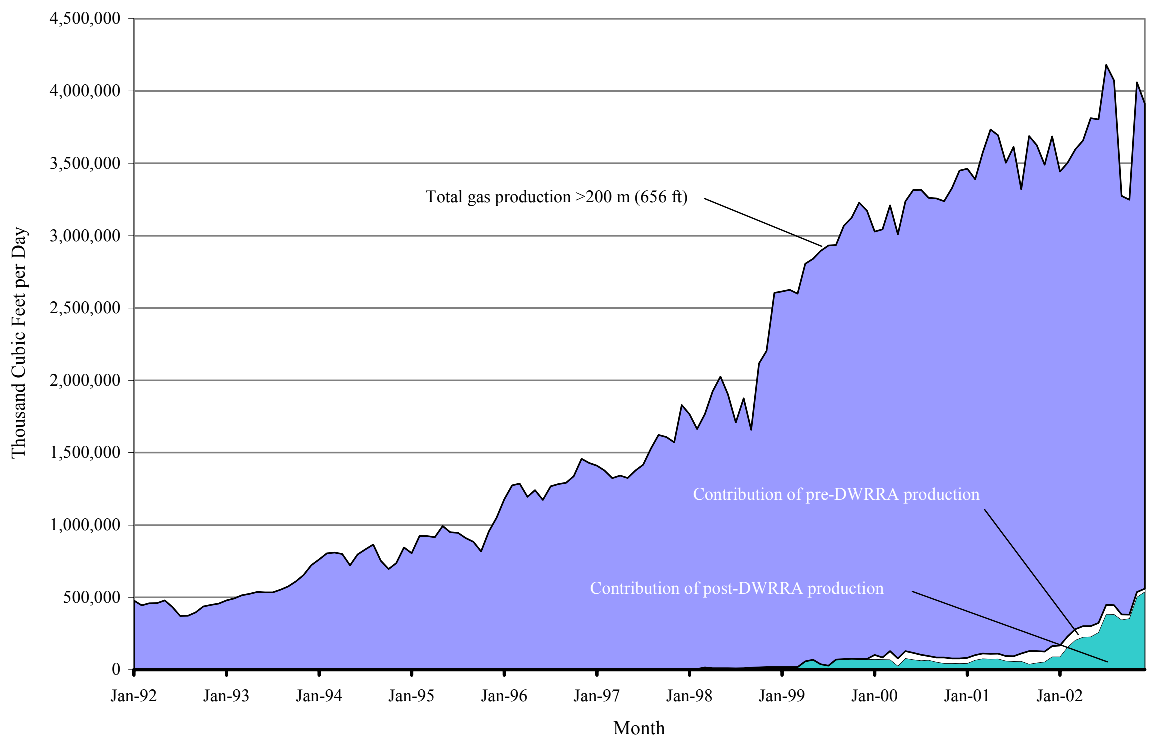

Figure 62b. Contribution of DWRRA gas production to total gas production in water depths greater than 200 m (656 ft).

production and about 50 percent of deepwater gas production. Figure 63a shows that very little deepwater oil production came from subsea completions until mid-1995, but by the fall of 1996 that production had risen to about 20 percent. Since 2000, subsea oil production has increased slightly, whereas total deepwater oil production has increased dramatically. Deepwater gas production from subsea completions began in early 1993, and by mid-1994 they accounted for over 40 percent of deepwater GOM gas production (Figure 63b). Gas production from subsea completions increased from 1996 through 1999, remained constant in 2000, and increased rapidly after 2000.

Companies and Production

Deepwater oil and gas production was confined almost entirely to major oil and gas companies through 1996 (figures 64a-b). (Production volumes in figures 64a-b, 65a-b, and 66a-b are attributed to companies on the basis of their percentage of lease ownership. For example, if Shell owned 75 percent of a particular lease in July 1997, then 75 percent of that lease's production was attributed to Shell that month.) In 1998 and 1999, nonmajor companies significantly increased their deepwater oil production (figure 64a). However, since 2000, nonmajor oil production has leveled off while major oil companies continued their steep increases in oil production. Gas production from nonmajor and major companies has increased at approximately the same rate (figure 64b). Nonmajor companies currently own about 25 percent of deepwater GOM oil production and 30 percent of gas production.

In shallow water, nonmajor companies now produce more oil than the majors (figure 65a). In addition, nonmajor gas production represents an increasingly greater share of the total shallow-water gas production (figure 65b). This confirms the speculation that majors have been concentrating more in deepwater for their production needs.

Figures 66a and 66b display production contributions from each major oil and gas company. Shell and BP were the driving forces behind increasing deepwater production, with Shell as the clear leader in both oil and gas production. Shell's dominance in deepwater oil production began before 1992 and its recent increases have outpaced those of the other major companies. Shell also led in deepwater gas production, including a dramatic increase in 1997. BP oil production increased significantly since 1998 (in part because Shell and BP have joint ownership in several large deepwater fields). BP is second in terms of gas production because of steep increases in deepwater gas production since the last report. Note that BP has several significant projects on the horizon (e.g., Mad Dog, Thunder Horse, and Atlantis) that will contribute significantly to its oil and gas production totals.

Production Rates

High well production rates have been a driving force behind the success of deepwater operations. Figure 67a illustrates the highest deepwater oil production rates (monthly production divided by actual production days). For example, a well within Shell's Bullwinkle field produced about 5,000 BOPD in 1992. In 1994, a well within Shell's Auger field set a record, producing about 10,000 BOPD. From 1994 through mid-1999, maximum deepwater oil production rates continued to climb, especially in water depths between 1,500 and 4,999 ft (457 and 1,524 m). Horn Mountain came on line in early 2002 in 5,400 ft (1,646 m) water depth with a single well maximum rate of more than 30,000 BOPD. The deepest production is currently held by Camden Hills in 7,216 ft (2,199 m) water depth.

Figure 67b shows maximum production rates for gas. These rates hovered around 25 MMCFPD until a well in Shell's Popeye field raised the deepwater production record to over 100 MMCFPD in 1996. Since then, the deepwater has yielded even higher maximum production rates. In 1997, Shell's Mensa field (5,379 ft [1,640 m] water depth) showed the excellent potential for deepwater production rates beyond the 5,000 ft (1,524 m) water depth. The record daily oil and gas production rates (for a single well) are 41,532 BOPD (Troika) and 145 MMCFPD (Mica).

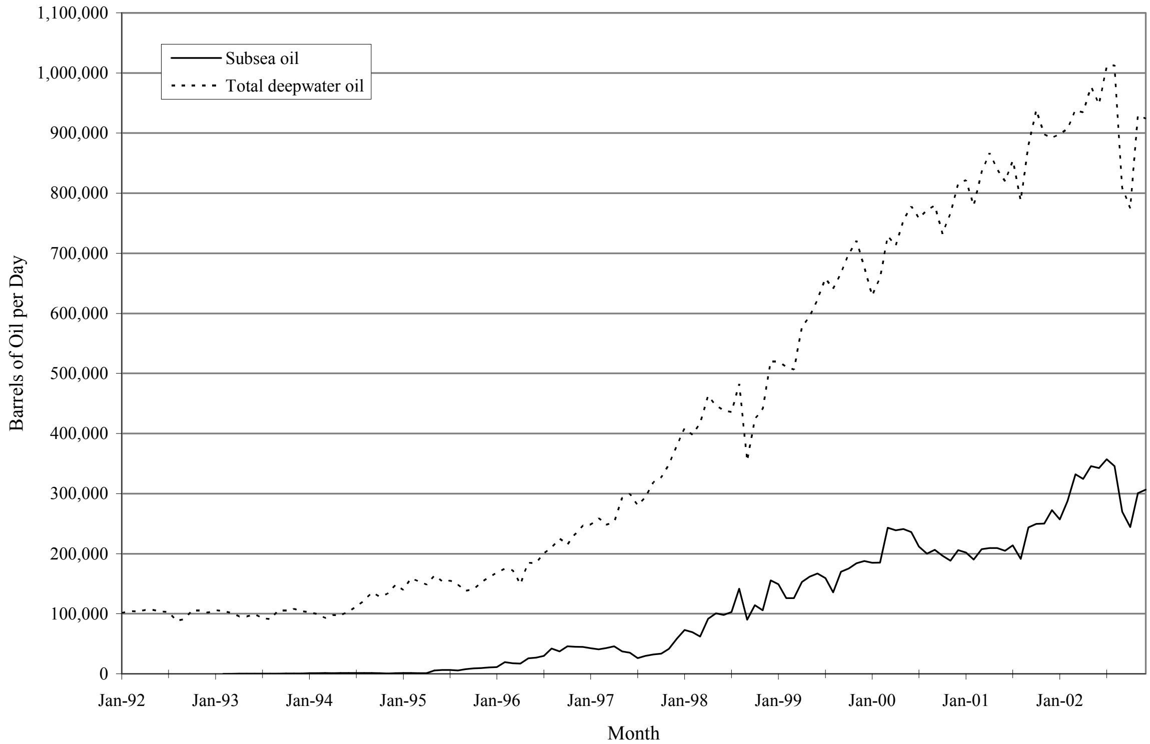

Figure 63a. Contributions from subsea completions toward total deepwater oil production.

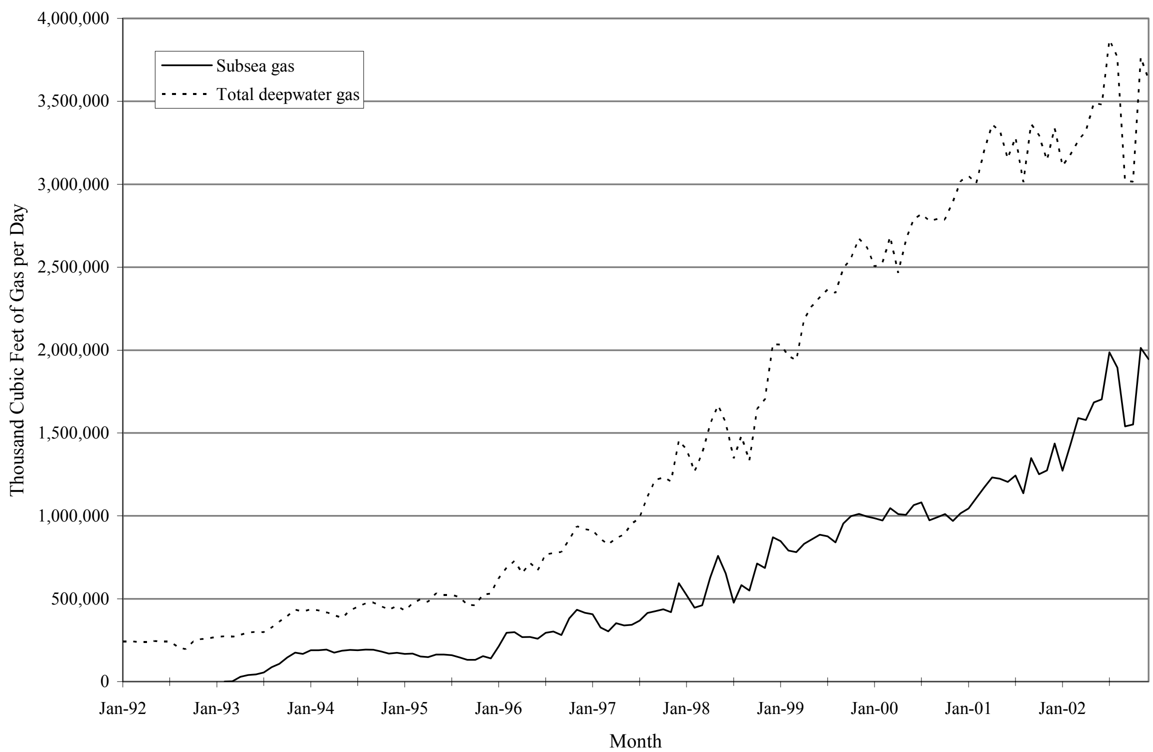

Figure 63b. Contributions from subsea completions toward total deepwater gas production.

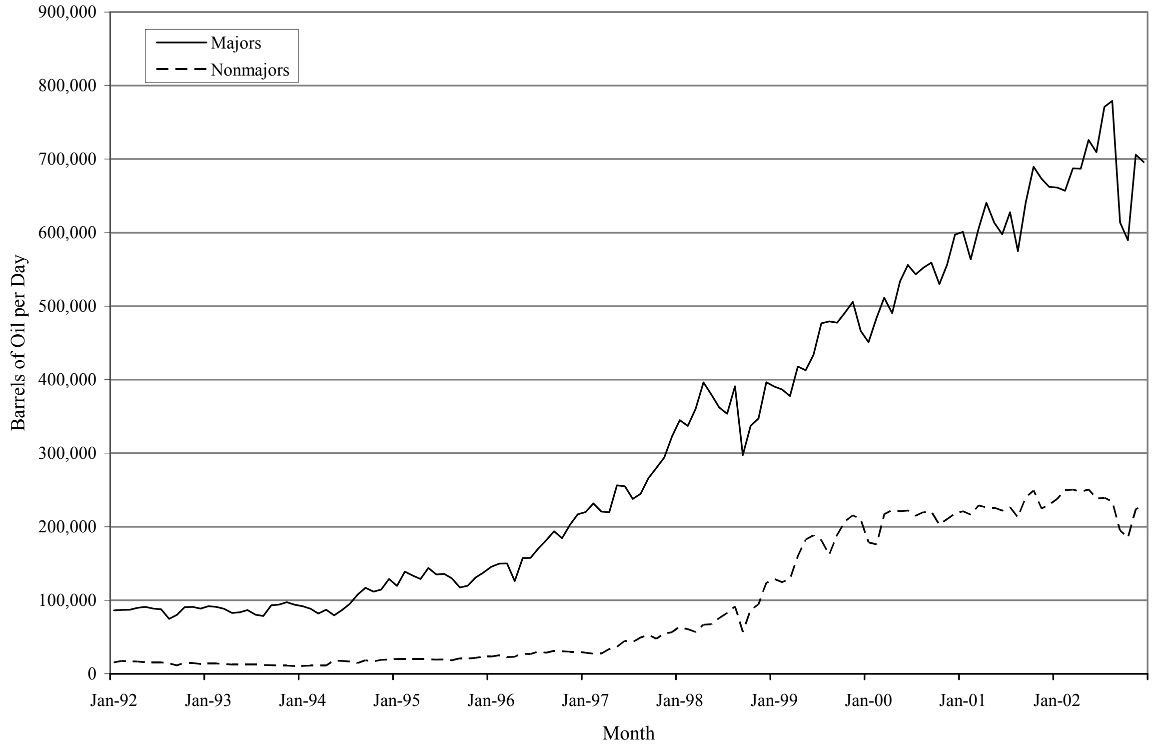

Figure 64a. Comparison of major and nonmajor companies in terms of deepwater oil production.

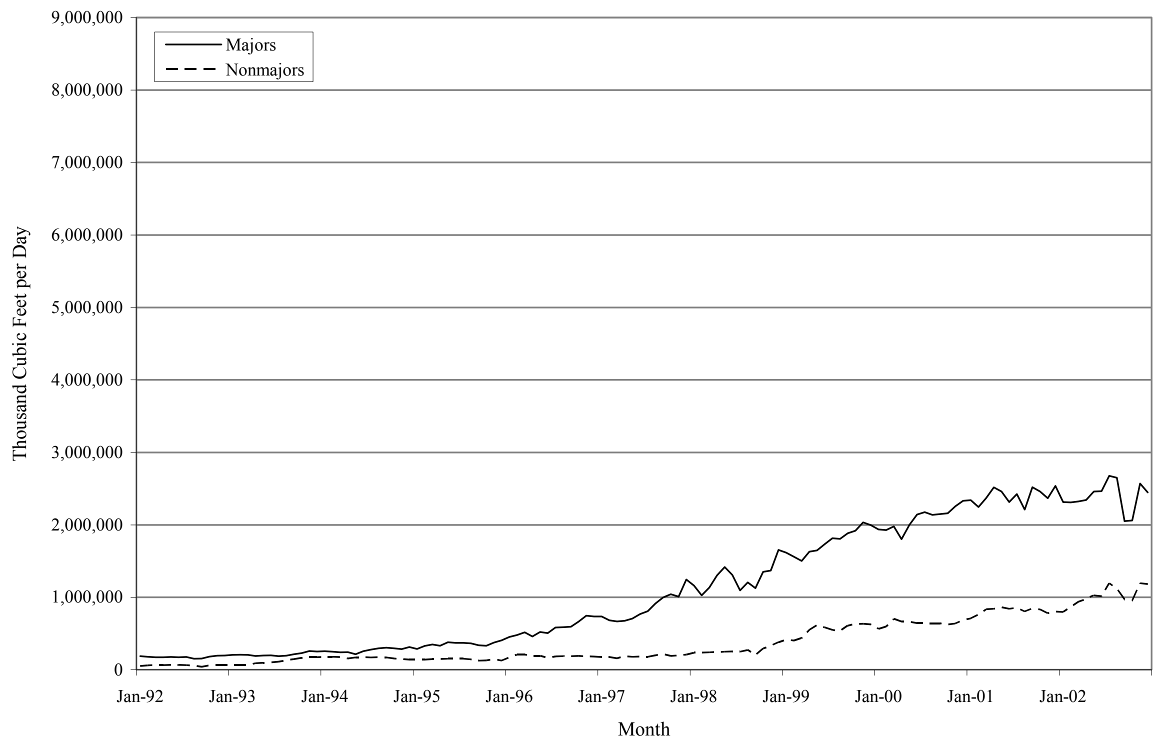

Figure 64b. Comparison of major and nonmajor companies in terms of deepwater gas production.

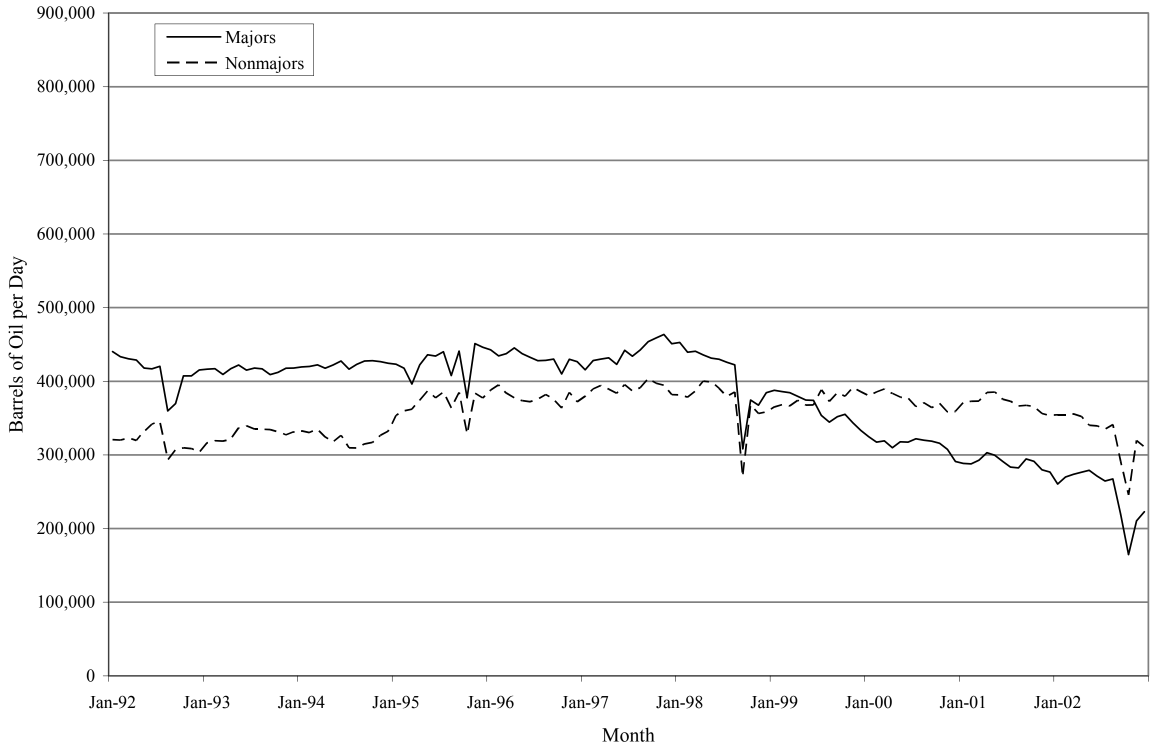

Figure 65a. Comparison of major and nonmajor companies in terms of shallow-water oil production.

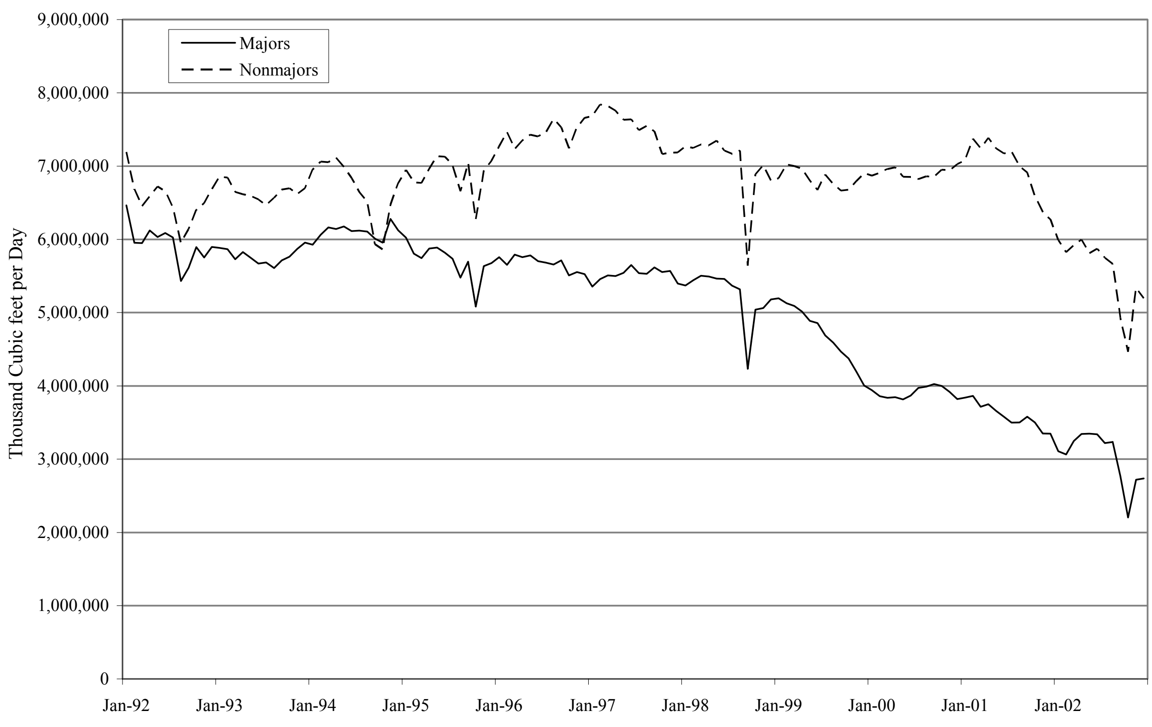

Figure 65b. Comparison of major and nonmajor companies in terms of shallow-water gas production.

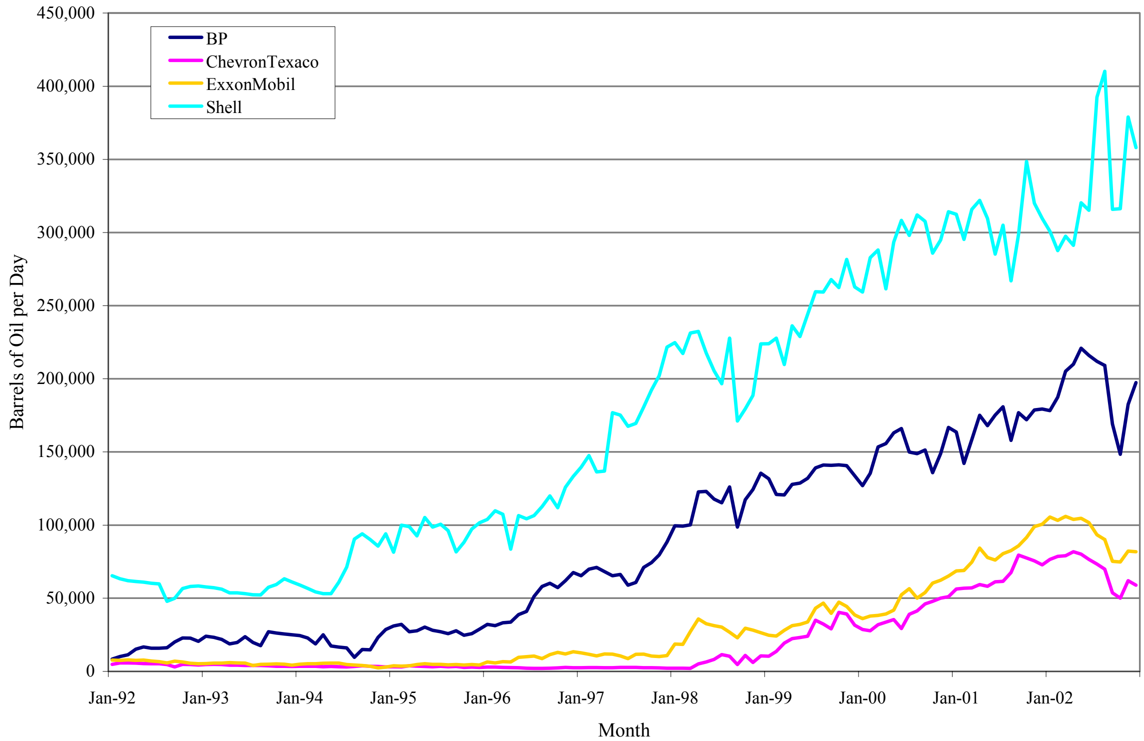

Figure 66a. Contributions from each major oil company toward total deepwater oil production.

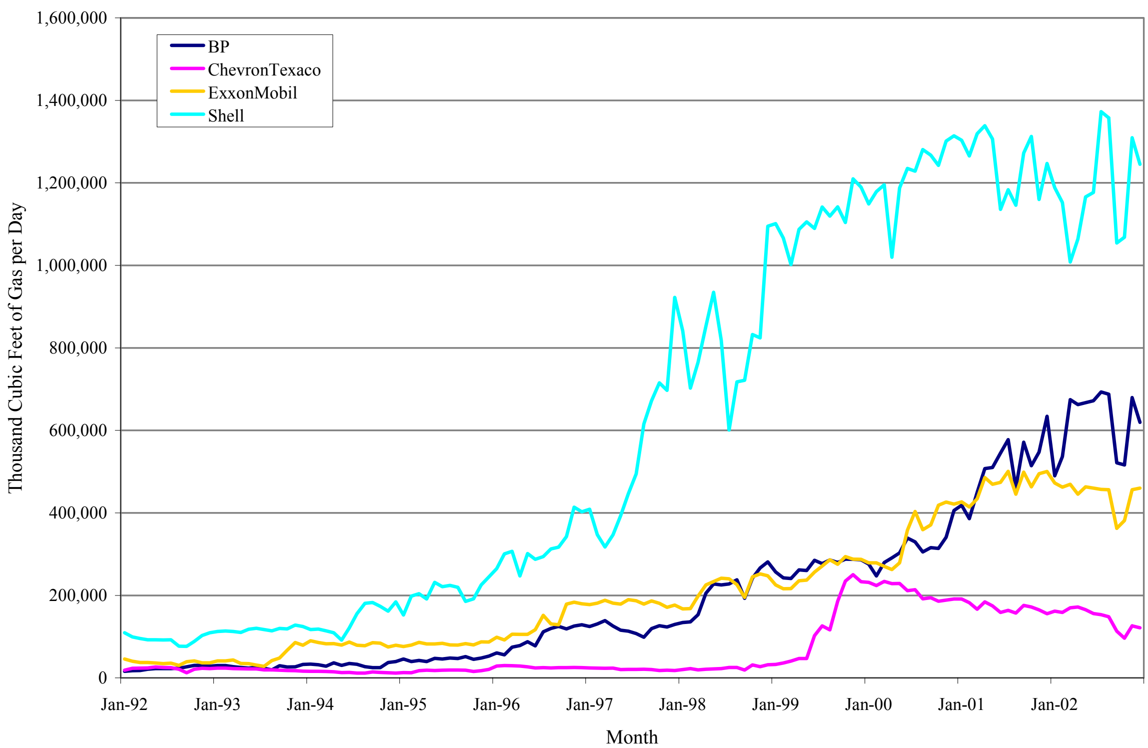

Figure 66b. Contributions from each major oil company toward total deepwater gas production.

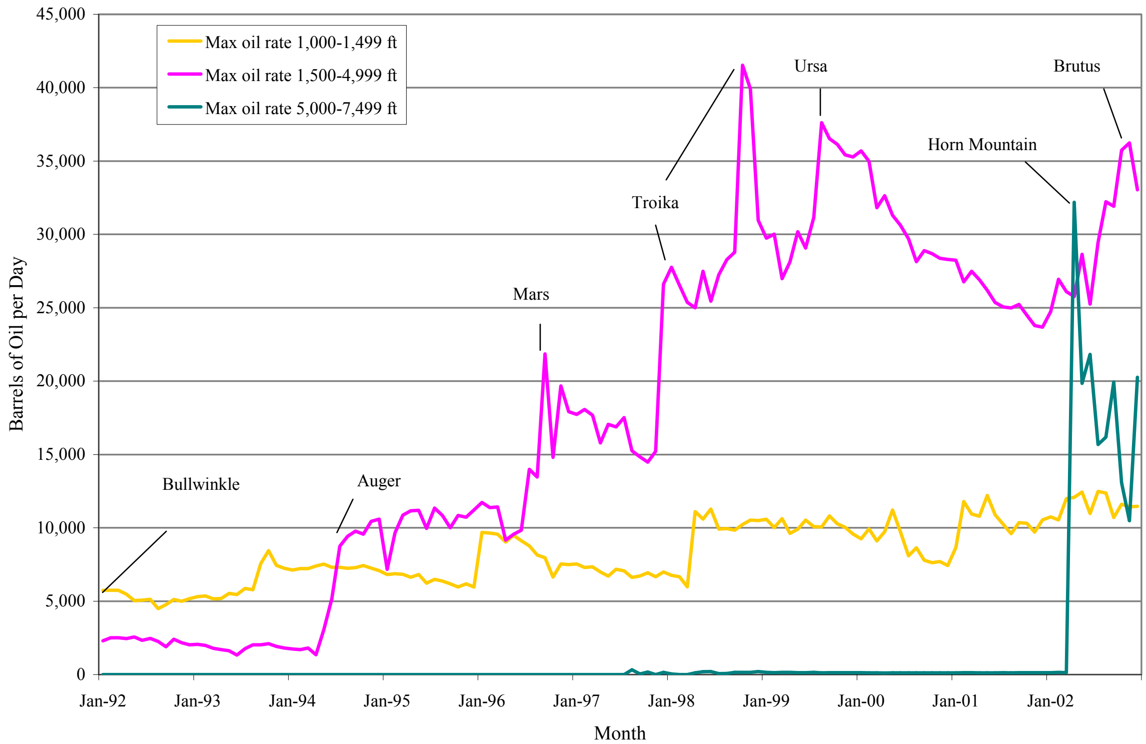

Figure 67a. Maximum production rates for a single well within each water-depth category for deepwater oil production.

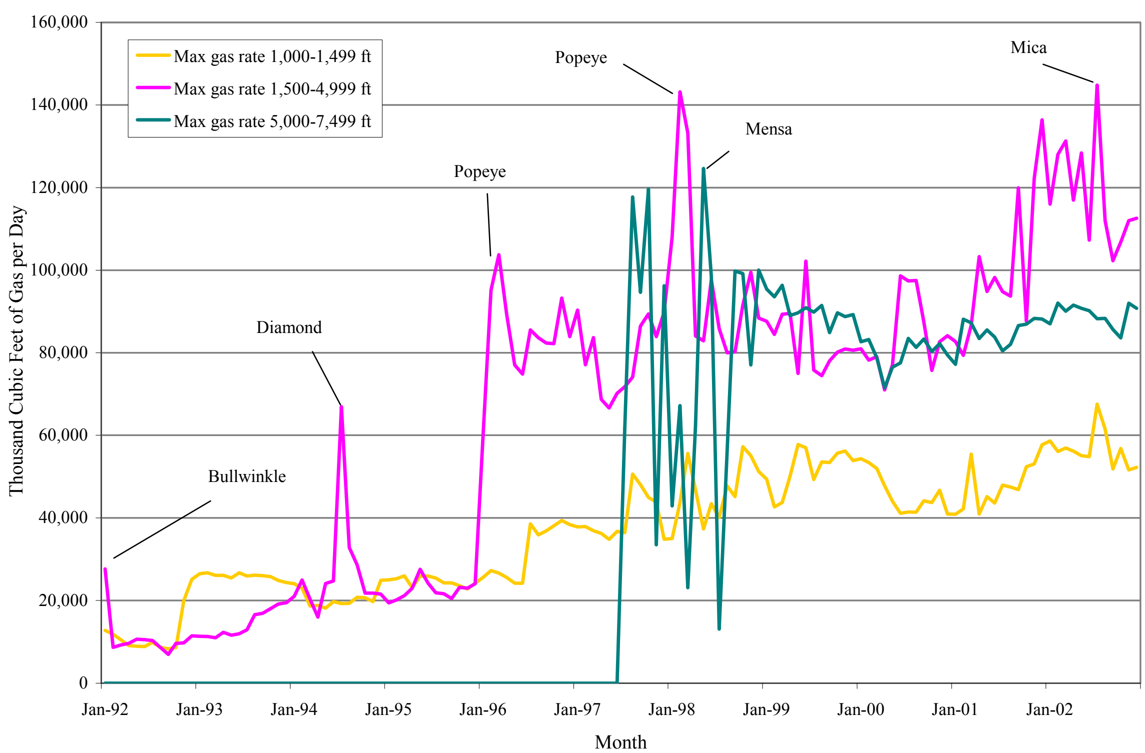

Figure 67b. Maximum production rates for a single well within each water-depth category for deepwater gas production.

Figure 68a shows that the average deepwater oil completion currently produces at 20 times the rate of the average shallow water (less than 1,000 ft [305 m]) oil completion. The average deepwater gas completion currently produces at 8 times the rate of the average shallow-water gas completion (figure 68b). Deepwater oil production rates increased rapidly from 1996 through 2000 and remained steady since that time. Deepwater gas production rates rose from 1996 to mid-1997 and then stabilized at the current high rates.

Two trends are readily apparent in figures 69a-b. First, average oil and gas production rates per well are increasing and, secondly, production rates are declining from their peaks more rapidly in recent years. These figures plot monthly average oil and gas production rates for all wells completed in a specific year. For example, in figure 69a, the 1992 line represents oil well production for oil wells completed in 1992 divided by the number of oil wells completed in that year. The 1992 line tracks production from these completions in successive years.

Figures 70a (oil) and 70b (gas) compare maximum historical production rates for each lease in the GOM, i.e., the well with the highest historical production rate is shown for each lease. These maps show that many deepwater fields produce at some of the highest rates encountered in the GOM. Figure 70a also shows that maximum oil rates were significantly higher off the southeast Louisiana coast than off the Texas coast. Figure 70b illustrates the high deepwater gas production rates relative to the rest of the GOM. Note also the excellent production rates from the Norphlet trend (off the Alabama coast) and the Corsair trend (off the Texas coast).

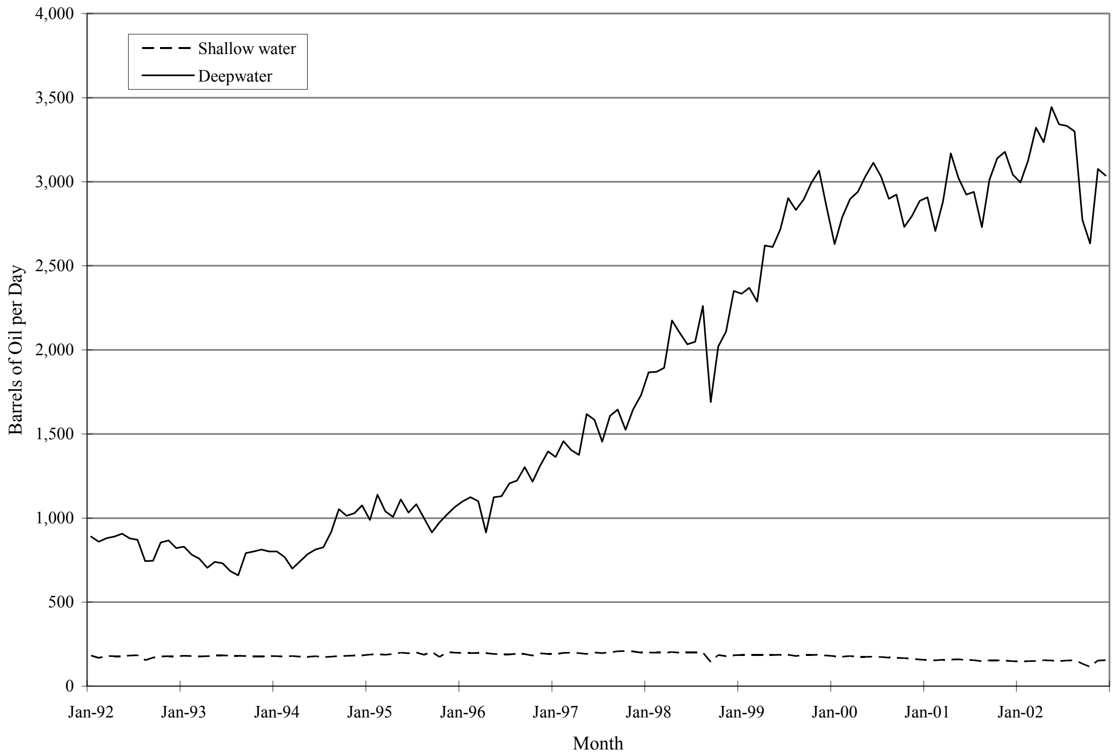

Figure 68a. Average production rates for shallow-water and deepwater oil well completions.

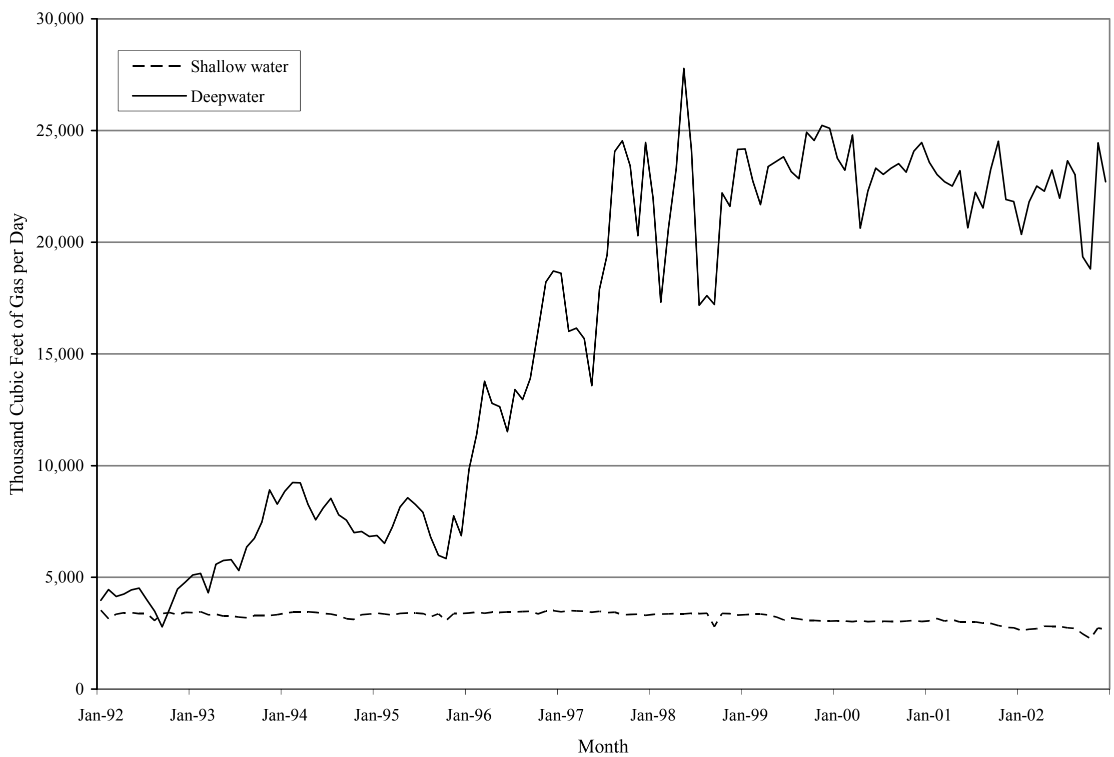

Figure 68b. Average production rates for shallow-water and deepwater gas well completions.

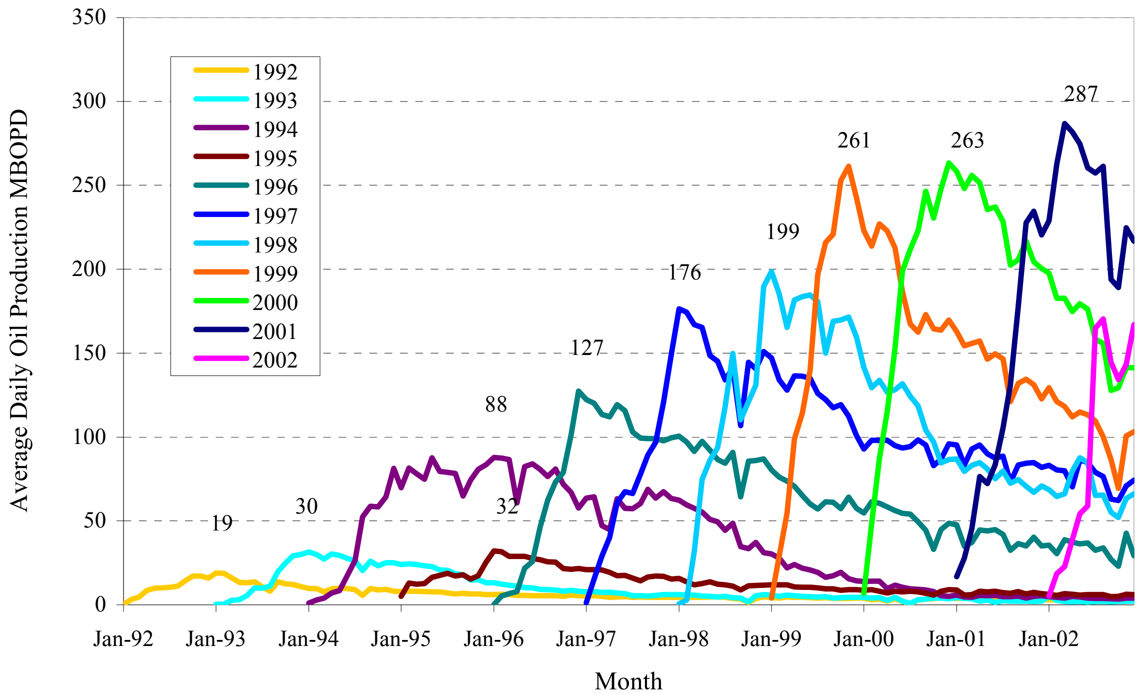

Figure 69a. Deepwater oil production profiles (oil wells coming onstream between 1992 and 2002).

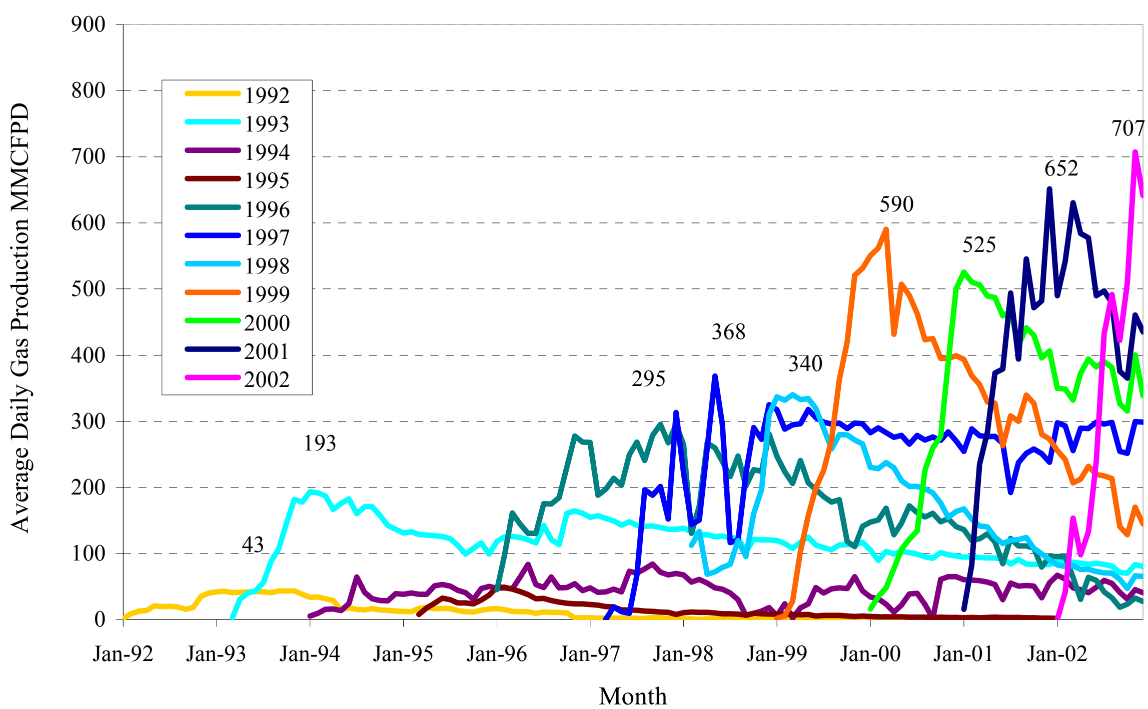

Figure 69b. Deepwater gas production profiles (gas wells coming onstream between 1992 and 2002).

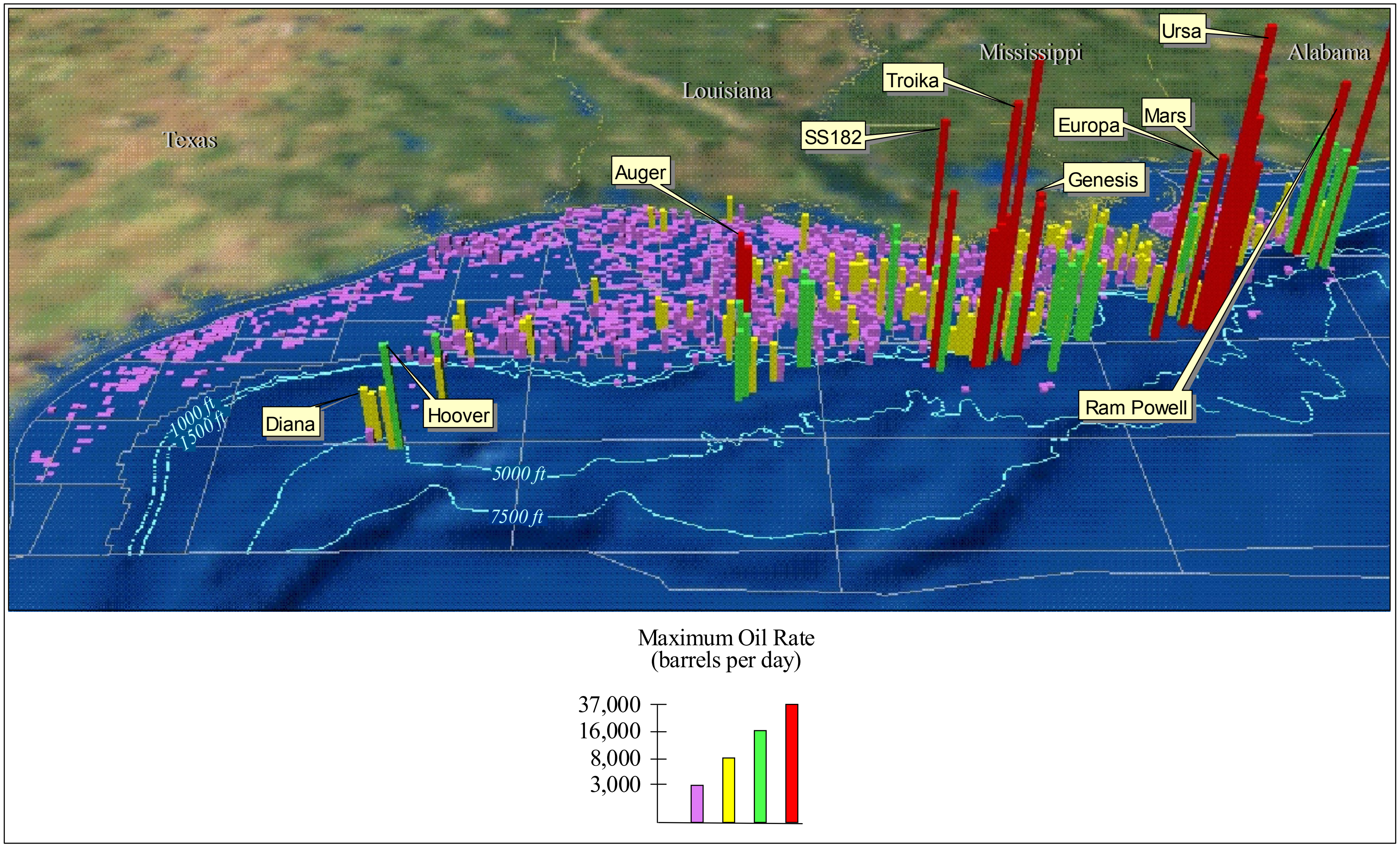

Figure 70a. Maximum historical oil production rates for Gulf of Mexico wells.

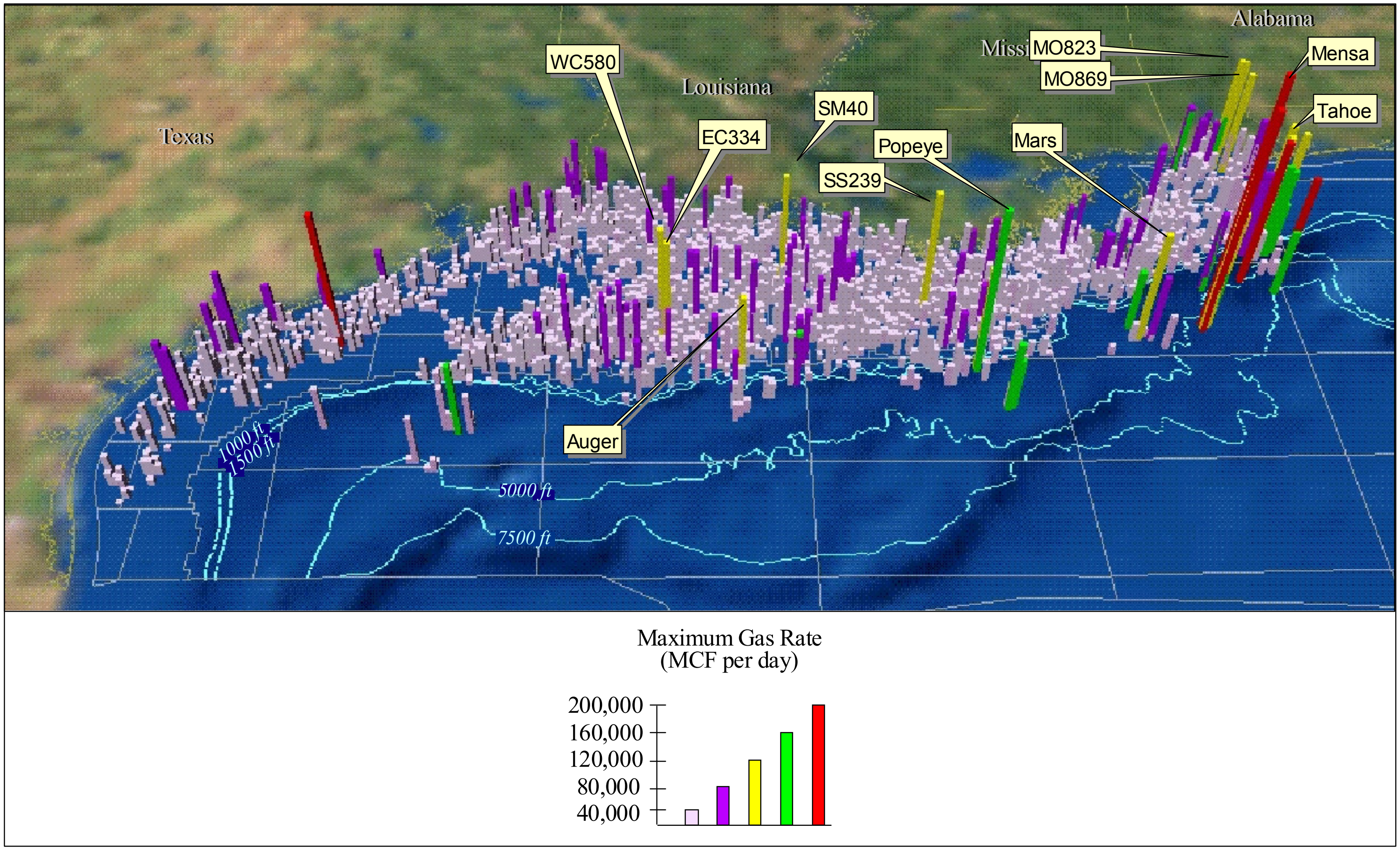

Figure 70b. Maximum historical gas production rates for Gulf of Mexico wells.

SUMMARY AND CONCLUSIONS

This report has discussed

- significant new discoveries that open large new geologic plays;
- technological innovations and new concepts (e.g., hydrate potential, impact of loop currents, and LNG terminals) that may have significant effects on the energy outlook of the GOM;
- sustained deepwater leasing activity and stabilized average bid amounts per block;
- deepwater leaseholdings of major oil and gas companies compared with nonmajor companies, showing the increased presence of nonmajor companies;
- future deepwater lease availability and anticipated lease expirations;
- declines in deepwater drilling;
- the progression of exploration activities, and the resulting discoveries, into the ultra-deep frontier;
- the extension of development activities and infrastructure, which include subsea wells, hubs, and pipelines reaching into ever deeper waters;
- the anticipated large deepwater reserve additions, especially when unproved reserves, known resources, and recent industry-announced discoveries are considered;
- the large increase in average deepwater field sizes when compared with same-year, shallow-water discoveries;
- predictions for future large deepwater field discoveries;
- the increasing contribution of deepwater oil and gas production toward total GOM production;
- the domination by major oil companies in deepwater production, led by Shell and BP; and
- the production rates of deepwater wells exceeding those of shallow-water wells by 800 to 2,000 percent.

The remainder of this report combines historical leasing, drilling, development, reserve, and production data, revealing overall trends in deepwater activity and expectations.

Figure 71 illustrates deepwater projects that began production in 2003 and those expected to commence production in the next 4 years. Twelve deepwater projects began production in 2003, another 13 are expected to begin in 2004, and many more are expected in the following years. In addition to the projects shown in figure 71, many more are likely to come online in the next few years, but are not shown because operators have not yet announced their plans.

DEVELOPMENT CYCLE

There was considerable lease activity in the late 1980's (figure 72). (Note that historic deepwater leasing shows no clear relation to average oil or gas prices.) Acreage at Auger (Garden Banks Block 426) was acquired in 1985 as part of this early activity. The first Auger well was drilled soon after in 1987. Even though Auger was leased and drilled early, first production did not begin until 1994, approximately 10 years after the initial lease acquisition. Acreage at Thunder Horse (Mississippi Canyon Block 778) was acquired in 1988; however, the discovery was not drilled until 1999, and production is not anticipated until 2005. This large gap highlights the considerable lag between leasing and first production. These lags are not unusual with complex deepwater developments. In contrast, other deepwater projects,

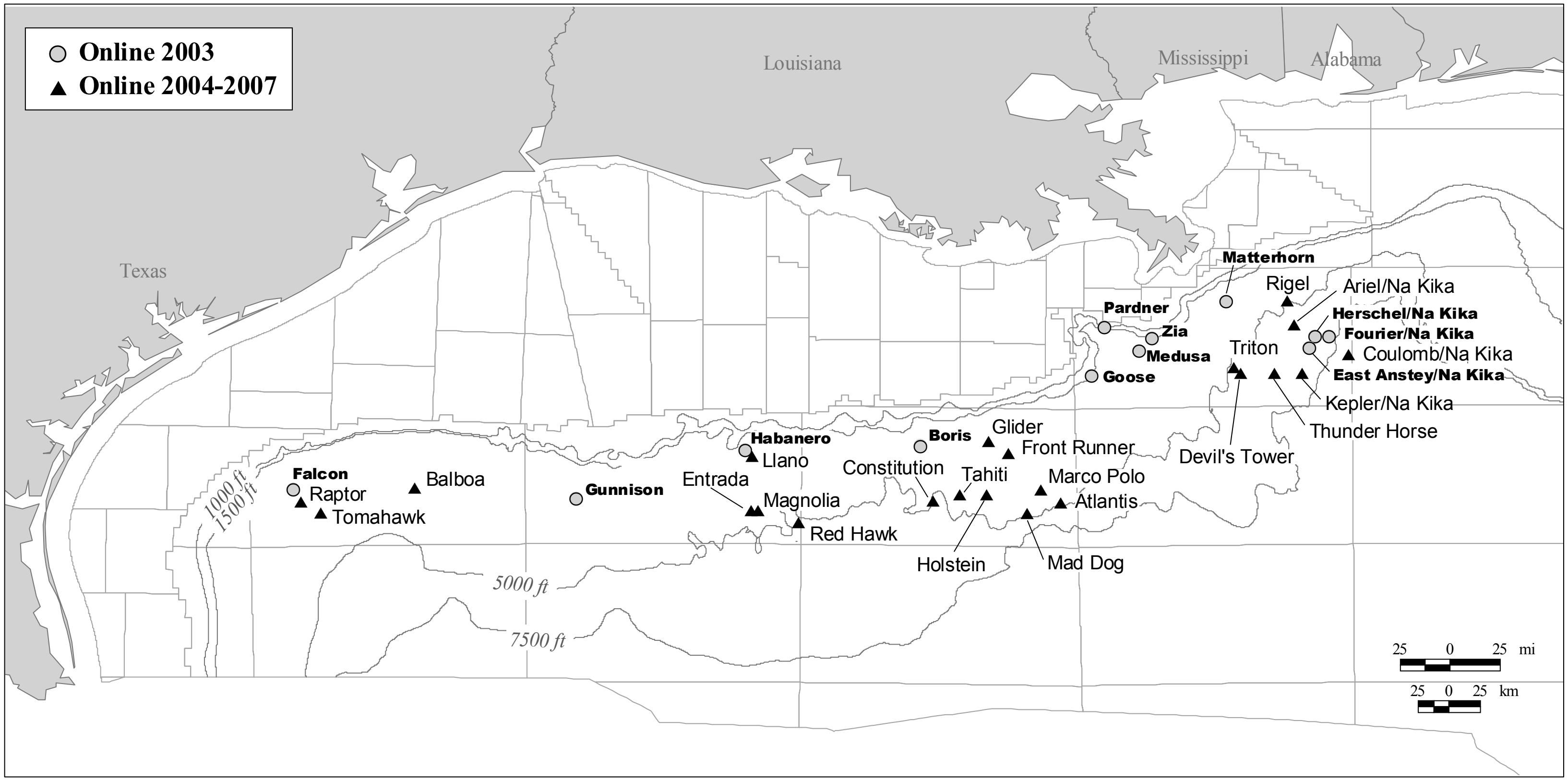

Figure 71. Deepwater projects that began production in 2003 and those expected to begin production by yearend 2007.

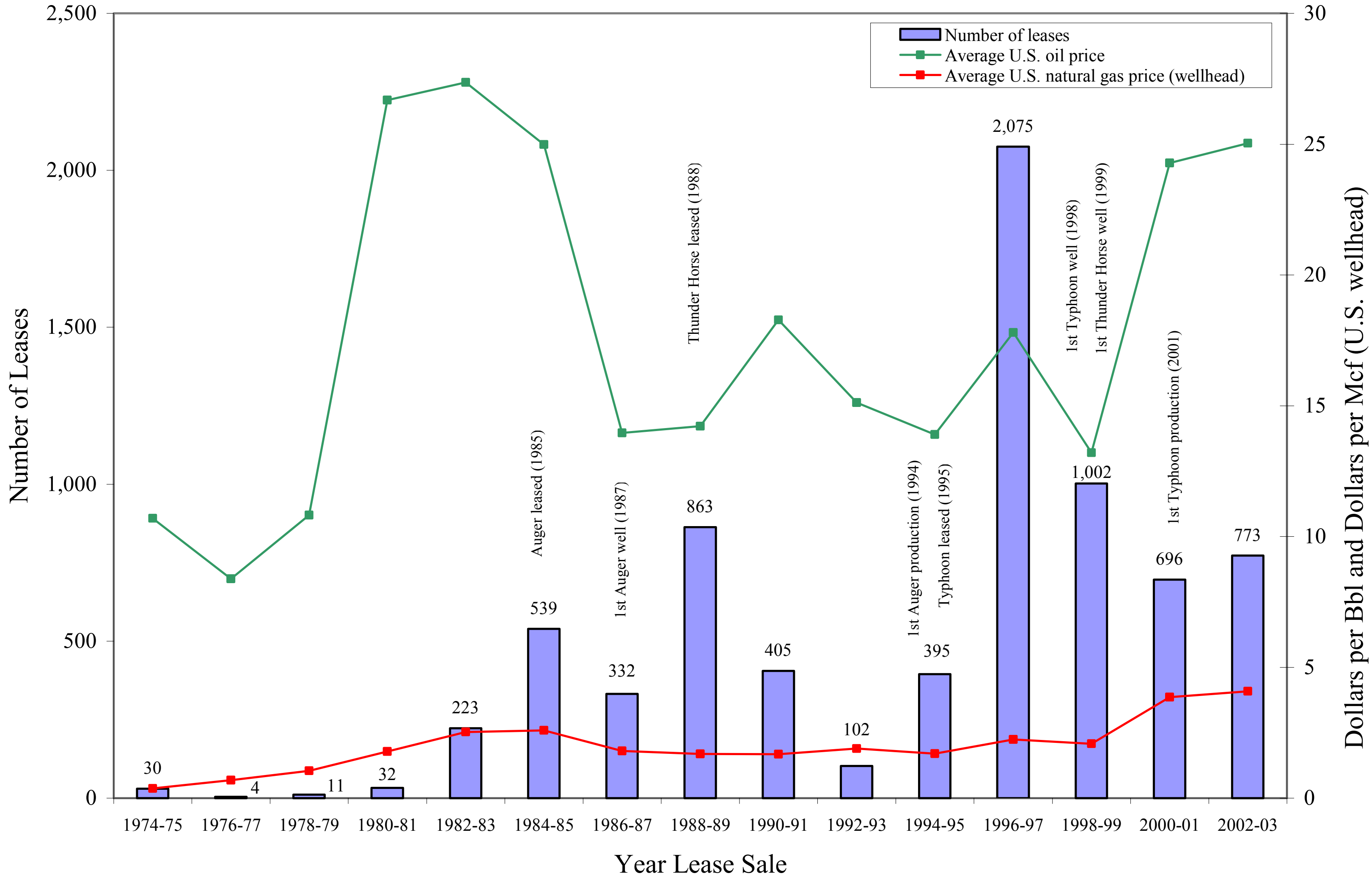

Figure 72. Deepwater lease activity and oil/natural gas prices (prices from U.S. Energy Information Administration: oil through September 2003 and natural gas through July 2003).

such as Typhoon (Green Canyon Block 237) and Constitution (Green Canyon Block 680), have achieved much shorter cycle times. ChevronTexaco acquired acreage at Typhoon in 1995, drilled the first well in 1998, and began producing the project in 2001. Similarly, acreage at Constitution was acquired in 2001, the first well was drilled that same year, and production is expected to begin in 2006. These shortened cycle times result from an accessible infrastructure and the use of proven development technologies.

Deepwater leasing activity accelerated in the late 1990's after Congress enacted the Deep Water Royalty Relief Act. The 3,000 leases that were issued during the record sales from 1996 to 1998 are nearing the end of their primary terms and, therefore, operators are facing key decisions about which leases to relinquish untested. Drilling activities are just beginning to prove the potential of these leases.

There is a significant time period from lease acquisition to first production; however, this interval has decreased from 10 to less than 7 years. Figures 73a-c demonstrate average lags associated with deepwater operations. These figures use data from only productive deepwater leases. Figure 73a shows the average number of years it took to drill a well from the time the lease was issued. Figure 73b shows the average length of time from lease issue to qualification[1] of the lease as productive. Figure 73c illustrates the lags between leasing, qualification, and first production.

There are two lags represented in figures 73a-c. First, there is a lag between a deepwater discovery and the operator's request for lease qualification. Operators sometimes announce discoveries to the public long before qualifying the lease as productive with MMS (and thereby being granted field status). The second lag depicted in figures 73a-c is the lag between leasing and subsequent operations (drilling, qualifying, and production). Note that, since deepwater leases are in effect for 8 or 10 years, the data are incomplete beyond 1993. The apparent decreasing lags for leases issued after 1993 are explained by the fact that the lease evaluation process has not yet been completed.

The data show an increase from 1976 to 1987 in the number of years before the first well is drilled (figure 73a). This is probably a reflection of two factors. First, the earliest deepwater leases purchased were of very high interest to the lessees and, therefore, were drilled quickly. Second, increasing lease inventories during the late 1980's meant that many leases could not be evaluated early in their lease terms (increased deepwater leasing in the mid- to late 1980's was probably related to the introduction of areawide leasing, the drop in minimum required bid from \$150/acre to \$25/acre, and the advent of 3-D seismic technology).

During the 1980's there was a gradual increase in the lag between drilling of the first well and qualifying the lease (figure 73b). During most of the 1980's, it took 10-11 years for the average field to come on production. It is important to note, however, that the time between drilling the first well and the beginning of production dropped significantly throughout the 1980's. That is, operators brought fields online in about 10 years, despite the fact that the first wells were not drilled, on average, until about the fourth year of the lease term by the late 1980's. The most recent complete data (many leases issued after 1993 are still in their primary terms) indicate that the time from lease to first production has decreased from over 10 to less than 7 years.

In summary, the latest complete data indicate a three-year average lag between leasing and initial drilling. There is an additional two-year average lag before the well is qualified, and a total of less than 7 years from lease issuance until production begins.

Another interesting trend is shown in figure 74. For any given lease-sale year, almost 50 percent of tested leases were first drilled within three years of lease acquisition, and 23 percent were drilled in year eight or later. Twenty-nine percent of the hydrocarbon volumes were discovered during the first three years of their lease terms, but 44 percent of the hydrocarbon volumes were discovered in year eight or later. The

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[1] An operator may request a "Determination of Well Producibility" from MMS. A successful MMS determination then "qualifies" the lease as producible. Not all qualified leases ultimately begin production.

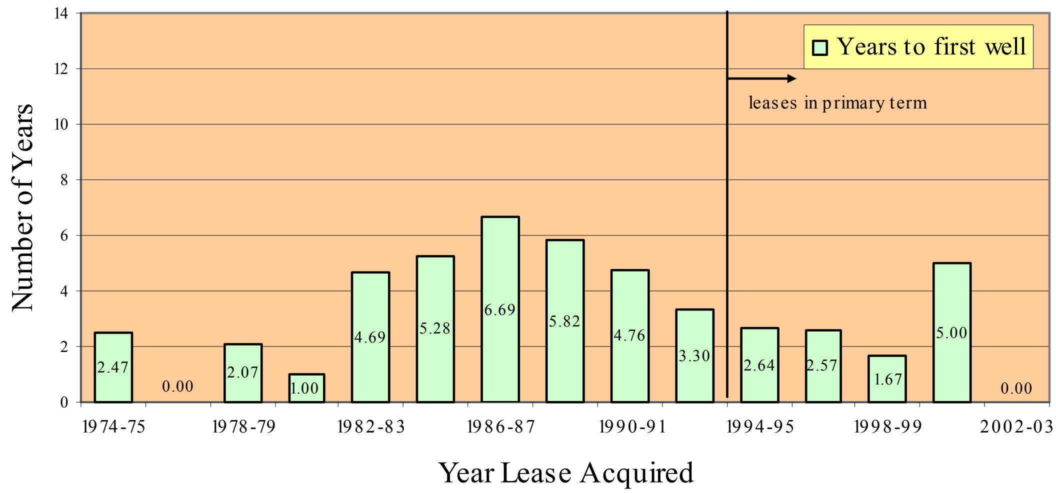


Figure 73a. Lag from leasing to first well for producing deepwater fields.

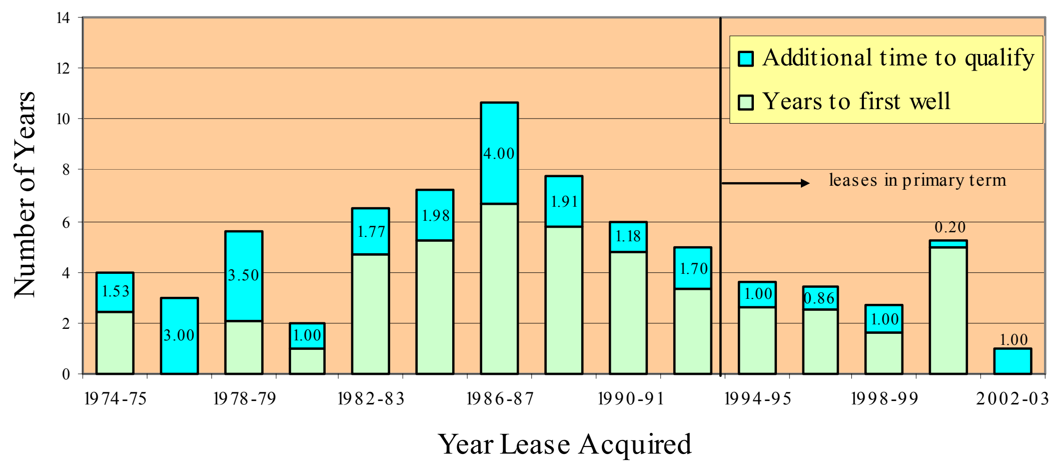


Figure 73b. Lag from leasing to qualifying for producing deepwater fields.

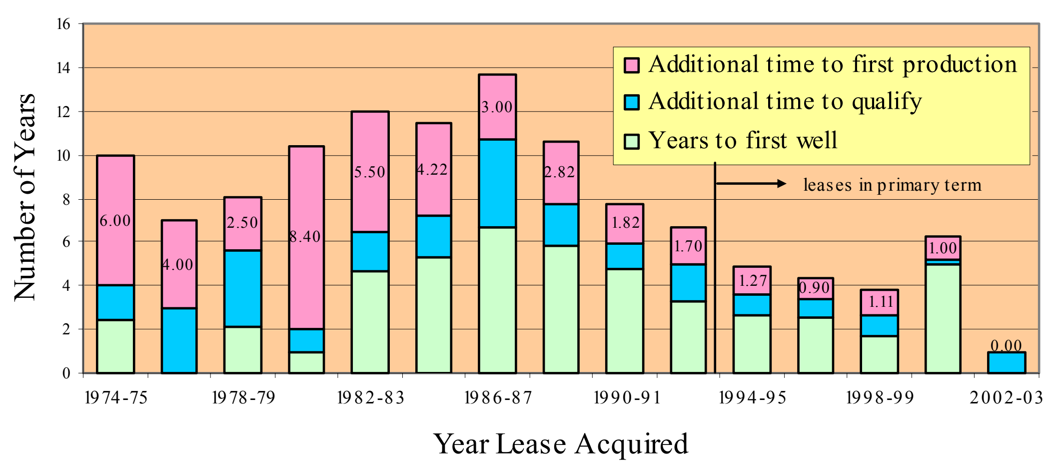
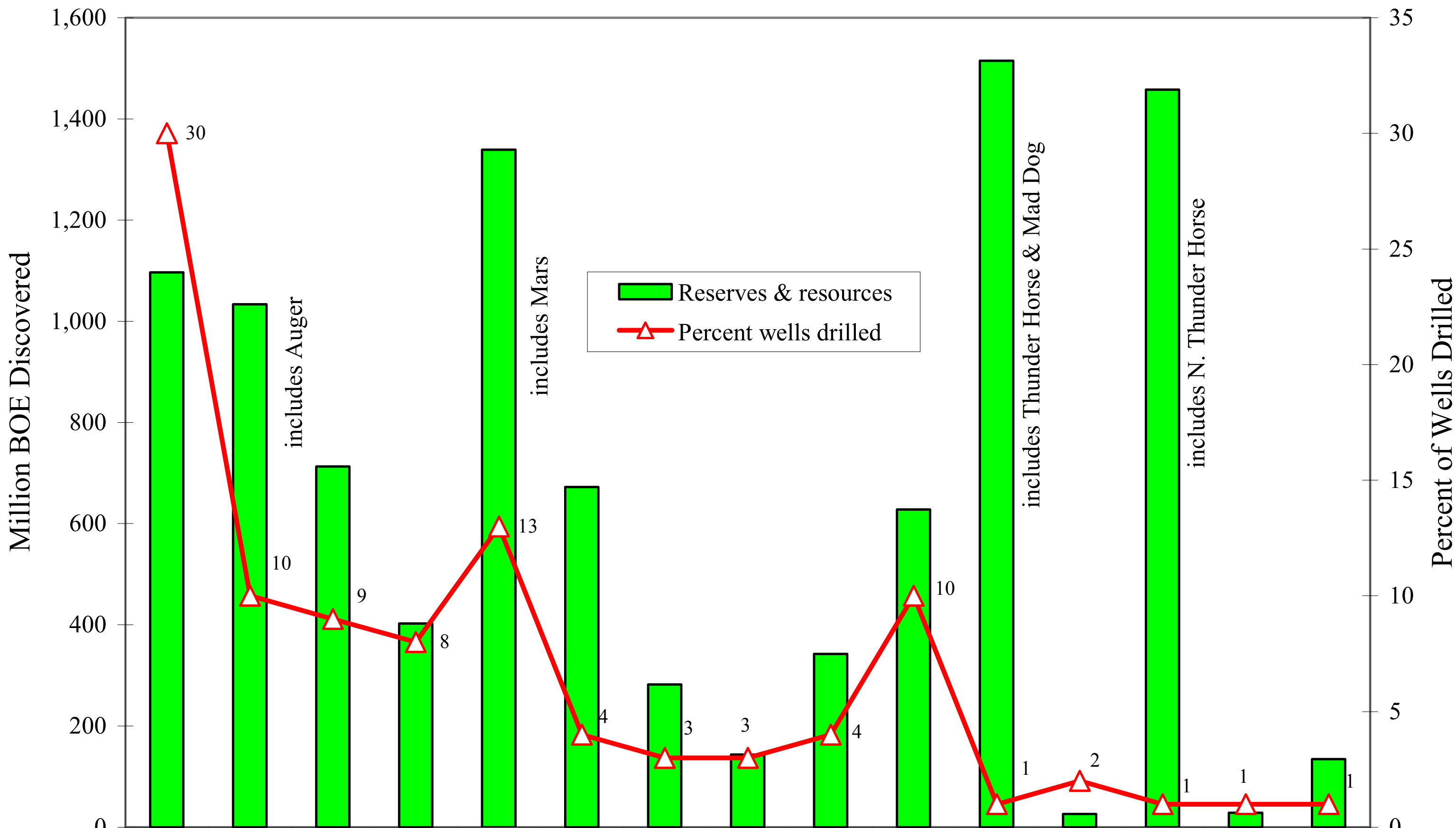


Figure 73c. Lag from leasing to first production for producing deepwater fields.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Reserves & resources	1096.431	1033.227	713.1991	402.4035	1339.217	672.2695	281.9353	143.1564	342.3876	627.8707	1515.078	25.83244	1457.957	28.19391	134.8227
Percent wells drilled	30	10	9	8	13	4	3	3	4	10	1	2	1	1	1

Year of Lease Term

Figure 74. Year in the lease term in which BOE was discovered and percent of leases were tested, for deepwater leases, 1974-1994.

data for this analysis include only deepwater leases acquired through 1994, since later leases are still within their primary terms.

As expected, the majority of wells are drilled in the first half of a lease's primary term, and the majority of hydrocarbons are also found during the same period. What is surprising is the amount of major discoveries found in the later years of some leases' terms. Certainly, the discoveries of Thunder Horse, North Thunder Horse, and Mad Dog, occurring late in their lease terms, have greatly impacted these volume totals. This demonstrates the difficulty in recognizing the best prospects at the beginning of a lease's term.

DRILLING THE LEASE INVENTORY

The combination of huge deepwater lease inventories and a limited rig fleet dedicated to the GOM means that the vast majority of today's leases will remain untested when their terms expire. Figure 75 shows historical lease activity trends. As mentioned previously, these data are complete only through 1993, since most deepwater leases beyond that time are still under their primary terms and still under evaluation. Similar to today's large lease inventory is the period from 1988 to 1989, during which large numbers of new leases were acquired. The percentage of leases drilled decreased as lease inventory swelled, because of a limited number of available rigs. During times of high lease inventory, fewer than 10 percent of deepwater leases were drilled and fewer than 5 percent were produced.

Figures 76a-b show that the reduction in drilling (figure 33) is not related to a lack of success in finding hydrocarbons. Exploratory drilling is arguably the most important indicator of exploration effort. Figures 76a-b use the number of newly drilled leases as the measure of this effort. The general relationship between exploration effort and amount of hydrocarbons discovered is shown in figure 76a. The amount discovered includes reserves, resources, and industry-announced discoveries (same data as figure 56). Notice that, in the last two years there has been a decline in the number of new leases tested and in the amount of hydrocarbons discovered. Much of the drop in the amount discovered is caused by the 24-month delay in industry's release of proprietary drilling results. Volumes in 2002 and 2003 are, therefore, significantly understated.

Figure 76b shows the average volume of hydrocarbons added for a tested lease. Although the scatter of data points is wide, the trend shows an increasing volume discovered per lease drilled. The figure shows that there is no decline in exploration rewards in the deepwater GOM. With the addition of complete discovery results for years 2002 and 2003, the trend will continue to increase.

Although the percentage of leases drilled decreased during the late 1980's, the actual number of leases issued and drilled generally increased, resulting in higher numbers of discoveries and producing leases. These relationships among leasing, drilling, and production of offshore deepwater blocks are shown in figures 77a-c. There is only a general correlation between the number of leases issued and those drilled and produced (figures 77a-b). In contrast, the number of deepwater leases drilled correlates strongly with the number of those leases that later produced (figure 77c).

Figure 78 illustrates the magnitude of the deepwater lease inventory and industry's ability to evaluate this large number of leases. The annual historic lease data from 1984 through 2003 are in the solid colored lines and depict the number of primary term leases, number of leases tested, and the number of leases expiring untested. The large increase in lease inventory from 1996 through 2000 is very evident and propagates through to 2010. Future values for primary term leases, lease expirations, and leases drilled are in the dotted lines. These values assume that, after the year 2004, all leases will expire unless drilled and that 60 untested deepwater leases will be drilled each year.

A historic review of GOM exploration activity indicates that, on average, about 10 percent of the deepwater leases acquired in the large sales are drilled. Of the approximately 3,200 deepwater leases issued from 1996 through 2000, however, only 6.5 percent have been drilled to date. There are over 2,400 leases from these sales still in their primary lease term, with more than 750 of these leases in water depths of greater than 7,000 ft (2,134 m). Only 34 wells have been drilled on the ultra-deepwater leases

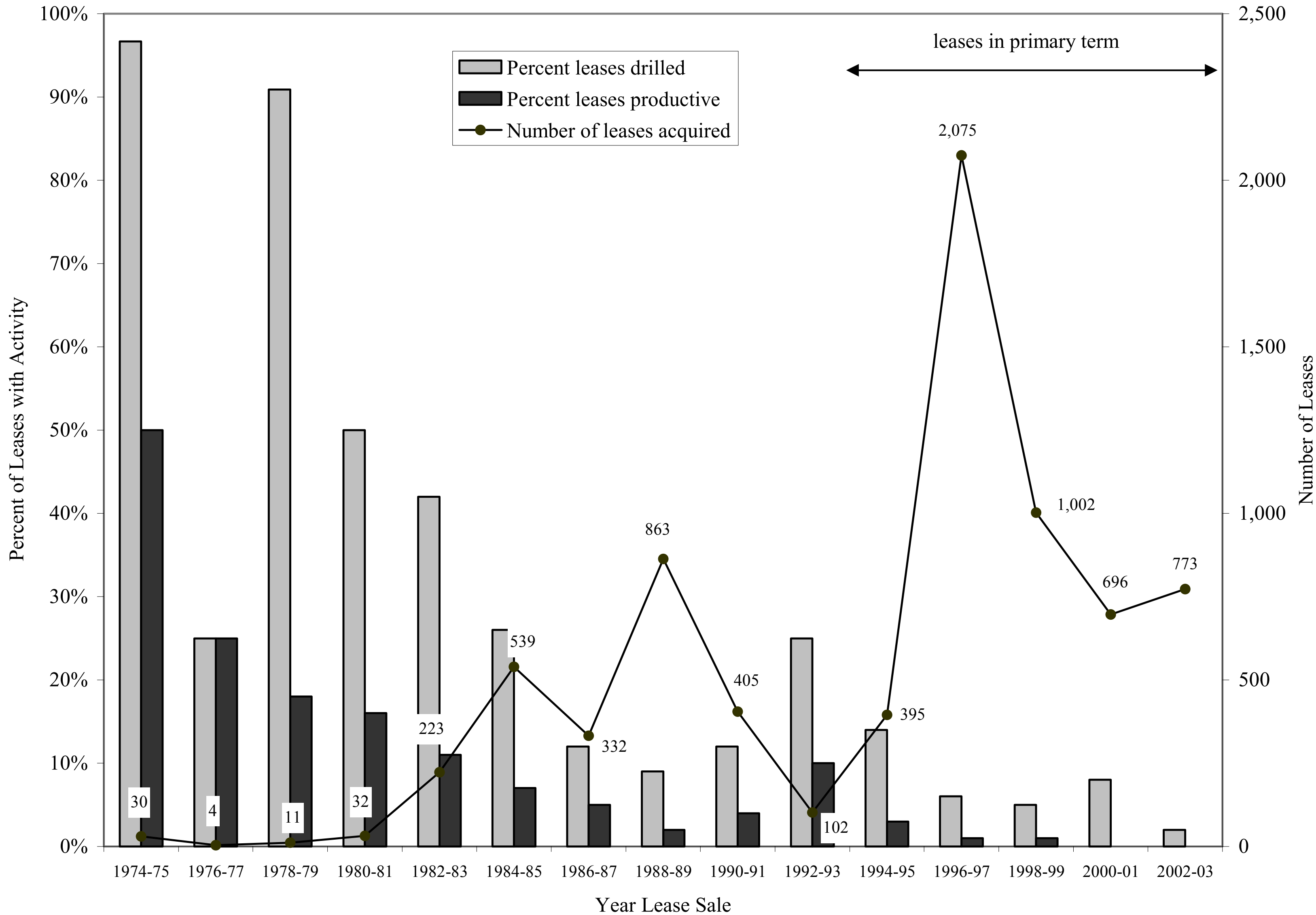


Figure 75. Activity on deepwater leases.

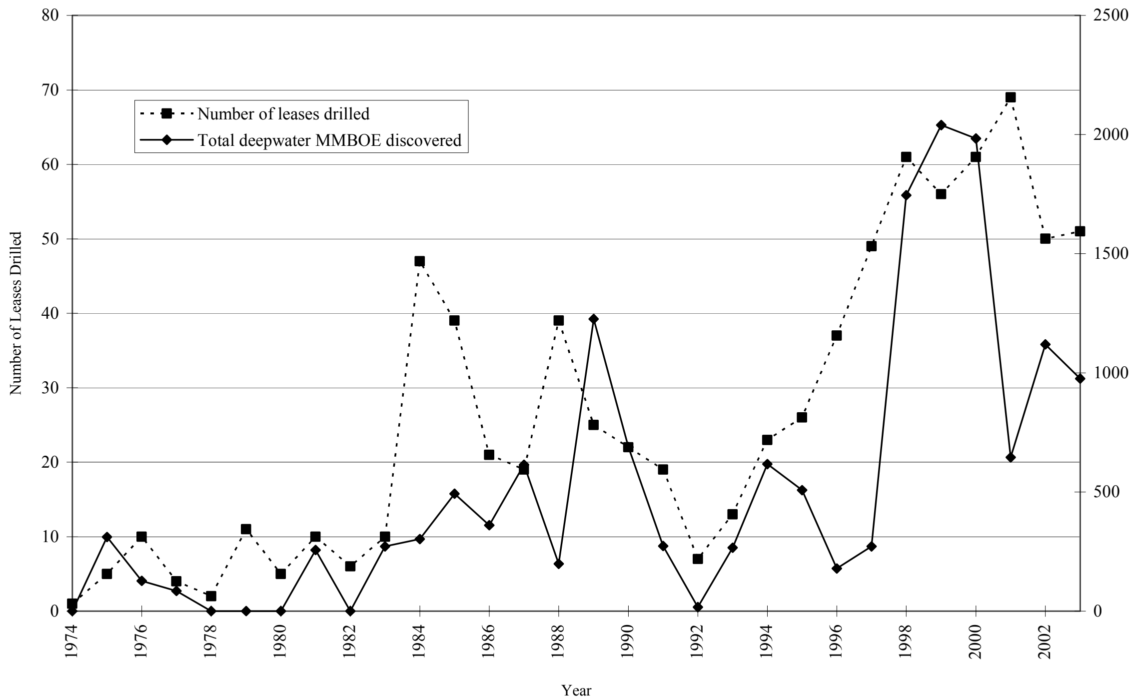


Figure 76a. Leases drilled and barrels found.

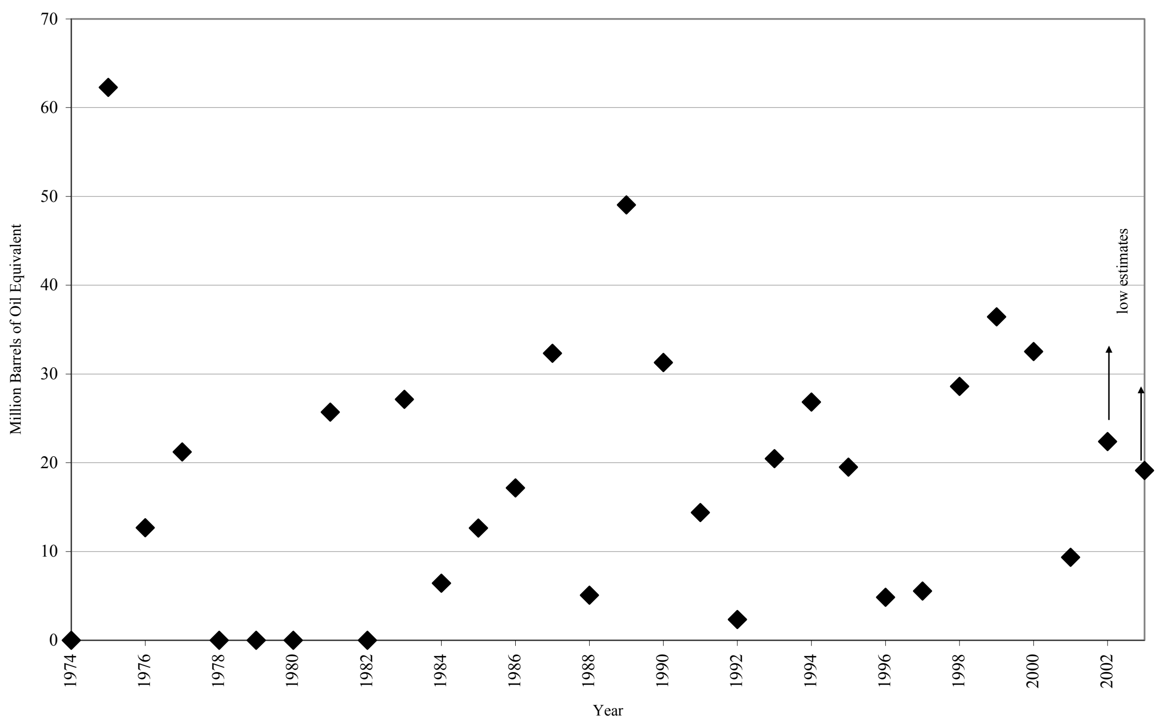


Figure 76b. Exploration effort and reward: number of leases drilled in a year and BOE discovered per lease.

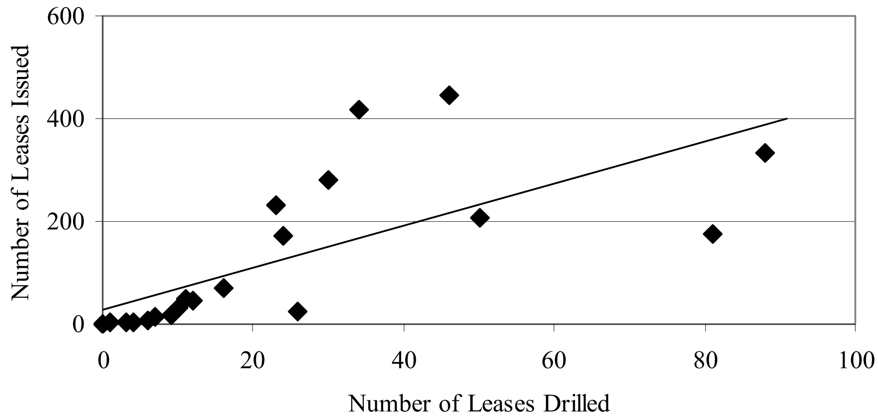


Figure 77a. Relationship between number of leases issued and number of leases drilled, 1974-1993.

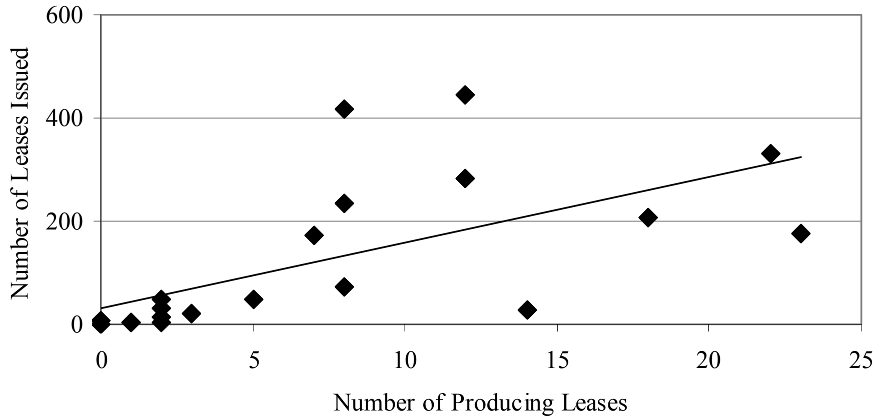


Figure 77b. Relationship between number of leases issued and number of resulting producing leases, 1974-1993.

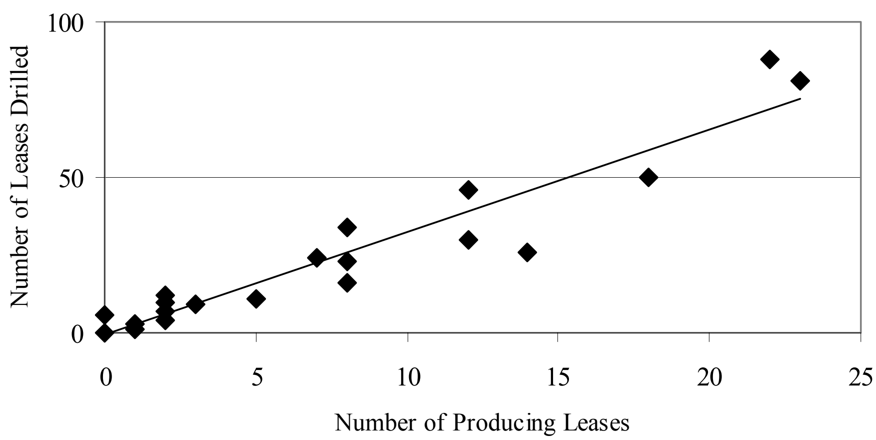


Figure 77c. Relationship between number of leases drilled and number of resulting producing leases, 1974-1993.

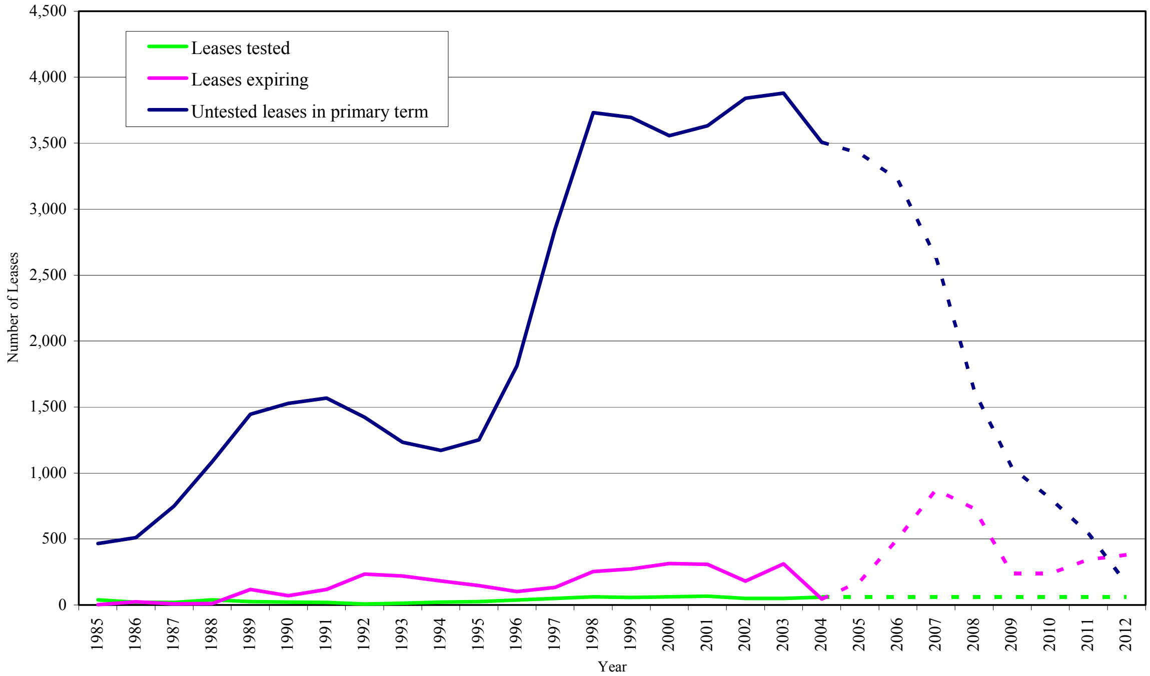


Figure 78. The challenge of deepwater lease evaluation.

from these sales, 11 of these wells resulted in announced discoveries. Figure 78 shows a steep decline in active leases as the large number of leases acquired in 1996 through 1998 start to expire. Note that this graph does not include the hundreds of new leases that will be added to the inventory each year from upcoming lease sales. The available deepwater rig fleet will challenge industry's ability to evaluate their lease inventory, both current and future additions. Other factors play a significant role in the industry's ability to evaluate their GOM lease inventory, including alternative deepwater exploration and development targets throughout the world, capital limitations, and limited qualified personnel.

EXPANDING FRONTIER

It is instructive to look back to the earlier deepwater reports (figure 79) and observe the dramatic increases in proved reserves and discovered volumes (which include proved and unproved reserves, resources, and industry-announced discoveries). Many of the discovered volumes in earlier reports have progressed to become proved reserves in subsequent reports. For example, in the last report, Thunder Horse was in the discovered-volumes category, and in this report its volumes are classified as proved reserves. While both proved reserves and discovered volumes have substantially increased from report to report, the most dramatic increases have occurred in the discovered volumes. This suggests a bright outlook for future deepwater production, as the less constrained resource and industry-announced volumes move into the reserve category and are produced.

The future of deepwater GOM exploration and production remains very promising. As shown in figure 78, industry is nearing the end of the primary lease term of the exceptional number of leases acquired in 1996 through 1998. Traditional deepwater minibasin plays are far from mature, as several recent discoveries attest, and new deepwater plays near and even beyond the Sigsbee Escarpment, beneath thick salt canopies, and in lightly explored Paleogene reservoirs show that the deepwater GOM is an expanding frontier. As shown in figure 57, the immature deepwater creaming curve predicts that numerous large undiscovered fields remain. The 2000 Assessment indicates that more than 50 billion recoverable BOE remain to be discovered (Lore et al., 2001).

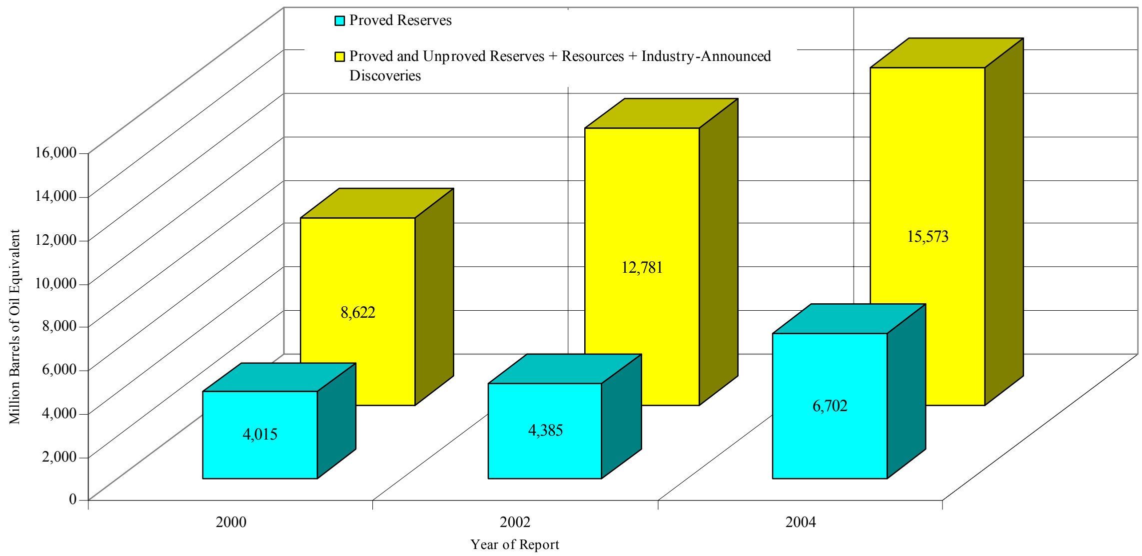


Figure 79. Comparison of 2000, 2002, and 2004 deepwater GOM reports: successive increases in deepwater BOE.

The deepwater arena has made great strides in the last few years, establishing itself as an expanding frontier. The previous edition of this report (Baud et al., 2002) documented the advancements made in deepwater exploration and development since 1974. Several notable changes have occurred in the deepwater GOM since the last report.

- The deepwater frontier is now in water depths greater than 7,000 ft (2,134 m).
- The first exploratory well was drilled in over 10,000-ft (3,048-m) water depth.
- The first deepwater well was drilled below 30,000-ft (9,144-m) depth (true vertical depth).
- Eleven discoveries were found in over 7,000-ft (2,134-m) water depths.
- The deepest production increased from approximately 5,300-ft (1,615-m) water depth (Mensa) to over 7,000-ft (2,134-m) water depth (Camden Hills).
- The first deepwater discoveries in the Eastern GOM were found.
- There were significant new discoveries in both Walker Ridge and Alaminos Canyon in older, lightly tested Paleogene reservoirs.
- Industry has made great technological achievements (e.g., polyester mooring, composite riser, cell spars, and 15,000-psi subsea trees).
- Loop currents have been recognized as posing significant design challenges for deepwater structures, rigs, and pipelines.
- The average number of operating rigs is down 29 percent and the number of wells drilled is down 37 percent.
- Average bid amounts per block have stabilized or decreased slightly.
- There was a 51 percent increase in the number of producing deepwater projects.

- Nonmajor companies have made more deepwater discoveries and hold more deepwater acreage than the major companies.
- Deepwater production rose more than 100 MBOPD and 400 MMCFPD each year since 1997.
- Subsea gas production has increased 90 percent since December 2000.

Since the start of 2000, new deepwater drilling added over 4.5 billion BOE, a 40 percent increase over the total deepwater BOE discovered from 1974 to 1999.

The deepwater GOM continues to increase in its importance to the Nation's energy supply. The large number of active deepwater leases, the drilling of important new discoveries, the growing deepwater infrastructure, and the increasing deepwater production are all indicators of the expanding frontier. This ensures that the deepwater GOM will remain as one of the world's premier oil and gas basins.

CONTRIBUTING PERSONNEL

This report includes contributions from the following individuals.

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Debbie Miller
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Terry Rankin
Mike Smith
Warren Williamson

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APPENDICES

Appendix A. Announced Deepwater Discoveries (Sorted by Project Name).

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Aconcagua	MC 305	7,100	MC 305	2/21/1999	2002	
Alabaster	MC 485	1,438	MC 397	8/27/1982	1992	
Allegheny	GC 254	3,294	GC 254	1/01/1985	1999	
Amberjack	MC 109	1,100	MC 109	11/13/1983	1991	
Angus	GC 112	2,045	GC 112	6/08/1997	1999	
Ariel/Na Kika	MC 429	6,240	MC 429	11/20/1995		
Arnold	EW 963	1,800	EW 963	6/12/1996	1998	
Aspen	GC 243	3,065	GC 243	1/27/2001	2002	
Atlantis	GC 699	6,133	GC 699	5/12/1998		
Atlas	LL 50	8,934				
Auger	GB 426	2,860	GB 426	5/01/1987	1994	
Baha	AC 600	7,620	AC 600	5/23/1996		
Balboa	EB 597	3,352	EB 597	7/2/2001		
Baldpate	GB 260	1,648	GB 260	11/01/1991	1998	
Bison	GC 166	2,381	GC 166	3/01/1986		
Black Widow	EW 966	1,850	EW 921	5/01/1986	2000	
Blind Faith	MC 696	6,989				
Boomvang	EB 643	3,650	EB 643	12/13/1997	2002	
Boris	GC 282	2,378	GC 282	9/29/2001	2003	
Brutus	GC 158	3,300	GC 158	3/01/1989	2001	
Bullwinkle	GC 65	1,353	GC 065	10/01/1983	1989	
Camden Hills	MC 348	7,216	MC 348	8/4/1999	2002	
Cascade	WR 206	8,143				
Champlain	AT 63	4,457	AT 063	2/11/2000		
Chinook	WR 469	8,831				
Cognac	MC 195	1,023	MC 194	7/01/1975	1979	
Conger	GB 215	1,500	GB 260	11/01/1991	2000	
Constitution	GC 680	5,071				
Cooper	GB 388	2,600	GB 388	3/16/1989	1995	1999
Coulomb/Na Kika	MC 657	7,591	MC 657	11/01/1987		
Crosby	MC 899	4,400	MC 899	1/04/1998	2001	
Cyclops	AT 8	3,135	AT 008	4/26/1997		
Dawson	GB 669	3,152	GB 668	5/22/2000		

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Devil's Tower	MC 773	5,610	MC 773	12/13/1999		
Diamond	MC 445	2,095	MC 445	12/05/1992	1993	1999
Diana	EB 945	4,500	EB 945	8/01/1990	2000	
Diana South	AC 65	4,852	AC 065	3/24/1997		
Dionysis	VK 864	1,508	VK 864	10/01/1981		
Dulcimer	GB 367	1,120	GB 367	2/09/1998	1999	
Durango	GB 667	3,105	GB 668	5/22/2000		
East Anstey/ Na Kika	MC 607	6,590	MC 607	11/12/1997	2003	
EB 377	EB 377	2,450	EB 377	10/01/1985		
Einset	VK 872	3,500	VK 873	3/01/1988	2001	
El Toro	GC 69	1,465	GC 069	9/13/1984		
Entrada	GB 782	4,690				
Europa	MC 935	3870	MC 935	4/22/1994	2000	
EW 1006	EW 1006	1,884	EW 1006	1/26/1988	1999	
EW 878	EW 878	1,585	EW 878	7/03/2000	2001	
Falcon	EB 579	3,638	EB 579	9/29/2002	2003	
Fourier/Na Kika	MC 522	6,950	MC 522	7/01/1989	2003	
Front Runner	GC 339	3,330	GC 339	6/08/2001		
Fuji	GC 506	4,262	GC 506	1/30/1995		
GB 208	GB 208	1,275	GB 208	9/01/1991		
GB 244	GB 244	2,130	GB 244	8/15/2001		
GB 302	GB 302	2,411	GB 302	2/01/1991		
GB 379	GB 379	2,076	GB 379	7/01/1985		
GC 147	GC 147	1,275	GC 147	5/01/1988		
GC 162	GC 162	2,616	GC 162	7/01/1989		
GC 21	GC 21	1,296	GC 021	10/01/1984		
GC 228	GC 228	1,950	GC 228	7/01/1985		
GC 27	GC 27	1,593	GC 027	7/01/1989		
GC 29	GC 29	1,554	GC 029	1/01/1984	1988	1990
GC 31	GC 31	2,243	GC 075	5/01/1985	1988	1989
GC 39	GC 39	2,068	GC 039	4/01/1984		
GC 463	GC 463	4,032	GC 463	12/01/1998		
GC 70	GC 70	1,618	GC 070	6/01/1984		
Gemini	MC 292	3,393	MC 292	9/07/1995	1999	
Genesis	GC 205	2,590	GC 205	9/01/1988	1999	
Glider	GC 248	3,440				
Gomez	MC 755	3,098	MC 755	3/19/1986		

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Goose	MC 751	1,624	MC 751	12/15/2002	2003	
Grand Canyon	GC 141	1,720				
Great White	AC 857	8,717				
Gretchen	GC 114	2,685	GC 114	12/18/1999		
Gunnison	GB 668	3,100	GB 668	5/22/2000	2003	
Habanero	GB 341	2,015	GB 387	10/03/1994	2003	
Hawkes	MC 509	4,174	MC 509	11/20/2001		
Herschel/Na Kika	MC 520	6,739	MC 522	7/01/1989	2003	
Holstein	GC 644	4,344	GC 644	2/11/1999		
Hoover	AC 25	4,825	AC 025	1/30/1997	2000	
Horn Mountain	MC 127	5,400	MC 084	1/01/1993	2002	
Hornet	GC 379	2,076	GC 379	12/14/2001		
Ida/Fastball	VK 1003	4,942				
Jolliet	GC 184	1,760	GC 184	7/01/1981	1989	
Jubilee	AT 349	8,825				
K2	GC 562	4,006	GC 562	8/14/1999		
Kepler/Na Kika	MC 383	5,759				
King (MC-BP)	MC 84	5,000	MC 084	1/01/1993	2002	
King (MC-Shell)	MC 764	3,250	MC 807	4/01/1989	2000	
King Kong	GC 472	3,980	GC 472	2/01/1989	2002	
King's Peak	DC 133	6,845	DC 133	3/01/1993	2002	
Ladybug	GB 409	1,355	GB 409	5/13/1997	2001	
Lena	MC 280	1,000	MC 281	5/01/1976	1984	
Leo	MC 546	2,505	MC 546	2/01/1986		
Llano	GB 386	2,663	GB 387	10/03/1994		
Lorien	GC 199	2,315				
Lost Ark	EB 421	2,960	EB 421	1/31/2001	2002	
Macaroni	GB 602	3,600	GB 602	1/21/1996	1999	
Mad Dog	GC 782	4,428	GC 826	11/24/1998		
Madison	AC 24	4,856	AC 024	6/25/1998	2002	
Magnolia	GB 783	4,674	GB 783	5/03/1999		
Manatee	GC 155	1,939	GC 110	8/07/1987	2002	
Marathon	GC 153	1,618	GC 153	4/01/1984		
Marco Polo	GC 608	4,320	GC 608	4/21/2000		
Marlin	VK 915	3,236	VK 915	6/01/1993	2000	
Mars	MC 807	2,933	MC 807	4/01/1989	1996	
Marshall	EB 949	4,376	EB 949	7/30/1998	2001	
Matterhorn	MC 243	2,850	MC 243	9/01/1990	2003	

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
MC 113	MC 113	1,986	MC 113	1/01/1976		
MC 285	MC 285	3,161	MC 285	9/01/1987		
MC 29	MC 29	2,266	MC 029	3/04/1998		
MC 455	MC 455	1,400	MC 455	2/01/1986		
MC 68	MC 68	1,360	MC 068	12/09/1975	2001	
MC 709	MC 709	2,599	MC 709	2/01/1987		
MC 837	MC 837	1,524	EW 878	7/03/2000		
MC 929	MC 929	2,250	MC 929	11/01/1987		
McKinley	GC 416	4,019	GC 416	7/14/1998		
Medusa	MC 582	2,223	MC 582	10/10/1998	2003	
Medusa North	MC 538	2,223	MC 582	10/10/1998		
Mensa	MC 731	5,318	MC 731	12/01/1986	1997	
Merganser	AT 37	8,015	AT 037	11/28/2001		
Mica	MC 211	4,580	MC 211	5/01/1990	2001	
Mighty Joe Young	GC 737	4,415				
Mirage	MC 941	3,927	MC 899	1/04/1998		
Moccasin	GB 254	1,920	GB 254	7/23/1993		
Morgus	MC 942	3,960	MC 899	1/04/1998		
Morpeth	EW 921	1,696	EW 921	5/01/1986	1998	
Mosquito Hawk	GB 269	1,102	GB 269	3/06/1996		
Nansen	EB 602	3,675	EB 602	9/25/1999	2002	
Navajo	EB 690	4,210	EB 602	9/25/1999	2002	
Navarro	GC 37	2,019				
Neptune (AT-BHP)	AT 575	6,220	AT 575	9/26/1995		
Neptune (VK-Kerr McGee)	VK 826	1,930	VK 825	11/01/1987	1997	
Ness	GC 507	3,947	GC 507	12/27/2001		
Nile	VK 914	3,535	VK 914	4/30/1997	2001	
Nirvana	MC 162	3,724	MC 162	11/30/1994		
Northwestern	GB 200	1,736	GB 200	5/14/1998	2000	
Oregano	GB 559	3,400	GB 559	3/27/1999	2001	
Oyster	EW 917	1,195	EW 873	12/01/1985	1998	
Pardner	MC 401	1,139	WD 152	10/01/1968	2003	
Penn State	GB 216	1,450	GB 260	11/01/1991	1999	
Petronius	VK 786	1,753	VK 786	7/14/1995	2000	
PI 525	PI 525	3,430	PI 525	4/30/1996		
Pilsner	EB 205	1,108	EB 205	5/02/2001	2001	

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Pluto	MC 674	2,828	MC 718	10/20/1995	1999	
Pompano	VK 990	1,290	VK 990	5/01/1981	1994	
Popeye	GC 116	2,000	GC 116	2/01/1985	1996	
Poseiden (GC)	GC 691	4,489	GC 691	2/27/1996		
Poseiden (MC)	MC 772	5,567	MC 728	6/30/2002		
Prince	EW 1003	1,500	EW 958	7/20/1994	2001	
Princess	MC 765	3,600	MC 807	4/01/1989	2002	
Prosperity	VK 742	1,004	VK 742	8/08/1997		
Ptolemy	GB 412	1,322	GB 412	7/01/1984		
Puma	GC 823	4,129				
Ram-Powell	VK 956	3,216	VK 956	5/01/1985	1997	
Raptor	EB 668	3,710	EB 668	9/13/2003		
Red Hawk	GB 877	5,334	GB 877	10/18/2001		
Rigel	MC 252	5,225	MC 252	11/29/1999		
Rockefeller	EB 992	4,872	EB 992	11/28/1995		
Rocky	GC 110	1,785	GC 110	8/07/1987	1996	
San Patricio	AT 153	4,785	AT 153	8/09/2001		
Sangria	GC 177	1,487	GC 177	8/22/1999	2002	
Serrano	GB 516	3,153	GB 516	7/23/1996	2001	
Shasta	GC 136	1,048	GC 136	7/01/1981	1995	
Shenzi	GC 653	4,238				
Spiderman	DC 621	8,087				
St. Malo	WR 678	7,036				
Sturgis	AT 183	3,710				
Supertramp	MC 26	1,272	MC 026	5/27/1994		
SW Horseshoe	EB 430	2,285	EB 430	5/03/2000		
Tahiti	GC 640	4,292				
Tahoe	VK 783	1,500	VK 783	12/01/1984	1994	
Thunder Horse	MC 778	6,050	MC 778	4/01/1999		
Thunder Horse North	MC 776	5,660				
Timberwolf	MC 555	4,749	MC 555	10/30/2001		
Tomahawk	EB 759	4,114	EB 759	1/28/2003		
Trident	AC 903	9,743				
Triton	MC 728	5,373	MC 728	6/30/2002		
Troika	GC 244	2,721	GC 244	5/30/1994	1997	
Tubular Bells	MC 725	4,334				
Tulane	GB 158	1,054	GB 200	5/14/1998	2002	

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Typhoon	GC 237	2,679	GC 236	10/01/1984	2001	
Ursa	MC 809	3,800	MC 807	4/01/1989	1999	
Virgo	VK 823	1,130	VK 823	1/01/1993	1999	
VK 862	VK 862	1,043	VK 862	10/01/1976	1995	
VK 917	VK 917	4,370	VK 917	12/08/2001		
VK 962	VK 962	4,677	VK 962	11/15/2001		
Vortex	AT 261	8,344				
Yosemite	GC 516	4,150	GC 472	2/01/1989	2002	
Zia	MC 496	1,804	MC 582	10/10/1998	2003	
Zinc	MC 354	1,478	MC 354	8/01/1977	1993	

[1] Water depths shown reflect depth at facility. If project is subsea or undeveloped, water depth reflects depth of deepest well location in project.

[2] The absence of a field discovery date indicates an industry-announced discovery without a qualified well on the lease. These discoveries have not necessarily been confirmed by the MMS and they are not yet classified as fields by the MMS.

Appendix B. Announced Deepwater Discoveries (Sorted by Discovery Date).

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Pardner	MC 401	1,139	WD 152	10/01/1968	2003	
Cognac	MC 194	1,023	MC 194	7/01/1975	1979	
MC 68	MC 68	1,360	MC 068	12/09/1975	2001	
MC 113	MC 113	1,986	MC 113	1/01/1976		
Lena	MC 280	1,000	MC 281	5/01/1976	1984	
VK 862	VK 862	1,043	VK 862	10/01/1976	1995	
Zinc	MC 354	1,478	MC 354	8/01/1977	1993	
Pompano	VK 990	1,290	VK 990	5/01/1981	1994	
Jolliet	GC 184	1,760	GC 184	7/01/1981	1989	
Shasta	GC 136	1,048	GC 136	7/01/1981	1995	
Dionysis	VK 864	1,508	VK 864	10/01/1981		
Alabaster	MC 485	1,438	MC 397	8/27/1982	1992	
Bullwinkle	GC 65	1,353	GC 065	10/01/1983	1989	
Amberjack	MC 109	1,100	MC 109	11/13/1983	1991	
GC 29	GC 29	1,554	GC 029	1/01/1984	1988	1990
GC 39	GC 39	2,068	GC 039	4/01/1984		
Marathon	GC 153	1,618	GC 153	4/01/1984		
GC 70	GC 70	1,618	GC 070	6/01/1984		
Ptolemy	GB 412	1,322	GB 412	7/01/1984		
El Toro	GC 69	1,465	GC 069	9/13/1984		
GC 21	GC 21	1,296	GC 021	10/01/1984		
Typhoon	GC 237	2,679	GC 236	10/01/1984	2001	
Tahoe	VK 783	1,500	VK 783	12/01/1984	1994	
Allegheny	GC 254	3,294	GC 254	1/01/1985	1999	
Popeye	GC 116	2,000	GC 116	2/01/1985	1996	
GC 31	GC 31	2,243	GC 075	5/01/1985	1988	1989
Ram-Powell	VK 956	3,216	VK 956	5/01/1985	1997	
GB 379	GB 379	2,076	GB 379	7/01/1985		
GC 228	GC 228	1,950	GC 228	7/01/1985		
EB 377	EB 377	2,450	EB 377	10/01/1985		
Oyster	EW 917	1,195	EW 873	12/01/1985	1998	
Leo	MC 546	2,505	MC 546	2/01/1986		
MC 455	MC 455	1,400	MC 455	2/01/1986		
Bison	GC 166	2,381	GC 166	3/01/1986		
Gomez	MC 755	3,098	MC 755	3/19/1986		
Black Widow	EW 966	1,850	EW 921	5/01/1986	2000	

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Morpeth	EW 921	1,696	EW 921	5/01/1986	1998	
Mensa	MC 731	5,318	MC 731	12/01/1986	1997	
MC 709	MC 709	2,599	MC 709	2/01/1987		
Auger	GB 426	2,860	GB 426	5/01/1987	1994	
Manatee	GC 155	1,939	GC 110	8/07/1987	2002	
Rocky	GC 110	1,785	GC 110	8/07/1987	1996	
MC 285	MC 285	3,161	MC 285	9/01/1987		
Coulomb/Na Kika	MC 657	7,591	MC 657	11/01/1987		
MC 929	MC 929	2,250	MC 929	11/01/1987		
Neptune (VK-Kerr McGee)	VK 826	1,930	VK, 825	11/01/1987	1997	
EW 1006	EW 1006	1,884	EW 1006	1/26/1988	1999	
Einset	VK 872	3,500	VK 873	3/01/1988	2001	
GC 147	GC 147	1,275	GC 147	5/01/1988		
Genesis	GC 205	2,590	GC 205	9/01/1988	1999	
King Kong	GC 472	3,980	GC 472	2/01/1989	2002	
Yosemite	GC 516	4,150	GC 472	2/01/1989	2002	
Brutus	GC 158	3,300	GC 158	3/01/1989	2001	
Cooper	GB 388	2,600	GB 388	3/16/1989	1995	1999
King (MC-Shell)	MC 764	3,250	MC 807	4/01/1989	2000	
Mars	MC 807	2,933	MC 807	4/01/1989	1996	
Princess	MC 765	3,600	MC 807	4/01/1989	2002	
Ursa	MC 809	3,800	MC 807	4/01/1989	1999	
Fourier/Na Kika	MC 522	6,950	MC 522	7/01/1989	2003	
GC 162	GC 162	2,616	GC 162	7/01/1989		
GC 27	GC 27	1,593	GC 027	7/01/1989		
Herschel/Na Kika	MC 520	6,739	MC 522	7/01/1989	2003	
Mica	MC 211	4,580	MC 211	5/01/1990	2001	
Diana	EB 945	4,500	EB 945	8/01/1990	2000	
Matterhorn	MC 243	2,850	MC 243	9/01/1990	2003	
GB 302	GB 302	2,411	GB 302	2/01/1991		
GB 208	GB 208	1,275	GB 208	9/01/1991		
Baldpate	GB 260	1,648	GB 260	11/01/1991	1998	
Conger	GB 215	1,500	GB 260	11/01/1991	2000	
Penn State	GB 216	1,450	GB 260	11/01/1991	1999	
Diamond	MC 445	2,095	MC 445	12/05/1992	1993	1999
Horn Mountain	MC 127	5,400	MC 084	1/01/1993	2002	
King (MC-BP)	MC 84	5,000	MC 084	1/01/1993	2002	

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Virgo	VK 823	1,130	VK 823	1/01/1993	1999	
King's Peak	DC 133	6,845	DC 133	3/01/1993	2002	
Marlin	VK 915	3,236	VK 915	6/01/1993	2000	
Moccasin	GB 254	1,920	GB 254	7/23/1993		
Europa	MC 935	3,870	MC 935	4/22/1994	2000	
Supertramp	MC 26	1,272	MC 026	5/27/1994		
Troika	GC 244	2,721	GC 244	5/30/1994	1997	
Prince	EW 1003	1,500	EW 958	7/20/1994	2001	
Habanero	GB 341	2,015	GB 387	10/03/1994	2003	
Llano	GB 386	2,663	GB 387	10/03/1994		
Nirvana	MC 162	3,724	MC 162	11/30/1994		
Fuji	GC 506	4,262	GC 506	1/30/1995		
Petronius	VK 786	1,753	VK 786	7/14/1995	2000	
Gemini	MC 292	3,393	MC 292	9/07/1995	1999	
Neptune (AT-BHP)	AT 575	6,220	AT 575	9/26/1995		
Pluto	MC 674	2,828	MC 718	10/20/1995	1999	
Ariel/Na Kika	MC 429	6,240	MC 429	11/20/1995		
Rockefeller	EB 992	4,872	EB 992	11/28/1995		
Macaroni	GB 602	3,600	GB 602	1/21/1996	1999	
Poseiden (GC)	GC 691	4,489	GC 691	2/27/1996		
Mosquito Hawk	GB 269	1,102	GB 269	3/06/1996		
PI 525	PI 525	3,430	PI 525	4/30/1996		
Baha	AC 600	7,620	AC 600	5/23/1996		
Arnold	EW 963	1,800	EW 963	6/12/1996	1998	
Serrano	GB 516	3,153	GB 516	7/23/1996	2001	
Hoover	AC 25	4,825	AC 025	1/30/1997	2000	
Diana South	AC 65	4,852	AC 065	3/24/1997		
Cyclops	AT 8	3,135	AT 008	4/26/1997		
Nile	VK 914	3,535	VK 914	4/30/1997	2001	
Ladybug	GB 409	1,355	GB 409	5/13/1997	2001	
Angus	GC 112	2,045	GC 112	6/08/1997	1999	
Prosperity	VK 742	1,004	VK 742	8/08/1997		
East Anstey/ Na Kika	MC 607	6,590	MC 607	11/12/1997	2003	
Boomvang	EB 643	3,650	EB 643	12/13/1997	2002	
Crosby	MC 899	4,400	MC 899	1/04/1998	2001	
Mirage	MC 941	3,927	MC 899	1/04/1998		

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Morgus	MC 942	3,960	MC 899	1/04/1998		
Dulcimer	GB 367	1,120	GB 367	2/09/1998	1999	
MC 29	MC 29	2,266	MC 029	3/04/1998		
Atlantis	GC 699	6,133	GC 699	5/12/1998		
Northwestern	GB 200	1,736	GB 200	5/14/1998	2000	
Tulane	GB 158	1,054	GB 200	5/14/1998	2002	
Madison	AC 24	4,856	AC 024	6/25/1998	2002	
McKinley	GC 416	4,019	GC 416	7/14/1998		
Marshall	EB 949	4,376	EB 949	7/30/1998	2001	
Medusa	MC 582	2,223	MC 582	10/10/1998	2003	
Medusa North	MC 538	2,223	MC 582	10/10/1998		
Zia	MC 496	1,804	MC 582	10/10/1998	2003	
Mad Dog	GC 782	4,428	GC 826	11/24/1998		
GC 463	GC 463	4,032	GC 463	12/01/1998		
Holstein	GC 644	4,344	GC 644	2/11/1999		
Aconcagua	MC 305	7,100	MC 305	2/21/1999	2002	
Oregano	GB 559	3,400	GB 559	3/27/1999	2001	
Thunder Horse	MC 778	6,050	MC 778	4/01/1999		
Magnolia	GB 783	4,674	GB 783	5/03/1999		
Camden Hills	MC 348	7,216	MC 348	8/04/1999	2002	
K2	GC 562	4,006	GC 562	8/14/1999		
Sangria	GC 177	1,487	GC 177	8/22/1999	2002	
Nansen	EB 602	3,675	EB 602	9/25/1999	2002	
Navajo	EB 690	4,210	EB 602	9/25/1999	2002	
Rigel	MC 252	5,225	MC 252	11/29/1999		
Devil's Tower	MC 773	5,610	MC 773	12/13/1999		
Gretchen	GC 114	2,685	GC 114	12/18/1999		
Champlain	AT 63	4,457	AT 063	2/11/2000		
Marco Polo	GC 608	4,320	GC 608	4/21/2000		
SW Horseshoe	EB 430	2,285	EB 430	5/3/2000		
Dawson	GB 669	3,152	GB 668	5/22/2000		
Durango	GB 667	3,105	GB 668	5/22/2000		
Gunnison	GB 668	3,100	GB 668	5/22/2000	2003	
EW 878	EW 878	1,585	EW 878	7/03/2000	2001	
MC 837	MC 837	1,524	EW 878	7/03/2000		
Aspen	GC 243	3,065	GC 243	1/27/2001	2002	
Lost Ark	EB 421	2,960	EB 421	1/31/2001	2002	
Pilsner	EB 205	1,108	EB 205	5/02/2001	2001	

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Front Runner	GC 339	3,330	GC 339	6/08/2001		
Balboa	EB 597	3,352	EB 597	7/02/2001		
San Patricio	AT 153	4,785	AT 153	8/09/2001		
GB 244	GB 244	2,130	GB 244	8/15/2001		
Boris	GC 282	2,378	GC 282	9/29/2001	2003	
Red Hawk	GB 877	5,334	GB 877	10/18/2001		
Timberwolf	MC 555	4,749	MC 555	10/30/2001		
VK 962	VK 962	4,677	VK 962	11/15/2001		
Hawkes	MC 509	4,174	MC 509	11/20/2001		
Merganser	AT 37	8,015	AT 037	11/28/2001		
VK 917	VK 917	4,370	VK 917	12/08/2001		
Hornet	GC 379	2,076	GC 379	12/14/2001		
Ness	GC 507	3,947	GC 507	12/27/2001		
Poseiden (MC)	MC 772	5,567	MC 728	6/30/2002		
Triton	MC 728	5,373	MC 728	6/30/2002		
Falcon	EB 579	3,638	EB 579	9/29/2002	2003	
Goose	MC 751	1,624	MC 751	12/15/2002	2003	
Tomahawk	EB 759	4,114	EB 759	1/28/2003		
Raptor	EB 668	3,710	EB 668	9/13/2003		
Atlas	LL 50	8,934				
Blind Faith	MC 696	6,989				
Cascade	WR 206	8,143				
Chinook	WR 469	8,831				
Constitution	GC 680	5,071				
Entrada	GB 782	4,690				
Glider	GC 248	3,440				
Grand Canyon	GC 141	1,720				
Great White	AC 857	8,717				
Ida/Fastball	VK 1003	4,942				
Jubilee	AT 349	8,825				
Kepler/Na Kika	MC 383	5,759				
Lorien	GC 199	2,315				
Mighty Joe Young	GC 737	4,415				
Navarro	GC 37	2,019				
Puma	GC 823	4,129				
Shenzi	GC 653	4,238				
Spiderman	DC 621	8,087				
St. Malo	WR 678	7,036				

Project Name	Area/Block	Water Depth (ft)[1]	Field	Field Discovery Date[2]	Year of First Production	Year of Last Production
Sturgis	AT 183	3,710				
Tahiti	GC 640	4,292				
Thunder Horse North	MC 776	5,660				
Trident	AC 903	9,743				
Tubular Bells	MC 725	4,334				
Vortex	AT 261	8,344				

[1] Water depths shown reflect depth at facility. If project is subsea or undeveloped, water depth reflects depth of deepest well location in project.

[2] The absence of a field discovery date indicates an industry-announced discovery without a qualified well on the lease. These discoveries have not necessarily been confirmed by the MMS and they are not yet classified as fields by the MMS.

Appendix C. Chronological Listing of GOM Lease Sales by Sale Location and Sale Date.

Sale Number	Sale Location	Sale Date
1	LA[1]	10/13/1954
1S	LA	10/13/1954
2	TX	11/09/1954
3	TX, LA	7/12/1955
6	LA[2]	8/11/1959
7	TX, LA	2/24/1960
8	LA[3]	5/19/1960
9	LA	3/13/1962
10	TX, LA	3/16/1962
11	LA[2]	10/09/1962
12	LA[2]	4/28/1964
13	SUL-TX[4]	12/14/1965
14	LA[2]	3/29/1966
15	LA[2]	10/18/1966
16	LA	6/13/1967
17	SA-LA[5]	9/05/1967
18	TX	5/21/1968
19	LA[2]	11/19/1968
19A	LA[2]	1/14/1969
20	SUL-LA[6]	5/13/1969
19B	LA[2]	12/16/1969
21	LA[2]	7/21/1970
22	LA	12/15/1970
23	LA[2]	11/04/1971
24	LA	9/12/1972
25	LA	12/19/1972
26	TX, LA	6/19/1973
32	MAFLA[7]	12/20/1973
33	LA	3/28/1974
34	TX	5/29/1974
S1	TX, LA	7/30/1974
36	LA	10/16/1974
37	TX	2/04/1975

Sale Number	Sale Location	Sale Date
38	TX, LA	5/28/1975
38A	TX, LA	7/29/1975
41	GOM	2/18/1976
44	TX, LA	11/16/1976
47	GOM	6/23/1977
45	TX, LA	4/25/1978
65	GOM	10/31/1978
51	TX, LA	12/19/1978
58	GOM	7/31/1979
58A	GOM	11/27/1979
A62	GOM	9/30/1980
62	GOM	11/18/1980
A66	GOM	7/21/1981
66	GOM	10/20/1981
67	GOM	2/09/1982
69	GOM	11/17/1982
69A	GOM	3/08/1983
72	CGOM	5/25/1983
74	WGOM	8/24/1983
79	EGOM	1/05/1984
81	CGOM	4/24/1984
84	WGOM	7/18/1984
98	CGOM	5/22/1985
102	WGOM	8/14/1985
94	EGOM	12/18/1985
104	CGOM	4/30/1986
105	WGOM	8/27/1986
110	CGOM	4/22/1987
112	WGOM	8/12/1987
SS	CGOM	2/24/1988
113	CGOM	3/30/1988
115	WGOM	8/31/1988
116	EGOM	11/16/1988

Sale Number	Sale Location	Sale Date
118	CGOM	3/15/1989
122	WGOM	8/23/1989
123	CGOM	3/21/1990
125	WGOM	8/22/1990
131	CGOM	3/27/1991
135	WGOM	8/21/1991
139	CGOM	5/13/1992
141	WGOM	8/19/1992
142	CGOM	3/24/1993
143	WGOM	9/15/1993
147	CGOM	3/30/1994
150	WGOM	8/17/1994
152	CGOM	5/10/1995
155	WGOM	9/15/1995
157	CGOM	4/24/1996
161	WGOM	9/25/1996
166	CGOM	3/05/1997
168	WGOM	8/27/1997
169	CGOM	3/18/1998
171	WGOM	8/26/1998
172	CGOM	3/17/1999

Sale Number	Sale Location	Sale Date
174	WGOM	8/25/1999
175	CGOM	3/15/2000
177	WGOM	8/23/2000
178-1	CGOM	3/28/2001
178-2	CGOM	8/22/2001
180	WGOM	8/22/2001
181	EGOM	12/05/2001
182	CGOM	3/20/2002
184	WGOM	8/21/2002
185	CGOM	3/19/2003
187	WGOM	8/20/2003
189	EGOM	12/10/2003
190	CGOM	3/17/2004
192	WGOM	
194	CGOM	
196	WGOM	
197	EGOM	
198	CGOM	
200	WGOM	
201	CGOM	

[1] Sale 1 was an oil, gas, and sulfur lease sale offshore Louisiana.
[2] These were oil and gas drainage lease sales offshore Louisiana.
[3] Sale 8 was a salt lease sale offshore Louisiana.
[4] Sale 13 was a sulfur and salt lease sale offshore Texas.
[5] Sale 17 was a salt lease sale offshore Louisiana.
[6] Sale 20 was a sulfur and salt lease sale offshore Louisiana.
[7] Sale 32 was an oil and gas lease sale offshore Mississippi, Alabama, and Florida.

LA = oil and gas lease sale offshore Louisiana (unless otherwise footnoted)
TX = oil and gas lease sale offshore Texas
GOM = oil and gas lease sale in the Gulf of Mexico
CGOM = oil and gas lease sale in the Central Gulf of Mexico Planning Area
EGOM = oil and gas lease sale in the Eastern Gulf of Mexico Planning Area
WGOM = oil and gas lease sale in the Western Gulf of Mexico Planning Area

Appendix D. Deepwater Studies Program.

***Active Studies** [MMS Study Number]*

Deepwater Program: Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico [85080]

Deepwater Program: Survey of Deepwater Currents in the Western Gulf of Mexico [71562]

Deepwater Program: Marathon - Case study (Numerical Modeling) (Subscription) [16073 B]

Deepwater Program: Conoco - Eddies (EJIP - data) (Membership) [16074 B]

Deepwater Program: Labor Migration and the Deepwater Oil Industry in Houma [16804 G]

Deepwater Program: Observation of Deepwater Manifestation of Loop Current Rings [16805 B]

Deepwater Program: Deepwater Currents at 92° W [16807 B]

Deepwater Program: An Analysis of the Socioeconomic Effects of OCS Activities on Ports and Surrounding Areas in the Gulf of Mexico Region [19957 G]

Deepwater Program: Labor Migration and the Deepwater Oil Industry [19958 G]

Deepwater Program: Potential Spatial and Temporal Vulnerability of Pelagic Fish Assemblages in the Gulf of Mexico to Surface Oil Spills Associated with Deepwater Petroleum Development [19962 M]

Deepwater Program: Assessing and Monitoring Industry Labor Needs [30898 G]

Deepwater Program: Benefits and Burdens of OCS Deepwater Activities on Selected Communities and Local Public Institutions [30899 G]

Deepwater Program: Development of a Deepwater Environmental Data Model [30917 I]

Deepwater Program: OCS-Related Infrastructure in the Gulf of Mexico [30955 G]

Deepwater Program: Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology [30991 C]

Deepwater Program: Study of Subsurface, High-Speed Current Jets in the Deep Water Region of the Gulf of Mexico [31026 B]

Deepwater Program: Analysis and Validation of a Mechanism that Generates Strong Mid-depth Currents and a Deep Cyclone Gyre in the Gulf of Mexico [31027 B]

Deepwater Program: Modeling and Data-Analysis of Subsurface Currents on the Northern Gulf of Mexico Slope and Rise: Effects of Topographic Rossby Waves and Eddy-Slope Interaction [31028 B]

Deepwater Program: Cross-Shelf Exchange Processes and the Deep-Water Circulation of the Gulf of Mexico: The Dynamical Effects of Submarine Canyons and the Interactions of Loop Current Eddies with Topography [31029 B]

Deepwater Program: Effects of Oil and Gas Exploration and Development at Selected Continental Slope Sites in the Gulf of Mexico [31034 E]

Deepwater Program: Joint Industry Project, Gulf of Mexico Comprehensive Synthetic Based Muds Monitoring Program [31069 E]

Deepwater Program: Supply Logistics of OCS Oil and Gas Development in the Gulf of Mexico – Evaluation of Technological and Economic Parameters of Ports as Supply and Manufacturing Bases [31154 G]

Deepwater Program: The Technology and Economics of Deepwater Production Projects [31019 G]

Deepwater Program: Exploratory Study of Deepwater Currents in the Gulf of Mexico [31152 B]

Completed Studies ***[MMS Study Number]***

Deepwater Program: The Fate and Effects of Synthetic-Based Drilling Fluids and Associated Cuttings Discharged into the Marine Environment [15240E]. Report Number 2000-064 - *Environmental Impacts of Synthetic-Based Drilling Fluids*

Deepwater Program: Workshop for Modeling Demographic and Socioeconomic Change in Local Coastal Areas in the Gulf of Mexico Region [19959 G]

Deepwater Program: Literature Review: Environmental Risks of Chemical Products Used in Deepwater Oil & Gas Operations [30900 E]. Report Number 2001-011 - *Deepwater Program: Literature Review, Environmental Risks of Chemical Products Used in Gulf of Mexico Deepwater Oil and Gas Operations, Volume I: Technical Report,* and Report Number 2001-012, *Deepwater Program: Literature Review, Environmental Risks of Chemical Products Used in Gulf of Mexico Deepwater Oil and Gas Operations, Volume II: Appendices*

Deepwater Program: Deepwater Physical Oceanography Reanalysis and Synthesis of Historical Data [30910 B]. Report Number 2001-064 - *Deepwater Physical Oceanography Reanalysis and Synthesis of Historical Data: Synthesis Report*

Deepwater Program: Gulf of Mexico Deepwater Information Resources Data Search and Literature Synthesis [30916 I]. Report Number 2000-049 - *Deepwater Gulf of Mexico Environmental and Socioeconomic Data Search and Literature Synthesis, Volume I: Technical Narrative* and Report Number 2000-050 - *Deepwater Gulf of Mexico Environmental and Socioeconomic Data Search and Literature Synthesis, Volume II: Annotated Bibliography*

Deepwater Program: Assessment and Reduction of Taxonomic Error in Benthic Macrofauna Surveys: An Initial Program Focused on Shelf and Slope Polychaete Worms [16801 C]. Report Number 2003-065, *Preparation of an Interactive Key for Northern Gulf of Mexico Polychaete Taxonomy Employing the DELTA/INTKEY System*

Deepwater Program: Summary of the Northern Gulf of Mexico Continental Slope Studies [17037 C]. Report Number 2003-072, *Selected Aspects of the Ecology of the Continental Slope Fauna of the Gulf of Mexico: A Synopsis of the Northern Gulf of Mexico Continental Slope Study, 1983-1988*

Deepwater Program: Offshore Petroleum Platforms: Functional Significance for Larval Fish Across Longitudinal and Latitudinal Gradients [19961 M]. Report Number 2002-078, *Offshore Petroleum Platforms: Functional Significance for Larval Fish Across Longitudinal and Latitudinal Gradients*

Deepwater Program: Bluewater Fishing and Deepwater OCS Activity: Interactions Between the Fishing and Petroleum Industries in Deepwaters of the Gulf of Mexico [31011 M]. Report Number 2002-078, *Deepwater Program: Bluewater Fishing and Deepwater OCS Activity, Interactions Between the Fishing and Petroleum Industries in Deepwaters of the Gulf of Mexico*

Study in the Procurement Process

Deepwater Program: Survey of Deepwater Currents in the Eastern Gulf of Mexico

All reports are available at our web site —

http://www.gomr.mms.gov/homepg/regulate/environ/deepenv.html.

Appendix E. Companies Defined as Majors in this Report.

Group Name	Company Name	MMS Number
BP	Amoco Canyon Company	00735
	Amoco Corporation	02244
	Amoco Foundation, Inc.	01679
	Amoco Pipeline Company	00751
	Amoco Production Company	00114
	ARCO Pipe Line Company	00486
	Atlantic Refining Company	00002
	Atlantic Richfield Company	00002
	Atlantic Richfield Company	00967
	BP Alaska Exploration Inc.	00301
	BP America Production Company	21396
	BP America Production Company	00114
	BP Americas Inc.	21372
	BP Amoco Corporation	02367
	BP Corporation North America Inc.	02367
	BP Exploration & Oil Inc.	01680
	BP Exploration & Production Inc.	02481
	BP Exploration Inc.	00593
	BP Exploration USA Inc.	00120
	BP Prod. Corp.	02350
	BP Oil Company	01680
	BP Oil Corporation	00120
	BP Pipelines (North America) Inc.	00751
	BP Prod Corp	02350
	Mardi Gras Endymion Oil Pipeline Company LLC	02529
	Mardi Gras Transportation System Inc.	02527
	Pan American Petroleum Corp	00114
	Sohio Alaska Petroleum Company	00113
	Sohio Natural Resources	00113
	Sohio Petroleum Company	00113
	Sohio Petroleum Company	00593
	Stanolind Oil and Gas Company	00114
	Vastar Offshore, Inc.	02316

Group Name	Company Name	MMS Number
	Vastar Pipeline, LLC	02317
	Vastar Resources, Inc.	01855
ChevronTexaco	California Oil Company	00078
	Chevron Corporation	02335
	Chevron Natural Gas Pipe Line Company	02626
	Chevron Oil Company	00078
	Chevron Oil Company of the Netherlands	01443
	Chevron PBC Inc.	01750
	Chevron Pipe Line Company	00400
	Chevron Texaco Corp.	21391
	Chevron U.S.A. Inc.	00078
	Chevron U.S.A. LP	02544
	ChevronTexaco Corporation	02335
	Equilon Pipeline Company LLC	01107
	Equilon Pipeline Company LLC	02289
	Four Star Oil & Gas Company	00005
	Four Star Oil and Gas Company	00005
	Getty Oil Company	00005
	Getty Pipeline, Inc.	01107
	Getty Reserve Oil, Inc.	00578
	Gulf Oil Corporation	00112
	Pennzoil Exploration and Production Company	01750
	Pennzoil Petroleum Company	01750
	Seaboard Oil Company	00025
	Texaco Exploration and Production	00771
	Texaco Inc.	00040
	Texaco Oils Inc.	00857
	Texaco Pipeline Inc.	01107
	Texaco Pipelines LLC	21200
	Texaco Producing Inc.	00771
	Texaco Seaboard Inc.	00025
	Texaco Trading and Transportation Inc.	02020
	Texas Company	00040

Group Name	Company Name	MMS Number
ExxonMobil	Exxon Asset Holdings LLC	02356
	Exxon Asset Management Company	02295
	Exxon Corporation	00276
	Exxon Mobil Corporation	00276
	Exxon Mobil Oil Corporation	00039
	Exxon Mobil Pipeline Company	00103
	Exxon Pipeline Company	00103
	Humble Pipe Line Company	00103
	Mobil Corporation	02221
	Mobil E&P U.S. Development Corporation	02203
	Mobil E&P U.S. Development Fund, L.P.	02209
	Mobil Eugene Island Pipeline Company	00883
	Mobil Exploration and Producing North America Inc.	01055
	Mobil Foundation, Inc.	01933
	Mobil NOC Inc.	00021
	Mobil Oil Corporation	00039
	Mobil Oil Exploration & Producing Southeast Inc.	00540
	Mobil Producing Texas & New Mexico Inc.	00565
	Mobil GC Corporation	00565
	Mobil-TransOcean Company	00637
	Newmont Oil Company	00021
	Socony Mobil Oil Co	00039
	Superior Oil Company	00047
Shell	Coral Offshore Gathering LLC	02253
	Enterprise Oil Gulf of Mexico Inc.	02117
	Enterprise Oil Louisiana Inc.	02118
	MG Gas Services Inc.	02128
	Mississippi Canyon Gas Pipeline, LLC	02254
	Shell Consolidated Energy Resources Inc.	01940
	Shell Deepwater Development Inc.	02139
	Shell Deepwater Production Inc.	02140
	Shell Energy Resources Inc.	00688
	Shell Frontier Oil & Gas Inc.	01728
	Shell Gas Gathering Company	02168

Group Name	Company Name	MMS Number
	Shell Gas Gathering Company, LLC	02253
	Shell Gas Gathering LLC	02253
	Shell Gas Pipeline Company	01070
	Shell Gas Pipeline Company LLC	02254
	Shell GOM Pipeline Company LLC	02621
	Shell Gulf of Mexico Inc.	02117
	Shell Land & Energy Company	01967
	Shell Offshore Inc.	00689
	Shell Offshore Properties and Capital II, Inc.	02128
	Shell Oil & Gas Investment Limited Partnership	01839
	Shell Oil Company	00117
	Shell Onshore Ventures Inc.	01845
	Shell Pipe Line Corporation	00124
	Shell Seahorse Company	02147
	Shell Western E&P Inc.	00832
	SWEPI LP	00832
	Tejas Offshore Gathering LLC	02253

Note: Some companies in this list may no longer be qualified with the MMS.

Appendix F. Number of Deepwater Production Facilities Installed Each Year (including Plans through 2006).

Year	Fixed Platform	Compliant Tower	TLP	Small TLP	Spar	Truss Spar	Semi-FPS	Subsea
1979	1	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0
1984	0	1	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	1	0
1989	1	0	1	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
1991	1	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	1
1993	0	0	0	0	0	0	0	2
1994	1	0	1	0	0	0	0	2
1995	0	0	0	0	0	0	1	2
1996	0	0	1	0	0	0	0	3
1997	0	0	1	0	1	0	0	2
1998	0	1	0	1	0	0	0	3
1999	1	0	2	1	1	0	0	7
2000	0	1	0	0	1	0	0	6
2001	0	0	1	2	0	1	0	12
2002	0	0	0	0	0	2	0	13
2003	0	0	0	2	0	2	1	9
2004*	0	0	1	0	1	2	1	10
2005*	0	0	0	0	0	1	0	10
2006*	0	0	0	0	0	0	1	10

* Estimated numbers.

Appendix G. Subsea Completions.

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
AC	24	608054000501	Exxon Mobil Corporation	2/03/2002	4,856
BA	A 17	427044034500	Spinnaker Exploration Company LLC	8/10/2003	140
DC	133	608234000200	BP Exploration & Production Inc	10/15/2001	6,376
EB	112	608044015700	Eni Petroleum Co Inc	5/01/1996	638
EB	117	608044016102	Apache Corporation	4/11/1996	570
EB	157	608044015200	Eni Petroleum Co Inc	5/23/1996	941
EB	168	608044016600	Walter Oil & Gas Corporation	7/16/1997	450
EB	168	608044023000	Walter Oil & Gas Corporation	12/15/2001	500
EB	205	608044021800	Union Oil Company of California	6/01/2001	1,081
EB	421	608044020000	Samedan Oil Corporation	5/12/2002	2,740
EB	579	608044023500	Pioneer Natural Resources USA Inc	11/18/2002	3,453
EB	602	608044019001	Kerr-McGee Oil & Gas Corporation	7/15/2001	3,678
EB	602	608044022000	Kerr-McGee Oil & Gas Corporation	8/11/2001	3,678
EB	602	608044022500	Kerr-McGee Oil & Gas Corporation	9/07/2001	3,644
EB	623	608044023400	Pioneer Natural Resources USA Inc	12/30/2002	3,412
EB	688	608044022400	Kerr-McGee Oil & Gas Corporation	12/13/2001	3,795
EB	688	608044022101	Kerr-McGee Oil & Gas Corporation	1/10/2002	3,788
EB	690	608044022801	Kerr-McGee Oil & Gas Corporation	2/18/2002	4,202
EB	945	608044017700	Exxon Mobil Corporation	11/20/1999	4,638
EB	945	608044016200	Exxon Mobil Corporation	3/31/2002	4,628
EB	945	608044017804	Exxon Mobil Corporation	9/25/2003	4,639
EB	946	608044018100	Exxon Mobil Corporation	3/08/2000	4,651
EB	946	608044018000	Exxon Mobil Corporation	5/31/2000	4,657
EB	948	608044017601	Exxon Mobil Corporation	5/06/2001	4,376
EB	949	608044019301	Exxon Mobil Corporation	4/02/2001	4,376
EC	57	177034047100	Houston Exploration Company	12/09/1984	52
EC	231	177034063800	Energy Resource Technology Inc	5/24/1993	122
EC	235	177034047300	Chevron USA Inc	11/16/1986	121
EC	305	177044100900	Remington Oil and Gas Corporation	9/10/2001	197
EC	328	177044080800	Maritech Resources Inc	2/13/1997	243
EC	335	177044030300	Devon Energy Production Company LP	7/15/1976	272
EC	341	177044067100	Walter Oil & Gas Corporation	10/21/1988	275

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
EC	374	177044101700	Energy Resource Technology Inc	7/17/2002	425
EC	378	608074015700	Energy Partners Ltd	1/27/1997	495
EC	380	177044102600	Walter Oil & Gas Corporation	6/28/2001	538
EI	294	177104126801	B T Operating Co	10/06/1991	214
EI	320	177104128700	Forest Oil Corporation	12/31/1993	244
EI	322	177104134100	BP America Production Company	10/30/1991	242
EI	349	177104100500	NCX Company LLC	11/23/1990	337
EI	364	177104138000	The Louisiana Land and Exploration Company	10/14/1994	357
EI	386	177104147500	Tarpon Offshore LP	2/24/2002	417
EW	868	608104011501	Walter Oil & Gas Corporation	10/17/2003	685
EW	871	608104011000	Walter Oil & Gas Corporation	11/13/2000	932
EW	871	608104011300	Walter Oil & Gas Corporation	4/13/2001	724
EW	878	608105009500	Walter Oil & Gas Corporation	7/26/2000	1,523
EW	878	608105009601	Walter Oil & Gas Corporation	9/25/2000	1,523
EW	914	608105002200	Tatham Offshore Inc	8/11/1993	946
EW	917	608105006500	Marathon Oil Company	4/08/1998	1,195
EW	921	608105008104	Eni Petroleum Co Inc	8/16/2002	1,692
EW	963	608105006000	Marathon Oil Company	5/25/1998	1,740
EW	963	608105006800	Marathon Oil Company	6/29/1998	1,758
EW	966	608104010001	Mariner Energy Inc	5/12/2000	1,853
EW	989	608104008600	Kerr-McGee Corporation	11/02/1994	565
EW	989	608104008701	Kerr-McGee Corporation	9/28/1995	565
EW	999	608104003202	Placid Oil Company	6/08/1988	1,462
EW	1006	608105004102	Walter Oil & Gas Corporation	3/01/2002	1,884
EW	1006	608104012100	Walter Oil & Gas Corporation	6/23/2003	1,851
EW	1006	608104012200	Walter Oil & Gas Corporation	8/27/2003	1,854
GA	A 192	427074010300	Walter Oil & Gas Corporation	5/22/2003	242
GB	70	608074007001	Newfield Exploration Company	9/29/1997	750
GB	71	608074013000	Newfield Exploration Company	4/30/1995	750
GB	73	608074021200	Mariner Energy Inc	4/06/2000	745
GB	108	608074020600	Kerr-McGee Oil & Gas Corporation	7/17/1999	619
GB	117	608074013500	Flextrend Development Company LLC	7/16/1996	922
GB	117	608074014901	Flextrend Development Company LLC	5/05/1997	924

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
GB	139	608074064501	W & T Offshore Inc	11/25/2002	550
GB	152	608074020800	Walter Oil & Gas Corporation	7/07/1999	619
GB	158	608074021702	Amerada Hess Corporation	1/28/2002	1,050
GB	161	608074015801	Newfield Exploration Company	9/20/1999	972
GB	161	608074017500	Newfield Exploration Company	11/17/1999	970
GB	179	608074063700	Walter Oil & Gas Corporation	10/12/1997	712
GB	200	608074021100	Amerada Hess Corporation	11/29/2000	1,736
GB	201	608074023701	Amerada Hess Corporation	11/02/2002	1,736
GB	205	608074024103	LLOG Exploration Offshore Inc	8/30/2002	1,330
GB	215	608074016001	Amerada Hess Corporation	12/15/2000	1,450
GB	215	608074020101	Amerada Hess Corporation	2/19/2001	1,457
GB	215	608074017202	Amerada Hess Corporation	12/30/2002	1,464
GB	216	608074081901	Amerada Hess Corporation	5/22/1999	1,456
GB	216	608074022600	Amerada Hess Corporation	6/20/2001	1,481
GB	224	608074061800	Kerr-McGee Oil & Gas Corporation	5/22/1991	742
GB	235	608074010600	W & T Offshore Inc	11/10/1994	785
GB	240	608074013100	Samedan Oil Corporation	1/29/1996	832
GB	341	608074025401	Shell Offshore Inc	6/14/2003	2,013
GB	341	608074019104	Shell Offshore Inc	7/30/2003	2,015
GB	367	608074064101	Mariner Energy Inc	2/10/2001	1,122
GB	387	608074014001	Newfield Exploration Gulf Coast Inc	3/03/1996	2,081
GB	388	608074005400	Newfield Exploration Gulf Coast Inc	3/19/1995	2,097
GB	388	608074008401	Newfield Exploration Gulf Coast Inc	5/01/1995	2,097
GB	388	608074015601	Newfield Exploration Gulf Coast Inc	2/25/1997	2,096
GB	409	608074016300	ATP Oil & Gas Corporation	5/12/2001	1,355
GB	409	608074063500	ATP Oil & Gas Corporation	5/16/2001	1,360
GB	472	608074020903	Shell Offshore Inc	10/21/2001	3,380
GB	472	608074024303	Shell Offshore Inc	4/24/2003	3,392
GB	516	608074022402	Shell Offshore Inc	11/21/2001	3,400
GB	559	608074019901	Shell Offshore Inc	8/03/2001	3,400
GB	559	608074022103	Shell Offshore Inc	9/02/2001	3,400
GB	559	608074023901	Shell Offshore Inc	3/18/2003	3,393
GB	602	608074019401	Shell Offshore Inc	8/16/1999	3,693

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
GB	602	608074014401	Shell Offshore Inc	12/28/1999	3,708
GB	602	608074019301	Shell Offshore Inc	2/27/2001	3,708
GC	20	608114021300	Shell Gulf of Mexico Inc	12/10/1999	880
GC	29	608114009100	Placid Oil Company	6/17/1989	1,526
GC	31	608114004701	EP Operating Limited Partner	8/07/1988	2,243
GC	31	608114009600	EP Operating Limited Partner	1/20/1989	2,234
GC	60	608114020101	Mobil Oil Exploration & Producing	6/22/1996	868
GC	110	608114020600	Shell Offshore Inc	1/23/1996	1,730
GC	113	608115013100	Shell Deepwater Development Inc	7/17/1999	1,968
GC	113	608115012701	Shell Deepwater Development Inc	9/01/1999	2,045
GC	116	608115008600	Shell Offshore Inc	1/11/1996	2,046
GC	116	608115012200	Shell Offshore Inc	2/14/1998	2,046
GC	136	608114020000	Chevron USA Inc	11/21/1995	860
GC	136	608114020401	Chevron USA Inc	12/20/1995	1,042
GC	136	608114029600	Chevron USA Inc	11/19/2002	990
GC	155	608114022803	Shell Offshore Inc	6/12/2002	1,890
GC	155	608114031100	Shell Offshore Inc	6/23/2002	1,939
GC	200	608114021800	BP Exploration & Production Inc	11/10/1997	2,670
GC	200	608114021600	BP Exploration & Production Inc	12/07/1997	2,670
GC	200	608114020501	BP Exploration & Production Inc	6/29/1998	2,670
GC	200	608114021901	BP Exploration & Production Inc	2/27/1999	2,670
GC	200	608114028900	BP Exploration & Production Inc	1/25/2001	2,672
GC	236	608114025201	Chevron USA Inc	2/08/2001	1,987
GC	237	608114024100	Chevron USA Inc	6/13/2001	2,025
GC	237	608114023101	Chevron USA Inc	7/09/2001	2,025
GC	237	608114024704	Chevron USA Inc	6/10/2003	1,982
GC	243	608114027606	Nexen Petroleum USA Inc	9/19/2002	3,065
GC	243	608114034000	Nexen Petroleum USA Inc	12/28/2002	3,048
GC	244	608114021701	BP Exploration & Production Inc	3/02/1998	2,670
GC	282	608114030804	BHP Billiton Petroleum (GOM) Inc	11/22/2002	2,386
GC	282	608114033701	BHP Billiton Petroleum (GOM) Inc	8/01/2003	2,370
GC	297	608115009400	Eni Petroleum Co Inc	9/11/2001	3,308
GC	472	608114030003	Eni Petroleum Co Inc	8/19/2001	3,780

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
GC	473	608114027300	Eni Petroleum Co Inc	9/15/2001	3,840
GC	516	608114030101	Eni Petroleum Co Inc	10/02/2001	3,839
GI	32	177174011700	BP America Production Company	3/09/1980	98
GI	41	177174009600	BP America Production Company	9/25/1978	91
GI	41	177174009700	BP America Production Company	10/08/1978	91
GI	41	177174009500	BP America Production Company	11/08/1978	91
GI	43	177174009800	BP America Production Company	8/01/1978	114
GI	47	177174009300	BP America Production Company	5/14/1978	88
GI	47	177174018500	BP America Production Company	5/20/1986	97
GI	101	177184010500	Walter Oil & Gas Corporation	9/29/2002	215
GI	109	177184009600	Walter Oil & Gas Corporation	10/16/2000	280
HI	A 309	427114070100	El Paso Production Oil & Gas Company	1/24/1995	213
HI	A 316	427114084301	El Paso Production Oil & Gas Company	11/23/2002	217
HI	A 345	427114083000	Seneca Resources Corporation	7/26/2003	238
HI	A 355	427114084100	Newfield Exploration Company	12/15/2002	285
HI	A 370	427114065100	Kerr-McGee Oil & Gas Corporation	10/30/1990	375
HI	A 378	427114075700	Kerr-McGee Oil & Gas Corporation	7/28/1996	360
HI	A 378	427114080601	Kerr-McGee Oil & Gas Corporation	4/01/1999	332
HI	A 441	427094109900	Remington Oil and Gas Corporation	9/25/2000	168
HI	A 531	427094106900	Hunt Oil Company	8/25/1999	194
HI	A 531	427094109100	Hunt Oil Company	3/24/2001	194
HI	A 544	427094113200	Energy Resource Technology Inc	9/06/2003	234
HI	A 573	427094053700	Apache Corporation	9/17/1980	350
MC	28	608164018600	BP Exploration & Production Inc	4/21/1995	1,290
MC	28	608174051900	BP Exploration & Production Inc	6/30/1996	1,853
MC	28	608174051600	BP Exploration & Production Inc	8/16/1996	1,853
MC	28	608174052000	BP Exploration & Production Inc	4/24/1998	1,853
MC	28	608174051704	BP Exploration & Production Inc	6/26/2001	1,853
MC	66	608174100101	Mariner Energy Inc	9/03/2003	1,144
MC	68	608174088600	Walter Oil & Gas Corporation	6/03/2000	1,337
MC	72	608174051500	BP Exploration & Production Inc	4/27/1996	1,853
MC	72	608174051800	BP Exploration & Production Inc	2/14/1997	1,853

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
MC	84	608174096500	BP Exploration & Production Inc	2/05/2003	5,418
MC	85	608174090801	BP Exploration & Production Inc	5/13/2001	5,317
MC	85	608174090100	BP Exploration & Production Inc	6/15/2001	5,173
MC	167	608174088800	Exxon Mobil Corporation	10/28/2000	4,350
MC	211	608174088900	Exxon Mobil Corporation	11/22/2000	4,317
MC	211	608174099200	Exxon Mobil Corporation	8/28/2002	4,318
MC	217	608174091001	BP Exploration & Production Inc	8/22/2001	6,420
MC	217	608174090900	BP Exploration & Production Inc	1/07/2002	6,390
MC	278	608174091502	Walter Oil & Gas Corporation	5/21/2001	560
MC	292	608174050900	Chevron USA Inc	5/25/1999	3,405
MC	292	608174083201	Chevron USA Inc	8/25/1999	3,393
MC	292	608174083301	Chevron USA Inc	9/24/1999	3,393
MC	305	608174091700	Total E&P USA Inc	5/01/2002	7,096
MC	305	608174083400	Total E&P USA Inc	7/12/2002	7,073
MC	305	608174098201	Total E&P USA Inc	8/15/2002	7,067
MC	305	608174087501	Total E&P USA Inc	9/11/2002	7,001
MC	321	608174089100	Walter Oil & Gas Corporation	9/15/2000	567
MC	322	608174093800	Walter Oil & Gas Corporation	7/08/2001	680
MC	322	608174094201	Walter Oil & Gas Corporation	8/12/2001	680
MC	348	608174084801	Marathon Oil Company	2/15/2002	7,209
MC	348	608174086801	Marathon Oil Company	5/31/2002	7,202
MC	354	608174044700	Exxon Mobil Corporation	7/05/1993	1,460
MC	355	608174044900	Exxon Mobil Corporation	5/29/1993	1,460
MC	355	608174044800	Exxon Mobil Corporation	9/11/1993	1,458
MC	355	608174084301	Exxon Mobil Corporation	7/02/1999	1,458
MC	357	608174053801	Newfield Exploration Company	2/25/1998	445
MC	383	608174094601	Shell Offshore Inc	8/11/2002	5,735
MC	383	608174094702	Shell Offshore Inc	8/26/2002	5,739
MC	401	608174034600	Kerr-McGee Oil & Gas Corporation	7/25/1993	1,700
MC	401	608174032901	Kerr-McGee Oil & Gas Corporation	8/25/1993	1,367
MC	401	608174096100	Anadarko Petroleum Corporation	5/17/2003	1,139
MC	429	608174051300	BP Exploration & Production Inc	10/23/2002	6,240
MC	429	608174095402	Shell Offshore Inc	2/02/2003	6,101

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
MC	429	608174084404	Shell Offshore Inc	2/19/2003	6,134
MC	441	608174038400	Newfield Exploration Gulf Coast Inc	11/20/1992	1,531
MC	441	608174040100	Newfield Exploration Gulf Coast Inc	12/27/1992	1,531
MC	441	608174040002	Newfield Exploration Gulf Coast Inc	1/26/1993	1,531
MC	441	608174037601	Newfield Exploration Gulf Coast Inc	4/17/1993	1,438
MC	441	608174041500	Newfield Exploration Gulf Coast Inc	7/03/1993	1,438
MC	445	608174042900	Kerr-McGee Oil & Gas Corporation	10/04/1993	2,094
MC	445	608174047300	Kerr-Mcgee Oil & Gas Corporation	7/23/1994	2,095
MC	485	608174041600	Newfield Exploration Gulf Coast Inc	5/24/1993	1,438
MC	520	608174054601	Shell Offshore Inc	7/01/2002	6,738
MC	522	608174096900	Shell Offshore Inc	11/26/2002	6,932
MC	522	608174097000	Shell Offshore Inc	12/16/2002	6,934
MC	522	608174085802	Shell Offshore Inc	12/31/2002	6,940
MC	608	608174098400	Shell Offshore Inc	7/22/2002	6,623
MC	661	608174083900	Pogo Producing Company	11/13/2001	854
MC	674	608174054404	Mariner Energy Inc	12/29/1999	2,710
MC	686	608174054100	Shell Offshore Inc	7/12/1997	5,292
MC	686	608174099600	Shell Offshore Inc	3/12/2003	5,318
MC	687	608174054000	Shell Offshore Inc	11/20/1998	5,292
MC	705	608174086001	Pogo Producing Company	12/24/2001	854
MC	730	608174054200	Shell Offshore Inc	11/04/1997	5,295
MC	764	608174058701	BP Exploration & Production Inc	4/06/2000	3,283
MC	765	608174100501	Shell Offshore Inc	7/18/2003	3,642
MC	766	608174096302	Shell Offshore Inc	9/11/2003	3,637
MC	807	608174038800	Shell Offshore Inc	3/25/1996	2,956
MC	837	608174092401	Walter Oil & Gas Corporation	6/22/2001	1,524
MC	890	608174082800	Shell Offshore Inc	9/08/1999	3,875
MC	899	608174058002	Shell Offshore Inc	7/24/2001	4,393
MC	899	608174091600	Shell Offshore Inc	8/13/2001	4,393
MC	899	608174087807	Shell Offshore Inc	10/31/2001	4,389
MC	934	608174083501	Shell Offshore Inc	11/13/1999	3,875
MC	934	608174083601	Shell Offshore Inc	3/10/2000	3,875
MC	934	608174083700	Shell Offshore Inc	9/01/2001	3,875

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
MP	131	177254060100	ATP Oil & Gas Corporation	11/03/1998	165
MP	145	177254047300	Conoco Inc	12/30/1985	213
MP	149	177254058901	Walter Oil & Gas Corporation	9/06/1994	220
MP	150	177254069600	Walter Oil & Gas Corporation	12/3/2000	245
MP	260	177244081400	Devon SFS Operating Inc	4/26/1999	315
MP	263	177244089600	Magnum Hunter Production Inc	3/31/2003	280
MP	281	177244069100	Walter Oil & Gas Corporation	7/28/1994	293
MP	286	177244090400	Walter Oil & Gas Corporation	11/17/2003	292
MP	291	177244056600	Allied Natural Gas Corporation	7/04/1992	272
MU	806	427024024500	Apache Corporation	11/30/1995	164
MU	A 124	427124010701	Walter Oil & Gas Corporation	6/25/1998	381
PN	996	427134009900	F-W Oil Exploration LLC	11/14/2003	159
PN	1010	427014005000	Walter Oil & Gas Corporation	6/27/1999	128
PN	A 9	427134050200	Denbury Offshore Inc	11/05/2003	201
PN	A 12	427134009600	Apache Corporation	11/01/2001	250
SP	32	177212050500	Devon Louisiana Corporation	6/12/2002	115
SS	176	177114099800	Chevron USA Inc	9/29/1990	100
SS	204	177110067200	Anadarko E&P Company LP	3/24/1968	100
SS	321	177124057000	ATP Oil & Gas Corporation	5/29/1997	323
SS	326	177124058700	Walter Oil & Gas Corporation	5/11/1998	364
SS	361	177124054900	Anadarko Petroleum Corporation	7/08/1998	405
ST	169	177154032600	Samedan Oil Corporation	4/27/1980	88
ST	169	177154062300	Samedan Oil Corporation	6/01/1985	102
ST	177	177154007800	Chevron USA Inc	11/06/1976	144
ST	212	177164031200	El Paso Production Company	11/06/2003	140
ST	239	177164031300	Walter Oil & Gas Corporation	9/25/2003	162
ST	248	177164029700	PRS Offshore LP	6/04/2002	178
VK	738	608164036601	Newfield Exploration Company	9/24/2000	809
VK	783	608164013401	Shell Offshore Inc	4/08/1991	1,494
VK	783	608164021701	Shell Offshore Inc	7/18/1996	1,142
VK	784	608164023200	Shell Offshore Inc	6/30/1996	1,750
VK	825	608164033201	Kerr-McGee Oil & Gas Corporation	10/16/1998	1,722
VK	825	608164034400	Kerr-McGee Oil & Gas Corporation	8/29/1999	1,711

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
VK	862	608164021600	Walter Oil & Gas Corporation	11/15/1995	1,067
VK	873	608164033601	Shell Offshore Inc	12/29/2001	3,463
VK	914	608164028403	BP Exploration & Production Inc	3/15/2001	3,535
VK	915	608164038300	BP Exploration & Production Inc	5/18/2001	3,460
VK	915	608164040200	BP Exploration & Production Inc	4/17/2002	3,460
VK	944	608164032200	Walter Oil & Gas Corporation	12/05/1997	730
VK	944	608164040602	Walter Oil & Gas Corporation	5/02/2002	730
VK	986	608164022800	Walter Oil & Gas Corporation	12/23/1995	893
VK	986	608164040800	Walter Oil & Gas Corporation	5/26/2002	895
VR	116	177054107201	Offshore Energy I LLC	4/19/1998	55
VR	215	177054028500	Newfield Exploration Company	12/22/1978	140
VR	246	177054034600	Chevron USA Inc	3/30/1981	155
VR	302	177064021701	Nexen Petroleum USA Inc	2/20/1977	197
VR	320	177064064200	Kerr-McGee Oil & Gas Corporation	11/12/1991	206
VR	332	177064091100	PRS Offshore LP	10/19/2002	223
WC	459	177024062900	Conoco Inc	5/16/1985	135
WC	548	177024106000	Walter Oil & Gas Corporation	6/14/1994	185
WC	584	177024085700	Walter Oil & Gas Corporation	3/03/1989	237
WC	592	177024106301	Walter Oil & Gas Corporation	7/11/1995	252
WC	635	177024127500	ATP Oil & Gas Corporation	1/08/2001	360
WC	638	177024116900	Denbury Offshore Inc	11/06/1998	373
WD	45	177190038200	Nexen Petroleum USA Inc	2/11/1959	50
WD	45	177190038300	Nexen Petroleum USA Inc	2/26/1959	72
WD	45	177190038402	Nexen Petroleum USA Inc	12/08/1981	50
WD	62	177194027900	Pioneer Natural Resources USA Inc	8/13/1985	130
WD	70	177190062800	BP America Production Company	2/02/1958	143
WD	70	177190063000	BP America Production Company	10/05/1961	143
WD	71	177190061900	BP America Production Company	7/23/1961	142
WD	77	177194065504	ATP Oil & Gas Corporation	8/29/1999	187
WD	106	177194056800	Walter Oil & Gas Corporation	12/28/1994	234
WD	106	177194070300	Walter Oil & Gas Corporation	6/14/2001	254
WD	107	177194056400	Walter Oil & Gas Corporation	1/02/1996	222
WD	111	177204013701	Walter Oil & Gas Corporation	4/23/1997	260

Appendix H. Average Annual GOM Oil and Gas Production.

Year	Shallow-water Oil (MBOPD)	Deepwater Oil (MBOPD)	Total GOM Oil (MBOPD)	Shallow-water Gas (BCFPD)	Deepwater Gas (BCFPD)	Total GOM Gas (BCFPD)
1947	0	0	0	0.0	0.0	0.0
1948	0	0	0	0.0	0.0	0.0
1949	0	0	0	0.0	0.0	0.0
1950	1	0	1	0.0	0.0	0.0
1951	1	0	1	0.0	0.0	0.0
1952	2	0	2	0.1	0.0	0.1
1953	3	0	3	0.1	0.0	0.1
1954	7	0	7	0.2	0.0	0.2
1955	11	0	11	0.2	0.0	0.2
1956	19	0	19	0.2	0.0	0.2
1957	32	0	32	0.3	0.0	0.3
1958	54	0	54	0.4	0.0	0.4
1959	81	0	81	0.6	0.0	0.6
1960	111	0	111	0.8	0.0	0.8
1961	153	0	153	0.9	0.0	0.9
1962	210	0	210	1.2	0.0	1.2
1963	264	0	264	1.5	0.0	1.5
1964	305	0	305	1.8	0.0	1.8
1965	372	0	372	2.0	0.0	2.0
1966	480	0	480	2.7	0.0	2.7
1967	574	0	574	3.5	0.0	3.5
1968	695	0	695	4.4	0.0	4.4
1969	801	0	801	5.3	0.0	5.3
1970	901	0	901	6.6	0.0	6.6
1971	1,029	0	1,029	7.5	0.0	7.5
1972	1,022	0	1,022	8.2	0.0	8.2
1973	1,002	0	1,002	9.1	0.0	9.1
1974	926	0	926	9.4	0.0	9.4
1975	848	0	848	9.4	0.0	9.4
1976	824	0	824	9.7	0.0	9.7
1977	778	0	778	10.3	0.0	10.3
1978	757	0	757	11.6	0.0	11.6

Year	Shallow-water Oil (MBOPD)	Deepwater Oil (MBOPD)	Total GOM Oil (MBOPD)	Shallow-water Gas (BCFPD)	Deepwater Gas (BCFPD)	Total GOM Gas (BCFPD)
1979	720	2	721	12.8	0.0	12.8
1980	711	14	725	13.0	0.0	13.1
1981	711	10	721	13.4	0.0	13.4
1982	748	36	784	12.7	0.0	12.8
1983	806	72	878	11.1	0.1	11.2
1984	905	68	973	12.4	0.1	12.5
1985	904	58	962	11.1	0.1	11.2
1986	924	52	976	11.0	0.1	11.1
1987	852	47	899	12.3	0.1	12.5
1988	791	36	827	12.5	0.1	12.6
1989	743	27	770	2.7	0.1	12.7
1990	720	33	753	3.4	0.1	13.5
1991	746	63	808	2.8	0.2	12.9
1992	734	102	836	12.5	0.2	12.8
1993	746	101	847	12.5	0.3	12.8
1994	748	115	862	12.8	0.4	13.3
1995	795	151	947	12.6	0.5	13.1
1996	814	198	1,012	13.2	0.8	14.0
1997	831	296	1,127	13.1	1.0	14.1
1998	781	436	1,218	12.3	1.5	13.8
1999	740	617	1,357	11.6	2.3	13.9
2000	691	743	1,434	10.9	2.7	13.6
2001	661	853	1,514	10.6	3.2	13.8
2002*	603	959	1,562	8.8	3.6	12.3

* Estimated values for the year 2002.

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 **Minerals Revenue Management** 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.