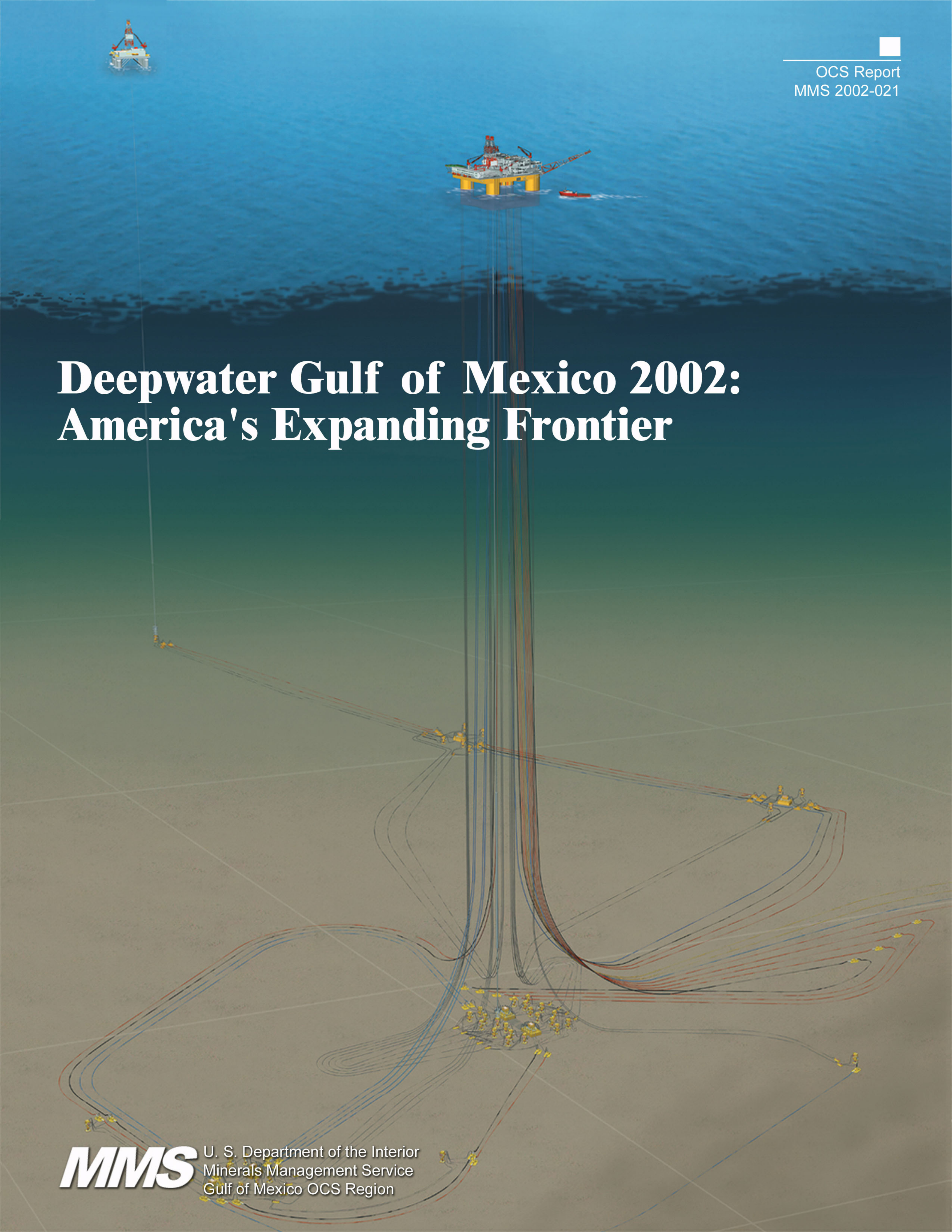
OCS Report
MMS 2002-021

Deepwater Gulf of Mexico 2002: America's Expanding Frontier



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

ON COVER — The cover features an artist's rendering of the Thunder Horse project and its associated development and production systems. Note the semisubmersible processing, drilling, and quarters platform in the center of the picture. (Image courtesy of BP Exploration Inc. and Exxon Mobil Corporation)

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Deepwater Gulf of Mexico 2002: America's Expanding Frontier

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

New Orleans
April 2002

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Preface

This publication is the third that Minerals Management Service (MMS) has released describing the astonishing levels of deepwater (greater than or equal to 1,000-foot depths) oil and gas activity in the Gulf of Mexico (GOM). Earlier versions of the publication in 1998 and 2000 chronicled the emergence of massive exploration and development in the GOM. A certain level of maturity has now been reached—the deepwater GOM is an expanding frontier.

While only 16 deepwater projects were on production in early 1997, this number grew to 51 by the end of 2001. A record 14 deepwater projects initiated production during 2001, and another 13 are projected to begin in 2002. The MMS estimates that, by the end of 2001, deepwater oil production had risen 500 percent and gas production had risen 550 percent since 1995. Fifty-nine percent of all oil production in the Gulf now comes from the deepwater.

Many different types of production-system technologies are now in use. There is a strong reliance on subsea tiebacks in deepwater and, surprisingly, in shallow water, with 38 subsea projects now producing throughout the GOM and more than 200 wells installed to date. With this reliance on subsea production technology and a growth of the pipeline infrastructure, operators have established numerous production hubs to support this expanding frontier. The Auger tension-leg platform (TLP), installed in 1994, now supports 3 separate subsea tieback developments – Macaroni (1999), Serrano (2001) and Oregano (2001). Shell began production from Brutus in 2001, the seventh TLP in the GOM. Installation of the unique class of small TLP's at the Typhoon and Prince fields shows the continued progression of floating production-system technology. The installation of the world's first truss spars at the Boomvang and Nansen fields, and the ongoing construction of five more, further demonstrates this progression.

In a sense, production of oil and gas is only now hitting its stride, and large increases in production are on the horizon for 2004-2006. Estimates by MMS of the substantial resource potential in deepwater will likely grow again when a new resource assessment is released.

Ultra-deepwater activity (greater than or equal to 5,000-foot depths) continues to accelerate; Unocal's announcement of a significant discovery at their world-record well on the Trident project (9,727 feet of water) serves to accentuate the unfolding potential of the deepwater GOM.

Chris C. Oynes
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. For purposes of this report, deepwater is defined as water depths greater than or equal to 1,000 feet (ft). A major milestone was reached in early 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. Deepwater development activities are expected to continue increasing. Included in this trend is an increasing number of ultra-deepwater (water depths greater than or equal to 5,000 ft) exploration and development activities. 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., 2000) 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 **Introductory** section discusses

- highlights of current deepwater GOM activity.

The **Leasing** section discusses

- historical water-depth and bidding trends in deepwater leasing,
- lease holdings of major oil companies compared with those of nonmajor oil companies,
- the impact of company mergers on deepwater exploration, 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,
- 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 2000 report.

Definitions

The Gulf of Mexico 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 the congressionally mandated Deepwater Royalty Relief Act (DWRRA) zones (200, 400, and 800 m) for reference.

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 paper 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.

More detailed definitions may be found in the annual *Estimated Proved and Unproved Oil and Gas Reserves, Gulf of Mexico, December 31, 1999* report (Crawford et al., 2002).

Throughout, this report refers to several deepwater fields by operator-designated project names. Appendices A and B provide locations, operators, and additional information regarding these fields. The field's identifying block number corresponds to the first lease qualified by MMS as capable of production. 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 May 2001 (the most recent complete data at the time of this writing).

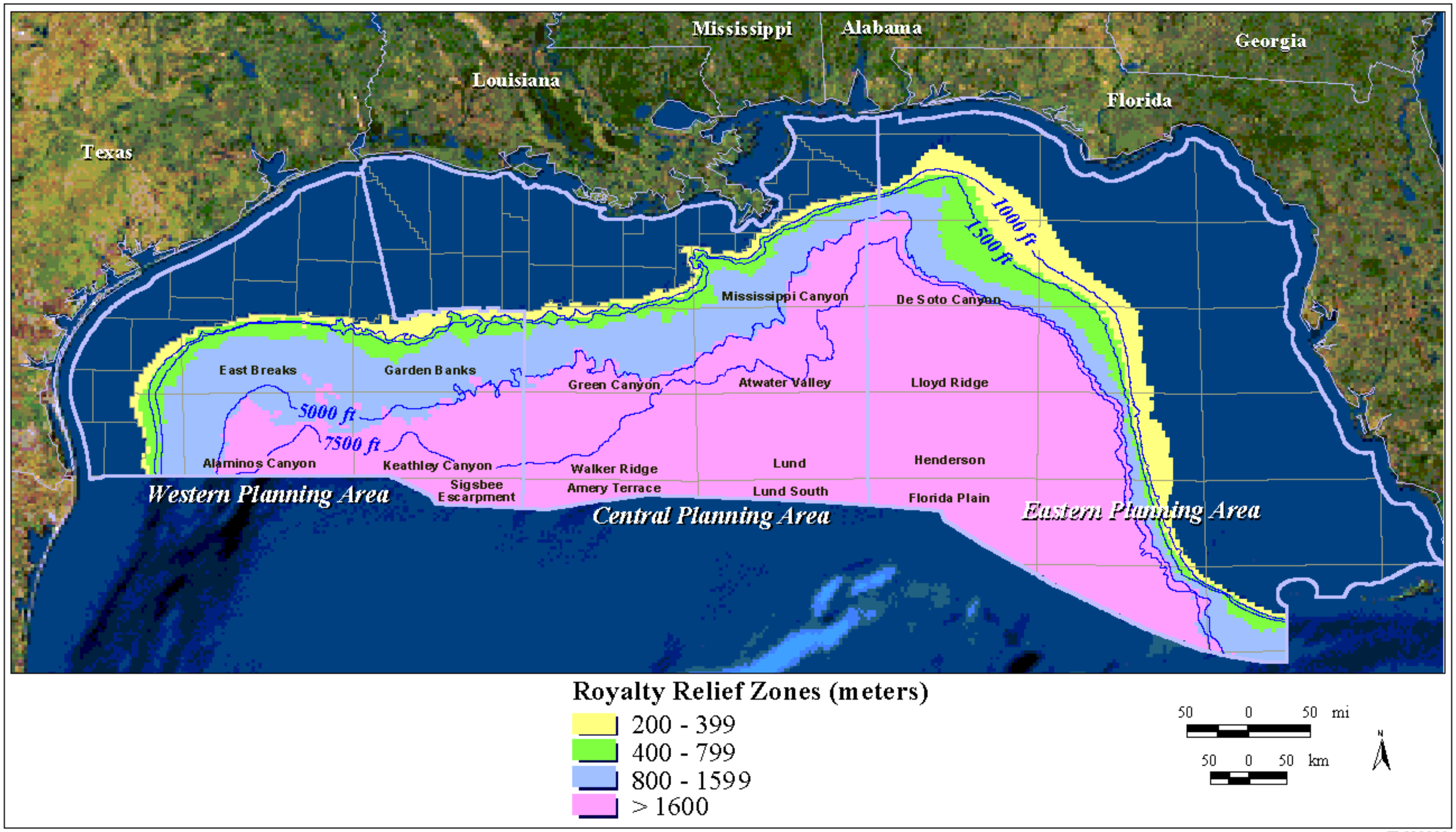

Figure 1. - The Gulf of Mexico OCS is divided into Western, Central, and Eastern Planning Areas. Water-depth categories used in this report are shown in addition to shaded Deepwater Royalty Relief Act zones.

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 intense leasing at that time. In February 1997 there were 16 producing deepwater fields, up from only 5 at the end of 1992. Industry was 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., 2000) highlighted dramatic advancements from 1997 through 1999. These advances have continued at a rapid pace since then.

At the end of 2001, there were 51 producing fields in the deepwater Gulf of Mexico, up 38 percent in just 12 months and up 59 percent in the two years since Baud et al., 2000. 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 (Exxon'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 continued to grow at an ever-increasing rate, leading to a flurry of activity in the past five years. This report focuses on changes during the last ten years, 1992-2001.

The growth in deepwater activity spans all phases of exploration and development, including leasing, drilling, and production. There are approximately 7,400 active leases in the Gulf of Mexico Outer Continental Shelf (OCS), 53 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 43 rigs drilling in deepwater in 2001, up from only 3 rigs in 1992 and 28 rigs in 1999. Likewise, deepwater oil production rose over 800 percent and deepwater gas production increased about 1,500 percent from 1992 to 2001.

All phases of exploration and development moved steadily into deeper waters over the past ten 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. A surge in production from nonmajors had been expected (Baud et al., 2000) when anticipated discoveries on their 1996 through 1999 lease acquisitions began production. Production from nonmajor companies has remained flat, however.

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 automatic 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. 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 automatic suspension volume provision of the DWRRA 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 in the post-DWRRA years for leases in water depths greater than 800 m (2,624 ft). Royalty relief volumes will range from 9 MMBOE in water depths of 800-1,599 m (2,625-5,246 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 as in the DWRRA. Post-DWRRA provisions are subject to change for each lease sale.

Seismic Activity

The DWRRA 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 greatly reduces the inherent risks of hydrocarbon exploration. Figure 2 illustrates the surge of seismic activity in the deepwater Gulf of Mexico during the last six 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 data sets 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 non-proprietary PrSDM surveys allows the widespread use of this technology in early phases of exploration. Industry is spending tens of millions of dollars to process seismic data to enhance the imaging capability of existing 3-D surveys.

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 re-entry of deepwater wells may promote the use of 4-D technology in the deepwater GOM.

Modern seismic data often generate new ideas leading to surges in leasing and drilling activities. Figure 4 illustrates several deepwater plays in the GOM. Although the traditional deepwater mini-basin plays are far from mature (especially considering the Thunder Horse and North

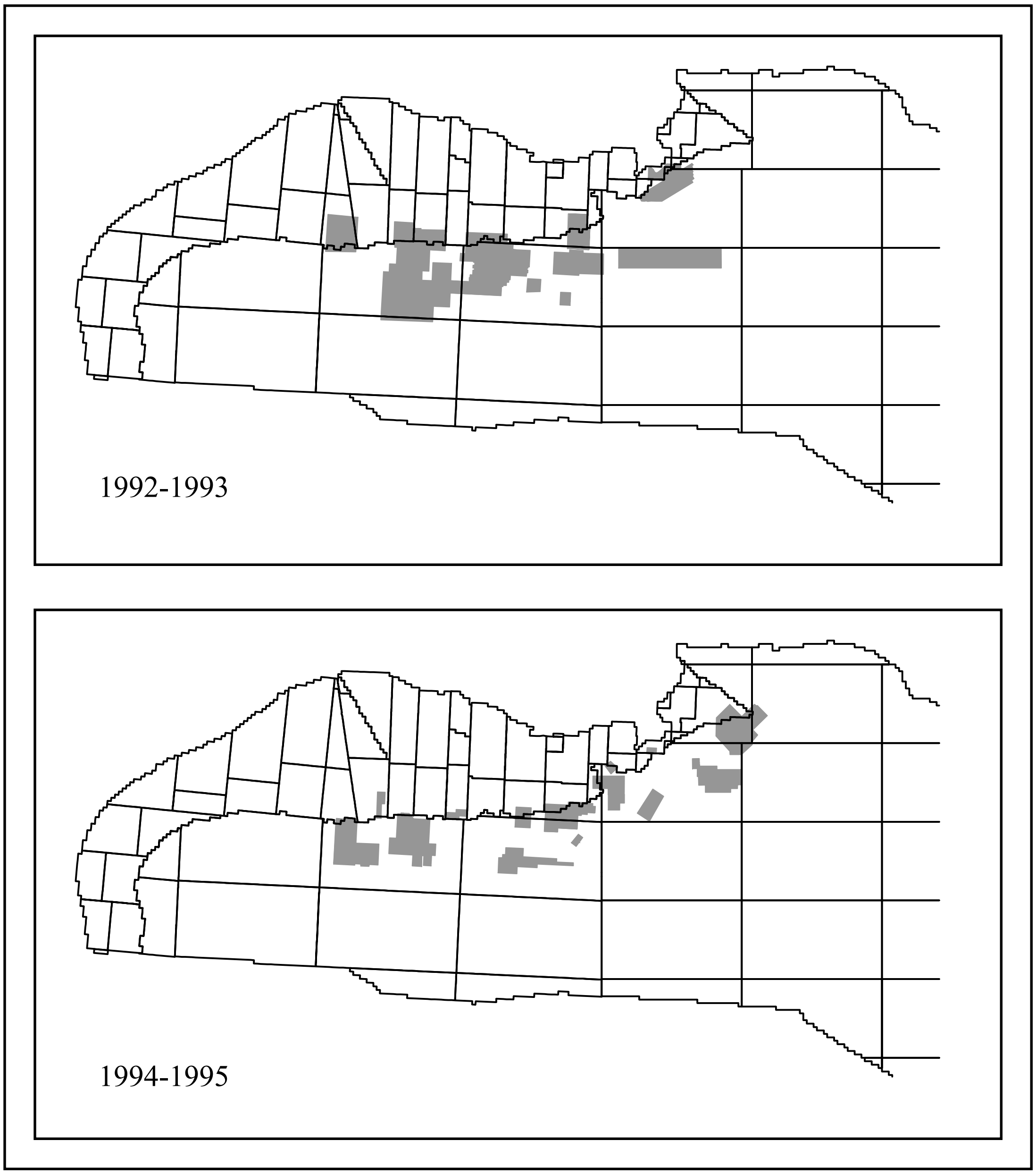

Figure 2. - Progressive deepwater 3-D seismic permit coverage.

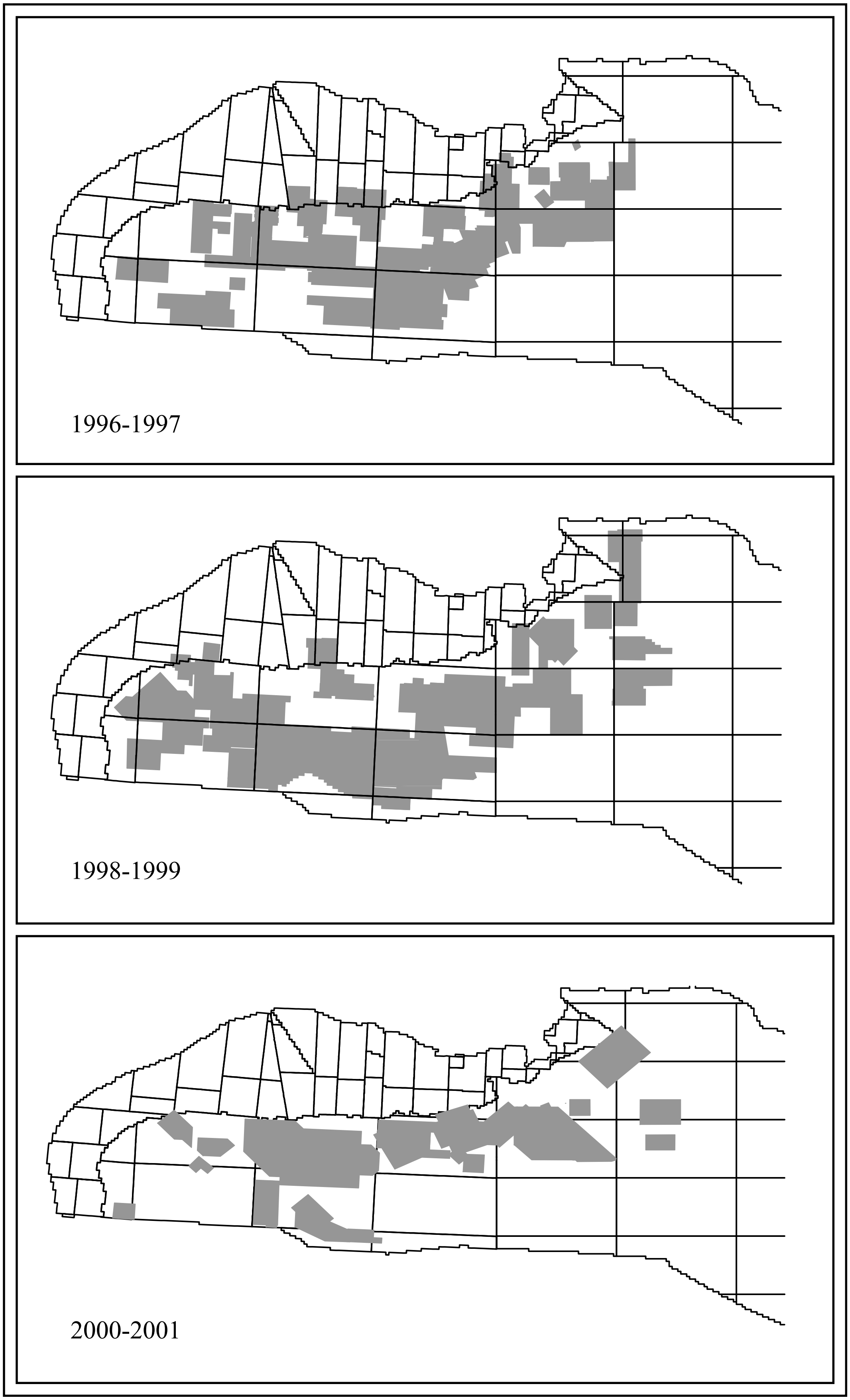

Figure 2. - *continued* - Progressive deepwater 3-D seismic permit coverage.

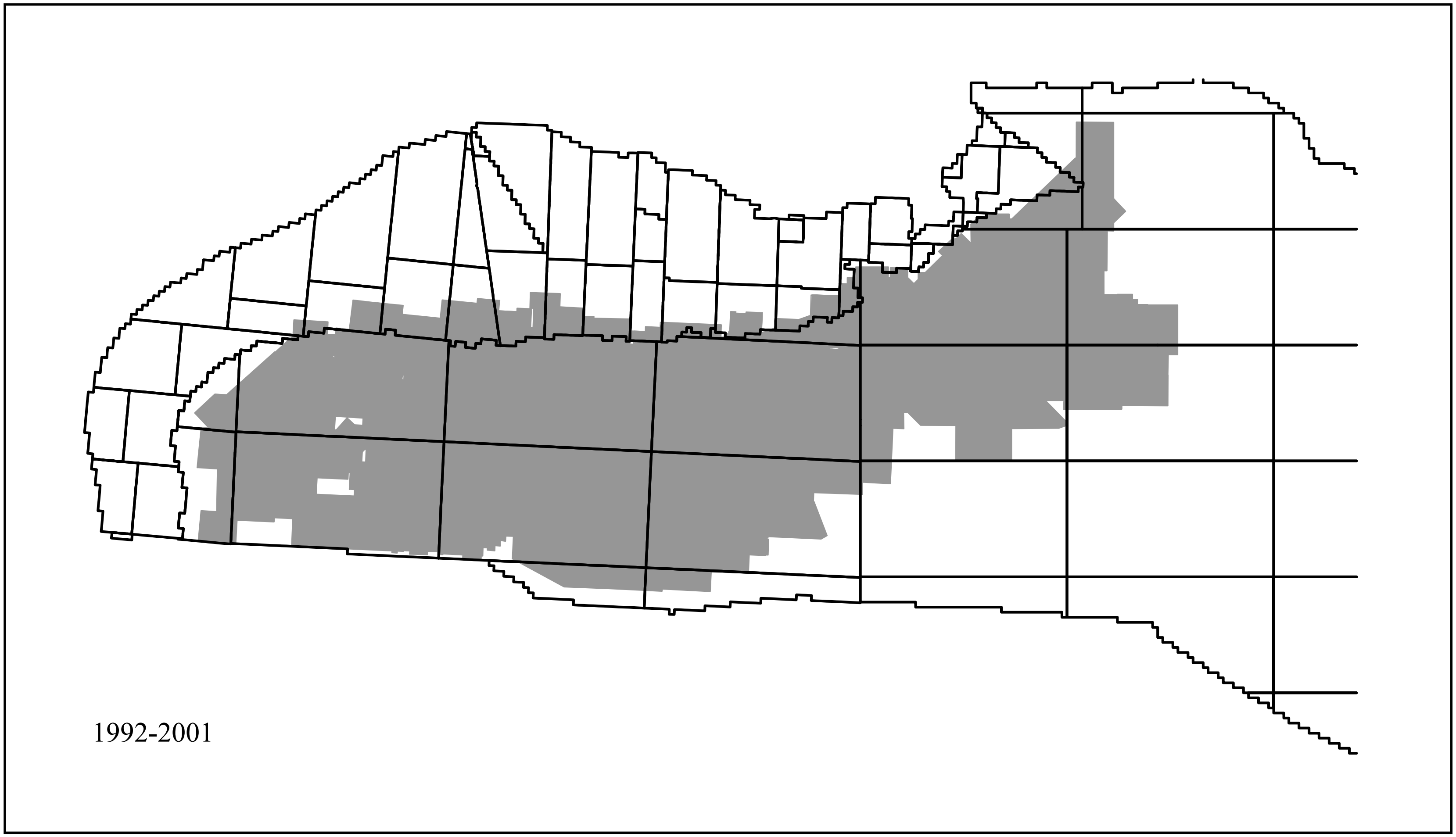

Figure 3. - Deepwater Gulf of Mexico 3-D seismic permit coverage from 1992 through 2001.

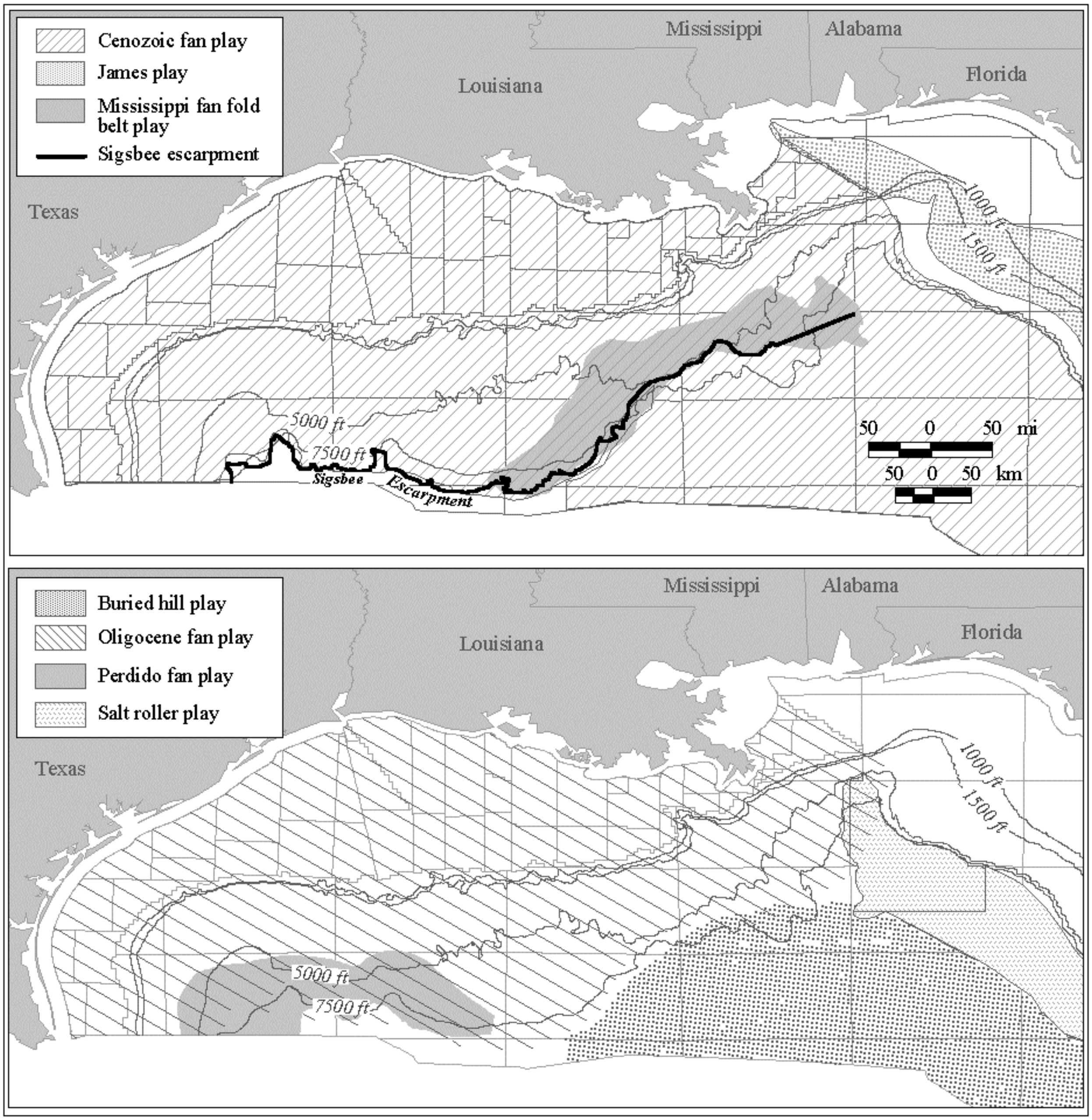

Figure 4. - New deepwater plays in the Gulf of Mexico.

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Thunder Horse discoveries in southern Mississippi Canyon), the Mississippi Fan Foldbelt, Perdido Foldbelt, and Tertiary Fan/Mesozoic Plays show that the deepwater arena is still very much a frontier area. Although sparsely tested, the Mississippi Fan Foldbelt Play shows great potential with announced discoveries at three locations (Mad Dog in Green Canyon Block 826, Neptune in Atwater Block 575, and Atlantis in Green Canyon Block 699). The Mississippi Fan Foldbelt Play also continues northward beneath the Sigsbee salt canopy. Industry-announced successes at K2-Timon (Green Canyon Block 562) and Champlain (Atwater Block 63) expand this exploration play to a large area north of the Sigsbee Escarpment. The first announced discovery within the Perdido Foldbelt Play occurred during 2001 at the Trident prospect (Alaminos Canyon Block 903). The Tertiary Fan/Mesozoic Play is heavily leased but remains untested. 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.

Leasing Activity

The DWRRA encouraged extensive leasing in the deepwater GOM. Figure 5 shows the recent history of deepwater leasing. Activity slowly increased from 1992 through 1995. Immediately after the DWRRA was enacted, however, 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.) Deepwater leasing activity slowed in 1998 and 1999 but has steadily increased since then.

The GOM leasing status is shown in figure 6. In contrast to the analogous figure in the previous edition of this report, fewer deepwater leasing voids remain. There are about 3,500 active leases in water depths less than 1,000 ft, about 160 active leases in 1,000-1,499 ft water depth, about 1,620 active leases in 1,500-4,999 ft water depth, about 1,320 active leases in 5,000-7,499 ft water depth, and about 820 active leases in water depths of 7,500 ft and greater. The abrupt termination of active leases south of the Alabama-Florida state line approximates the eastern edge of Lease Sale 181 acreage. Lease Sale 181 occurred in December 2001, the first Eastern Gulf lease sale since 1988. The lack of activity in the eastern GOM is caused by leasing restrictions.

The lease area for Sale 181 is more than 161 km (100 miles) offshore from the State of Alabama and is adjacent to the Central Planning Area. Of the 233 tracts in the sale area (approximately 1.3 million acres), the MMS received 190 bids on about 547,000 acres. The MMS awarded 95 leases (about 41% of the tracts offered) in Sale 181. All of these leases are located in water depths greater than 1,600 m (5,250 ft). The high bid per acre for Sale 181 was approximately \$622, as compared with about \$93 for the Western Gulf Sale 180 in August 2001, and approximately \$185 for the Central Gulf Sale 178, Part 1 in March 2001.

Figure 7 shows the historic total active leasing trends by water-depth range. Notice the dramatic increase in active leases for the greater than 800 m range. In 2001, for the first time in GOM history, the total active leases in this range outnumber those in shallow water (less than 200 m).

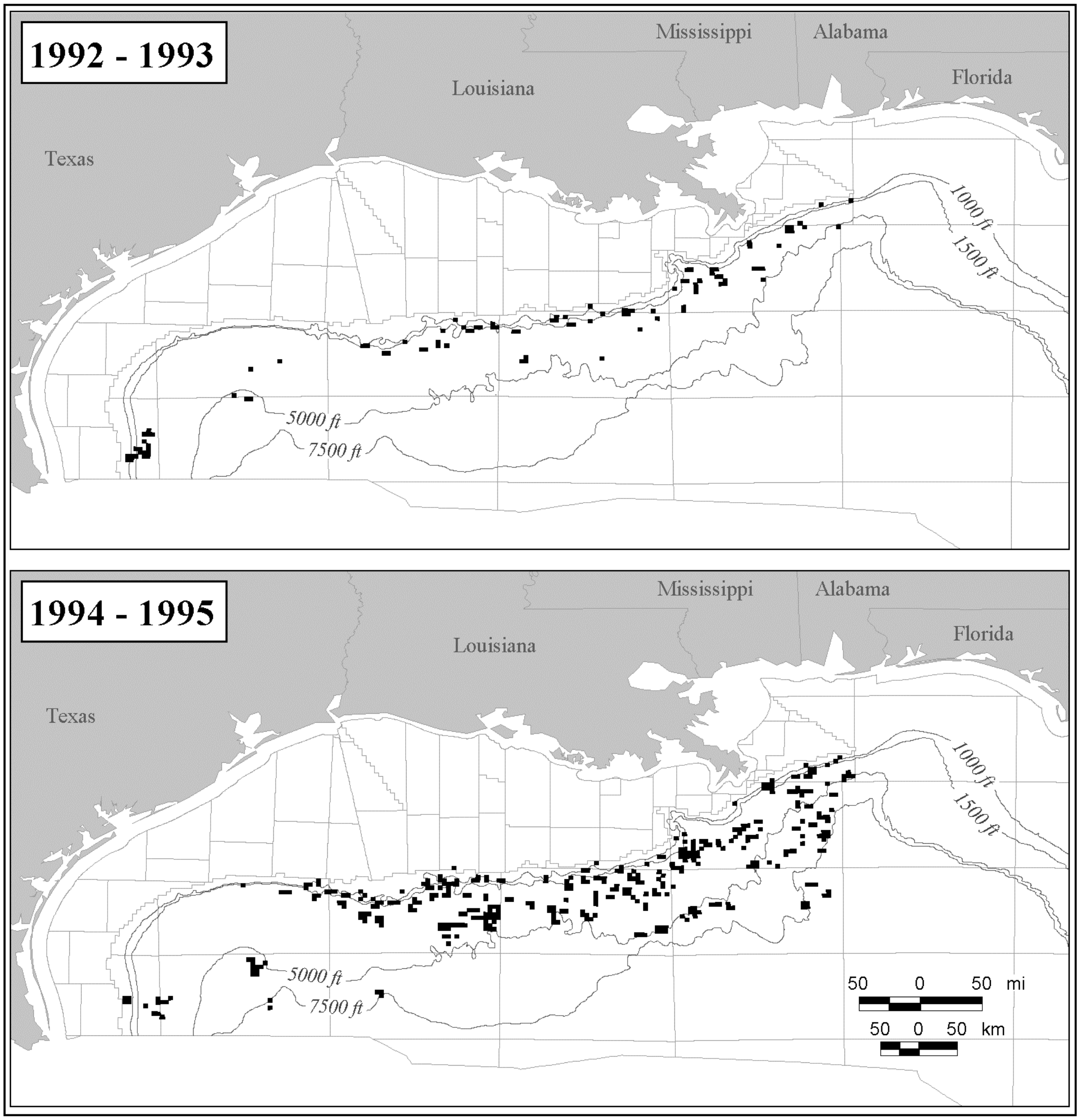

Figure 5. - Deepwater leases issued in the Gulf of Mexico. TM02024A

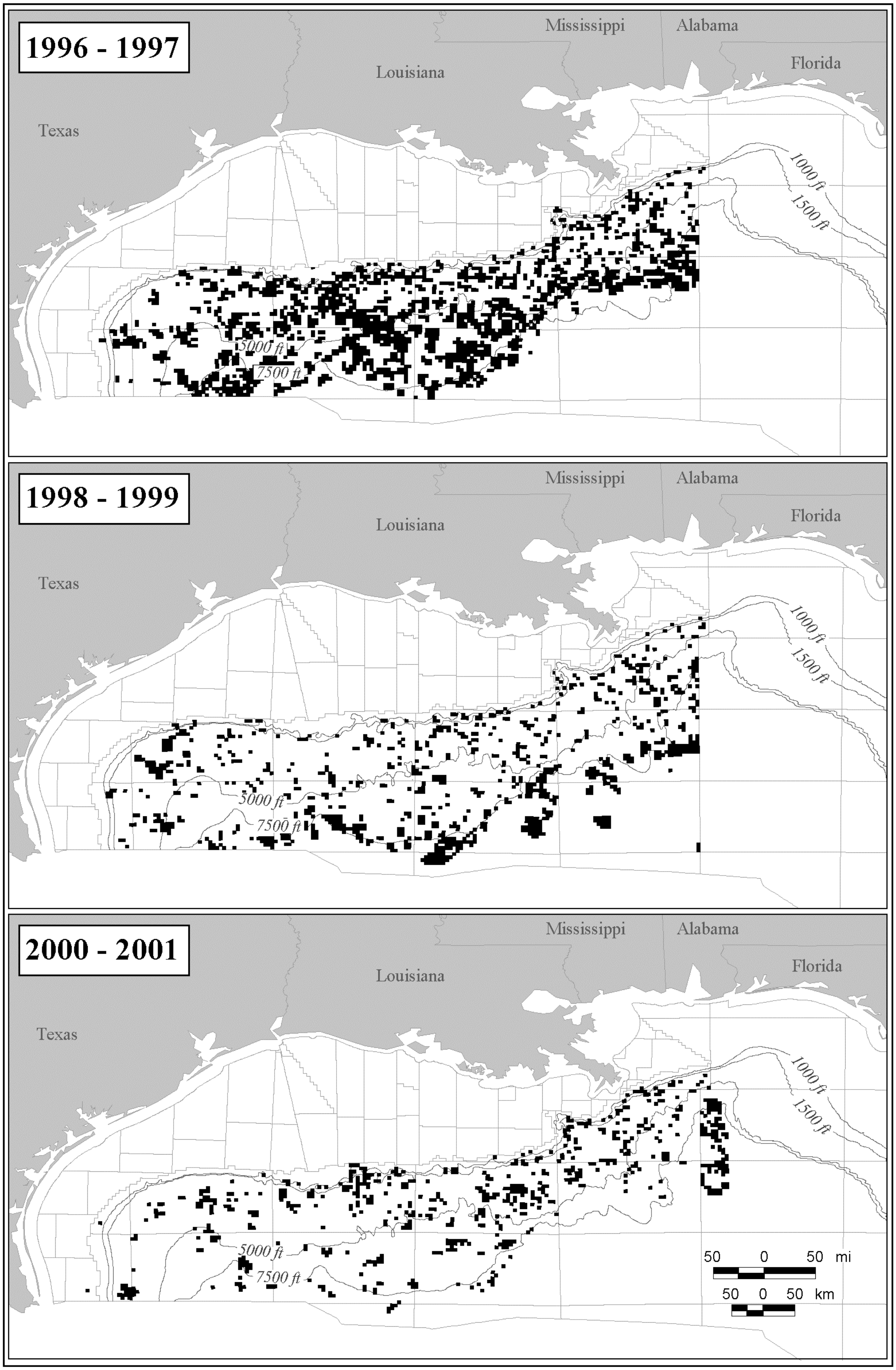

Figure 5. - *continued* - Deepwater leases issued in the Gulf of Mexico.

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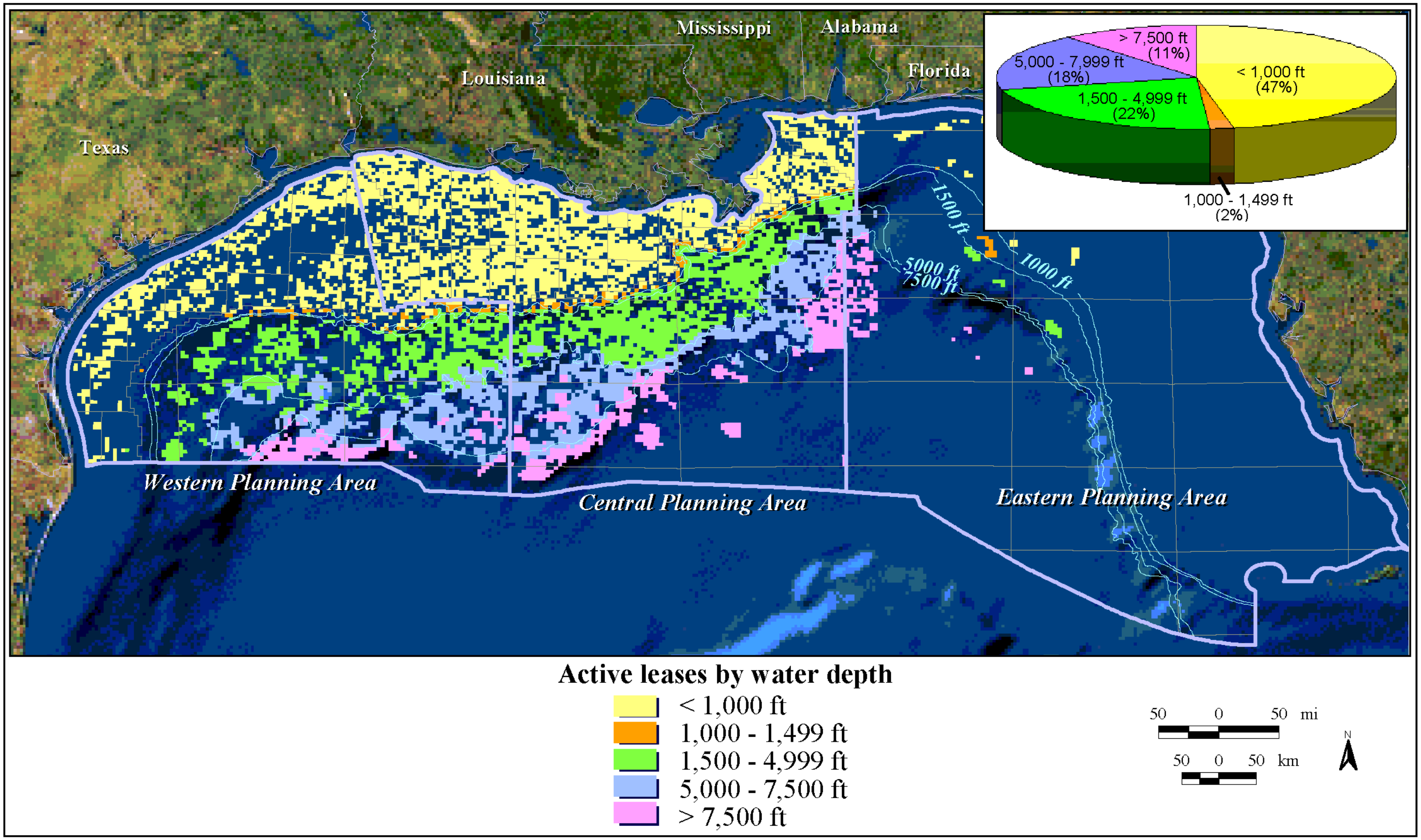

Figure 6. - Active leases in the Gulf of Mexico.

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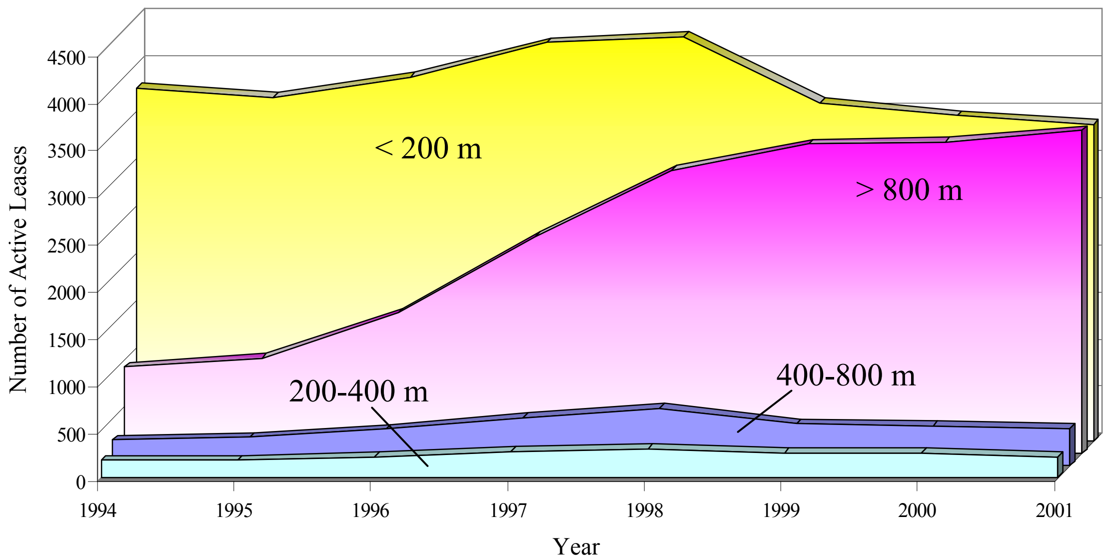

Water Depth	1994	1995	1996	1997	1998	1999	2000	2001
< 200 m	3753	3652	3867	4235	4300	3596	3459	3366
200-400 m	181	184	216	276	304	262	257	220
400-800 m	270	301	386	509	605	443	423	392
> 800 m	916	1012	1491	2298	3002	3282	3304	3424

Figure 7. - Total active leases by year and water-depth range.

Operators contend with numerous obstacles when venturing into the deepwater arena. Figure 8 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.

Environmental Activity

The nature of the deepwater GOM requires extensive scientific knowledge and 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 unique issues as industry moved into deepwater. For example, studies were initiated to evaluate the sensitivity of chemosynthetic ecosystems. Refer to Appendix E 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 in compliance with the National Environmental Policy Act (NEPA). The grid system divided the Gulf into 17 areas or "grids" of biological similarity (figure 9). 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 "host" 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 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 1 below shows the status of the grid PEA's.

Table 1. - Completed and pending grid PEA's within the Central and Western Planning Areas of the Gulf of Mexico.

Grid	Project	Company	Plan	Area & Blocks
4*	Nansen	Kerr-McGee	N-7045	EB 602, EB 646
10*	Holstein	British Petroleum	N-7216	GC 644, GC 645
12	Medusa	Murphy	N-7269	MC 538, MC 538
15*	Matterhorn	TotalFinaElf	N-7249	MC 243

*Indicates completed grid PEA's.
EB = East Breaks
GC = Green Canyon
MC = Mississippi Canyon

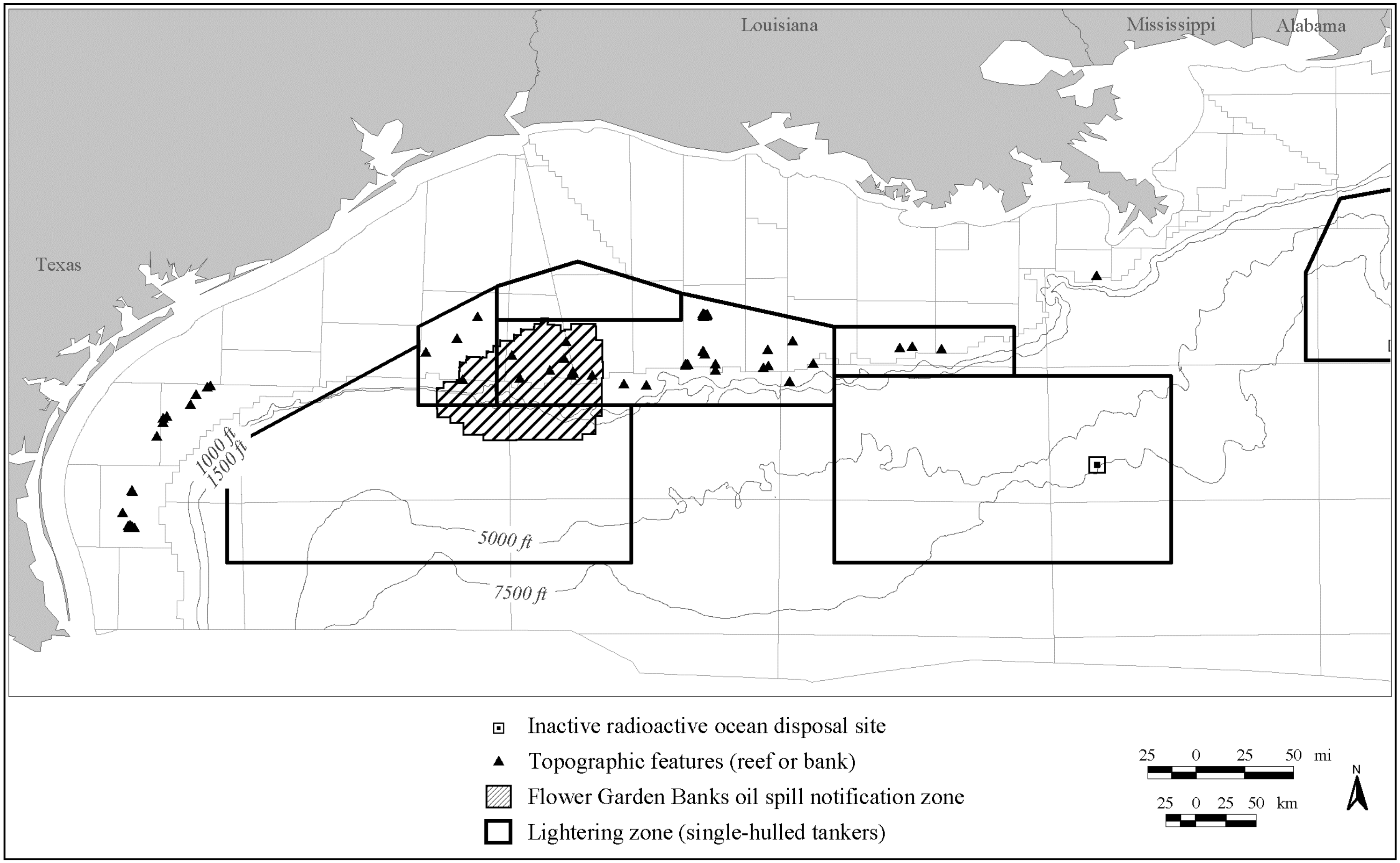

Figure 8. - Environmental and deepwater administrative features.

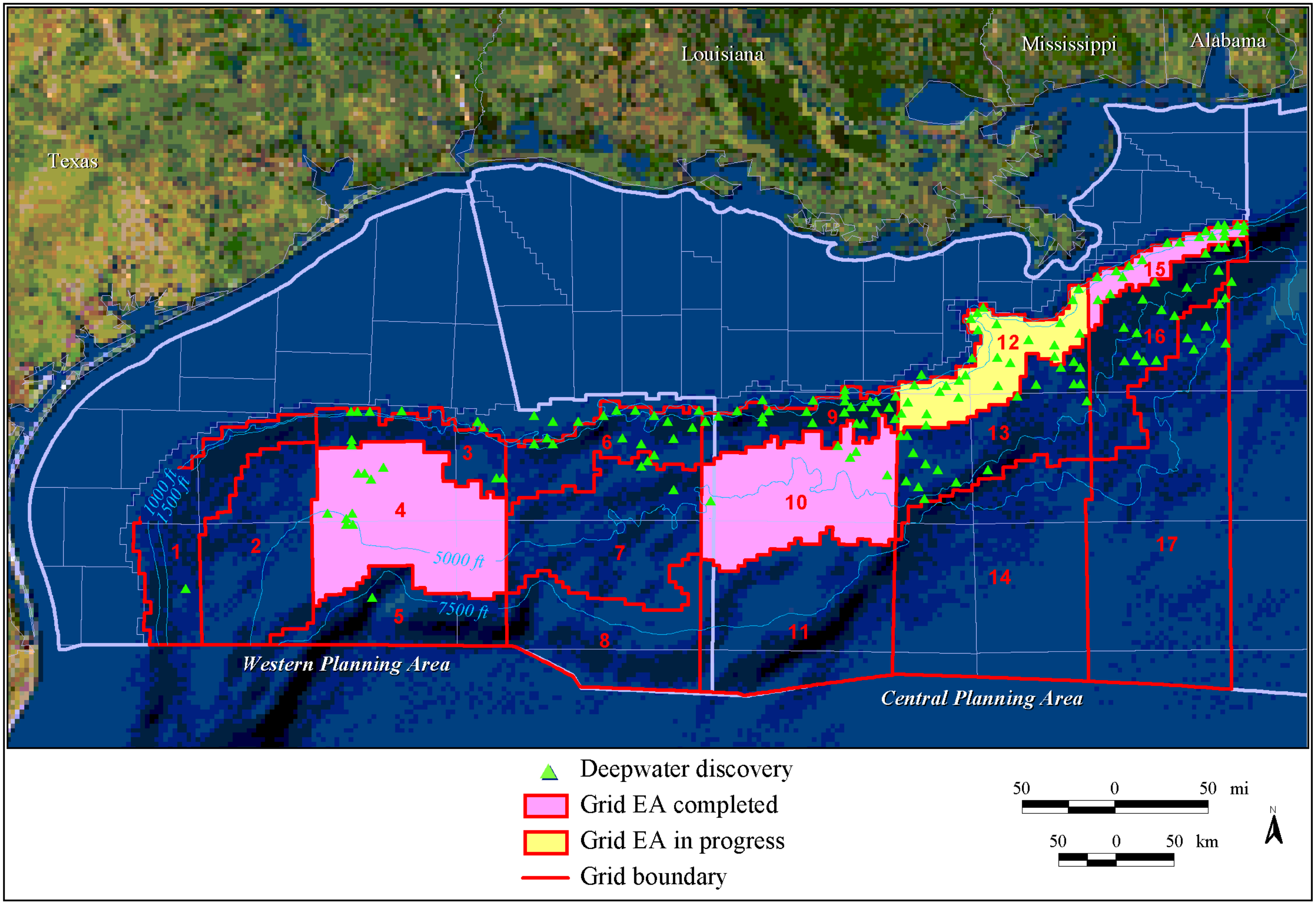

Figure 9. - Grid EA's completed and in progress.

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To implement its deepwater strategy further, the MMS issued Notice to Lessees and Operators (NTL) No. 2001-G04, *Remotely Operated Vehicle Surveys in Deepwater*, with an effective date of June 1, 2001. 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.

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 17 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 10 shows the locations 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.

Floating Production, Storage, and Offloading Systems

The MMS prepared, under contract, an environmental impact statement (EIS) to evaluate potential environmental effects of floating production, storage, and offloading (FPSO) systems in water depths greater than 200 m in the Central and Western Planning Areas in the GOM (USDOI, MMS, 2001). The EIS analyzed the most likely configuration of a ship-shaped, permanently moored FPSO with one million barrels of oil storage (figure 11). The EIS evaluated a ten-year period, the years 2001 through 2010. A regulatory framework and a risk analysis were completed on a parallel path to the EIS to enhance the technical review of an FPSO-based project. The FPSO system presents industry with a viable deepwater production and transportation option in areas where other development systems may be infeasible because of economic or technical concerns.

The EIS was prepared as a programmatic document to examine the fundamental issues associated with the proposed use of FPSO's in the GOM. A project-specific review would be necessary before an FPSO would be permitted to operate in the GOM.

The Record of Decision for this EIS was signed by MMS on December 13, 2001, and announced on January 2, 2002. Approved was the general concept of using FPSO's in the GOM Outer Continental Shelf except within the U.S. Coast Guard (USCG) designated lightering-prohibited areas (figure 12). The excluded area comprises 471 blocks along the shelf edge from Galveston

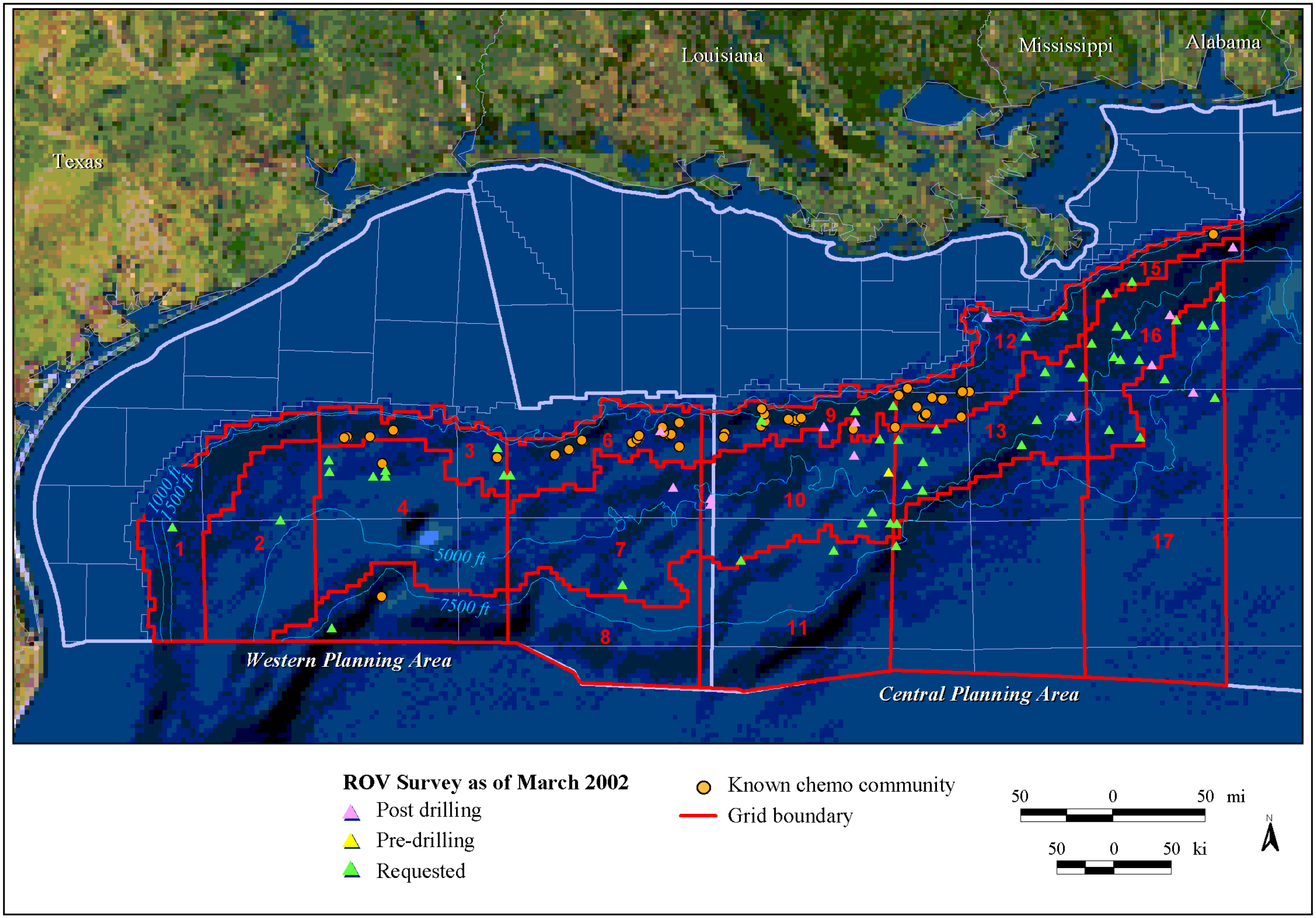

Figure 10. - ROV surveys including known chemosynthetic communities.

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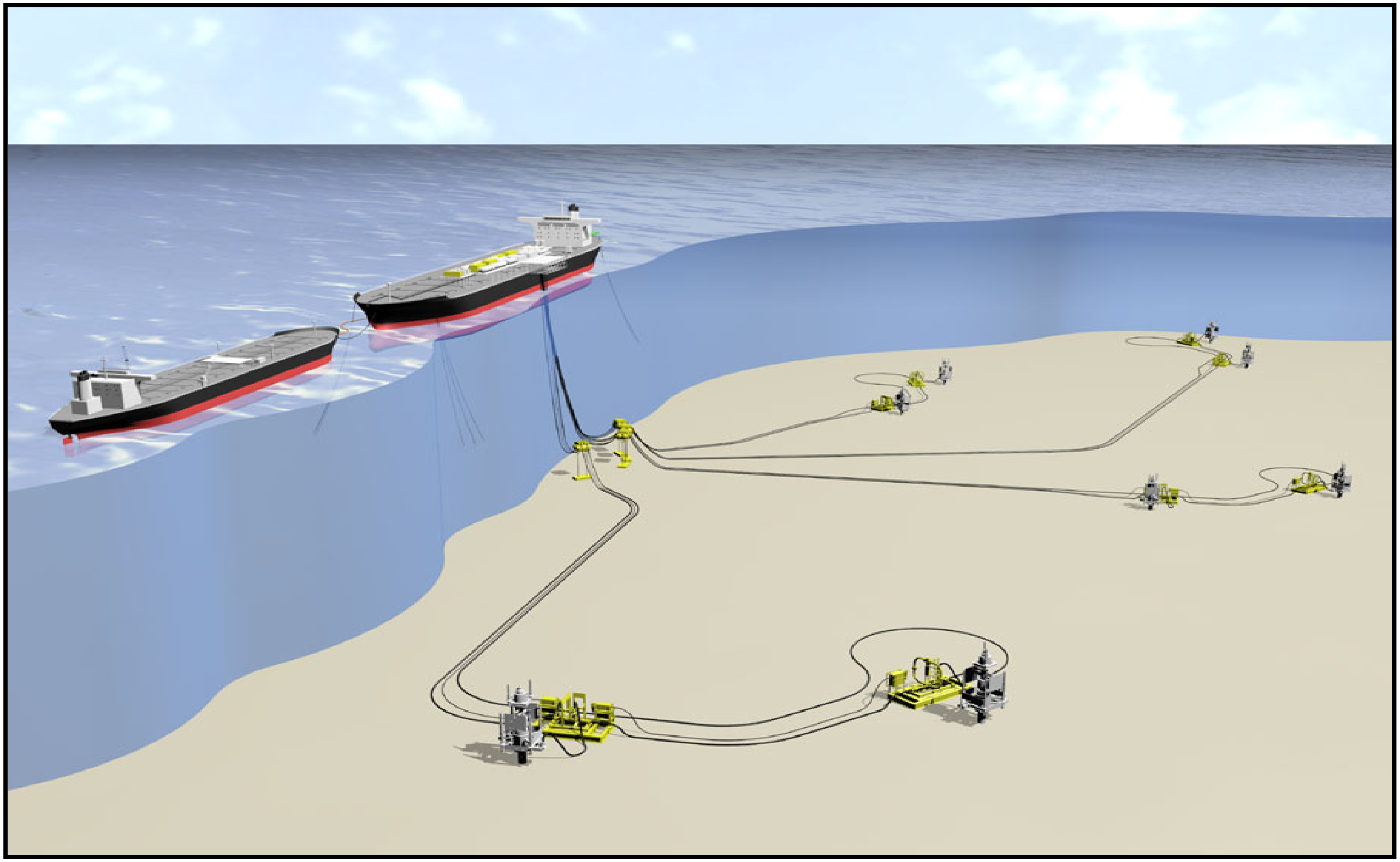

Figure 11. – Artist's rendition of an FPSO system with subsea trees and flowlines. (Courtesy of Intec Engineering, Inc.)

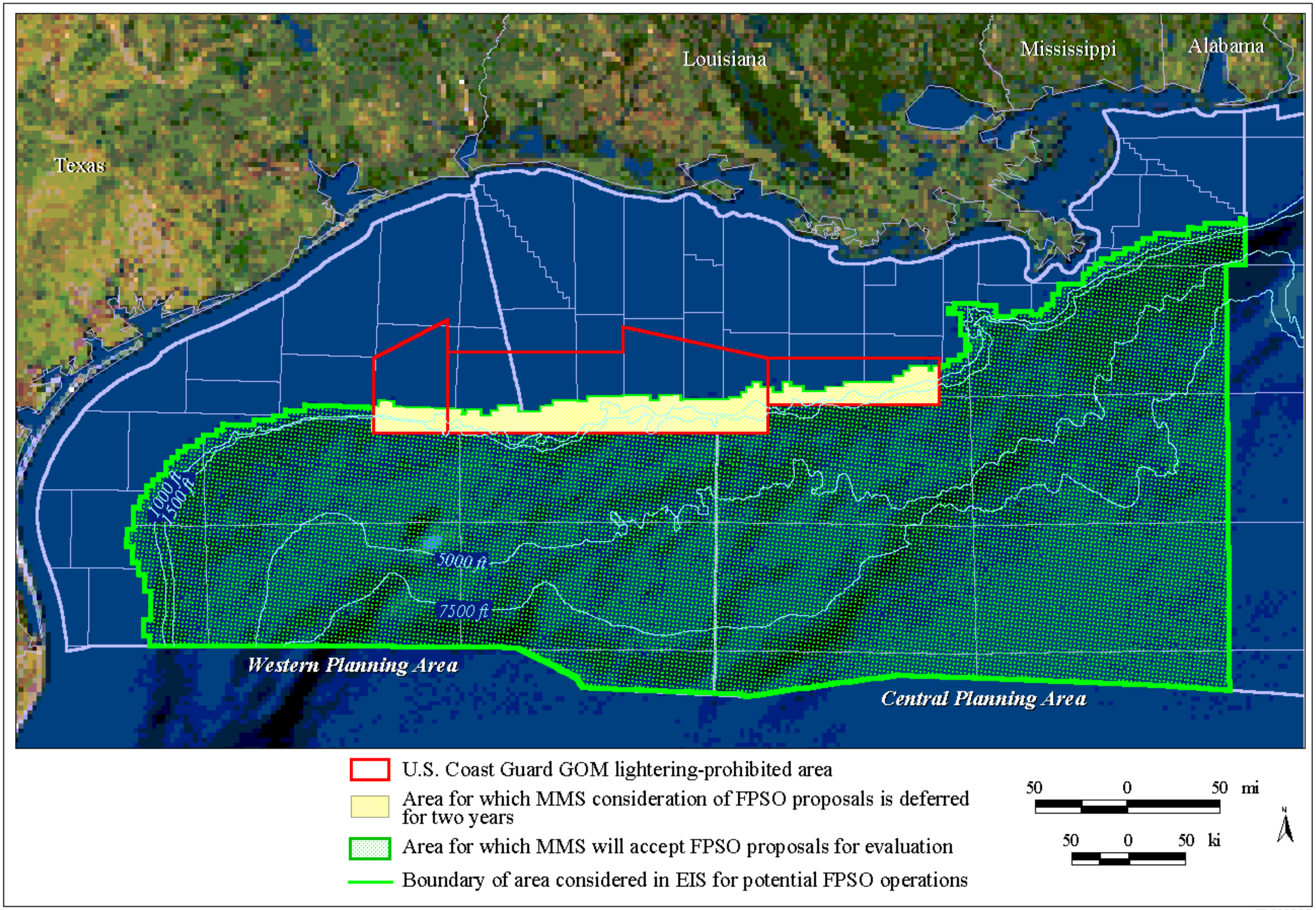

Figure 12. - FPSO EIS area of consideration and deferral FPSO proposal areas.

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to New Orleans. Proposals for the use of FPSO's in this area will not be accepted by the MMS for a two-year period to allow continuing MMS and USCG discussion on potential protective measures for that sector.

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 13 shows the history of discoveries in the deepwater GOM. There is a shift toward deeper water with time, and the number of deepwater discoveries continues at a steady pace. Note that the first frame of this figure represents a 10-year span, whereas the other frames represent shorter spans. Figure 14 shows how major and nonmajor oil and gas companies compare in terms of deepwater discoveries. (Appendix C lists those companies defined as majors.) To date, majors are responsible for about two-thirds of the deepwater discoveries. Additionally, discoveries by nonmajor companies tend to be in the shallower portions of the deepwater, while majors tend to dominate the ultra-deepwater frontier areas.

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 15 illustrates the estimated sizes and distributions of 53 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 16). Pending Plans of Exploration (EP's) and Development Operations Coordination Documents (DOCD's) filed with MMS indicate that support from southeast Louisiana will grow significantly and that additional support will come from southwest Louisiana, Mississippi, and the Texas coast (figure 17). Although expanding along the Gulf Coast, shore-based support for deepwater operations is likely to remain concentrated in southeastern Louisiana.

The infrastructure needed to bring deepwater production online continues to develop over time. Figure 18 shows the framework of major oil and gas pipelines in the shallow-water GOM. Figure 19 illustrates the existing network of deepwater pipelines.

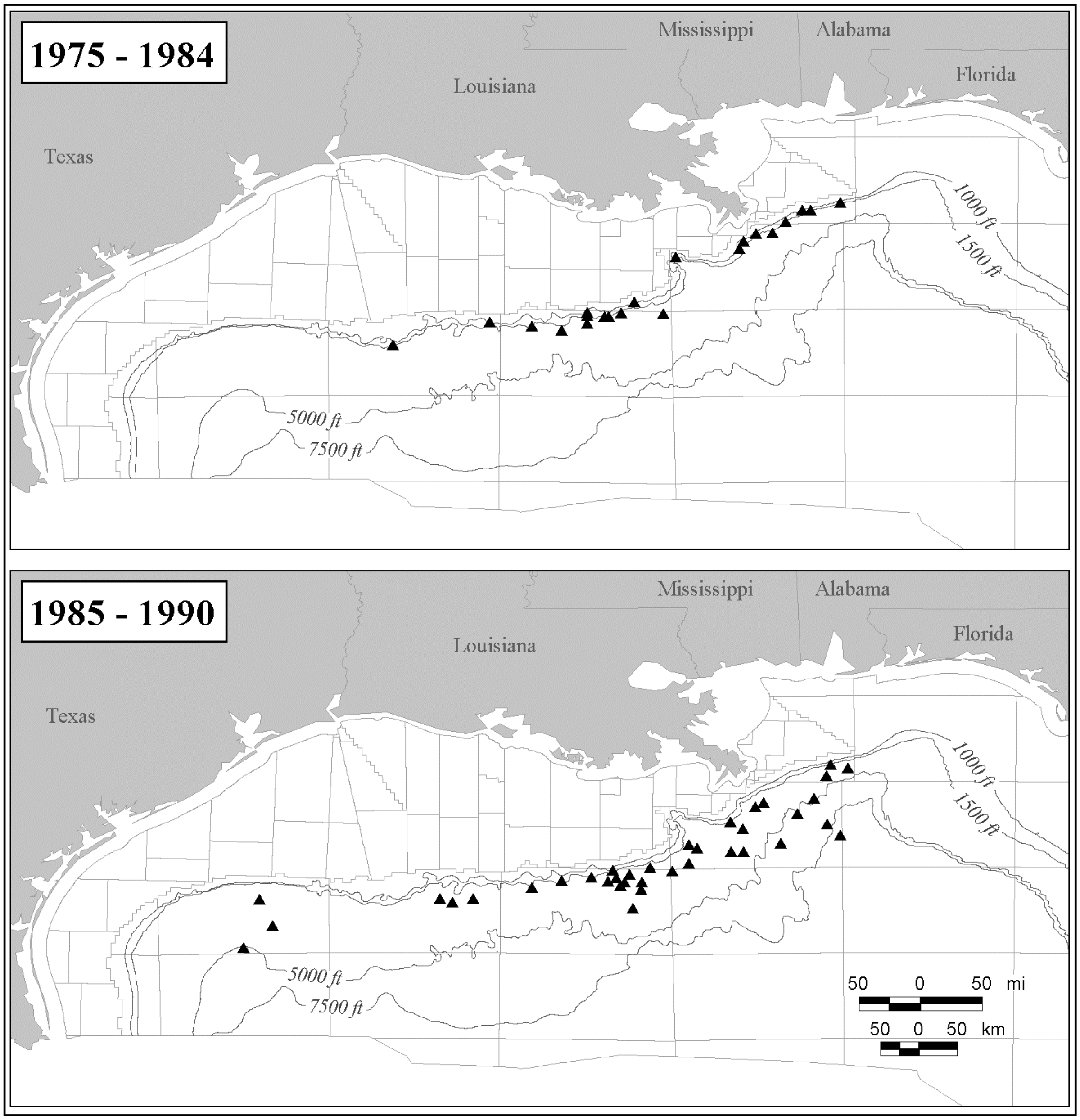

Figure 13.- Deepwater discoveries in the Gulf of Mexico.

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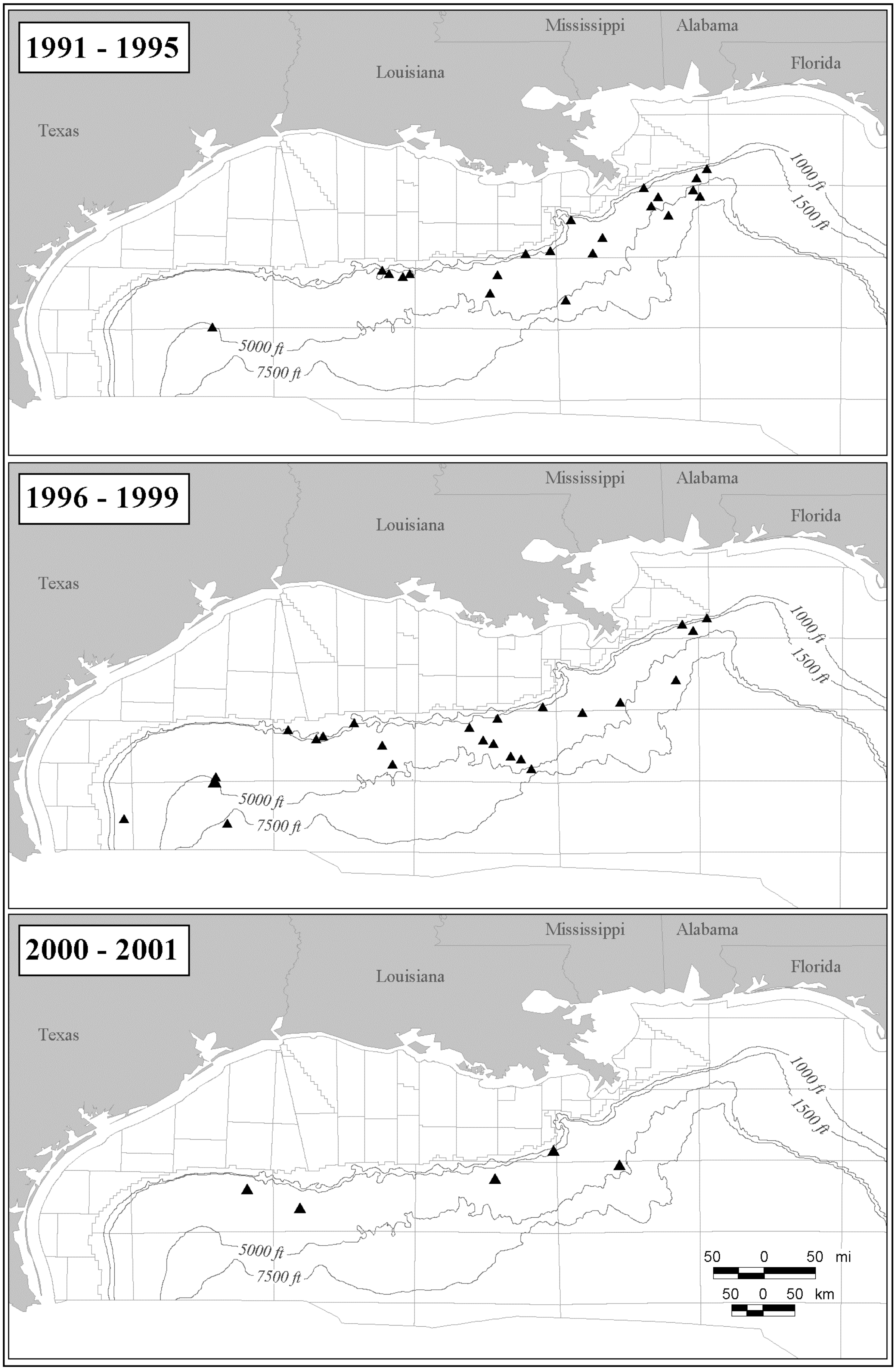

Figure 13. - *continued* - Deepwater discoveries in the Gulf of Mexico. TM02014B

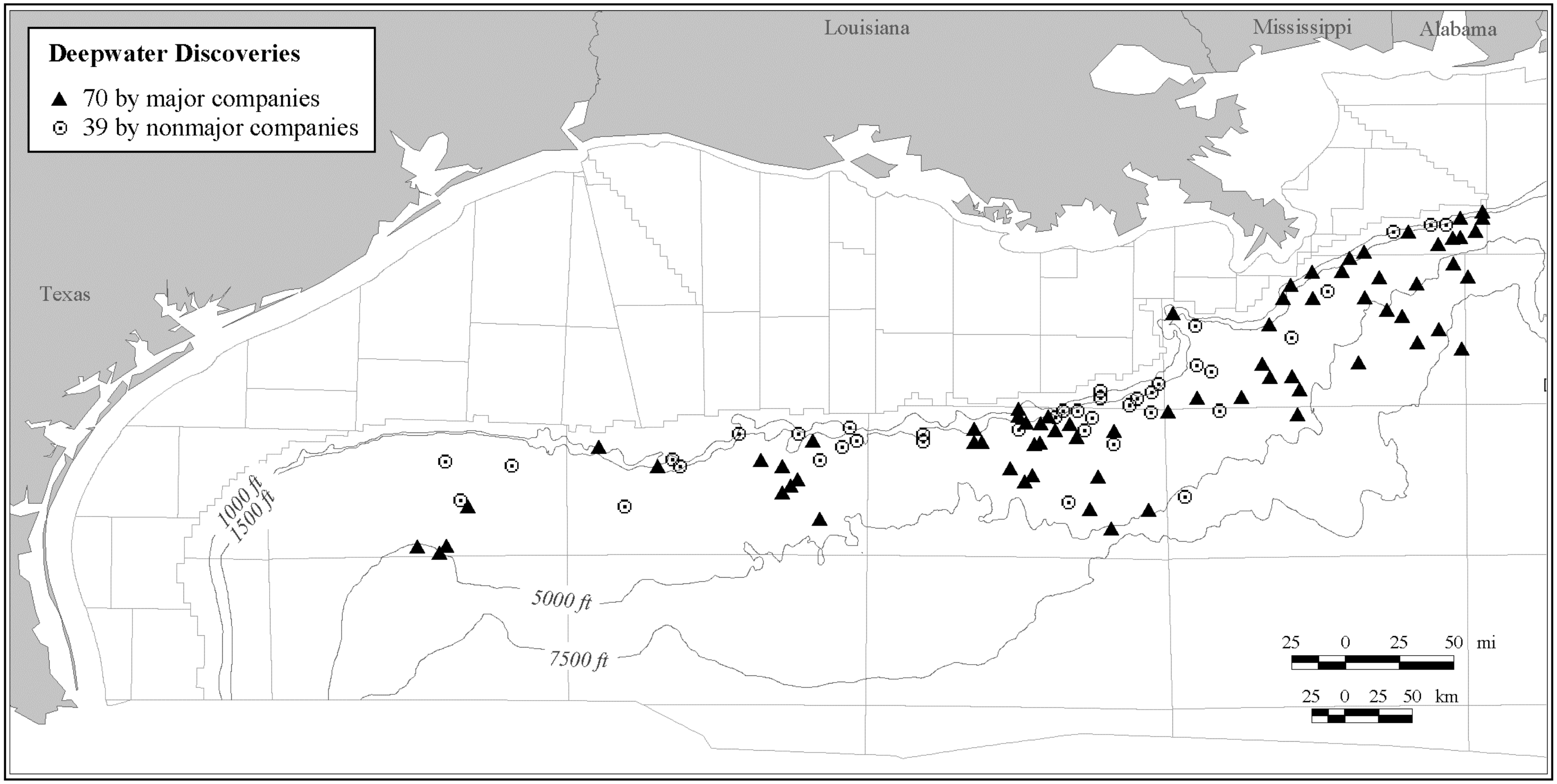

Figure 14. - Ownership of deepwater discoveries.

TM02030

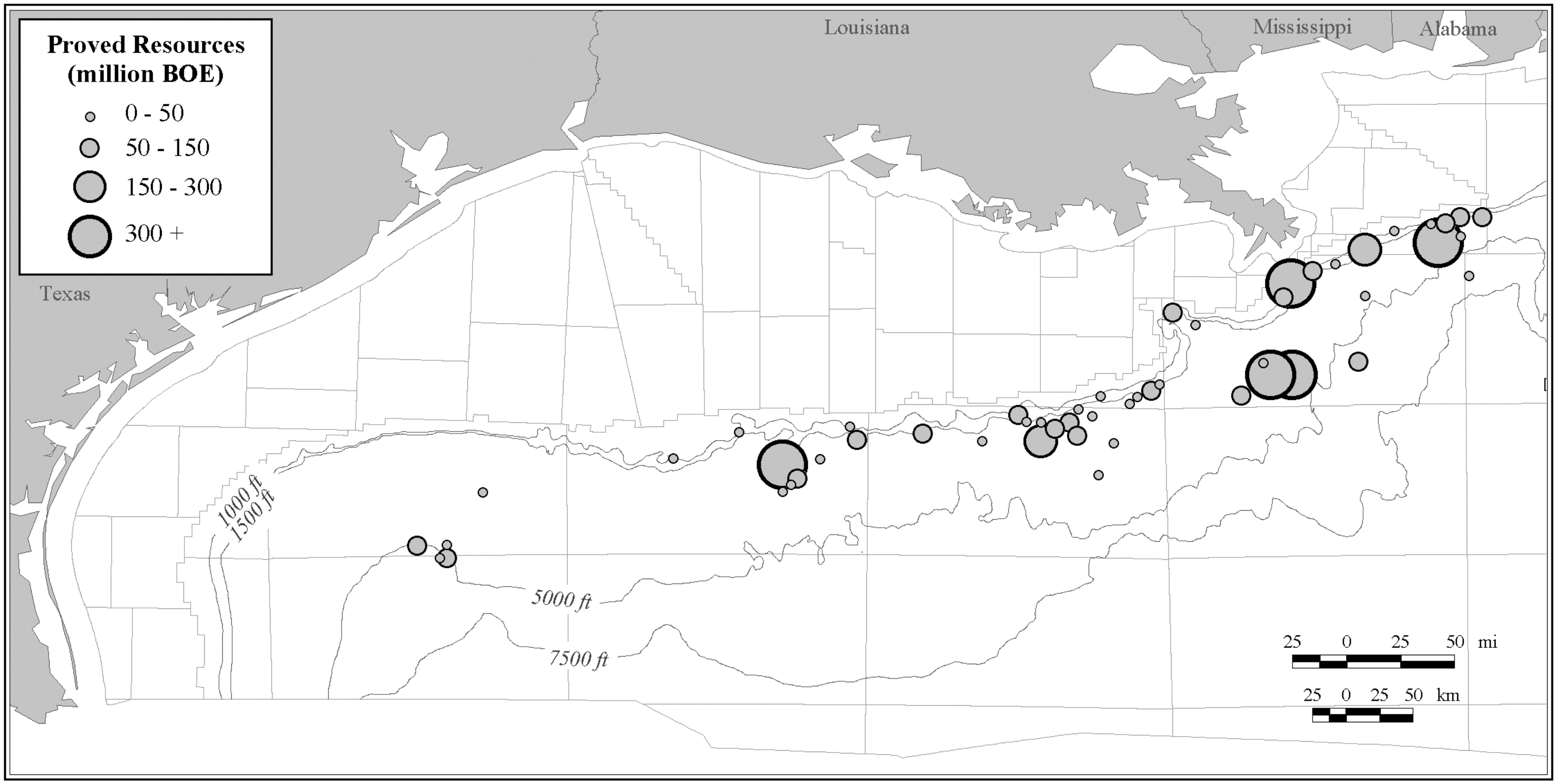

Figure 15. - Estimated volumes of 53 proved deepwater fields.

TM02013

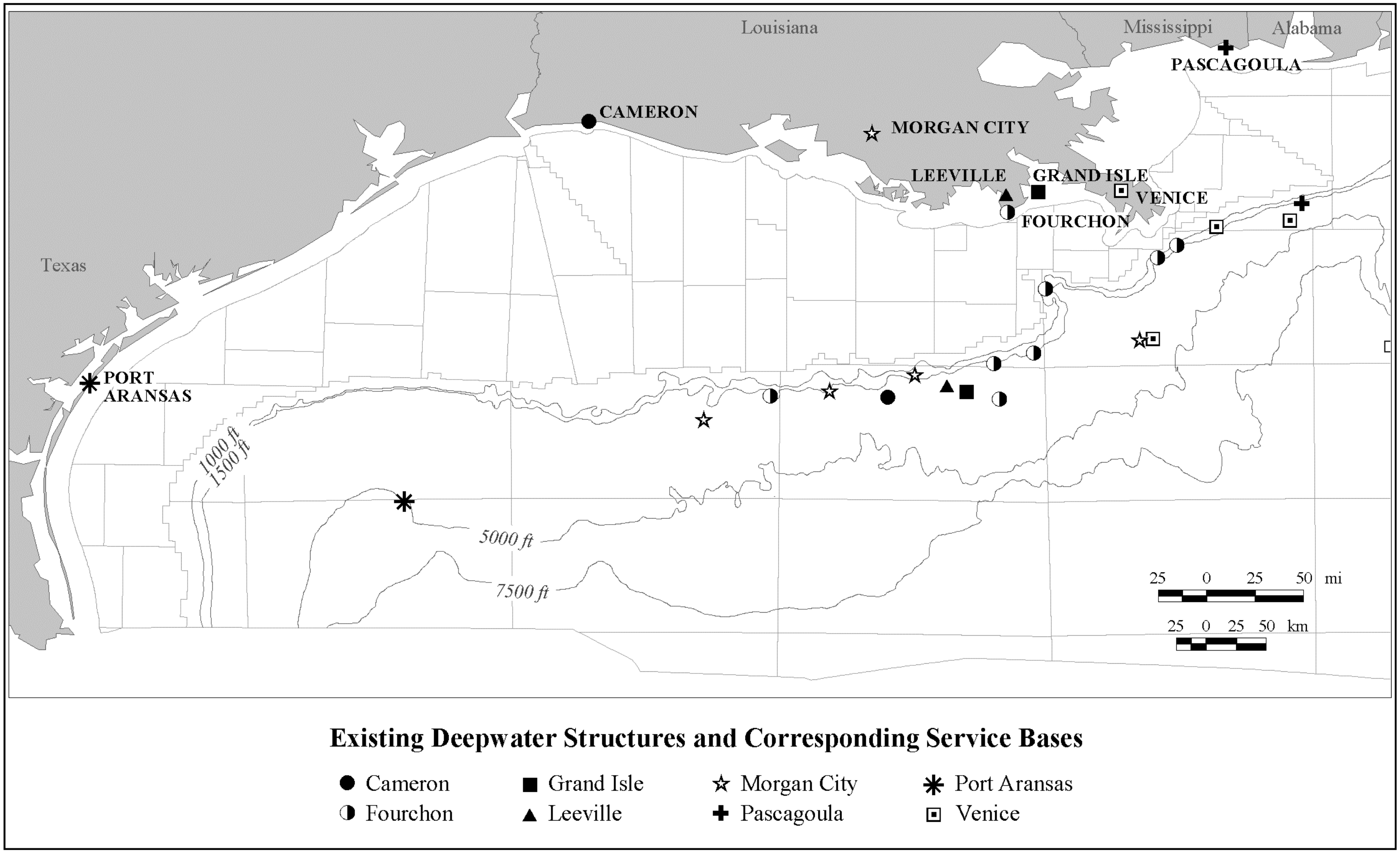

Figure 16. - Onshore service bases for existing deepwater structures.

TM02017A

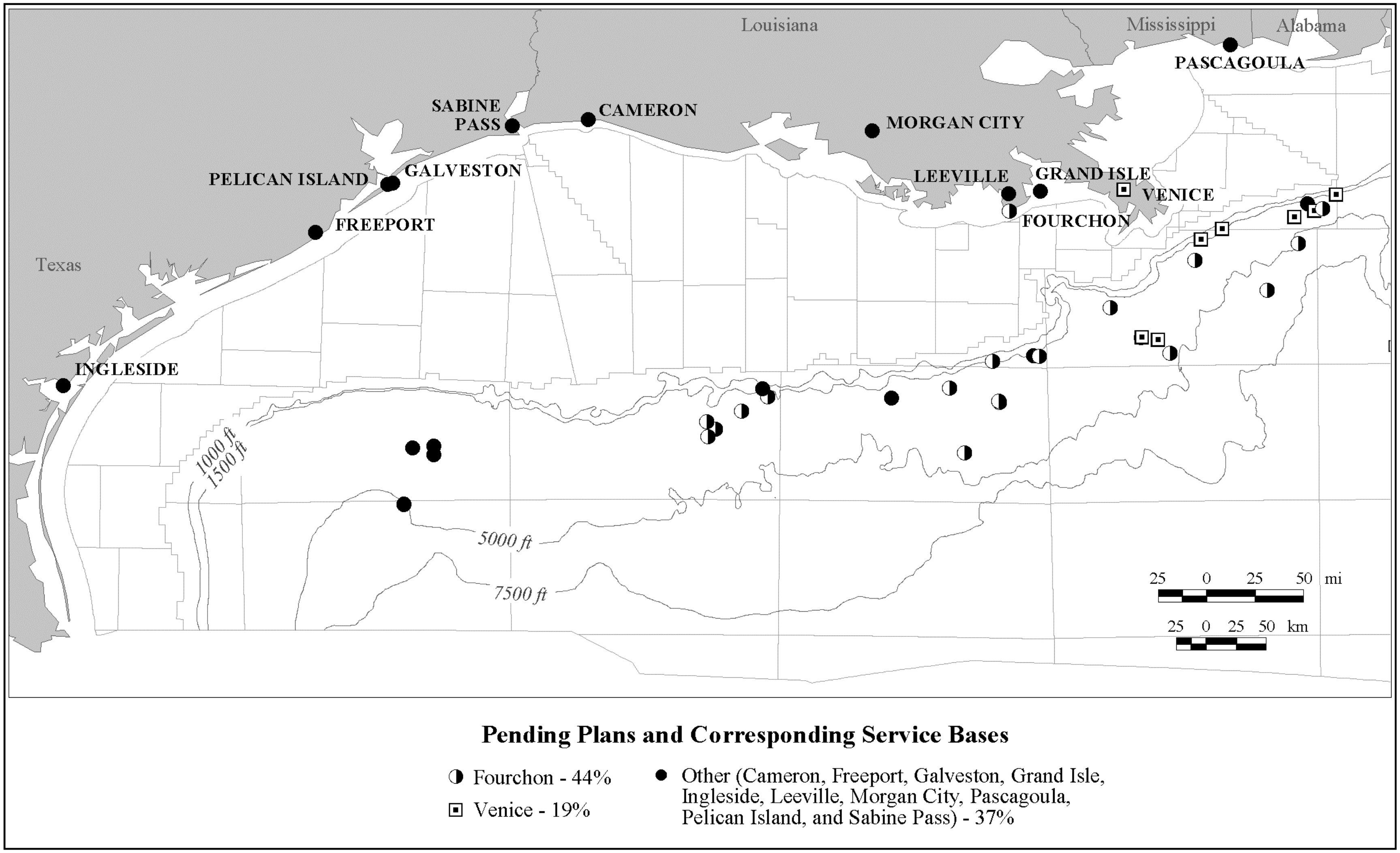

Figure 17. - Onshore service bases for pending deepwater plans.

TM02017B

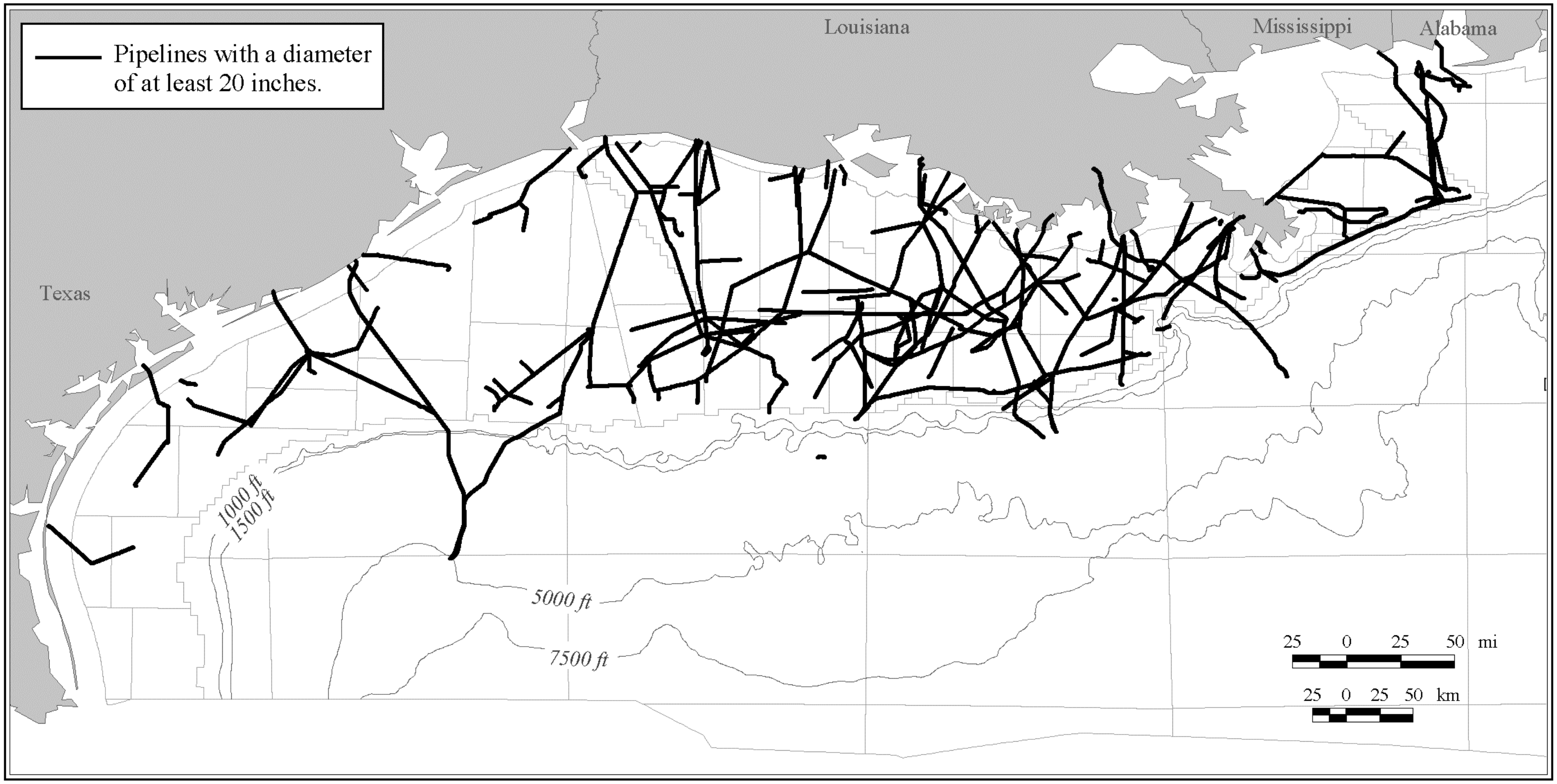

Figure 18. - Oil and gas pipelines with diameters greater than or equal to 20 inches.

TM02031A

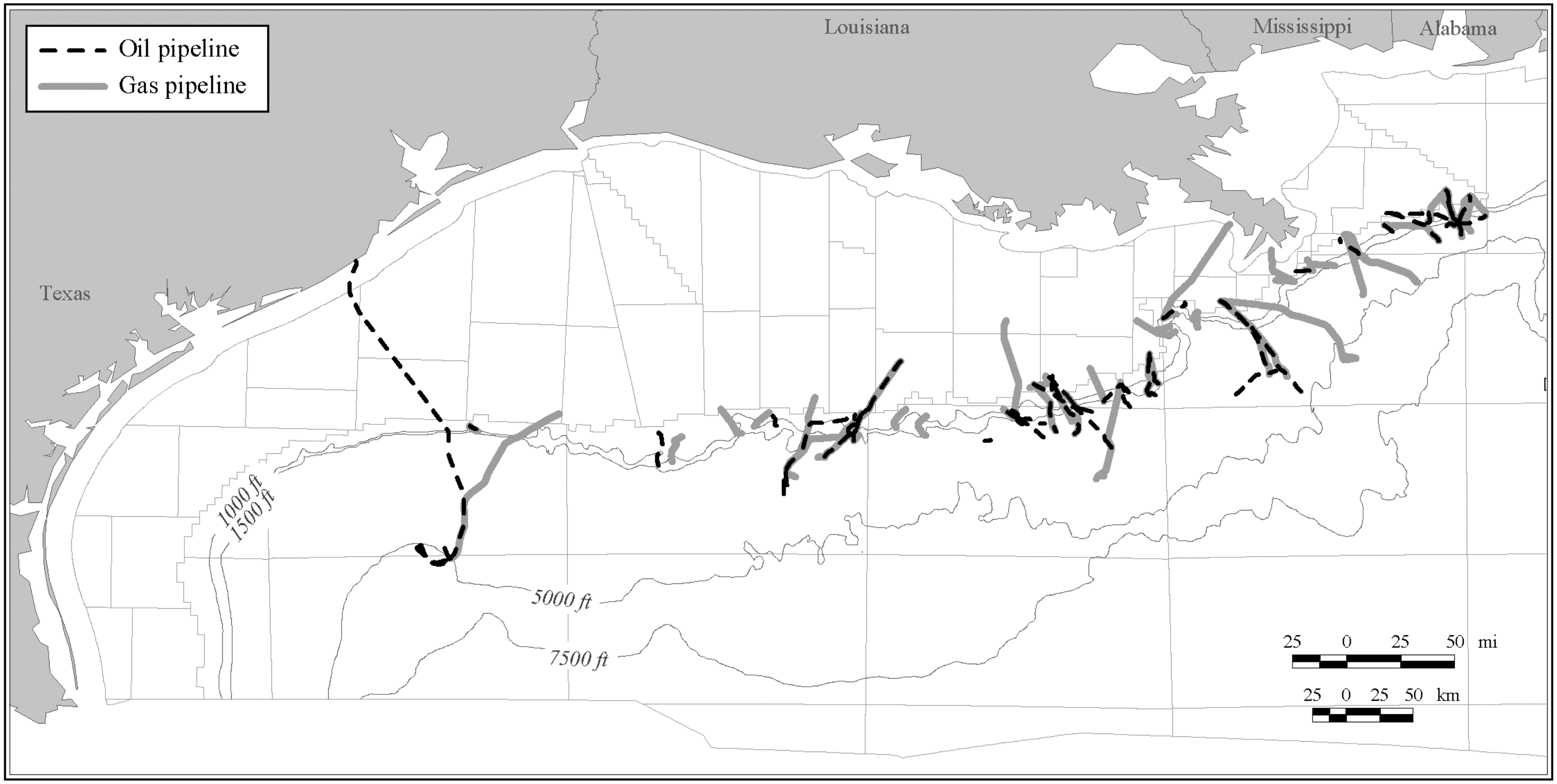

Figure 19. - Deepwater oil and gas pipelines in the Gulf of Mexico.

TM02031B

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 200 m or less). For example, in 1992 there were only 28 leases issued in water depths of greater than 200 m. These leases represented approximately 14 percent of the total number of leases issued for that year. Figure 20 shows the magnitude of the DWRRA impact, with tremendous deepwater leasing activity from 1996 through 1998 in water depths greater than 800 m (where the greatest royalty relief was available).

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 or less range and the greater than 800 m range, evidenced by increasing leasing activities in 1999-2001. Note that shelf leasing has once again outpaced leasing in water depths greater than 800 m. From 1999 through 2001, leasing activities on the shelf constituted 50, 59, and 48 percent of the leases issued in each of the respective years (figure 21). Some of the resurgent interest in 2001 may be the result of the recent royalty suspension program for new deep-gas development in water depths less than 200 m. Note that during this same interval, leasing activities in the greater than 800 m range constituted 41, 34, and 41 percent of the leases issued for these years.

Sale 182 was the latest lease offering in the Central Planning Area of the Gulf of Mexico. The sale transpired on March 20, 2002. A total of 506 tracts received bids, about 40 percent of which were in deepwater.

The water-depth categories depicted in figures 20 and 21 are based on the divisions used in DWRRA. These figures include shallow- and deepwater leasing trends for a ten-year period. Figure 22a was derived from the data in figures 20 and 21 but displays the deepwater categories used elsewhere in this report (shallow-water data are excluded from figure 22a). The deepwater data show the rapid increase in leasing activity that began in 1995. Notice that three water-depth intervals (1,500-4,999 ft, 5,000-7,499 ft, and greater than 7,500 ft) had annual increases in lease activity, and each was the most active leasing interval in successive years. Although GOM leasing activity plummeted in 1999, there has since been a steady increase in bidding for all water-depth ranges, with the greatest increases occurring in the 1,500-4,999 ft interval.

Figure 22b shows the total amount of money bid annually for each water-depth range. Large financial investments were made by the oil and gas industry from 1996 through 1998. Interestingly, in the 5,000-7,499 ft range, the number of bids received dropped from 503 in 1997 to 281 in 1998, yet the bid amounts increased slightly. All bidding activity and corresponding bid amounts were depressed in 1999; however, in 2000 and 2001, activity levels increased. Notable increases were seen in the 1,500-4,999 ft and the greater than 7,500 ft intervals.

Figure 22c illustrates the average bid price for deepwater leases through time. Overall, the average bid price for all deepwater leases steadily increased from 1992 through 2001. In 2001, industry bid high amounts per block in water depths greater than 7,500 ft. Interest in these leases

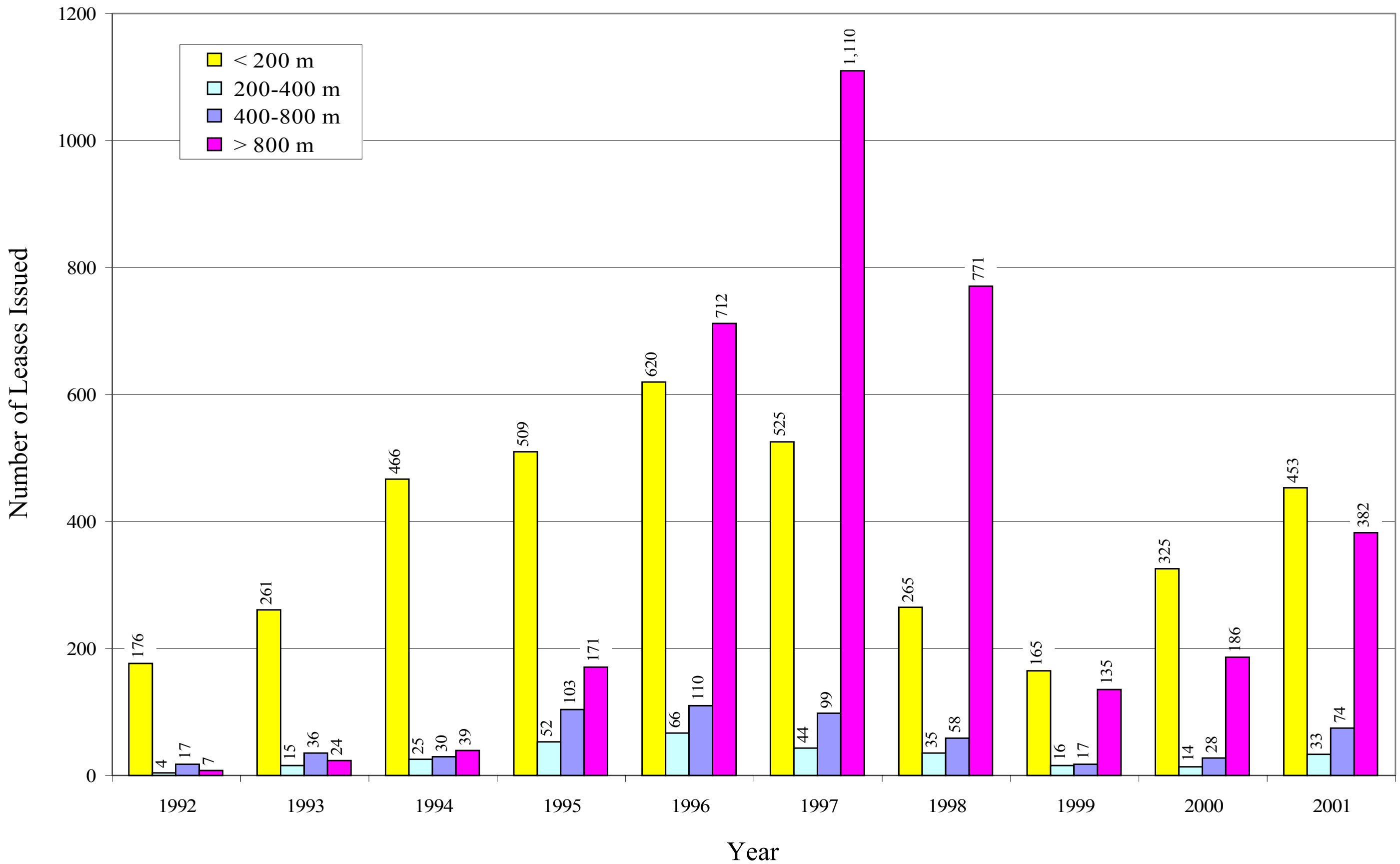

Figure 20. - Number of leases issued each year subdivided by DWRRA water-depth categories.

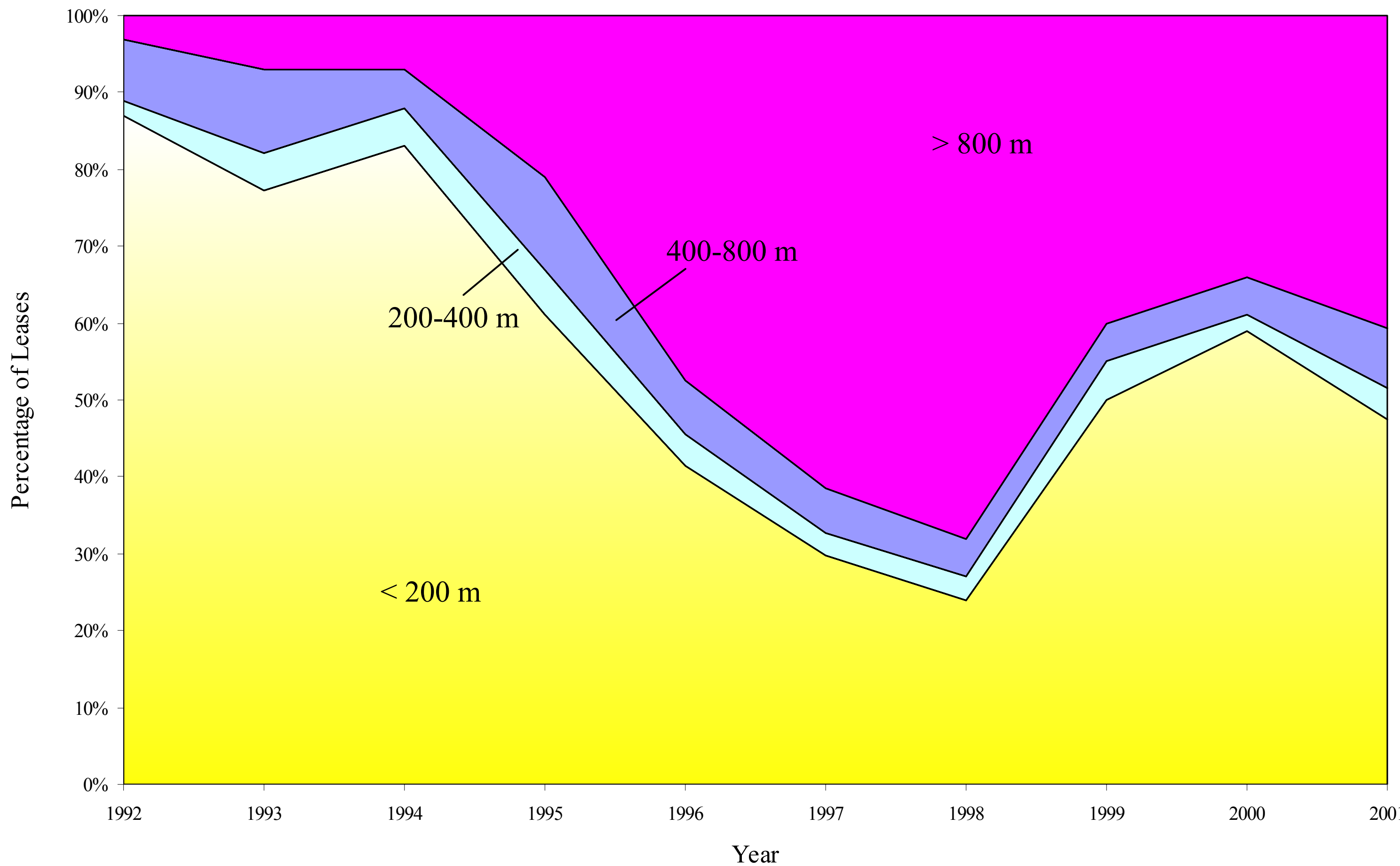

Figure 21. - Percentage of leases issued each year within each DWRRA water-depth category.

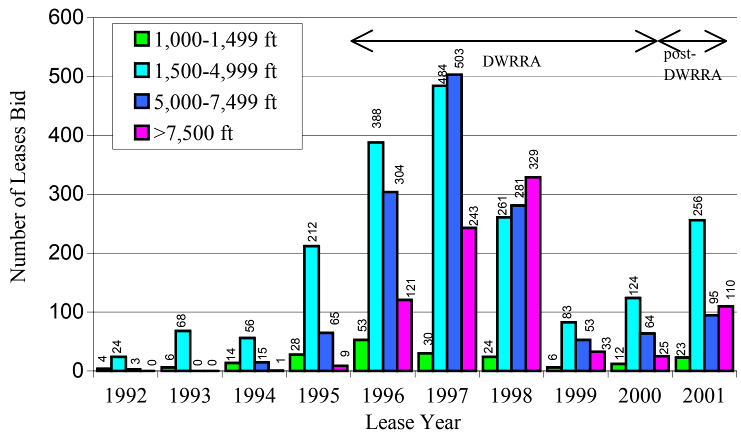

Figure 22a. - Number of leases bid in each deepwater interval.

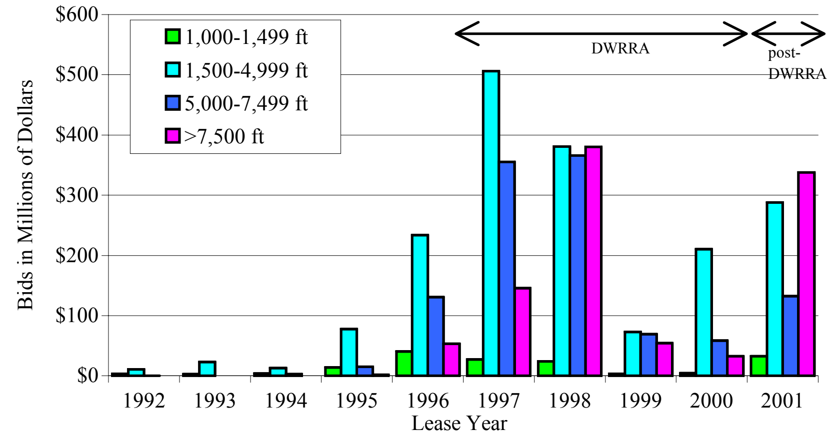

Figure 22b. - Total bid amounts in deepwater intervals.

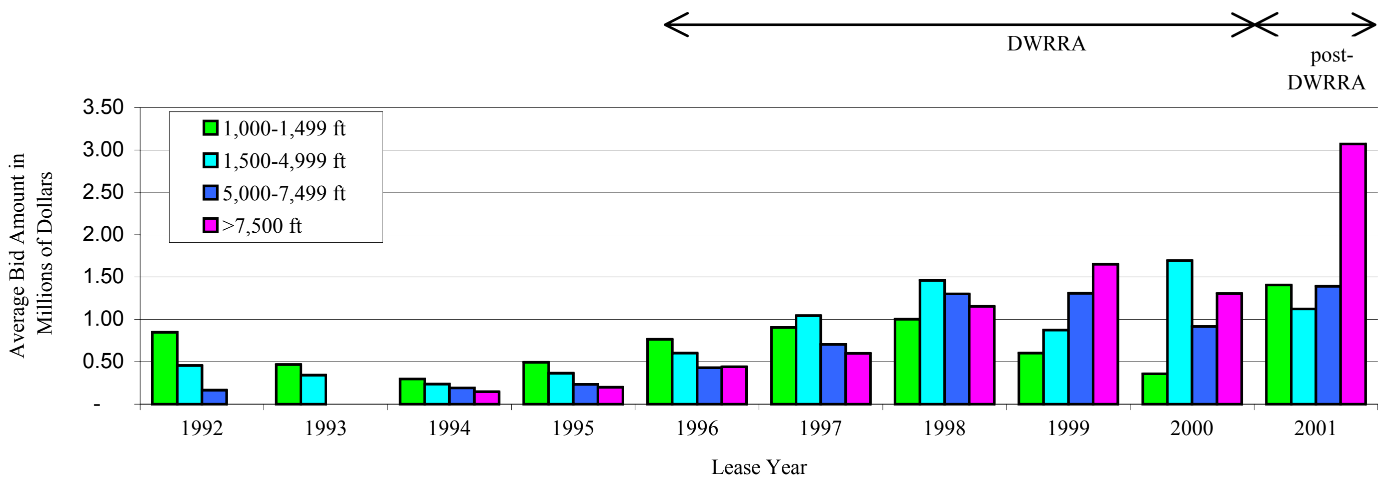

Figure 22c. - Average bid amount per block in deepwater intervals.

was likely caused by several significant discoveries, very large structural traps, and the improved feasibility of developing ultra-deepwater fields.

As the value of deepwater leases increased throughout the 1990's, the MMS rejected an increasing number of deepwater high bids that it viewed as insufficient (figure 23). Apparent also in figure 23 is the fact that tracts with rejected bids moved into increasingly deeper waters over time. From 1992 through 1995, almost all rejected bids were on the shelf. In 1996-1997, bid rejects were evenly divided between shallow- and deepwater. In 1998-1999, however, an increasing number of bids were rejected in deepwater. This trend continued in 2000-2001 but at reduced numbers. 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 leased deepwater blocks, leading to the increased net present worth of many unleased blocks.

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 (merger not yet filed with MMS), ExxonMobil, and Shell. Appendix C shows the companies and subsidiaries combined to 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 24 illustrates the relative lease-holding positions of majors versus nonmajors. Note that majors dominated deepwater leasing in 1992-1993. In 1994-1995, majors still dominated leasing in the deepest waters, leading the charge into this frontier. In 1996, nonmajors began acquiring significant lease holdings, a trend that continued to grow through 2001.

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. Figure 25 shows the impact on lease holdings caused by several mergers. The industry mergers increased the diversity of lease holdings 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.

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, potentially high-quality leases may expire without being tested. The turnover of these leases often results in re-leasing at higher prices, "farm-outs" to nonmajors, opportunities for nonmajors to gain a lease position and, potentially, more rapid exploration and development of the acreage.

Figure 26 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, eight

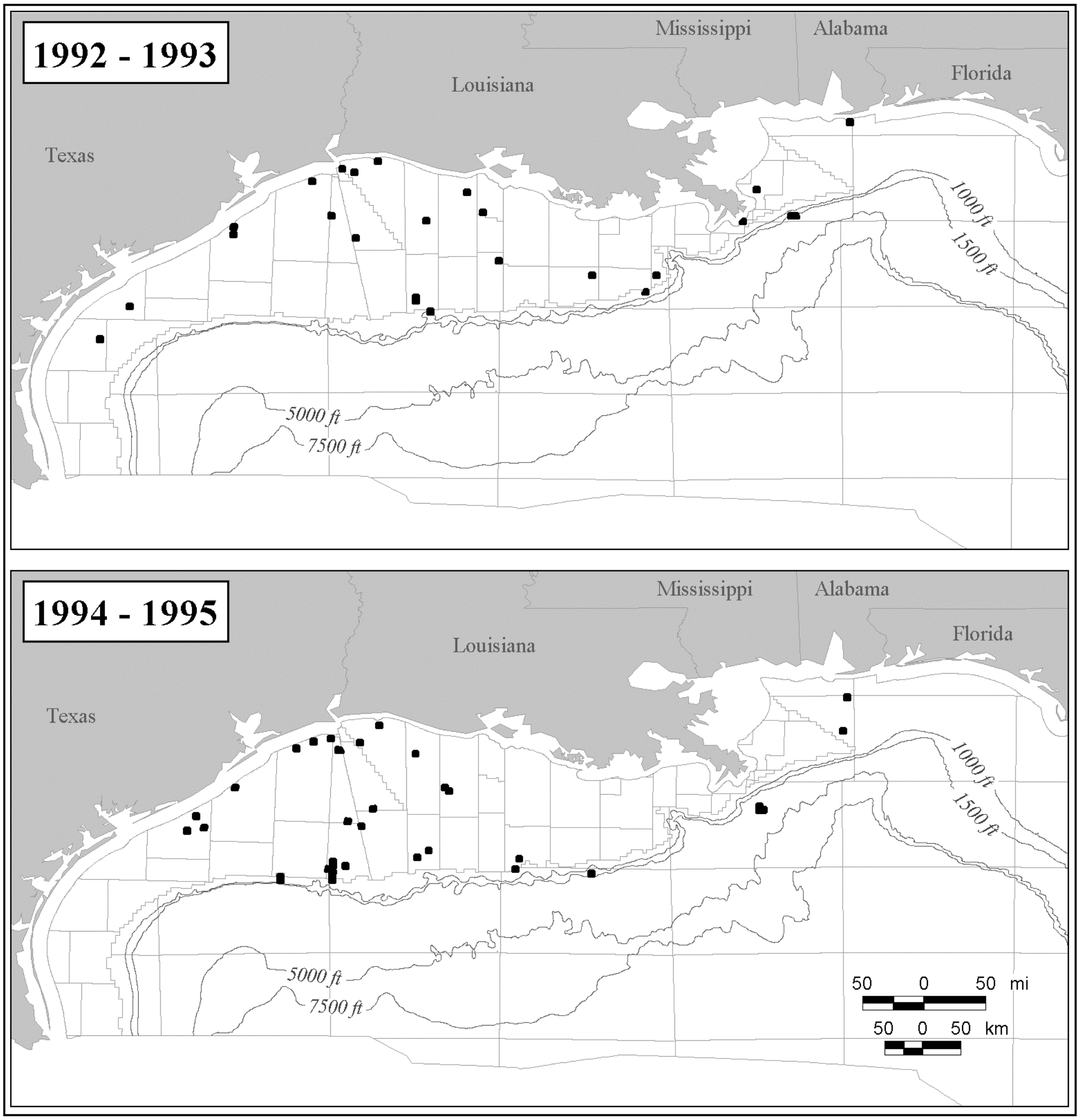

Figure 23. - Rejected shallow- and deepwater Gulf of Mexico bids.

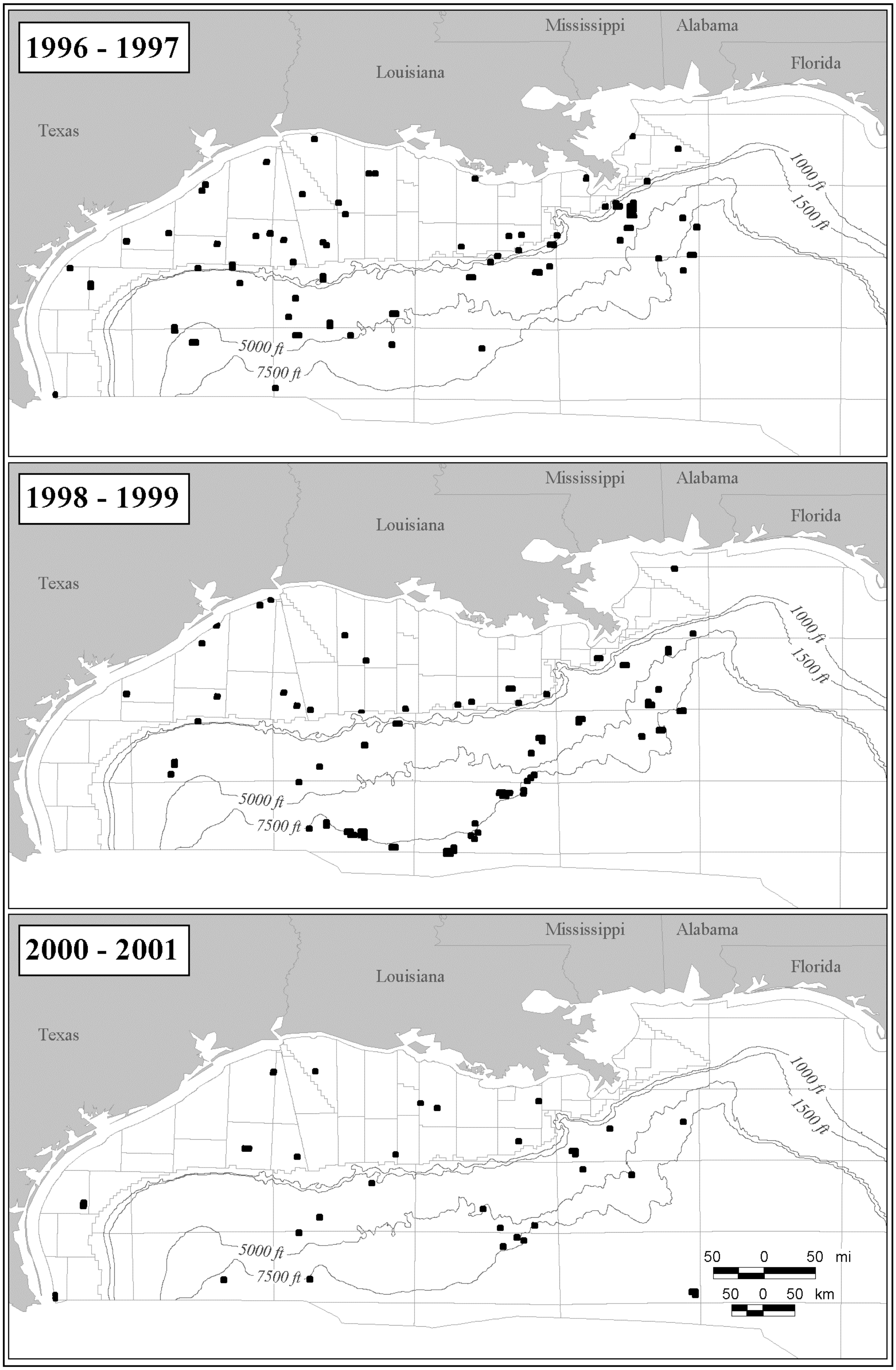

Figure 23. - *continued* - Rejected shallow- and deepwater Gulf of Mexico bids.

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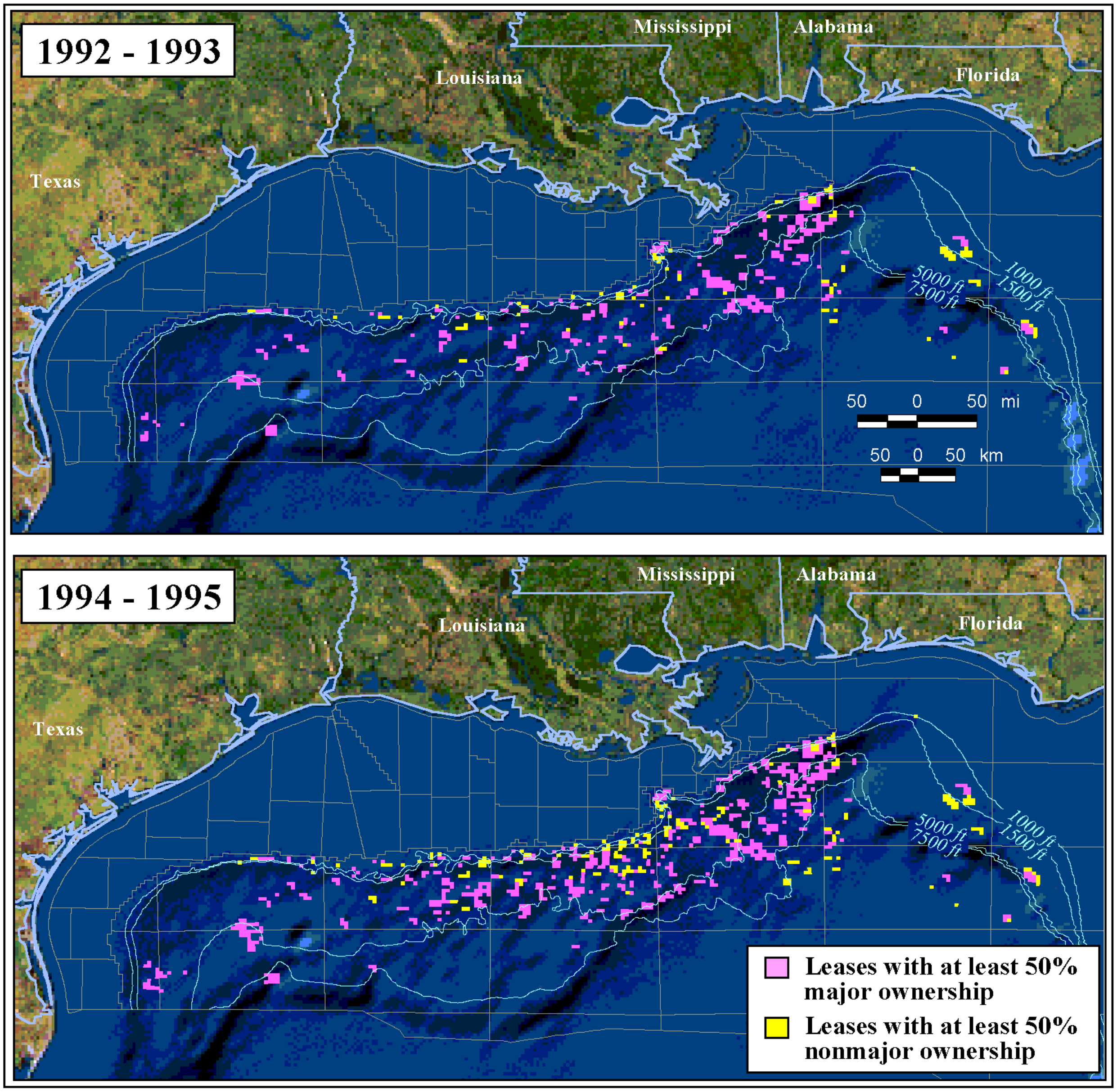

Figure 24. - Ownership of deepwater leases.

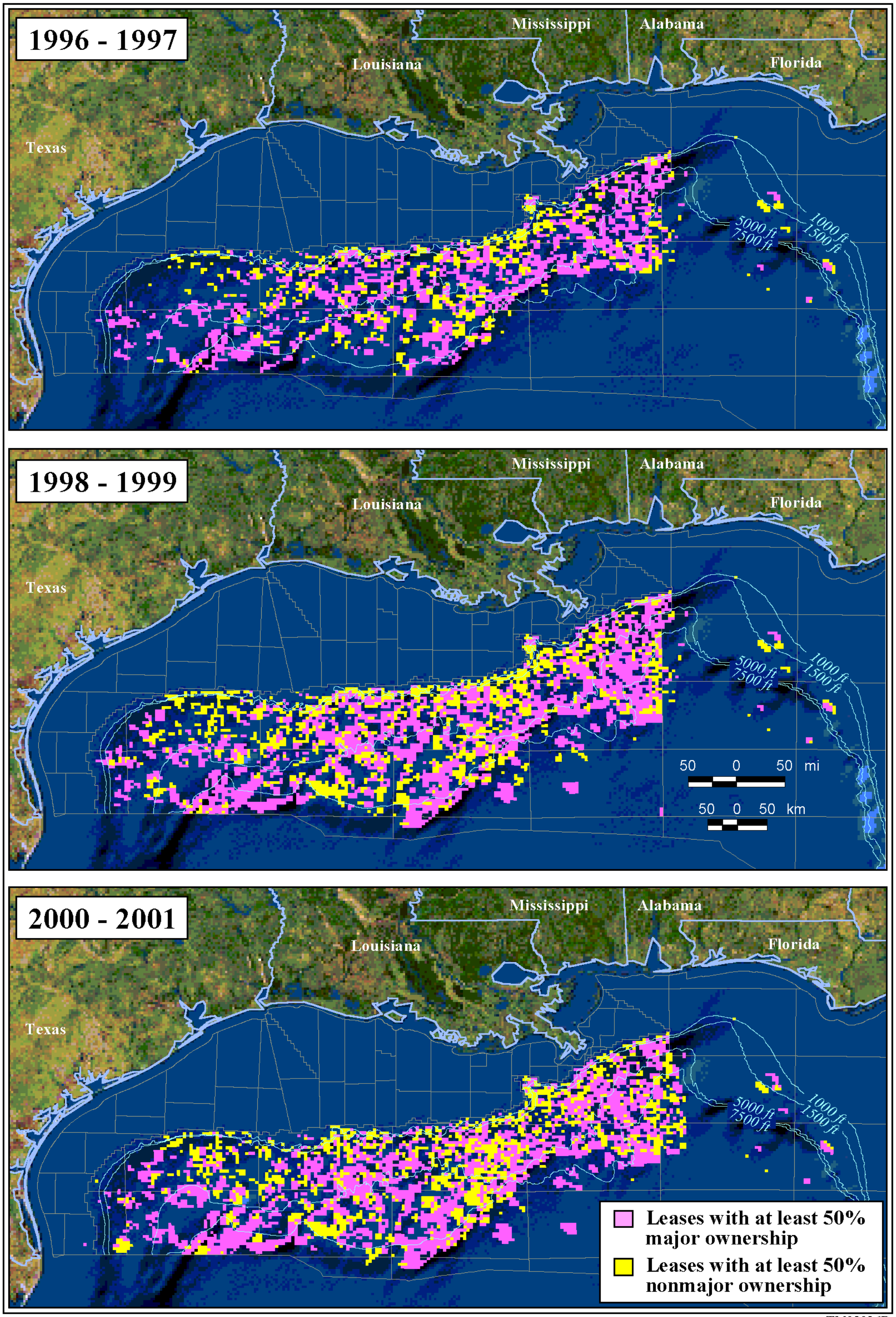

Figure 24. - *continued* - Ownership of deepwater leases.

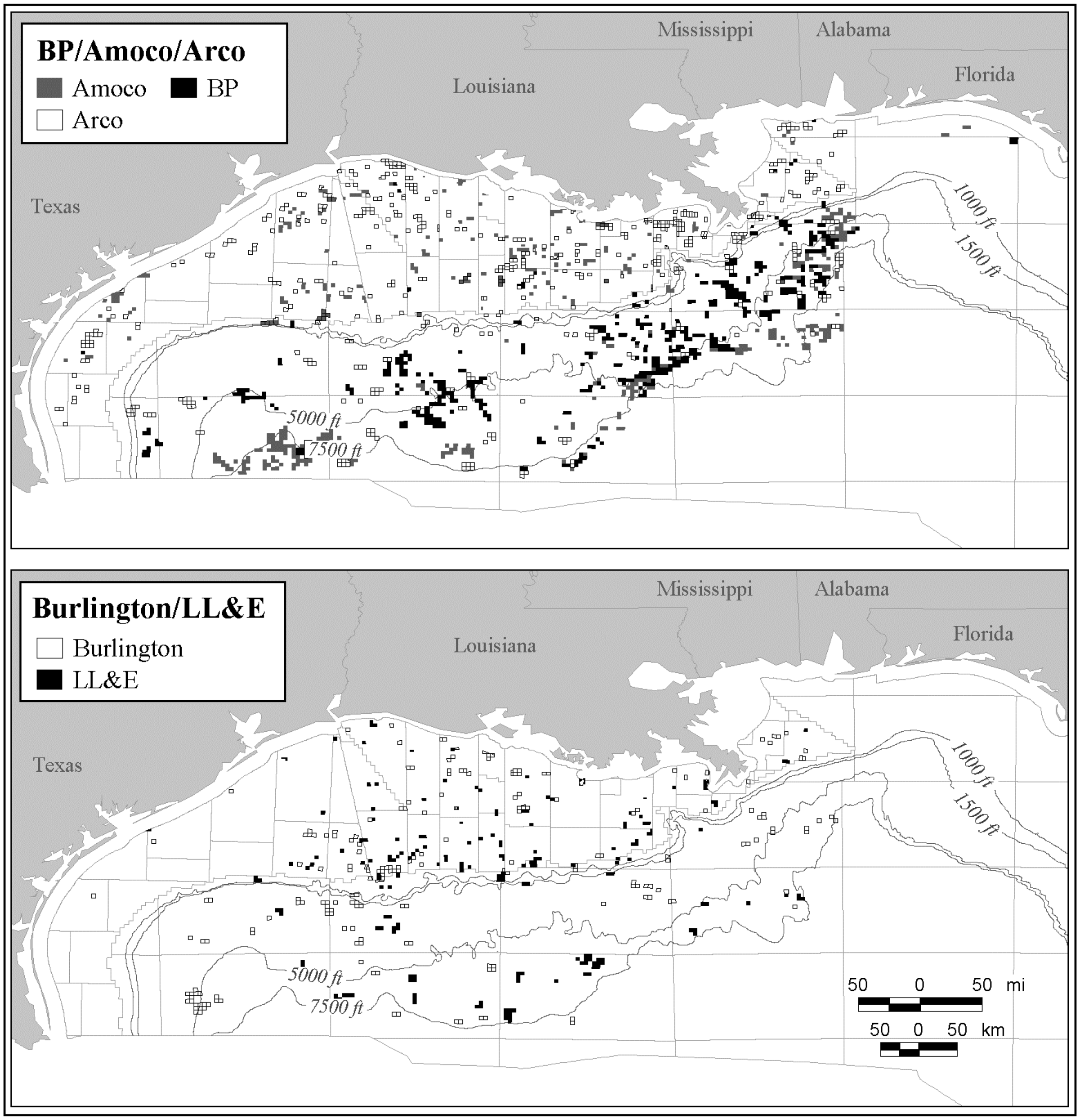

Figure 25. - Leasing impact of recent company mergers.

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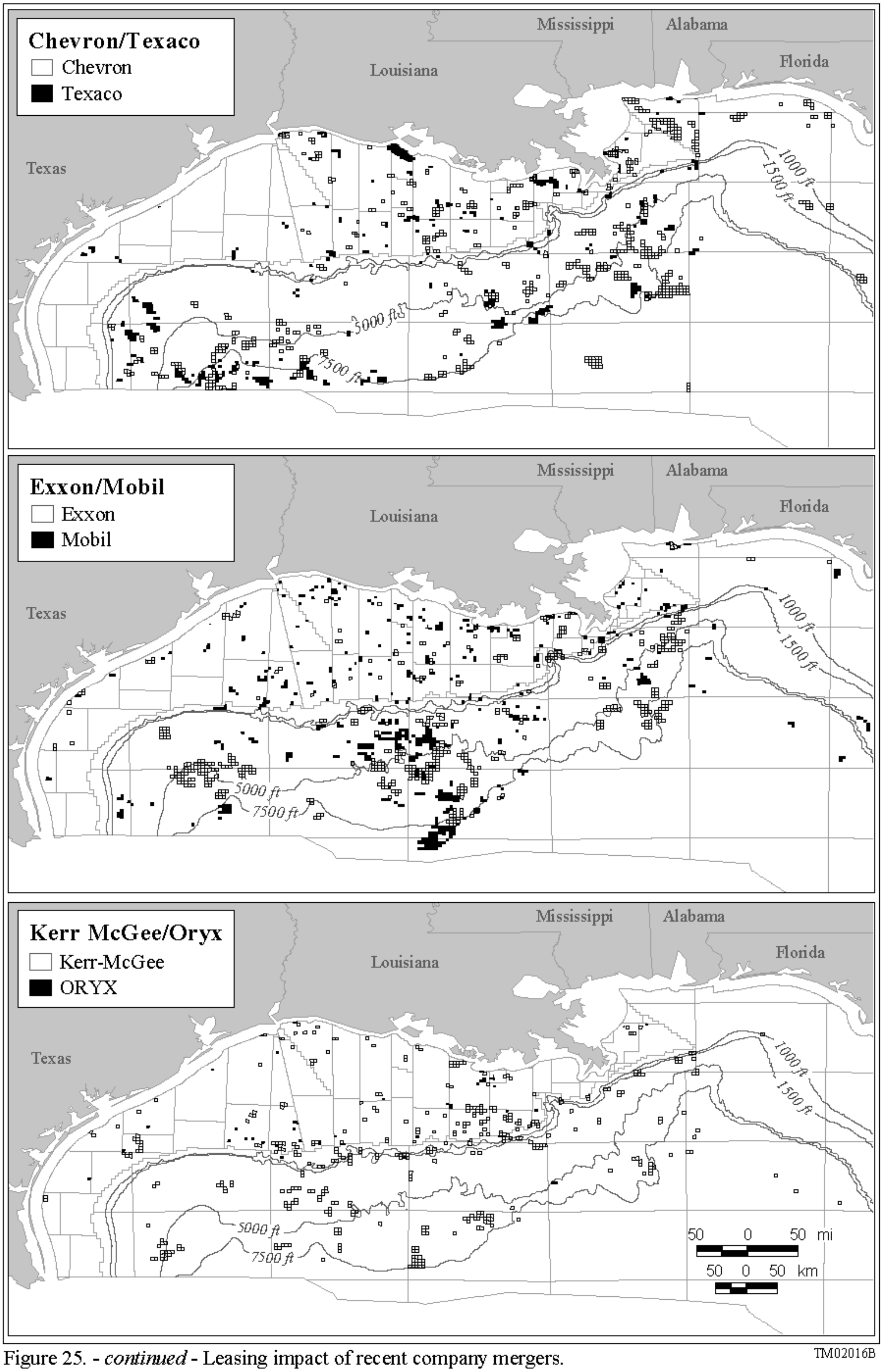

Figure 25. - *continued* - Leasing impact of recent company mergers.

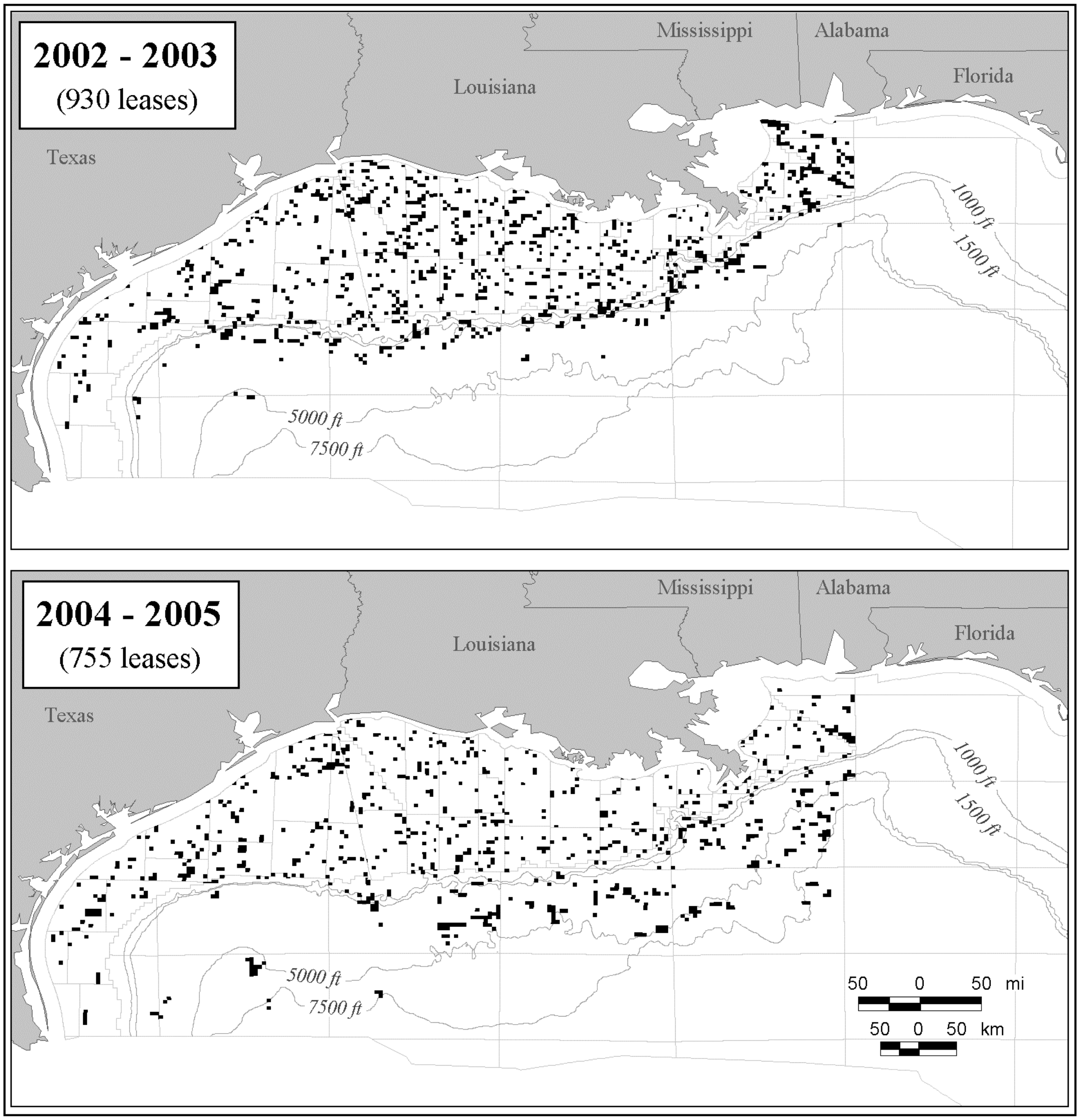

Figure 26. - Anticipated lease expirations in the Gulf of Mexico. TM02027A

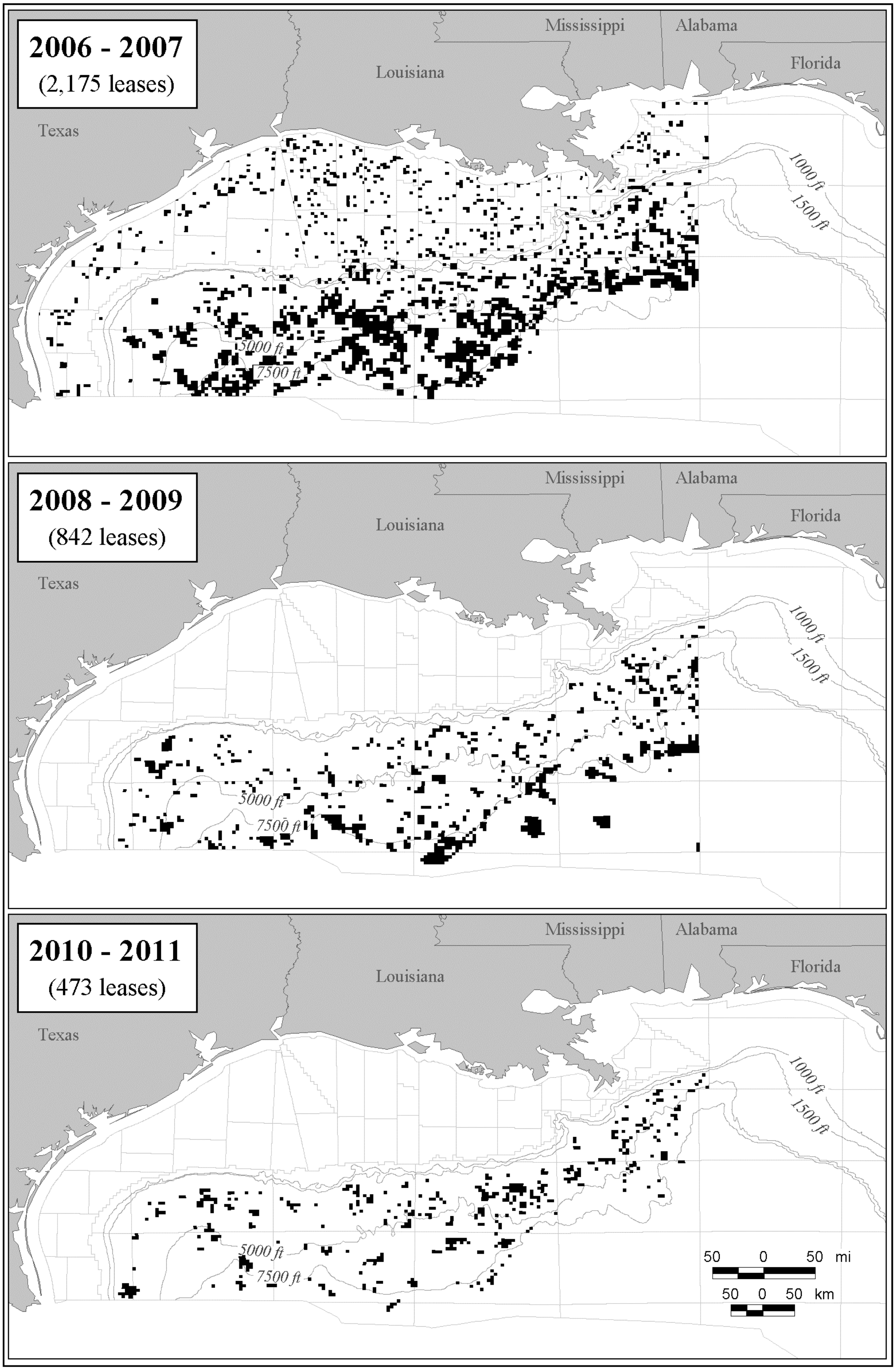

Figure 26. - *continued* - Anticipated lease expirations in the Gulf of Mexico.

TM02027B

years for blocks in 400-799 m, and ten years for blocks in 800 m or greater. Therefore, in the absence of primary lease term extensions, all active shallow-water leases will expire before 2008 (explaining the absence of expiring shallow-water leases in certain frames of figure 26). The 2002 and 2003 lease sales will offer only a handful of expired deepwater leases because of depressed leasing activity in 1992 and 1993. The availability of previously leased blocks should increase again in 2004 and 2005 and, beginning in 2006-2007, a significant number of deepwater leases (2,175) will become available, resulting from the leasing boom that began in 1996 and continued through 1998. A decreasing number of deepwater tracts will become available via expiration in the 2008 to 2011 year interval. 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 excess acreage.

Drilling and Development

Deepwater drilling occurs from mobile offshore drilling units (MODU's), such as semisubmersible units or drillships (figures 27a and 27b), 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. Figure 28 depicts deepwater rigs operating in the GOM from 1992 through 2001.[1] The MMS has noted a steady increase in deepwater rig activity; the average number of deepwater rigs operating in the GOM during 2001 represents a 34 percent increase over the previous year. This major increase can be attributed to several deepwater MODU's entering service. However, there are few new deepwater MODU's under construction. On the basis of statistics gathered during the first quarter of this year, MMS projects rig use to drop in 2002, then rebound in 2003-2004. This projected rebound reflects new production facilities expected to have platform rigs and reflects anticipated drilling activity related to leases nearing expiration.

Figure 29 shows the number of deepwater MODU's by water-depth categories in the GOM and worldwide. Approximately 50 percent of the world's fleet of deepwater drilling rigs is committed to GOM service (Maksoud, 2001; Harding and Albaugh, 2001). The pie chart within figure 29 shows the distribution of deepwater rigs by major operating area. The number of GOM rigs capable of operating in water depths beyond 7,500 ft tripled from 4 to 13 since the 2000 edition of this report (Baud et al., 2000). 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 28 and 29. As mentioned above, figure 28 includes platform rigs in addition to MODU's; figure 29 addresses MODU's only. Further, upgrades to MODU's that increase their water-depth capability will alter the rig counts shown, so the reader is also cautioned about using these data to draw conclusions from year-to-year comparisons.

Drilling Activity

The number of deepwater wells drilled has steadily increased since 1992. 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 30 shows that most of the drilling has occurred in the 1,500-4,999 ft water-depth range. Drilling from 1998 through 1999 remained at the 1997 level; however, a significant increase in the number of wells drilled in ultra-deepwater (greater than 5,000 ft) began in 1999, as shown in figure 31. The increases in ultra-deepwater wells during 1999 and again in 2001 coincide with the addition of several new drilling rigs capable of

[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 27a. – The *Ocean Confidence*, a Class III, dynamically positioned, submersible drilling rig. However, anchors may be deployed for some applications. (Photograph courtesy of Diamond Offshore Drilling, Inc.)

Figure 27b. – The *Deepwater Pathfinder*, a dynamically positioned drillship (Photograph courtesy of Transocean SedcoForex).

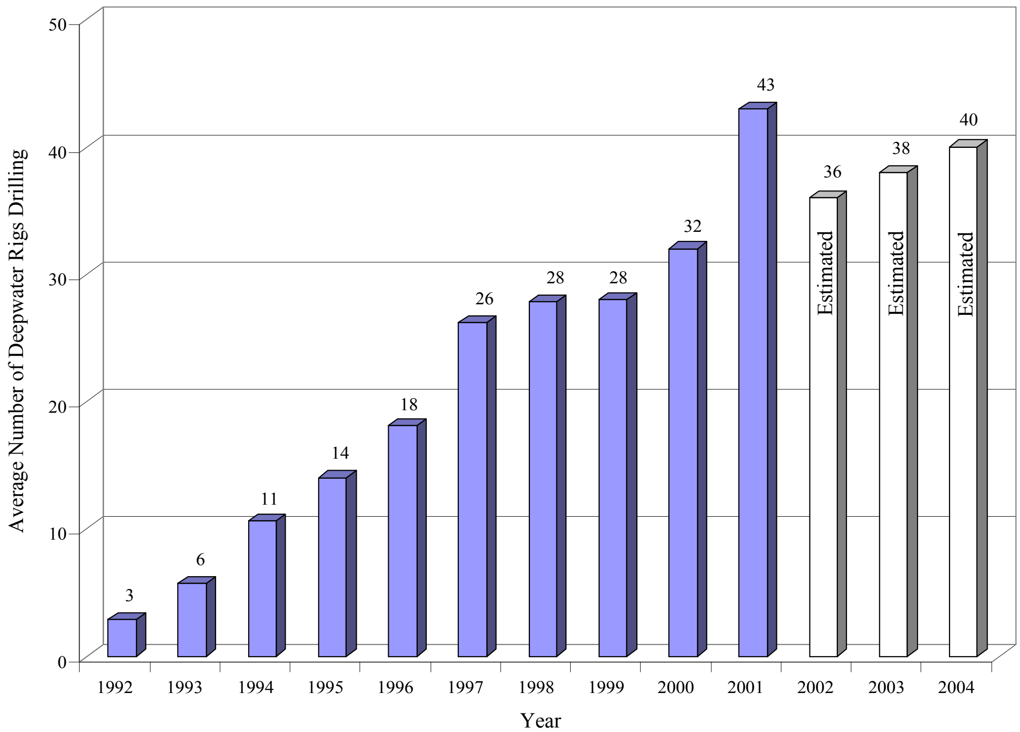

Figure 28. - Average number of rigs drilling in the deepwater Gulf of Mexico.

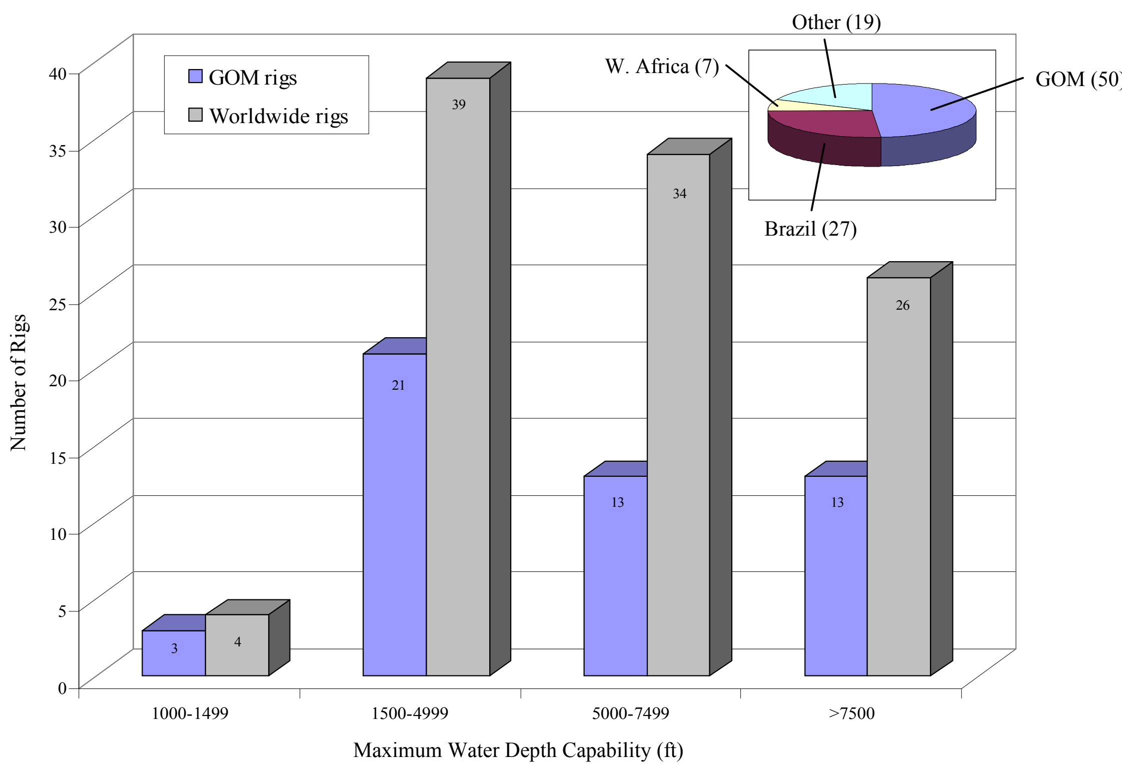

Figure 29. - Approximate number of deepwater rigs (GOM and worldwide) subdivided according to their maximum water-depth capabilities. Inset shows the number of deepwater rigs in various locations.

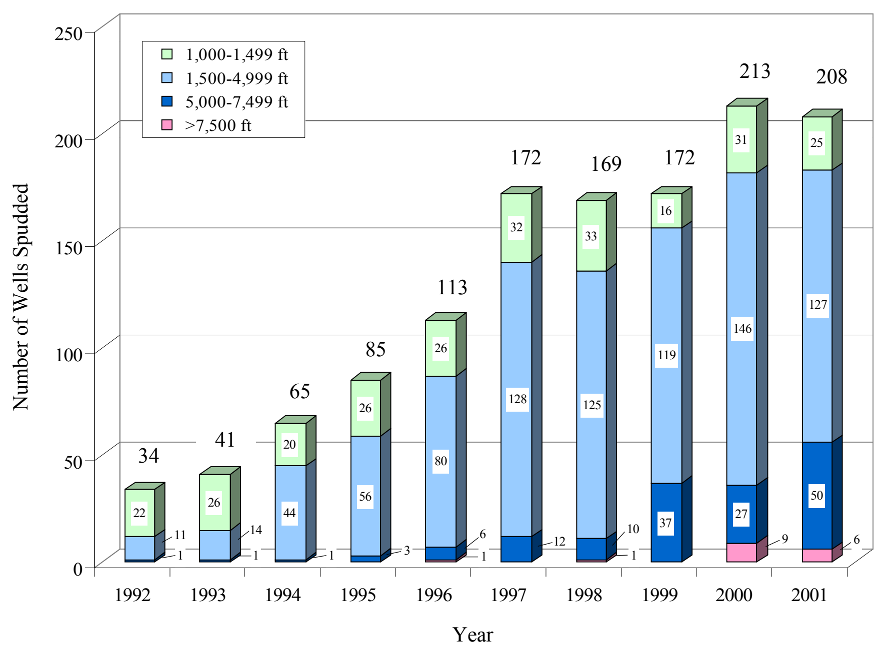

Figure 30. - All deepwater wells drilled in the Gulf of Mexico, subdivided by water depth.

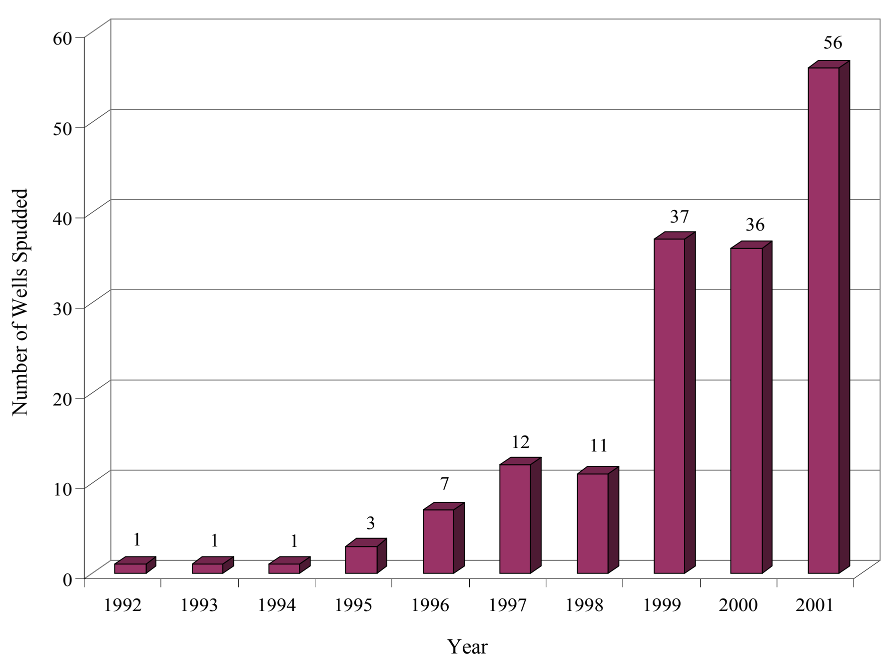

Figure 31. - Ultra-deepwater (5,000 ft or greater) wells drilled in the Gulf of Mexico.

operating in water depths approaching 10,000 ft. Notice in figure 30 the increasing contribution of wells in water depths exceeding 7,500 ft.

Figures 32 and 33 further break down the deepwater well counts into exploratory and development wells, respectively. Exploratory wells are defined in this report as those numbered 1 through 5 in the MMS database. There has been an average 19 percent increase in the number of exploratory wells drilled each subsequent year beginning with 1997. Exploratory drilling in water depths greater than 7,500 ft was limited to just two wells during 1992-1998. Fifteen wells, which represent approximately 5 percent of the total deepwater exploratory well count, have been drilled in the last two years. Development drilling from 1997 through 2001 has decreased to a level 36 percent below the peak in 1997. Possible reasons for the 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 1,500-4,999 ft water-depth range; there are no development wells in water depths exceeding 7,500 ft. Figure 34 illustrates the geographic distribution of deepwater exploratory wells. Note the progression into the western GOM and into deeper water through time. Figure 35 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.

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),
- drill development wells,
- file a Preliminary DWOP, then
- begin production.

Figure 36 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 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 sharp increase in deepwater exploratory plan submittals from 1992 through 1999. The number of EP submittals in 2000 was nearly identical to 1999, with a 10 percent decline in 2001. The number of deepwater DOCD submittals also showed a general increase during this

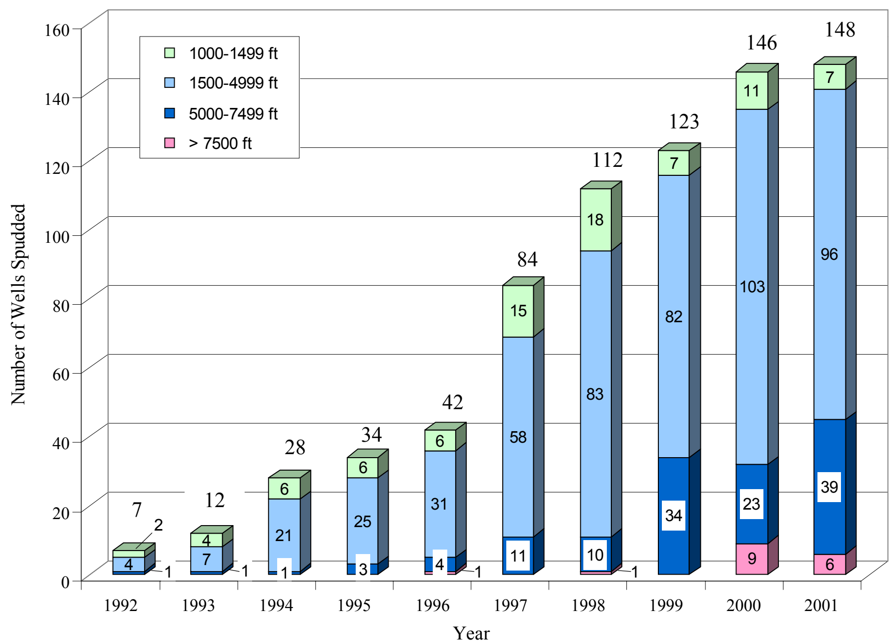

Figure 32. - Deepwater exploratory wells drilled in the Gulf of Mexico, subdivided by water depth.

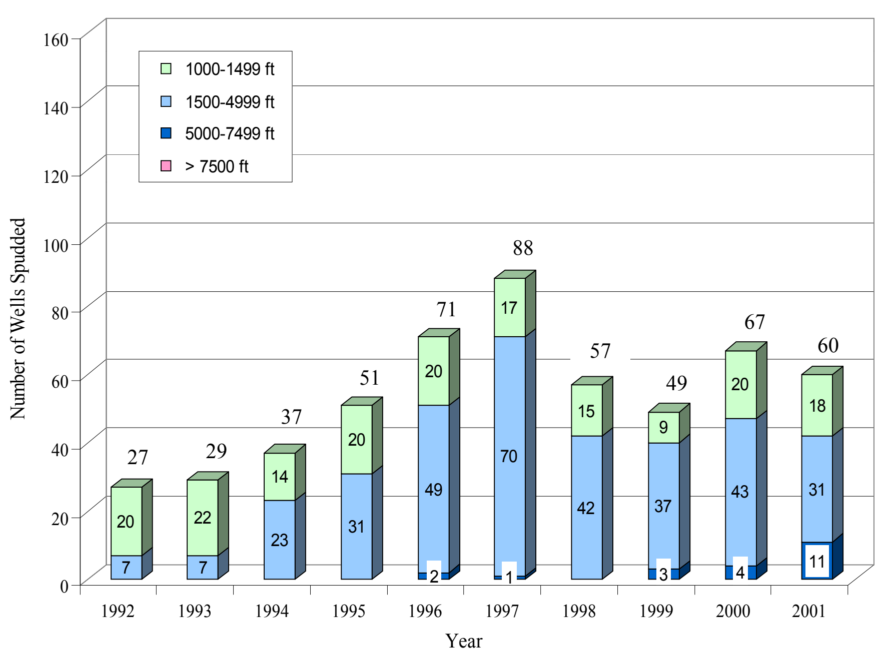

Figure 33. - Deepwater development wells drilled in the Gulf of Mexico, subdivided by water depth.

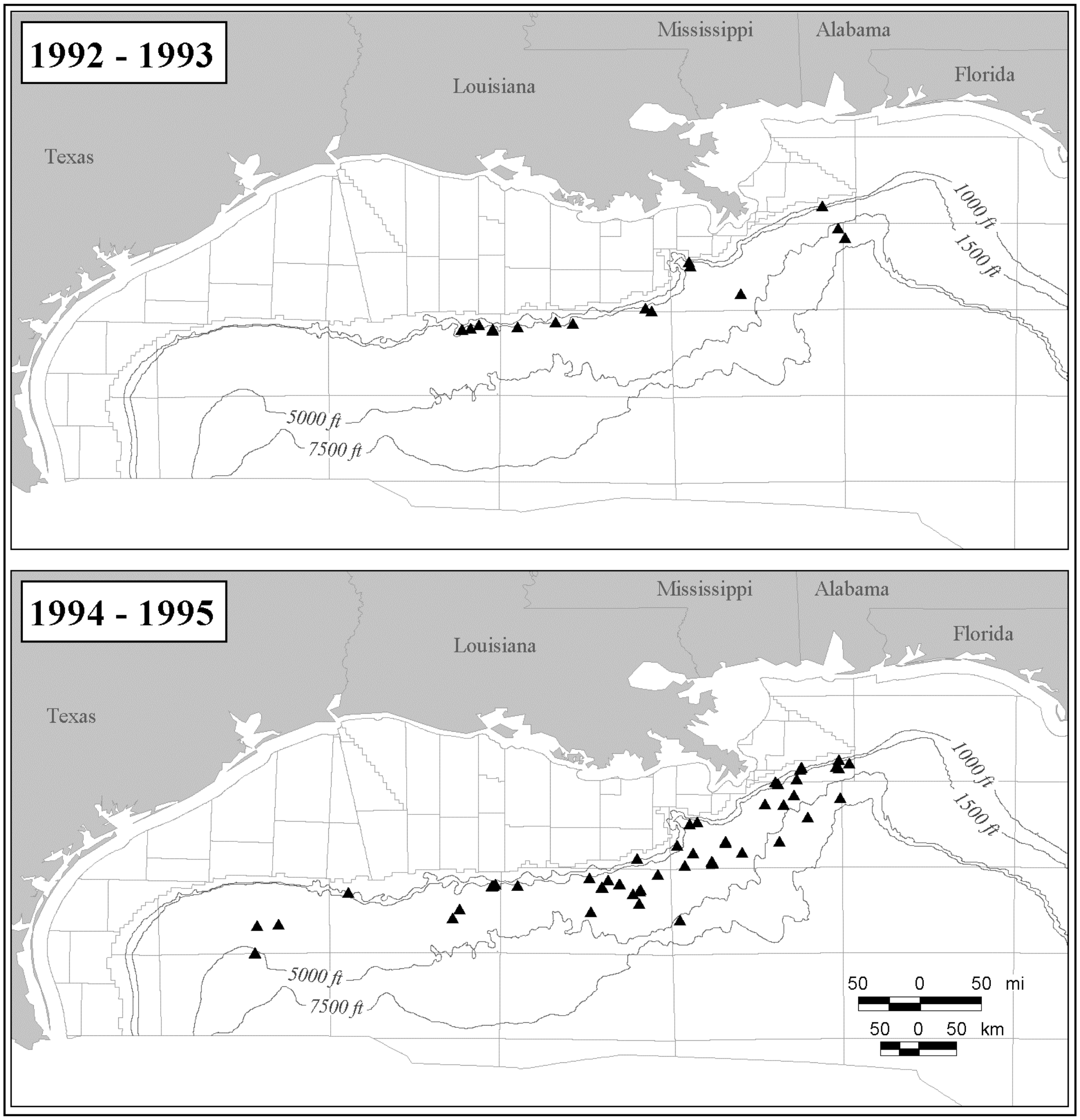

Figure 34.- Deepwater exploratory wells drilled in the Gulf of Mexico.

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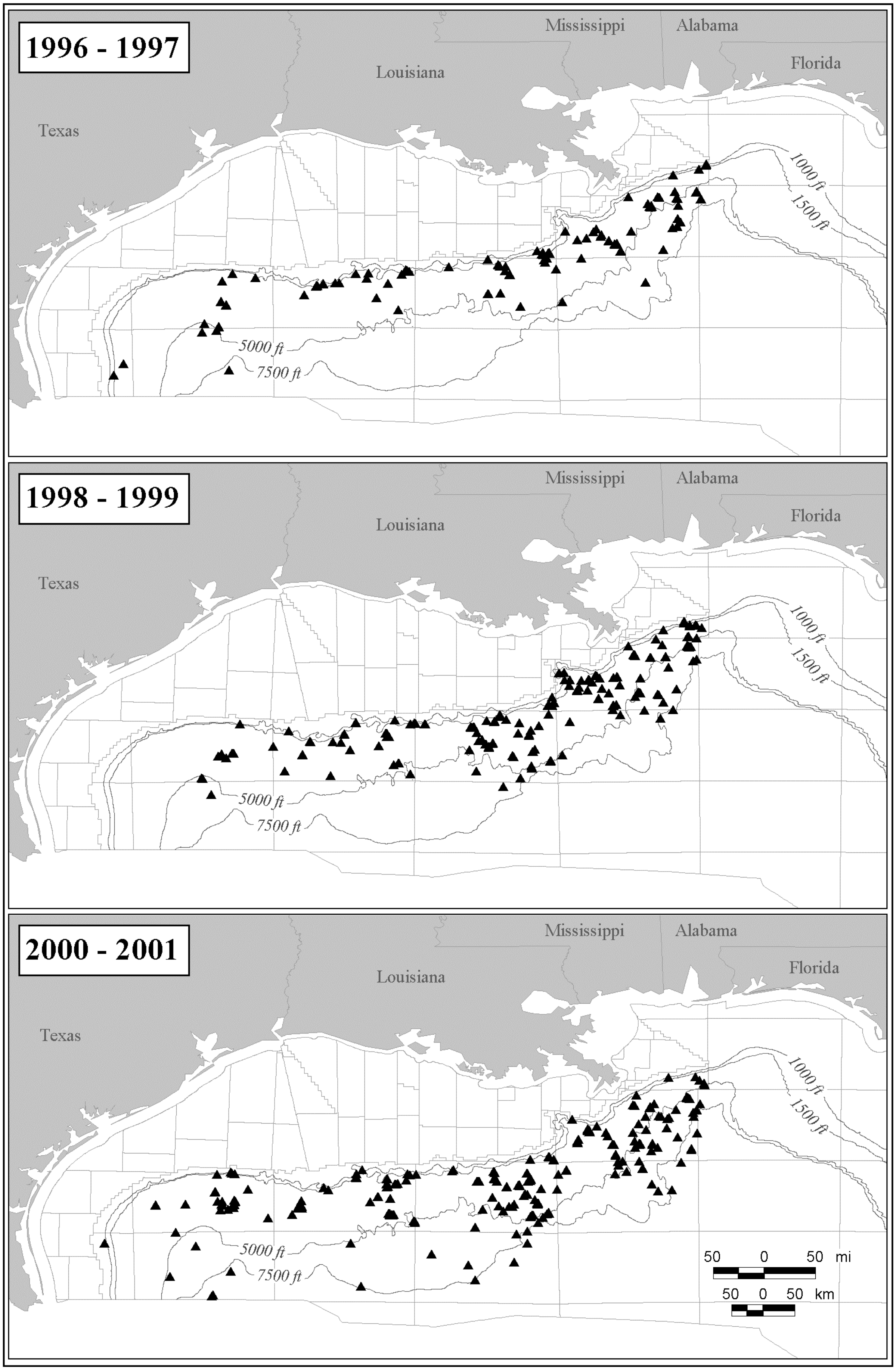


Figure 34. - *continued* - Deepwater exploratory wells drilled in the Gulf of Mexico.

TM02028B

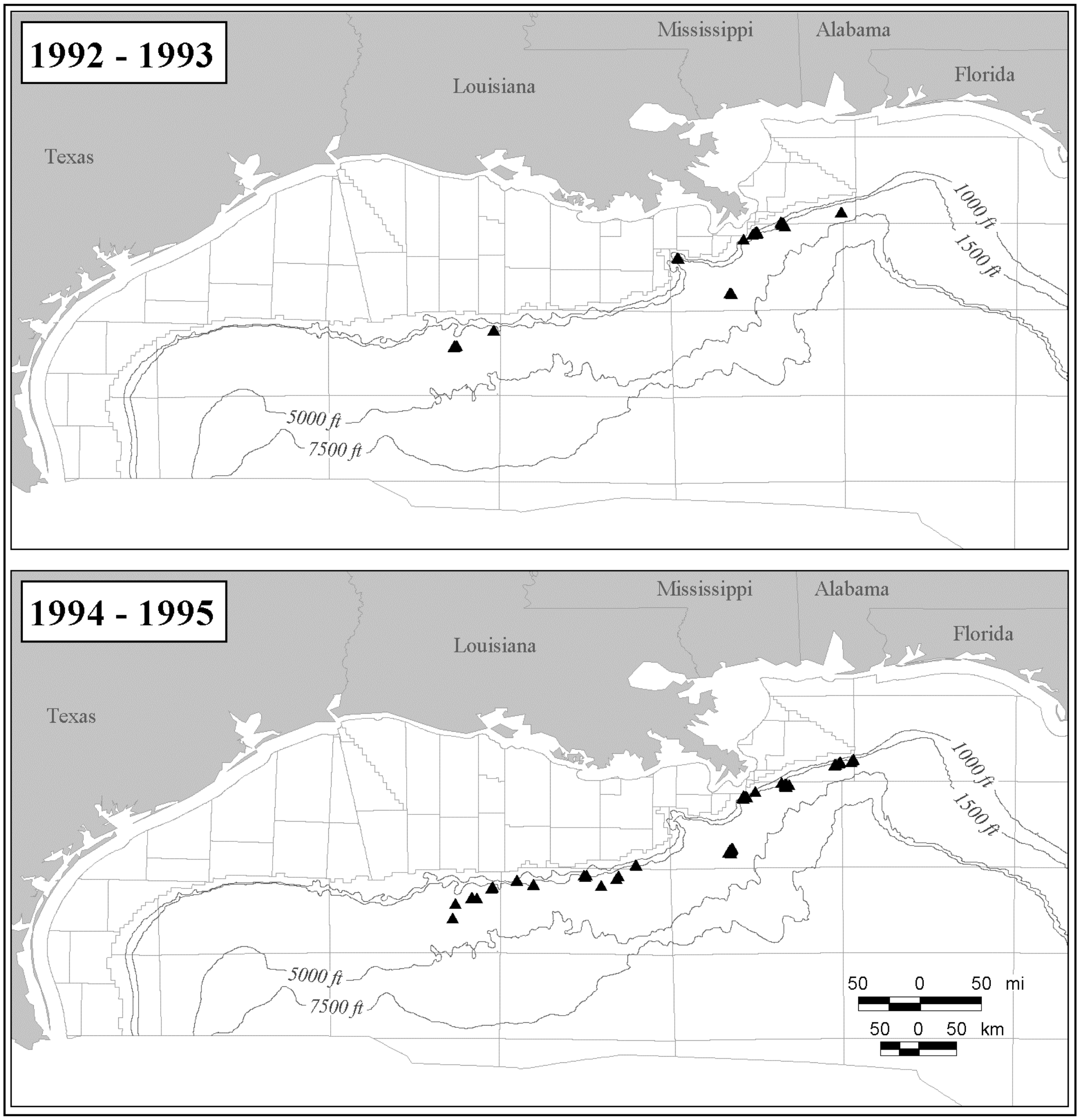


Figure 35.- Deepwater development wells drilled in the Gulf of Mexico.

TM02029A

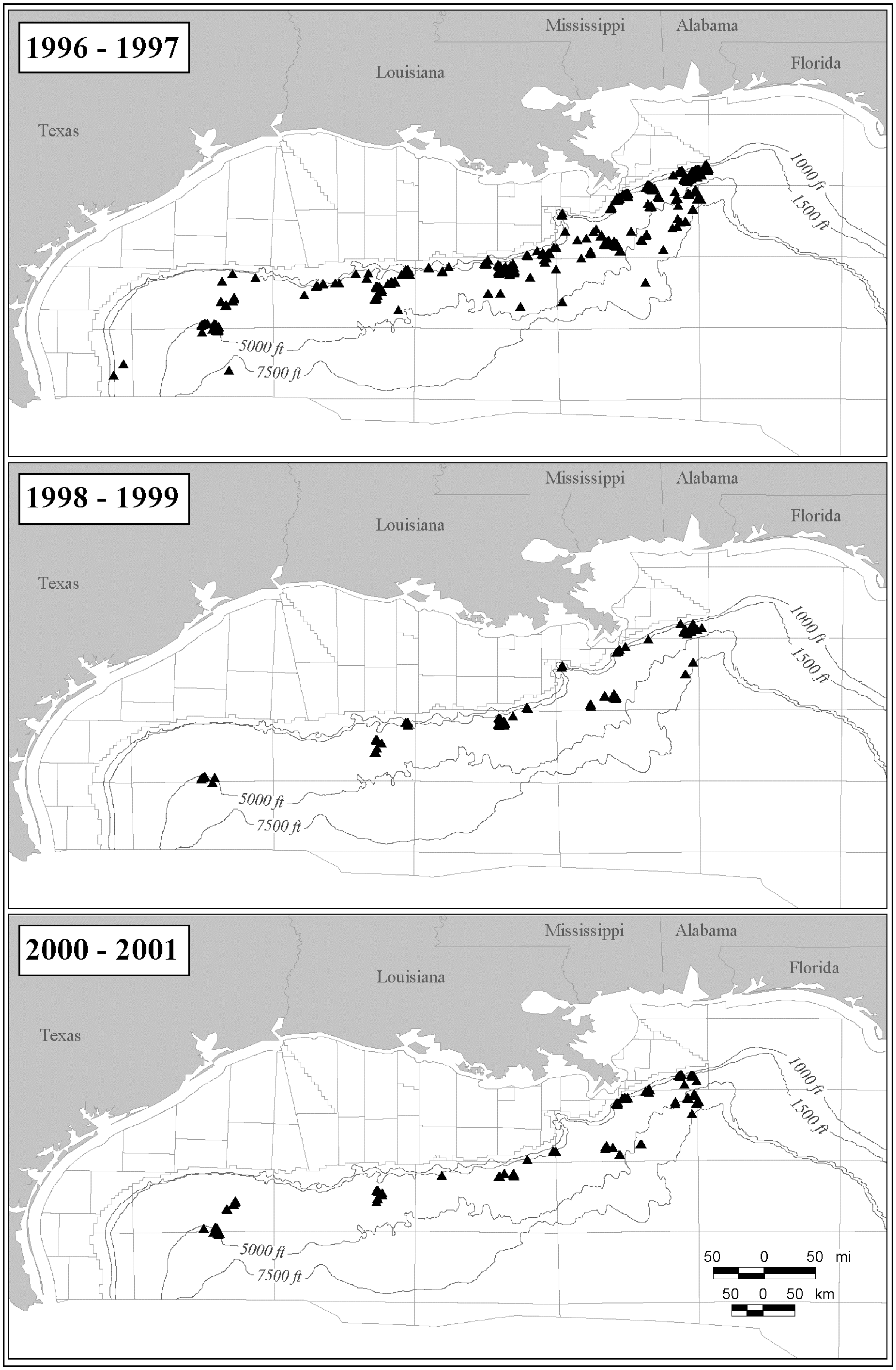


Figure 35. - *continued* - Deepwater development wells drilled in the Gulf of Mexico. TM02029B

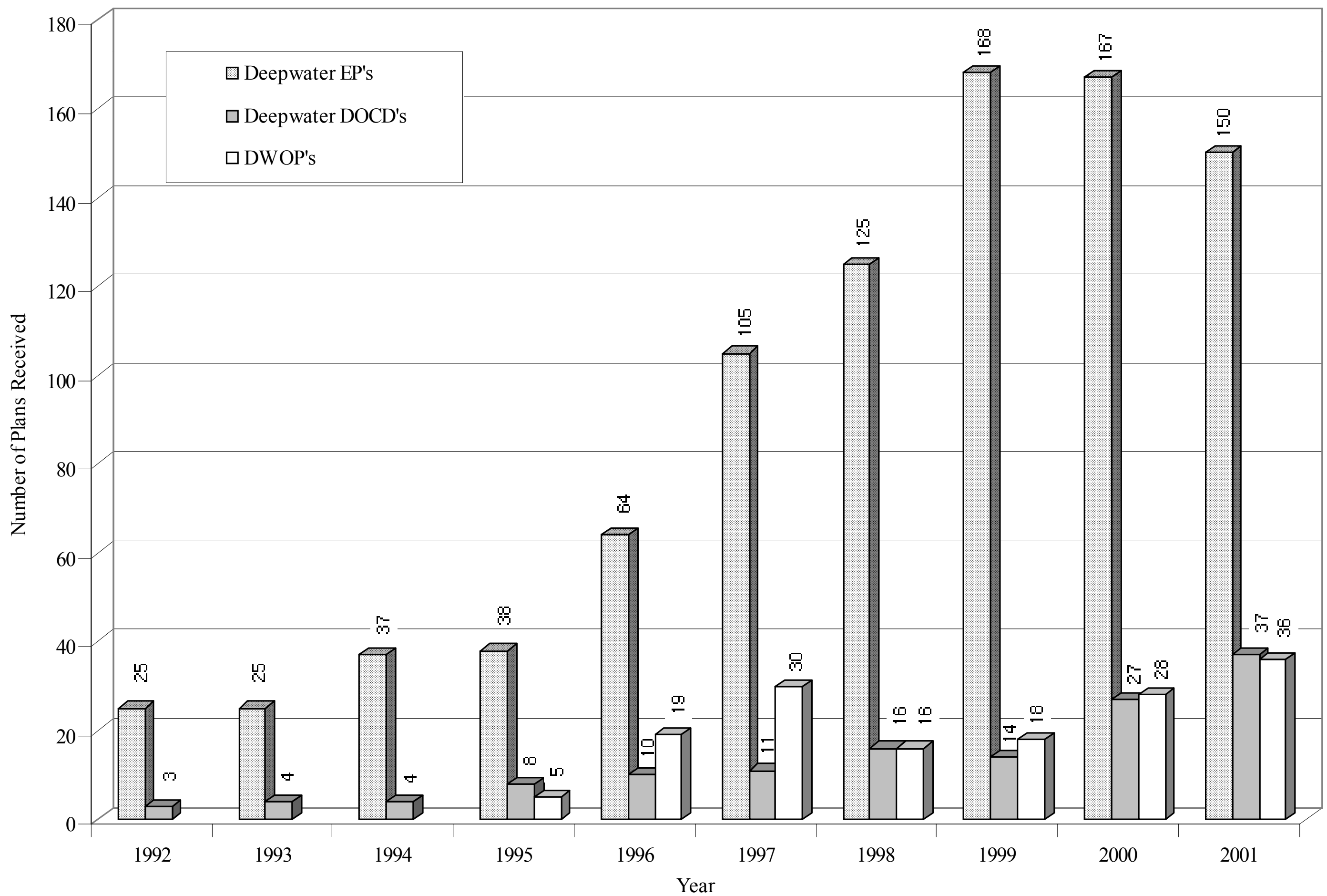


Figure 36. - Deepwater EP's, DOCD's, and DWOP's received in the Gulf of Mexico since 1992.

time, although not quite as dramatic when considered for the interval of 1992 through 2001. The number of DWOP's doubled (18 to 36) from 1999 to 2001.

There has been a gradual increase of true vertical depth (TVD) through time, whereas the progression into greater water depths has been very rapid. Figure 37 shows the maximum TVD of wells drilled each year since 1947 (when drilling in the Gulf of Mexico OCS began). The maximum TVD increased gradually from 13,636 ft in 1948 to 26,978 ft in 1998. The recent dramatic increase in TVD to a record 29,680 ft in 2000 may be attributed to several factors, including enhanced rig capabilities, deeper exploration targets, and the general trend toward greater water depths.

Figure 38 shows the maximum water depth drilled in the total GOM each year since 1947. Deepwater drilling began in 1974 (1,024 ft); significant water depth records occurred in 1976 (1,986 ft), 1984 (3,534 ft), and 1987 (7,500 ft). The most recent water-depth accomplishment is the world record established in October 2001 by Unocal; the Trident prospect (Alaminos Canyon Block 903) was drilled in 9,727 ft of water. There are approved plans for wells in water depths greater than 10,000 ft that could be drilled in the near future.

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 39 shows the different systems that can be used to develop deepwater discoveries. Table 2 lists the systems that have begun production. The blocks referenced in Table 2 represent the MMS field designations, which sometimes differ from the facility locations. Fixed platforms (e.g., Bullwinkle) have economic water-depth limits of about 1,400 ft. Compliant towers (e.g., Petronius) may be considered for water depths of approximately 1,000 to 3,000 ft. Tension-leg platforms (TLP's) (e.g., Brutus and Typhoon) are frequently used in 1,000 to 5,000-ft water depths. Figure 40 shows three competing versions of TLP's used in the GOM, along with a photograph of the larger Ursa TLP operated by Shell. Examples of the SeaStar TLP are Morpeth, Allegheny, and Typhoon; the first MOSES TLP was installed to develop El Paso's Prince field. Spars (e.g., Genesis) and semisubmersible production units (e.g., Thunder Horse, as shown on the cover of this report) may be used in water depths ranging up to 10,000 feet. Figure 41 shows the two competing versions of spars used in the GOM to date. Examples of the conventional spar design include Neptune, Genesis, and Hoover. The world's first truss spar was installed by Kerr-McGee at their Nansen development during 2001.

A Floating Production, Storage, and Offloading (FPSO) system is an offshore production facility that is typically ship-shaped and stores crude oil in tanks located in the hull of the vessel. The crude oil is periodically offloaded to shuttle tankers or ocean-going barges for transport to shore. The FPSO would use one of the following arrangements to remain at the production location: fixed mooring (anchored to the seafloor, similar to a spar), turret mooring (allowing the FPSO to weathervane around a fixed point), or dynamically positioned (relying on thrusters to maintain the location). An FPSO could be used to develop a discovery in water depths ranging from

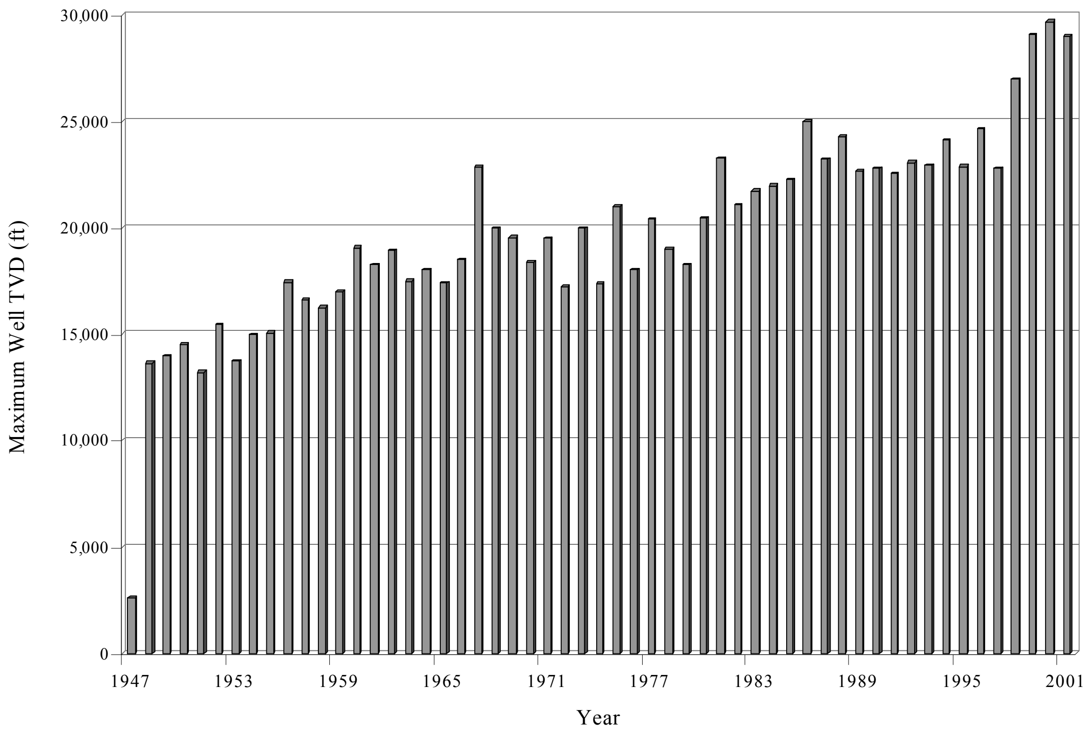


Figure 37. – Maximum wellbore true vertical depth (TVD) drilled in the total GOM each year.

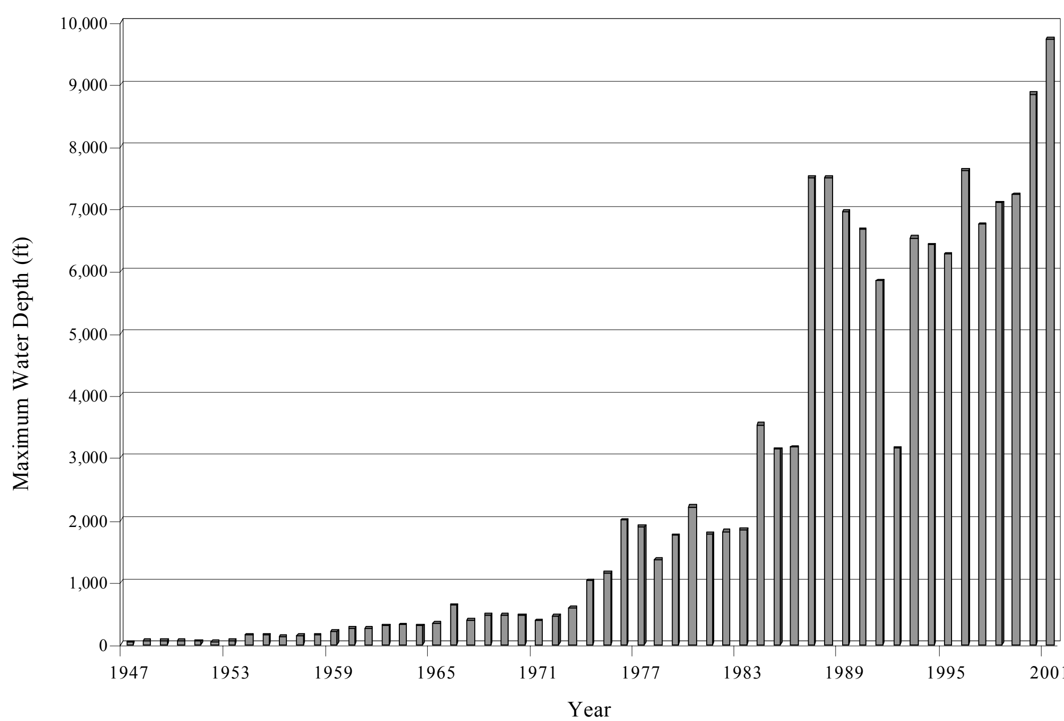


Figure 38. – Maximum water depth drilled each year.

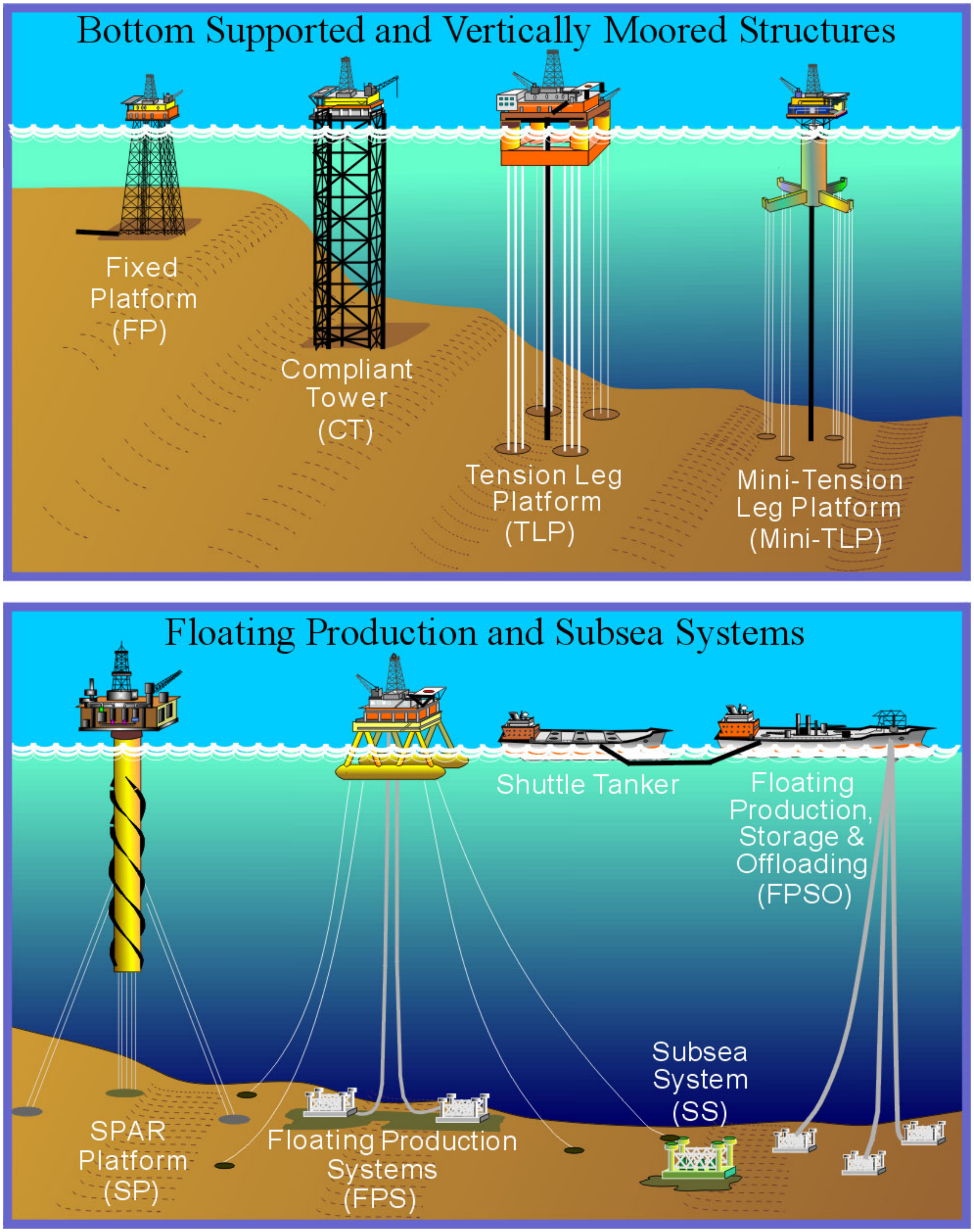


Figure 39. – Deepwater development systems.

Table 2. – Development Systems of Productive Deepwater GOM Fields.

Year of First Production	Field Nickname	System Type	Block	Water Depth (ft)	Operator
1979	Cognac	Fixed Platform	MC 194	1,023	Shell
1984	Lena	Compliant Tower	MC 281	1,017	ExxonMobil
1988*	Unnamed	FPS	GC 75	2,172	Oryx
1988*	Unnamed	Semi-Submersible	GC 29	1,554	Placid
1989	Bullwinkle	Fixed Platform	GC 65	1,330	Shell
1989	Jolliet	TLP	GC 184	1,724	Conoco
1991	Amberjack	Fixed Platform	MC 109	1,050	BP
1993*	Diamond	Subsea	MC 445	2,095	Oryx
1993*	Seattle Slew	Fixed Platform/Subsea	EW 914	1,019	Tatham
1993	Zinc	Subsea	MC 354	1,475	ExxonMobil
1994	Auger	TLP	GB 426	2,863	Shell
1994	Pompano/Pompano II	Fixed Platform/Subsea	VK 990	1,440	BP
1994	Tahoe/ Tahoe II	Subsea	VK 783	1,391	Shell
1995*	Cooper	Semi-Submersible	GB 387	2,260	EEX
1995	Unnamed	Subsea	VK 862	1,043	Walter
1996	Mars	TLP/Subsea	MC 807	2,992	Shell
1996	Popeye	Subsea	GC 116	2,065	Shell
1996	Rocky	Subsea	GC 110	1,719	Shell
1997	Mensa	Subsea	MC 731	5,276	Shell
1997	Neptune/Thor	Spar/Subsea	VK 825	1,866	Kerr McGee
1997	Ram-Powell	TLP	VK 956	3,243	Shell
1997	Troika	Subsea	GC 244	2,679	BP
1998	Arnold	Subsea	EW 963	1,752	Marathon
1998	Baldpate	Compliant Tower	GB 260	1,604	Amerada Hess
1998	Morpeth/Klamath	TLP/Subsea	EW 921	1,747	Agip
1998	Salsa	Subsea	GB 171	1,121	Shell
1999	Allegheny	TLP/Subsea	GC 254	3,194	Agip
1999	Angus	Subsea	GC 112	1,901	Shell
1999	Diana	Subsea	EB 945	4,670	ExxonMobil
1999	Dulcimer	Subsea	GB 367	1,123	Mariner
1999	Genesis	Spar	GC 205	2,597	ChevronTexaco
1999	Gemini	Subsea	MC 292	3,488	ChevronTexaco
1999	Macaroni	Subsea	GB 602	3,691	Shell
1999	Pluto	Subsea	MC 718	2,748	Mariner
1999	Unnamed	Subsea	EW 1006	1,832	Walter
1999	Ursa	TLP	MC 810	3,877	Shell
1999	Virgo	Fixed Platform	VK 823	1,136	TotalFinaElf
2000	Europa	Subsea	MC 935	3,880	Shell
2000	Hoover	Spar	AC 25	4,806	ExxonMobil
2000	Marlin	TLP	VK 915	3,300	BP
2000	Northwestern	Subsea	GB 200	1,261	Amerada Hess
2000	Petronius	Compliant Tower	VK 786	1,753	ChevronTexaco
2001	Brutus	TLP	GC 158	2,952	Shell
2001	Einset	Subsea	VK 873	3,584	Shell
2001	Crosby	Subsea	MC 899	4,400	Shell
2001	Ladybug	Subsea	GB 409	1,357	ATP
2001	Madison	Subsea	AC 24	4,854	ExxonMobil
2001	Marshall	Subsea	EB 949	4,376	ExxonMobil
2001	Mica	Subsea	MC 211	4,337	ExxonMobil
2001	Nile	Subsea	VK 914	3,535	BP
2001	Oregano	Subsea	GB 559	3,400	Shell
2001	Prince	TLP	EW 958	1,493	Argo
2001	Serrano	Subsea	GB 516	3,359	Shell
2001	Typhoon	TLP/Subsea	GC 236	2,679	ChevronTexaco
2001	Unnamed	Subsea	EW 878	1,585	Walter
2001	Unnamed	Subsea	MC 68	1,214	Walter

* Indicates fields that are no longer on production.

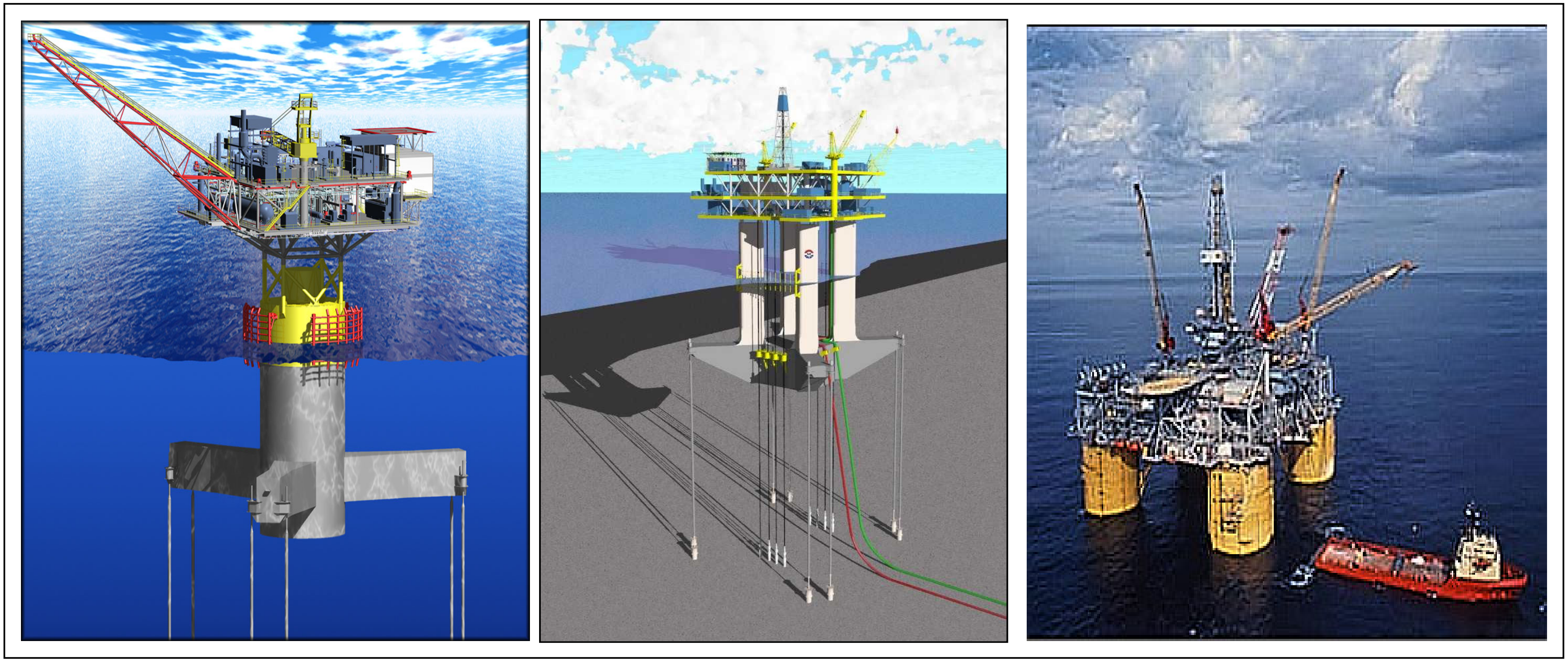


Figure 40. – Three different versions of TLP's (left to right): a SeaStar installed at ChevronTexaco's Typhoon field, a MOSES installed at El Paso's Prince field, and a conventional TLP installed at Shell's Ursa field. (Photographs courtesy of ChevronTexaco, El Paso, and Shell, respectively.)

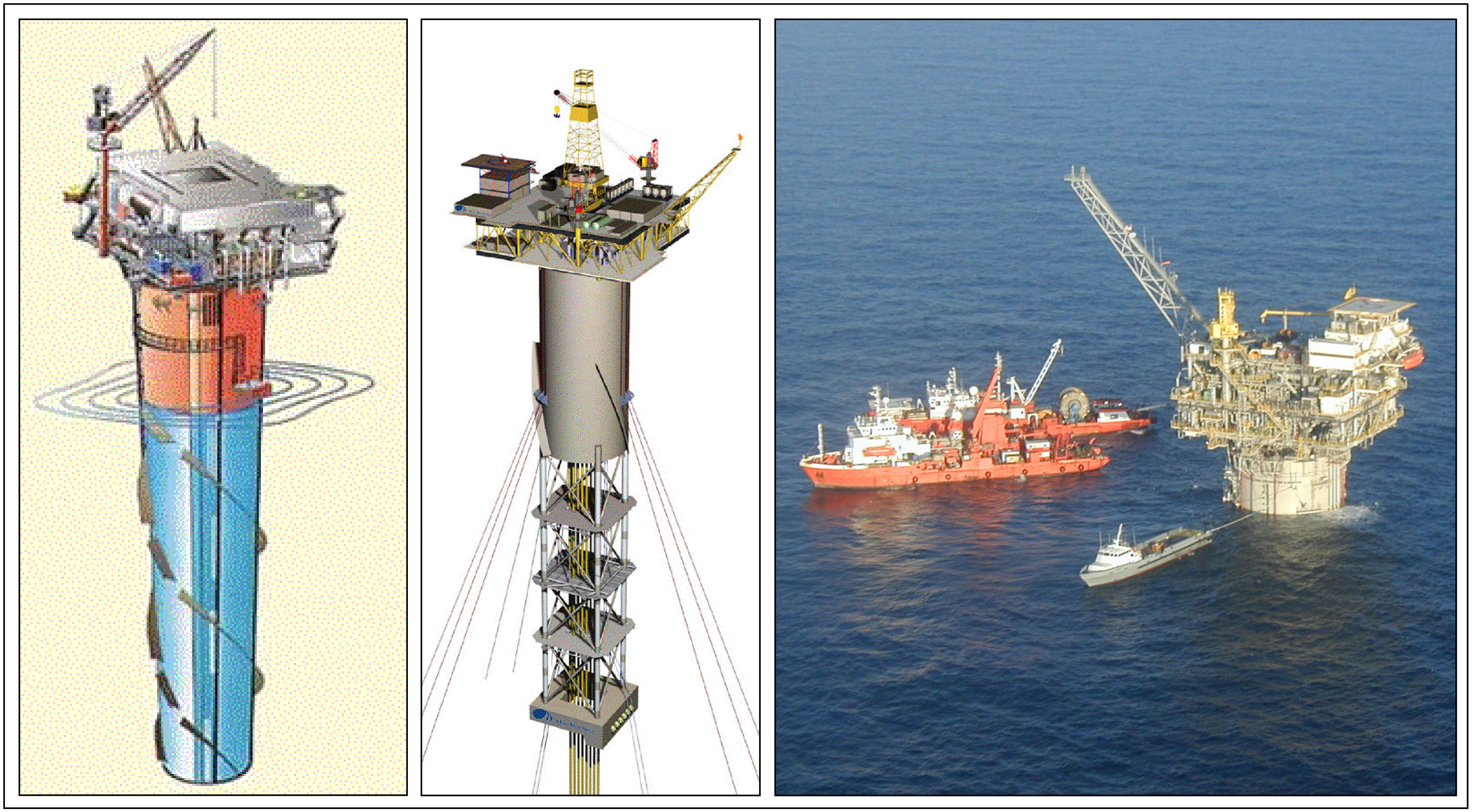


Figure 41. – Two competing versions of the production spar. A conventional spar is shown in the artist's drawing at the left, as installed at Kerr-McGee's Neptune field. The middle graphic shows the truss spar planned for BP's Holstein development. The photograph at the right is the world's first truss spar, installed at the Nansen field by Kerr-McGee. (Photographs courtesy of Oryx, BP, and Kerr-McGee, respectively.)

several hundred feet to well beyond 8,000 ft, although historically nearly all have been installed in less than 3,000 ft of water.

A marginal deepwater field that is remote from established pipeline infrastructure would be a likely FPSO-based development scenario in the GOM. To date, no operator has proposed the use of an FPSO to develop a GOM discovery in U.S. waters.

Figure 42 shows the different types of production systems installed each year (the pie chart within figure 42 shows all the deepwater development systems that are producing). Data values can be found in appendix G. At least seven deepwater production facilities (primarily truss spars) are under construction or pending installation at this time.

Subsea systems (e.g., Mensa), as shown in figure 43, 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 to 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 44a shows the number of subsea completions each year since 1955 (only productive wells were counted). There were fewer than five subsea completions per year until 1989. This number increased dramatically throughout the 1990's. The number of subsea wells installed in 2000 appears anomalous. While it is not possible to identify specifically why there were so few subsea completions, the trend is consistent with deepwater start-ups as shown in table 2 (11 in 1999; 5 in 2000; 14 in 2001). Drilling activities and permitting of deepwater developments (figure 36) remained at high levels during this one-year decline, implying that subsea well installations are likely to remain close to 1999 and 2001 levels. Well complexity, deeper water discoveries, project schedules, equipment availability, and other challenges will affect the number of yearly subsea well installations. The pie chart within figure 44a shows that shallow-water subsea wells are a significant contribution to the subsea well population in the GOM. Shallow-water subsea wells accounted for 136 of the 218 total subsea wells in the GOM by yearend 2001. 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 32 wells.

The technology required to implement subsea production systems in deepwater evolved significantly in the last decade. This evolution is apparent in figure 44b, which shows the deepest subsea completion was in 350 ft of water until 1988, when the water depth record (GOM) jumped to 2,243 ft (GC 75 field). In 1996 another record was reached with a subsea

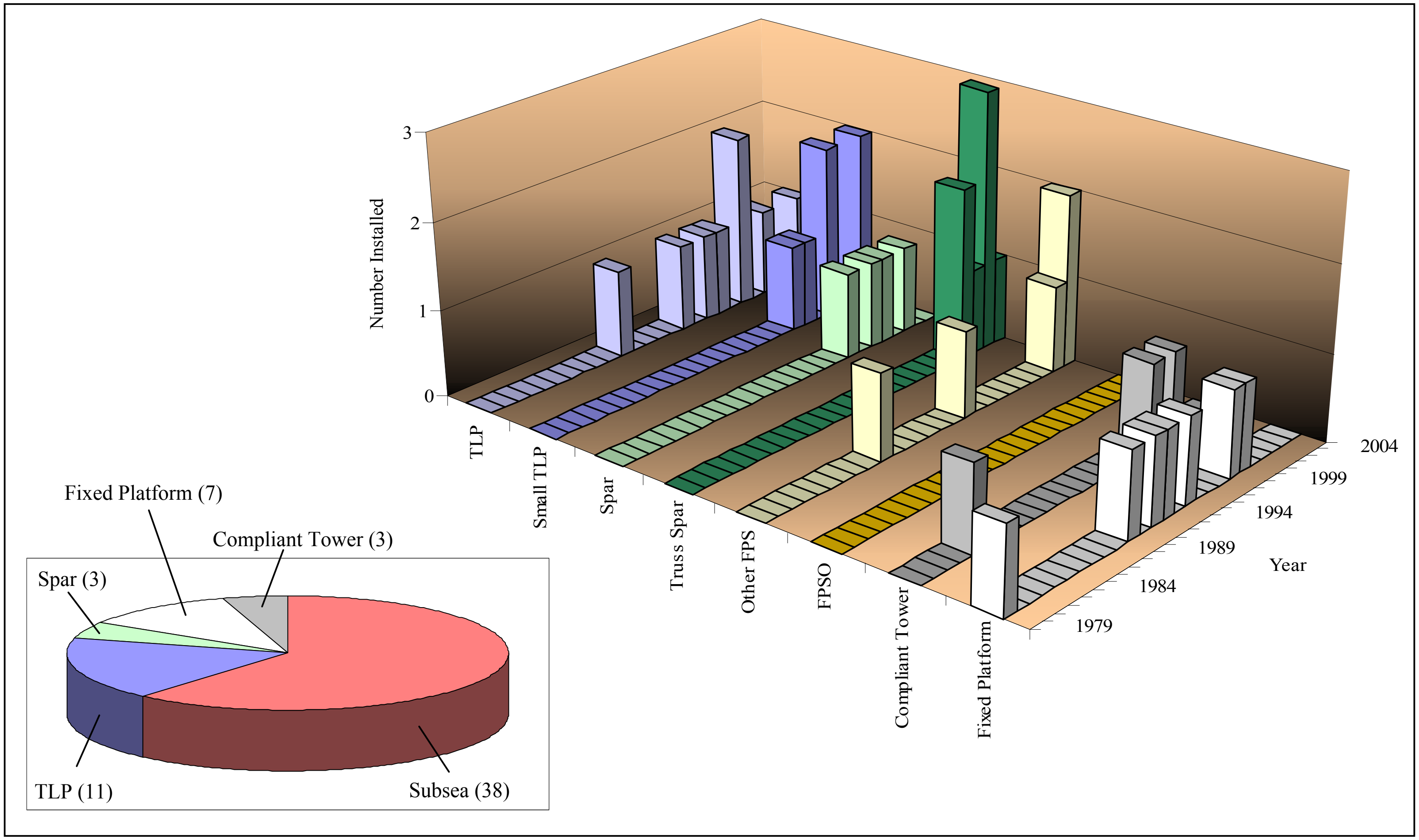


Figure 42. - GOM deepwater production facilities installed each year (including plans through 2004). Inset shows production systems for currently producing fields (including subsea systems).

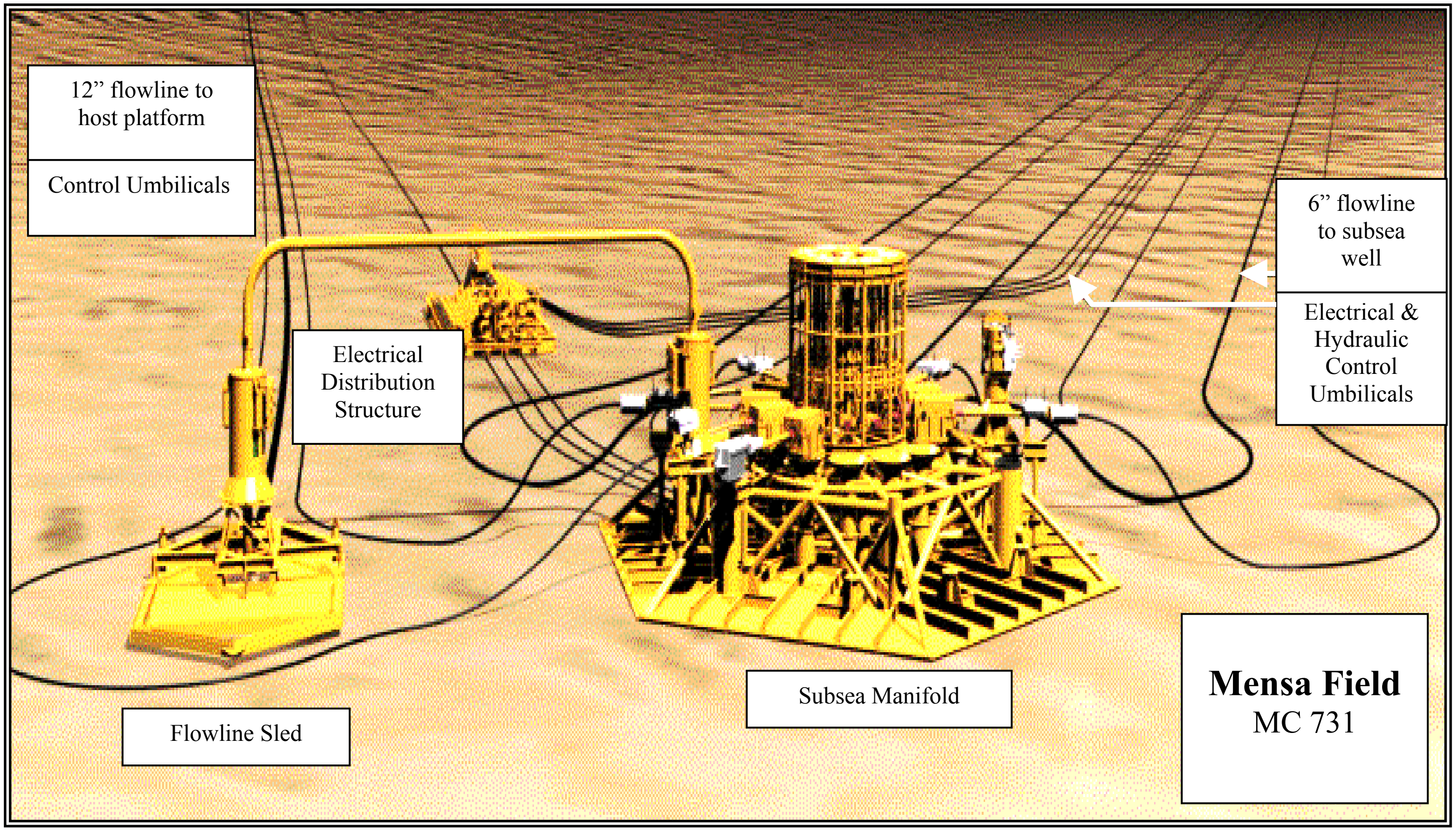


Figure 43. – Mensa Project subsea equipment layout (courtesy of Shell).

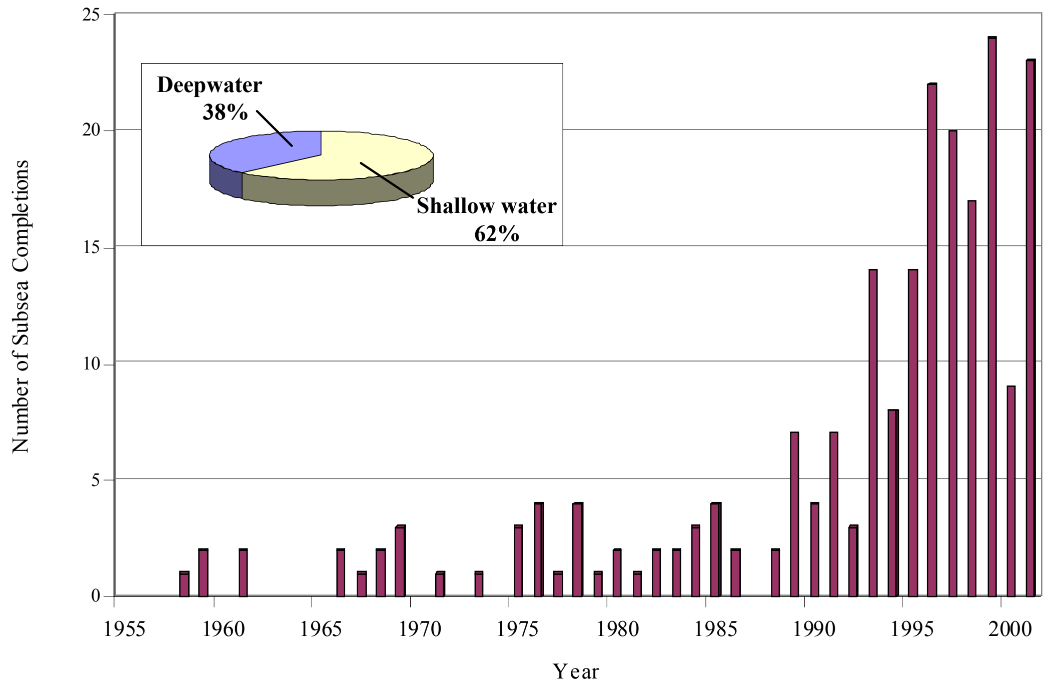


Figure 44a. – Number of subsea completions each year.

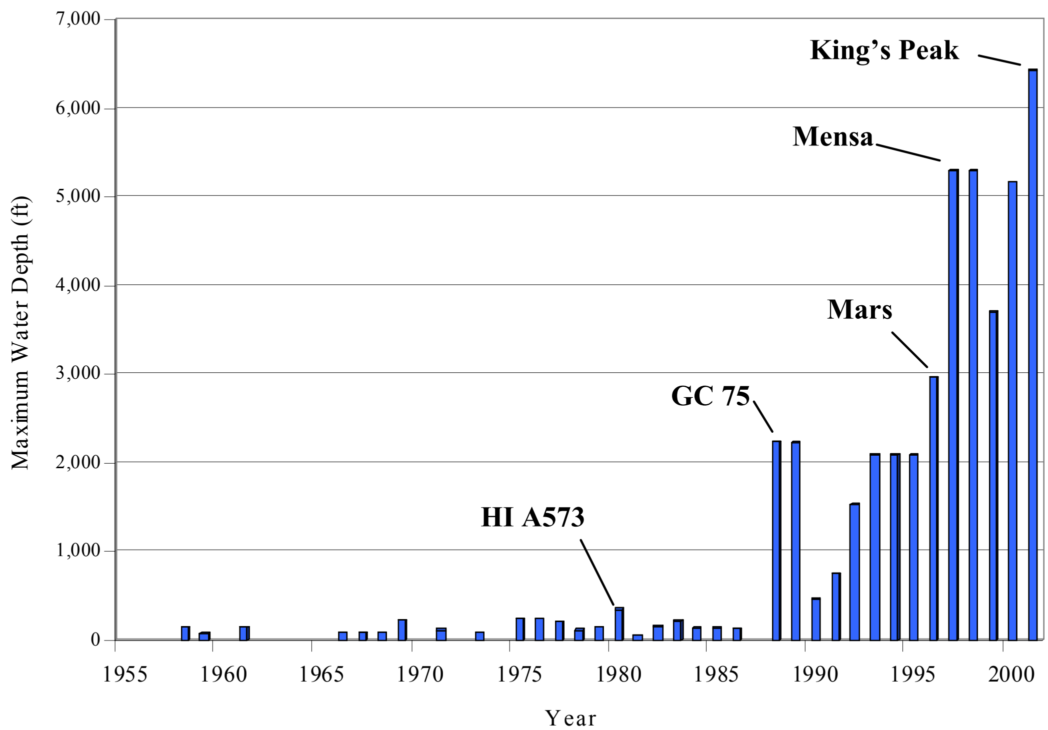


Figure 44b. – Maximum water depths of subsea completions each year.

completion in 2,956 ft of water (Mars field), followed by a 1997 subsea completion in 5,295 ft of water (Mensa field). Mensa has the deepest production in the GOM to date. Production from water depths greater than 7,000 ft is expected in summer 2002 from multiple wells in the Aconcagua and Camden Hills fields. A listing of productive subsea completions in the GOM Outer Continental Shelf can be found in Appendix D.

The breakdown of shallow-water and deepwater subsea wells is shown in figure 45. There have been 218 subsea completions installed, 82 of these (38%) in deepwater. Since 1996, there have been 115 subsea completions, with 60 installed (52%) in deepwater. Figure 45 demonstrates the increasing reliance of industry on subsea technology, to develop both shallow-water and deepwater fields, beginning in the late 1980's.

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 46. Most subsea wells are within 10 miles of the host platform, with the Mensa field remaining the current world record holder for a subsea tieback length of 62 miles from the host platform. The second longest subsea tieback in the world (55 miles) is Canyon Express, linking Aconcagua, Camden Hills, and King's Peak projects to their host platform. Figure 47 shows the number of subsea tieback projects by water-depth range, illustrating the preponderance of projects in water depths less than 2,500 ft.

Deepwater pipelines approved for installation are shown in Figures 48a and 48b. The data include the total length of all pipelines originating at a deepwater development, including any shallow-water segments (control umbilicals are excluded). Figure 48a shows deepwater pipelines that are less than or equal to 12 inches in diameter. The dominance of gas pipeline miles approved in deepwater is surprising – 67 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 in diameter) has fallen significantly since peaking in 1999 (Figure 48b). The peak in 1999 was driven by the approval of the Hoover, Petronius, and Ram-Powell projects.

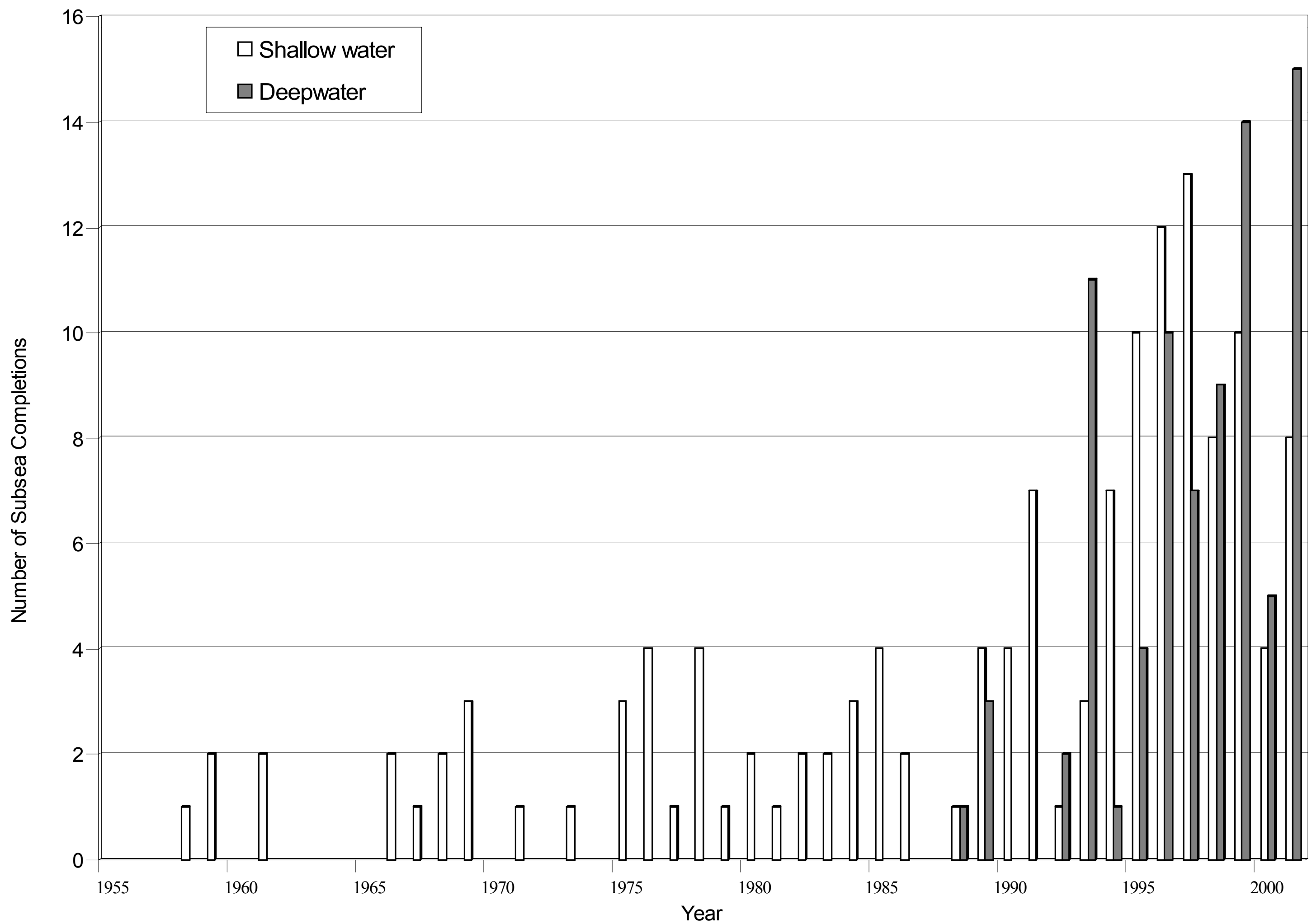


Figure 45. – Number of shallow- and deepwater subsea completions each year.

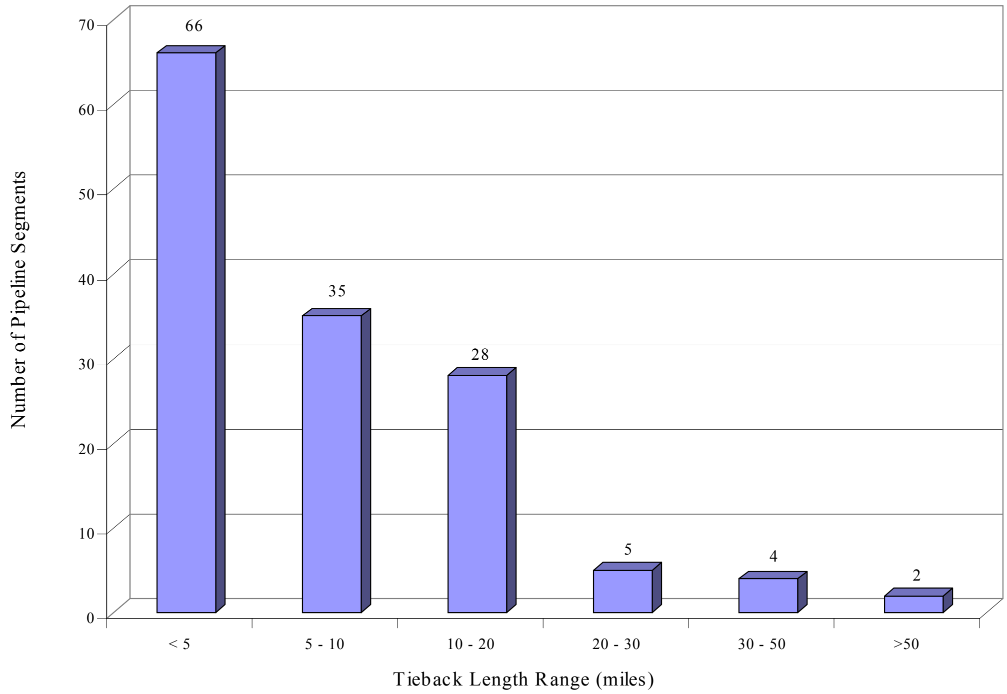


Figure 46. – Length of subsea tiebacks.

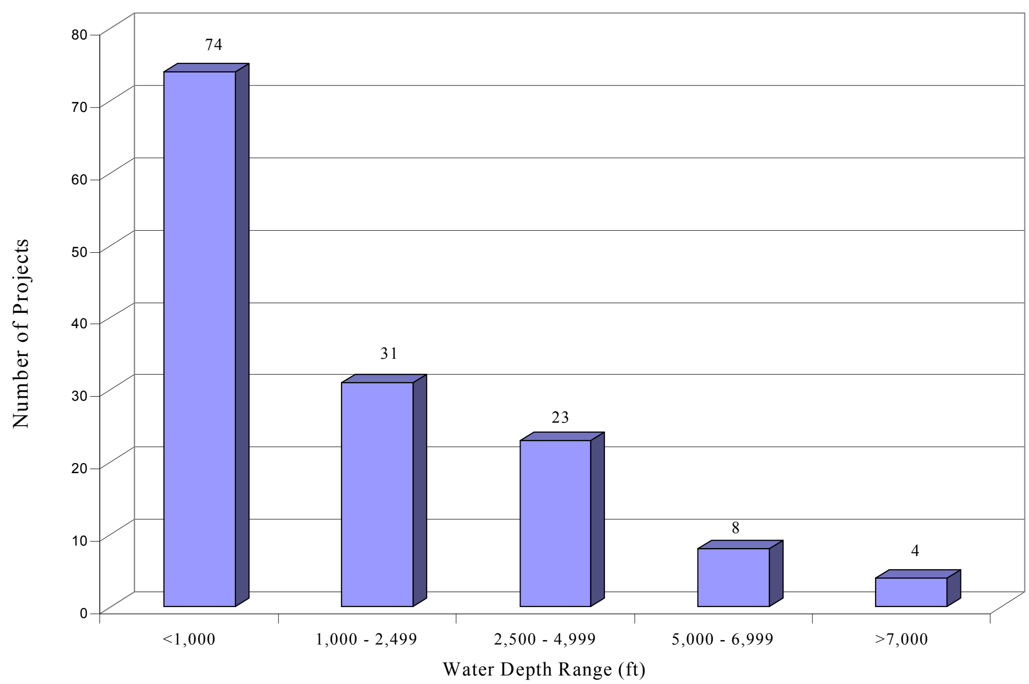
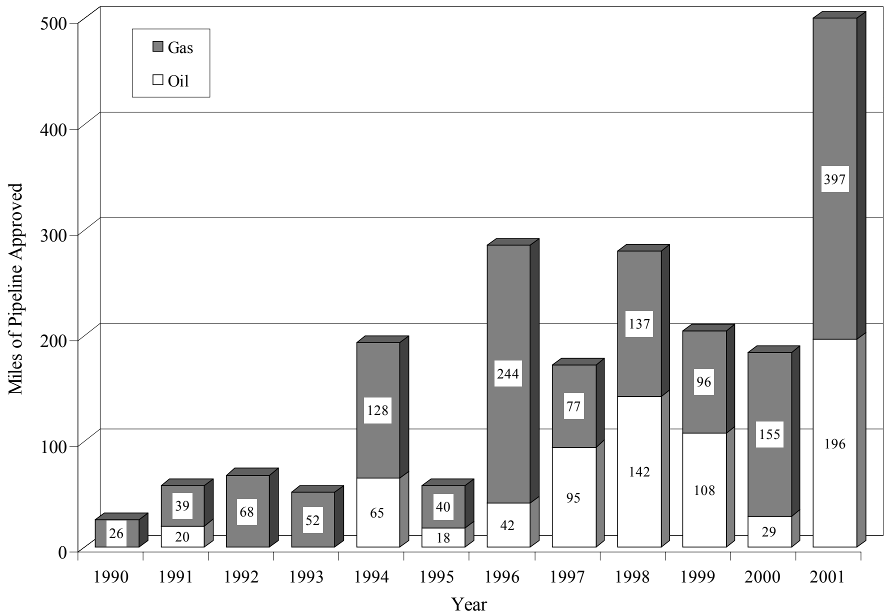


Figure 47. – Water depth of subsea tiebacks.

(a)



(b)

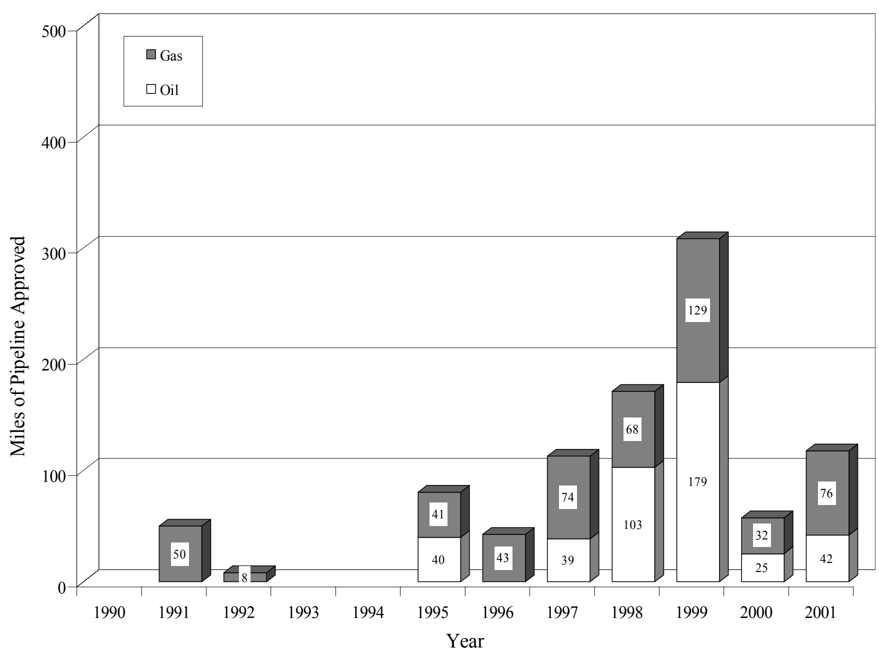


Figure 48. – Approved deepwater oil and gas pipelines (a) less than or equal to 12 inches in diameter, and (b) greater than 12 inches in diameter.

Reserves and Production

The deepwater GOM has contributed major additions to the total reserves in the GOM. Figure 49 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 of water. It was not until 1984 that major additions came from water depths greater than 1,500 ft.

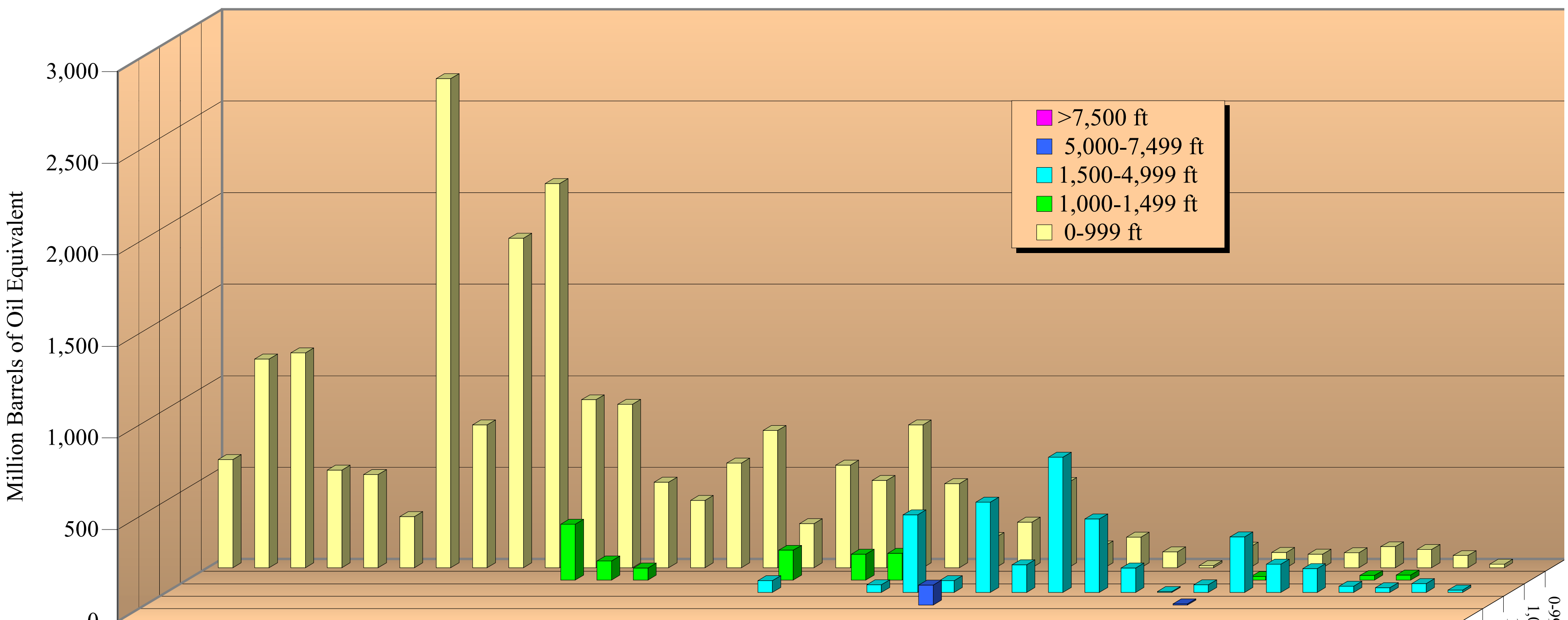
There is often a significant lag between a successful exploratory well and its hydrocarbons being produced. The success of an exploratory well may remain concealed from the public for several years until the operator requests a "Determination of Well Producibility" from MMS. A successful MMS determination 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 50 includes both proved and unproved reserves for each water-depth category. This figure shows declining reserve additions in shallow water, similar to figure 49, but reveals significantly more deepwater reserve additions and large significant unproved reserve additions in water depths greater than 5,000 ft beginning in 1998.

Figure 51 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 6 MMBOE of proved and unproved reserves. In contrast, the average deepwater field added over 64 MMBOE of proved and unproved reserves. In the most active deepwater exploration area, water depths between 1,500 and 7,499 ft, the average deepwater field contributed more than 73 MMBOE (12 times more than the average shallow-water field addition).

Discoveries

Figure 52 shows the number of deepwater fields discovered each year, according to MMS criteria, since 1975. (See appendices A and B for listings of deepwater fields 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 are not yet reflected in MMS proved and unproved reserve estimates.

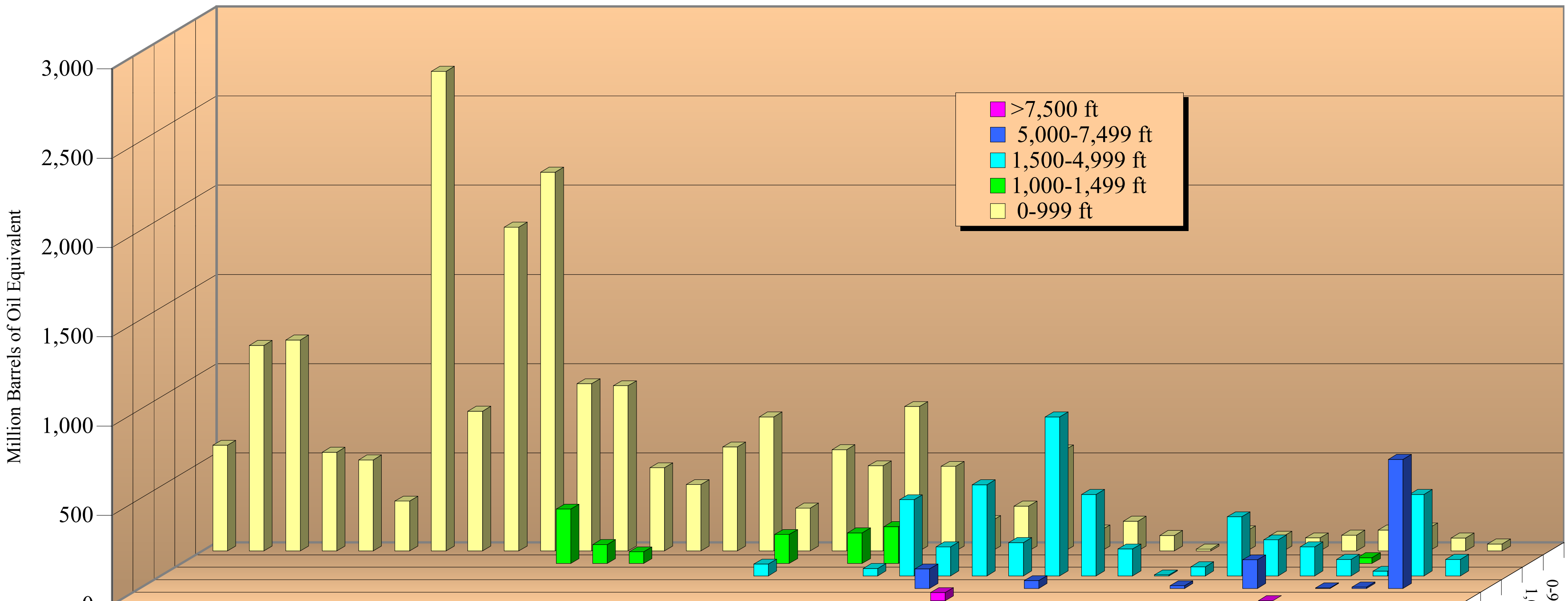
In an attempt to capture the impact of these deepwater exploratory successes, figure 53 adds MMS-known resource estimates and industry-announced discoveries to the proved and unproved reserve volumes. The industry-announced discovery volumes contain considerable uncertainty, are based on limited drilling, include numerous assumptions, and have not been confirmed by independent MMS analyses. They do, however, illustrate recent activity better than using only



	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																	65		
1,000-1,499 ft											305	105	66				163		141
0-999 ft	590	1140	1172	532	508	279	2670	780	1798	2096	917	891	466	367	571	749	241	560	477

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
>7,500 ft																		
5,000-7,499 ft			109							6								
1,500-4,999 ft	42	424	65	492	152	739	402	134	6	43	304	155	130	34	27	48	13	
1,000-1,499 ft	145										20			25	27			
0-999 ft	779	459	164	248	465	118	167	87	11	112	84	73	81	114	98	66	19	

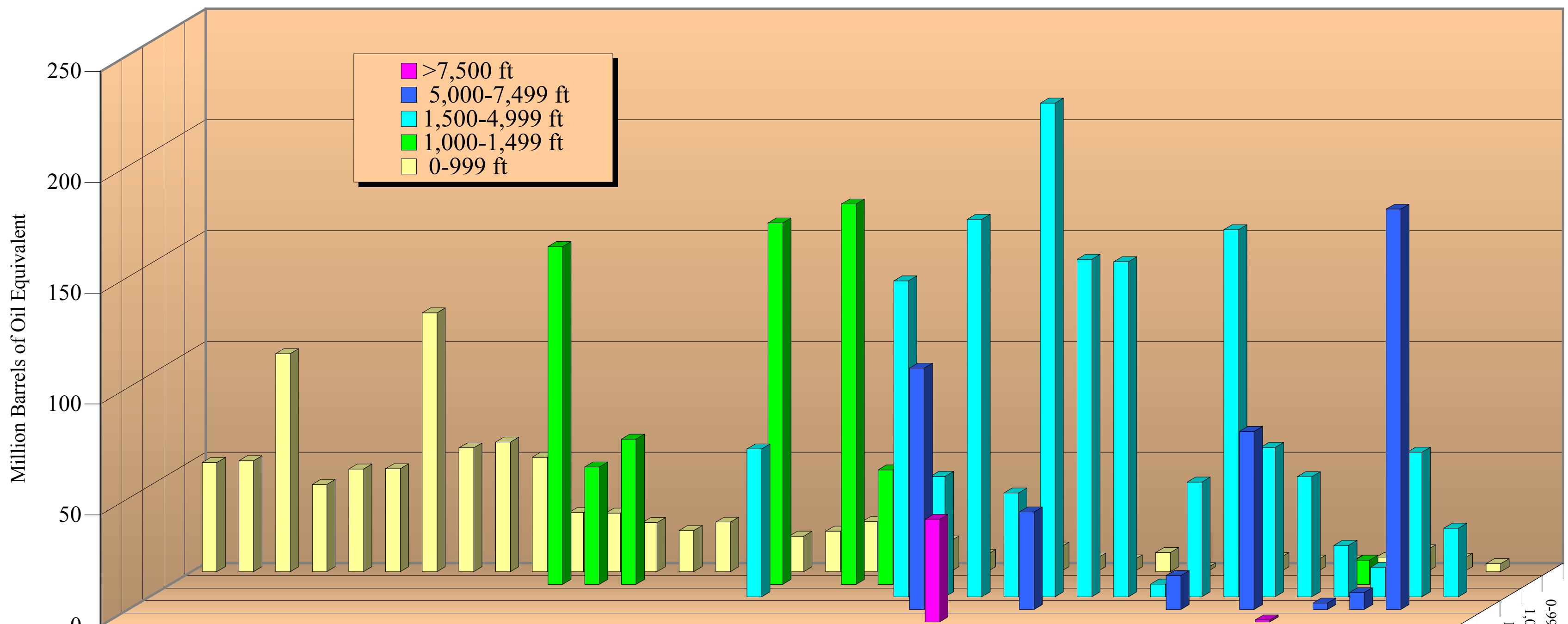
Figure 49. – Proved reserve additions.



	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																	67		
1,000-1,499 ft											305	106	66				163		172
0-999 ft	592	1151	1181	553	510	279	2686	783	1813	2122	937	925	466	372	583	751	241	567	477

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
>7,500 ft				46									1					
5,000-7,499 ft			109			44				15		160		3	8	722		
1,500-4,999 ft	42	428	163	511	187	891	457	151	6	52	331	202	163	93	27	457	93	
1,000-1,499 ft	206										20			33	27			
0-999 ft	809	474	170	252	567	118	167	87	11	114	84	74	89	118	129	73	40	

Figure 50. – Proved and unproved 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																	67		
1,000-1,499 ft											152	53	66				163		172
0-999 ft	49	50	98	39	46	47	117	56	58	52	27	26	22	19	22	38	16	18	23

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
>7,500 ft				46									1					
5,000-7,499 ft			109			44				15		80		3	8	181		
1,500-4,999 ft		143	54	170	47	223	152	151	6	52	166	67	54	23	13	65	31	
1,000-1,499 ft	52										20			11	13			
0-999 ft	12	14	8	7	11	6	5	9	2	9	6	5	5	7	10	6	4	

Figure 51. – Average field size using proved and unproved reserves.

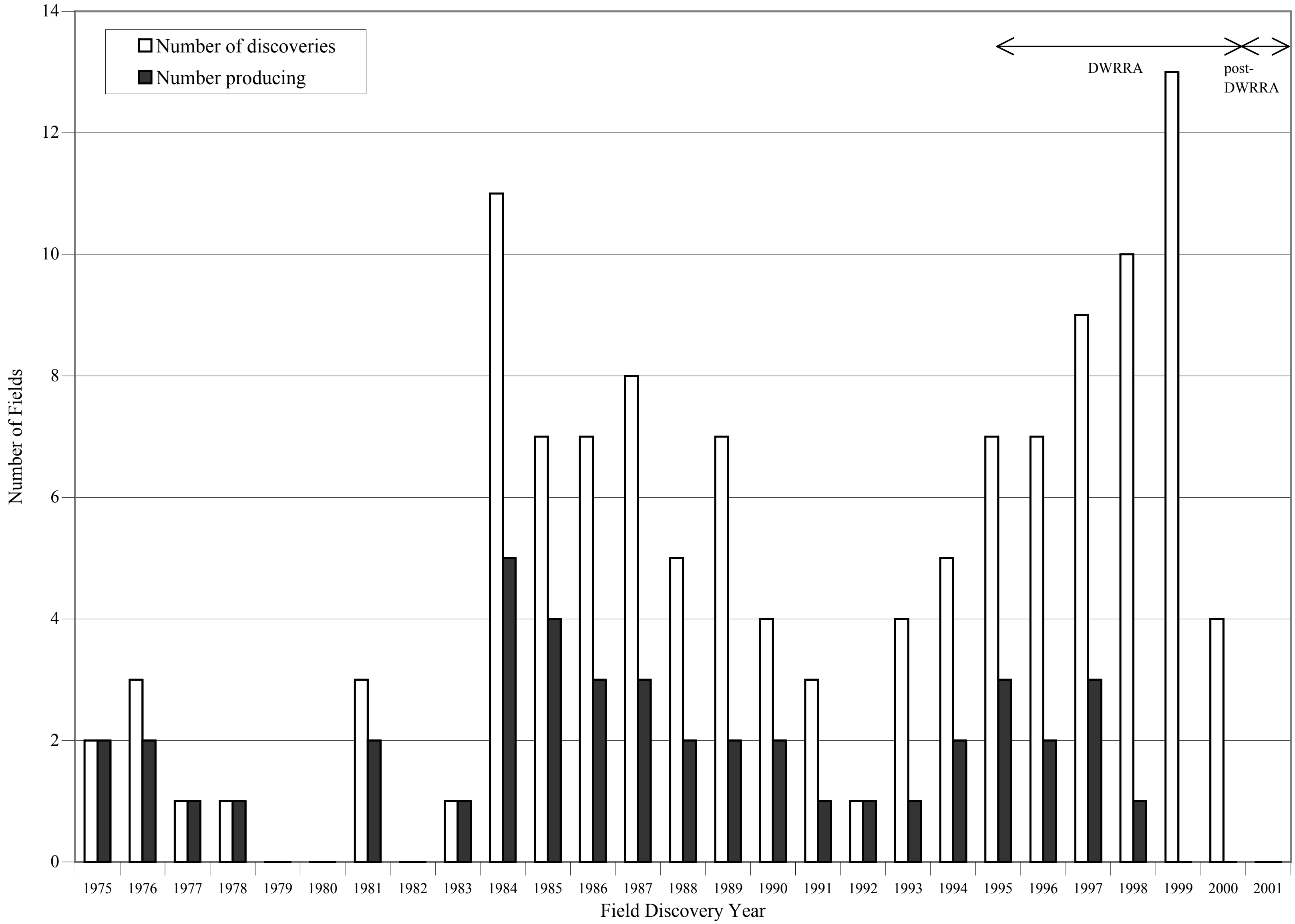


Figure 52. - Number of deepwater field discoveries and resulting number of producing fields.

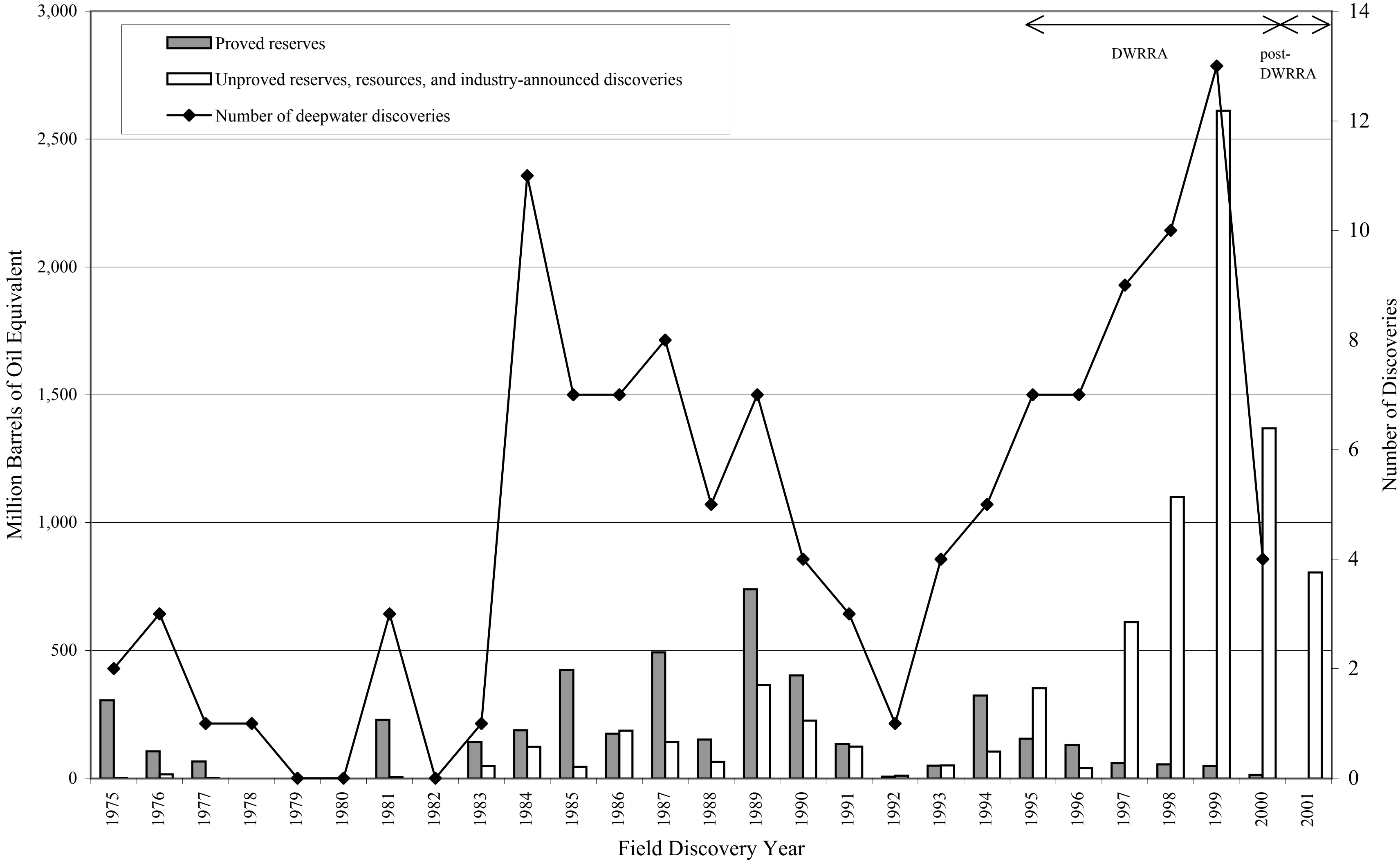


Figure 53. - Number of deepwater field discoveries and new hydrocarbons found (MMS reserves, MMS resources, and industry-announced discoveries).

MMS proved reserve numbers. The apparent decline of proved reserve additions in recent years is caused by the previously mentioned developmental lag.

Figure 54 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.

Reserve Potential

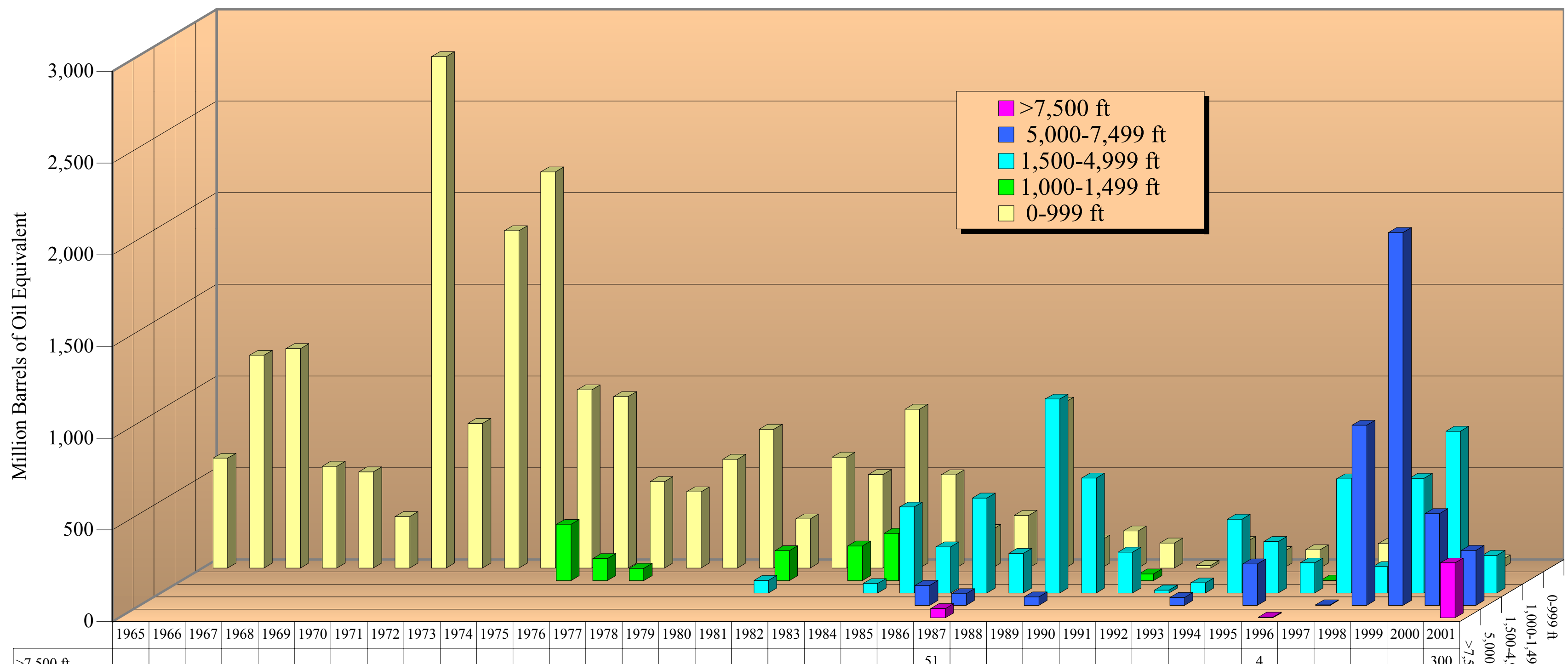
This report has examined the history of reserve growth in the GOM. Figure 54 illustrates results of the latest drilling in the GOM, suggesting very significant production volumes in the near future. Predicting future discoveries is more difficult. To address the amount of hydrocarbons yet to be discovered 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.

The creaming curve, figure 55, 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 55 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 49, 50, 51, and 54, 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, summarized in figure 56. 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



	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																	69		
1,000-1,499 ft											306	120	67				163		188
0-999 ft	599	1161	1197	555	524	280	2790	789	1839	2161	972	935	472	416	593	757	268	606	511

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
>7,500 ft				51									4					300
5,000-7,499 ft			109	65		46				44		227		4	983	2034	500	300
1,500-4,999 ft	52	469	251	517	216	1057	627	222	16	55	402	281	164	622	145	625	882	205
1,000-1,499 ft	258							36			26		2	43	27			
0-999 ft	866	509	210	287	905	153	202	136	15	145	90	100	111	133	133	77	45	

Figure 54. – BOE added (reserves, known resources, and industry-announced discoveries).

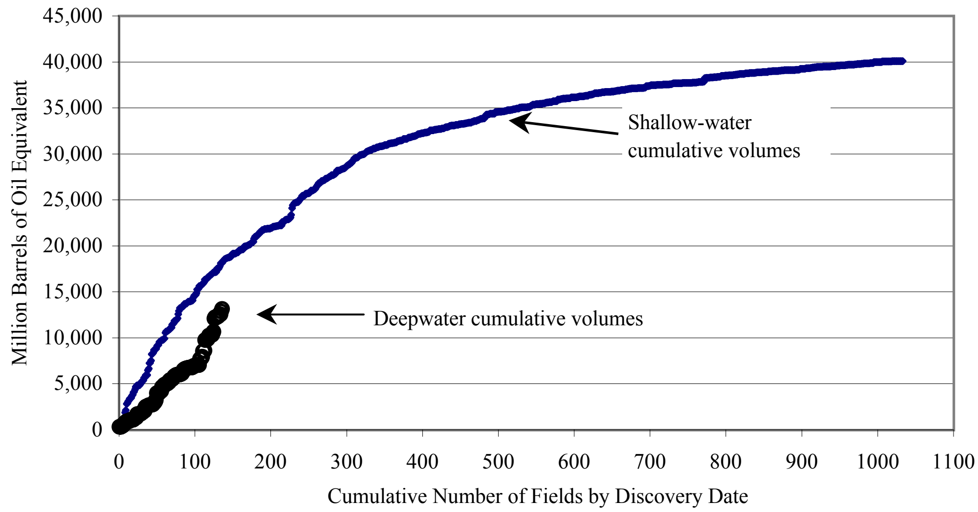


Figure 55. - Creaming curve for shallow- and deepwater areas of the GOM (includes reserves, resources, and industry-announced discoveries).

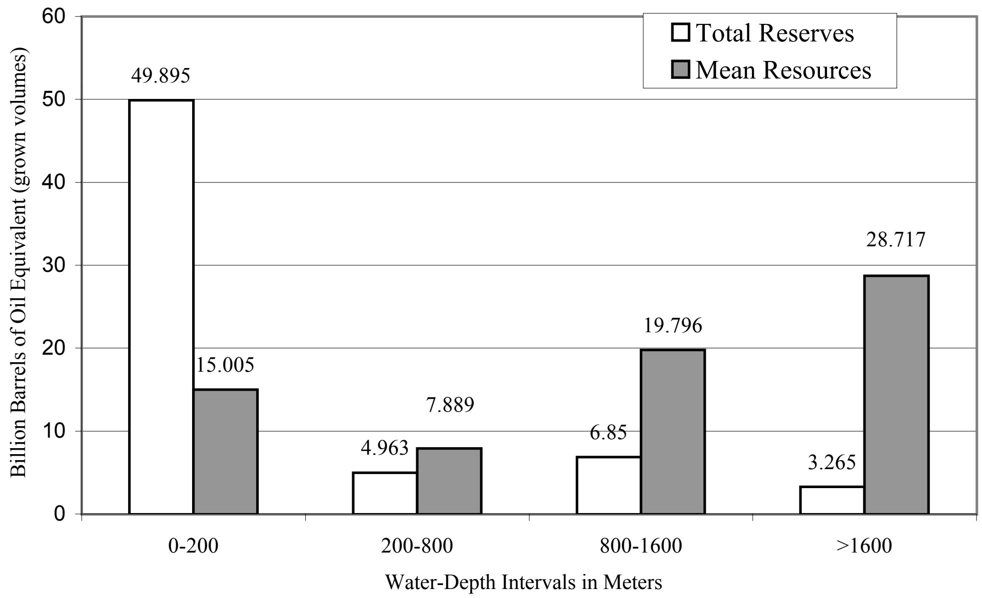


Figure 56. - Reserves and future discovery volumes in the deepwater GOM (from Lore et al., 2001).

be discovered.[2] Compare this with the shallow-water ultimate reserves of approximately 65 billion BOE, of which 15.2 billion BOE remain to be discovered.

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 57 illustrates the relative volume of production from each GOM block through time. Notice the large deepwater volumes that first appear in 1996 and 1997. Table 3 shows that the most prolific blocks (on a BOE basis) are currently in the deepwater GOM.

Table 3. - Top 20 producing blocks for the years 2000–2001.

Block	Project Name	Owner	Water Depth (ft)	Production (BOE)*
MC 807	Mars	Shell	3,327	78,035,724
GB 427	Auger	Shell	2,953	51,878,082
GC 200	Troika	BP	2,828	49,193,970
MC 809	Ursa	Shell	3,947	44,113,351
GB 260	Baldpate	Amerada Hess	1,759	27,450,880
ST 37	Unnamed	ChevronTexaco	59	19,632,336
GC 113	Angus	Shell	2,713	15,893,963
MI 622	Unnamed	BP	89	15,265,265
MC 853	Ursa	Shell	4,052	15,039,580
EW 873	Unnamed	Marathon	988	13,925,569
VK 956	Ram Powell	Shell	4,059	13,734,616
MC 934	Europa	Shell	3,904	13,495,243
VK 912	Ram Powell	Shell	3,294	13,383,491
MC 28	Pompano/Pompano II	BP	1,972	12,665,320
GB 426	Auger	Shell	2,884	11,985,662
GC 161	Genesis	ChevronTexaco	2,772	11,909,477
VK 786	Petronius	ChevronTexaco	2,539	11,689,383
GC 205	Genesis	ChevronTexaco	2,828	11,442,541
MO 824	Unnamed	ExxonMobil	49	11,327,104
SM 222	Unnamed	ChevronTexaco	16	11,296,799

*cumulative production from January 2000 through May 2001

[2] 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 then forecast the number of hydrocarbons remaining to be discovered in the GOM on the following factors:

1) the number and size of discovered accumulations in an established play
2) an estimate of the number of undiscovered accumulations in a play
3) 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 may 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.

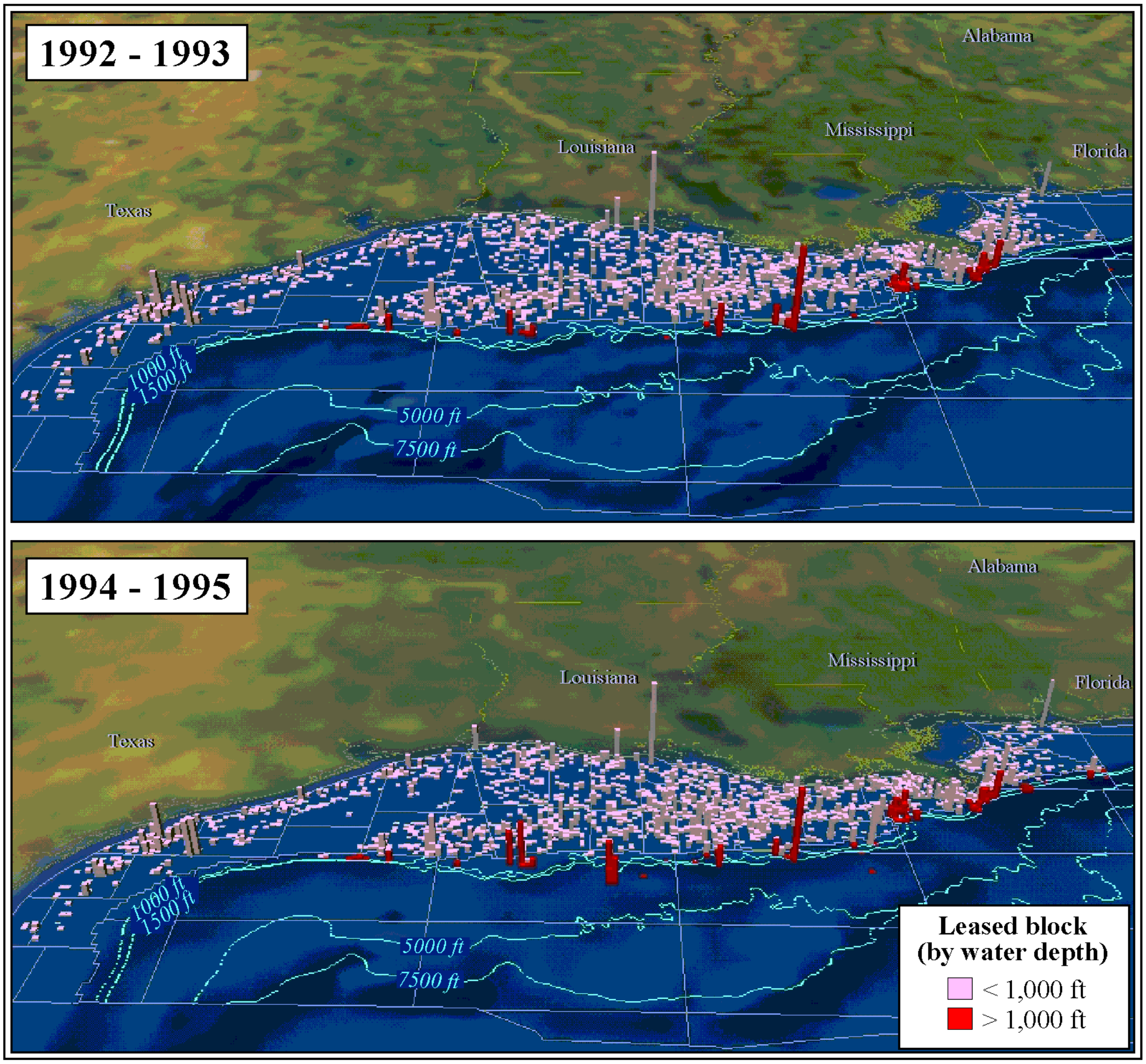


Figure 57. - Relative volume of production from each Gulf of Mexico lease. Bar heights are proportional to total lease production (barrels of oil equivalent) during that interval.

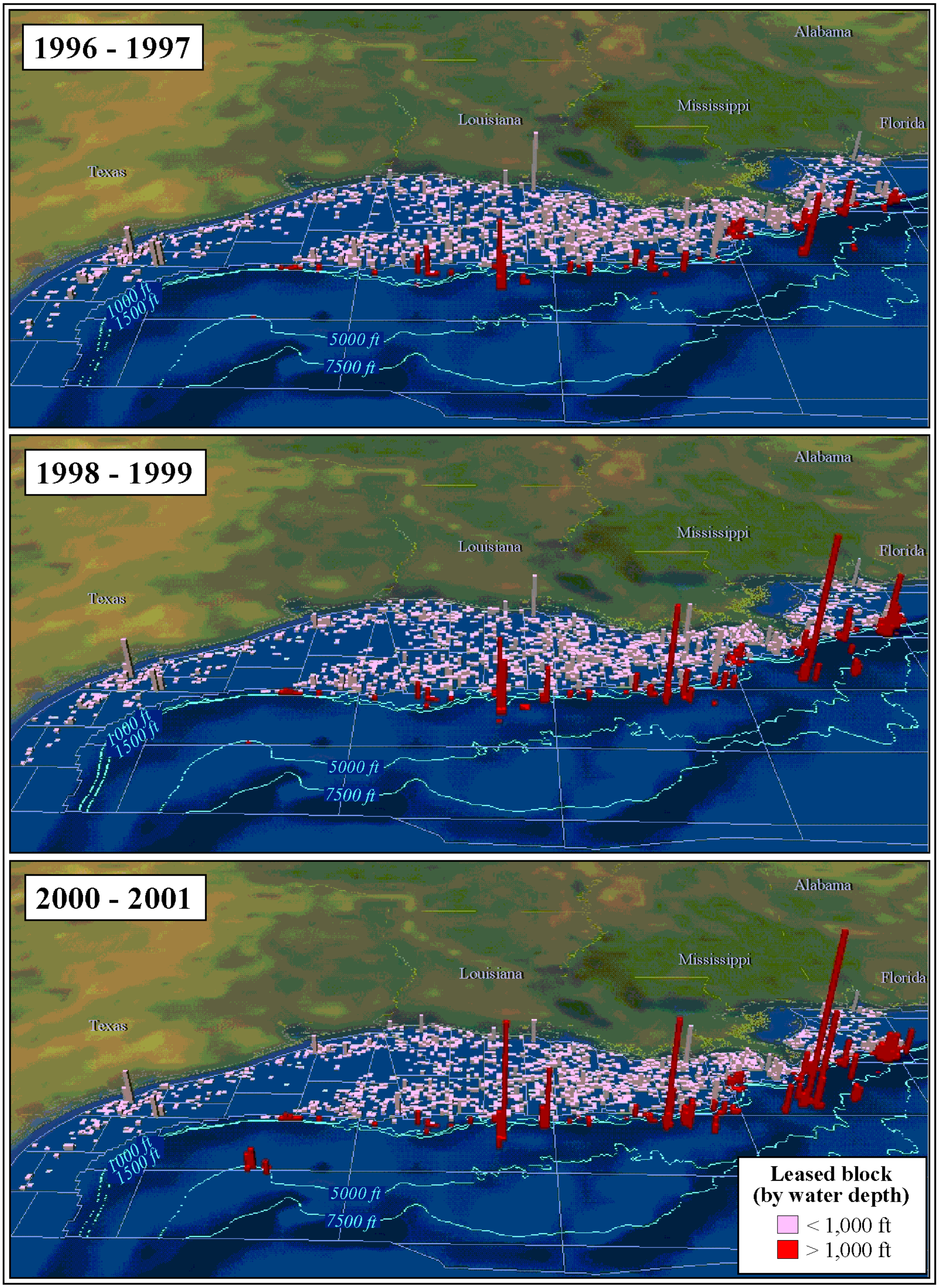


Figure 57. - *continued* - Relative volume of production from each Gulf of Mexico lease. Bar heights are proportional to total lease production (barrels of oil equivalent) during that interval.

Figure 58a 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 is now 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. (2002) 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 2001, deepwater oil production accounted for 59 percent of GOM oil production.

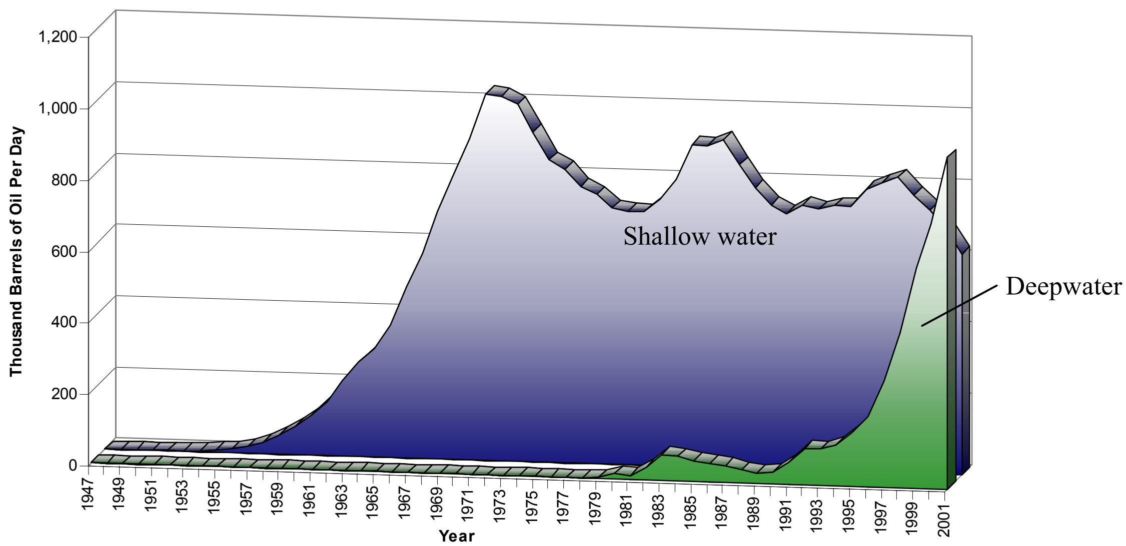
Figure 58b shows similar production trends for gas. Shallow-water gas production rose sharply throughout the 1960's and 1970's, then remained relatively stable over the next 15 years before declining steadily from 1996 through today. Although the deepwater gas production increase has not been as dramatic as with oil, the steady increase in deepwater gas production that occurred in the past few years offsets the shallow-water decline. Appendix F lists historical GOM oil and gas production rates. These trends in oil and gas production indicate that the deepwater GOM is an expanding frontier.

A significant portion of deepwater production comes from subsea completions. Figure 59a 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. Deepwater subsea oil production increased through 1999, representing almost 30 percent of all deepwater oil production in January 2000. However, a surprising trend of declining deepwater subsea oil production occurred in 2000 and early 2001. Deepwater gas production from subsea completions (figure 59b) showed a similar trend. No deepwater gas production came from subsea completions in early 1993, but by mid-1994 these accounted for over 40 percent of deepwater GOM gas production. Gas production from subsea completions increased from 1996 through 1999, but declined in 2000 and early 2001. These oil and gas production declines are likely related to the anomalously small number of subsea completions in 2000 (figure 43 and table 2). However, numerous subsea projects began production in 2001, and many more are expected in the next few years. Therefore, we do not anticipate a continued decline in oil and gas production coming from subsea completions. Subsea completions currently account for about 20 percent of deepwater oil production and about 25 percent of deepwater gas production.

Companies and Production

Deepwater oil and gas production was confined almost entirely to major oil and gas companies through 1996 (figures 60a and 60b). (Production volumes in figures 60a-b and 61a-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. However, in 2000 and early 2001 nonmajor oil production leveled off while major oil companies continued their steep increases in oil production. Figures 61a and 61b show that nonmajor oil and gas companies contributed about 15 percent of deepwater oil production from 1992 through 1997. Nonmajor companies increased their share of deepwater oil production in 1998 and early 1999. In contrast, nonmajor companies accounted for about 40 percent of deepwater gas production in early 1994. This

(a)



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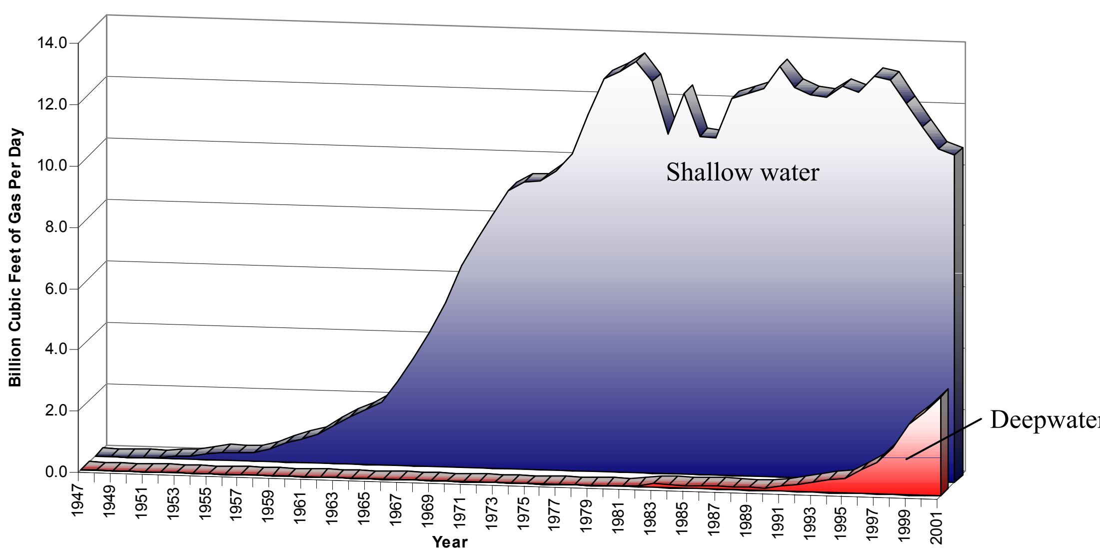


Figure 58. - Comparison of average annual shallow- and deepwater (a) oil production and (b) gas production.

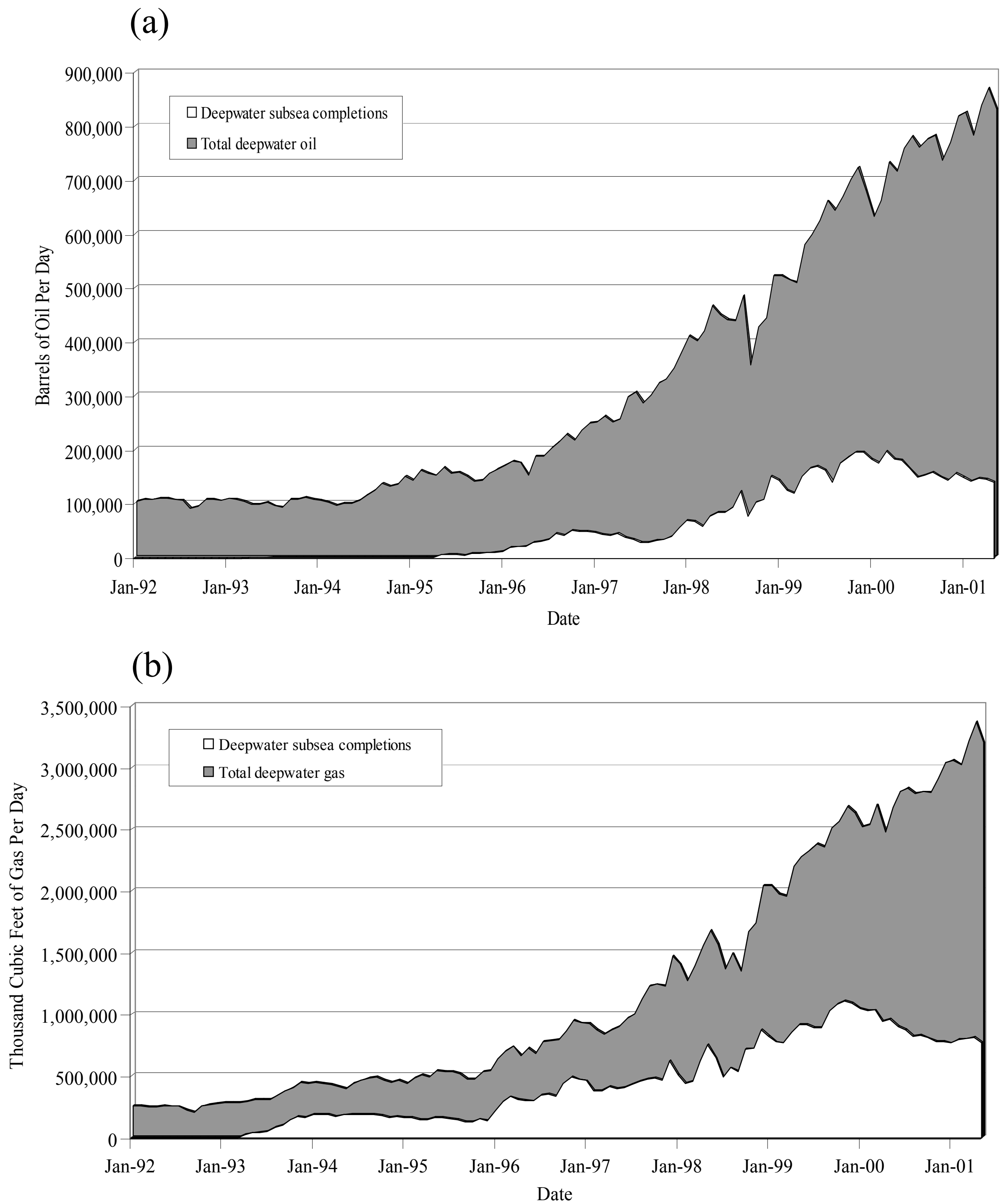
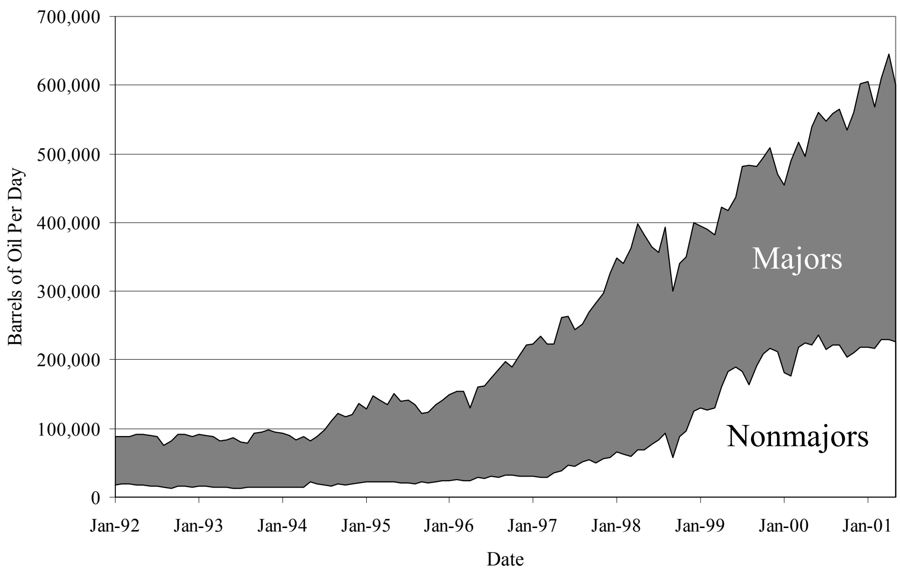


Figure 59. - Contributions from subsea completions toward total deepwater (a) oil production and (b) gas production.

(a)



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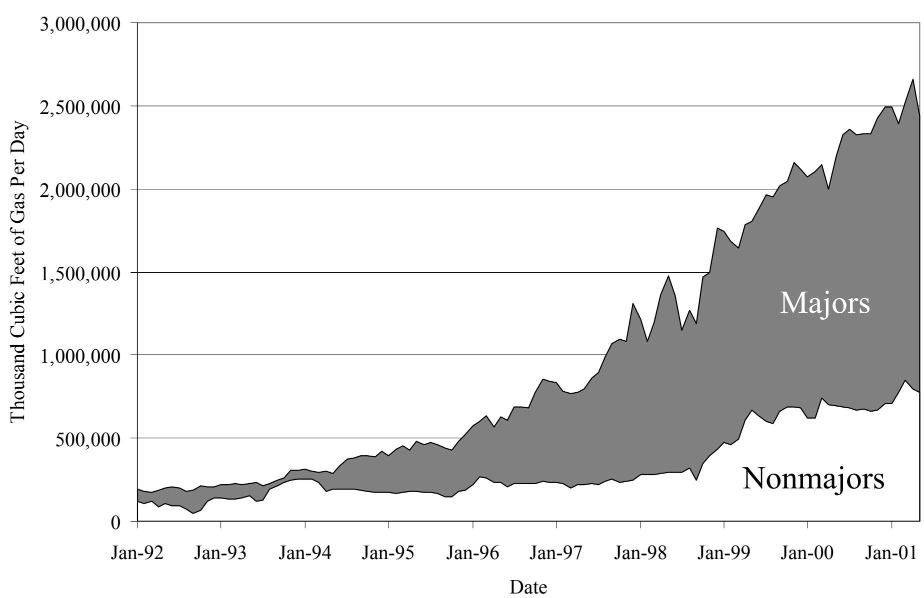
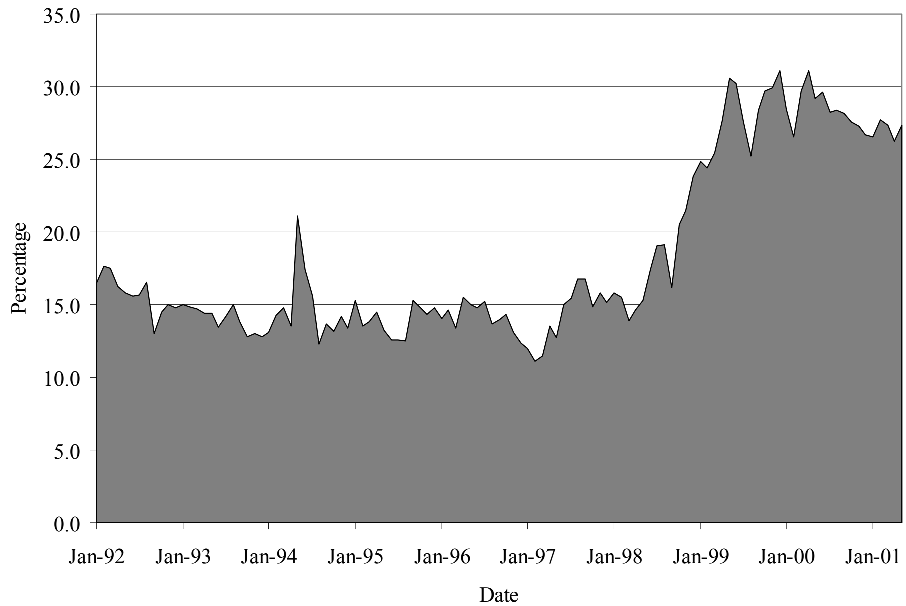


Figure 60. - Comparison of major companies and nonmajor companies in terms of deepwater (a) oil production and (b) gas production.

(a)



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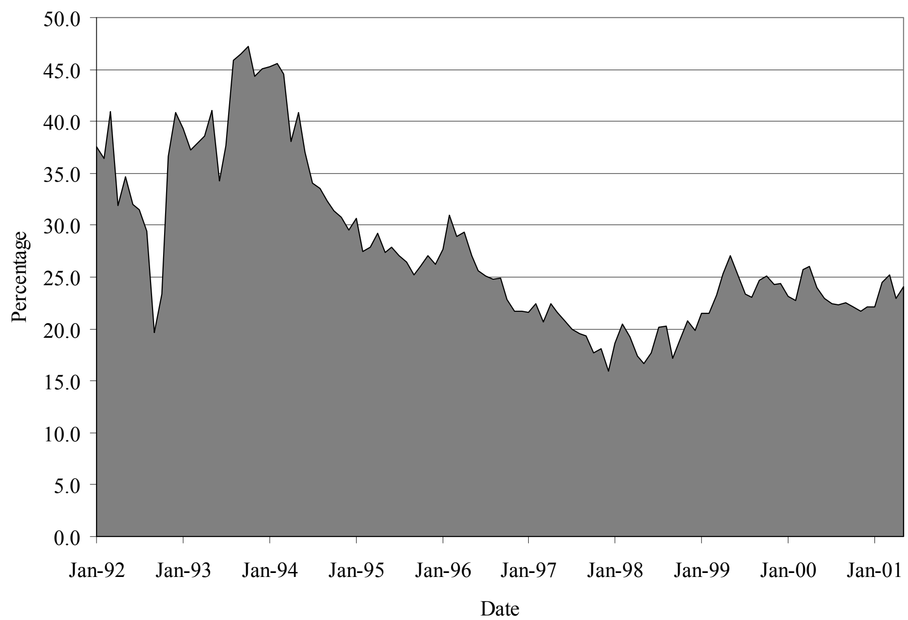


Figure 61. - Percentage of deepwater (a) oil production and (b) gas production from nonmajor oil and gas companies.

percentage declined steadily until 1998 (primarily because of Shell's increased deepwater gas production). Nonmajor companies slightly increased their share of deepwater gas production in 1998 and early 1999, but this trend ended in mid-1999. Nonmajor companies currently own about 25 percent of deepwater GOM oil and gas production.

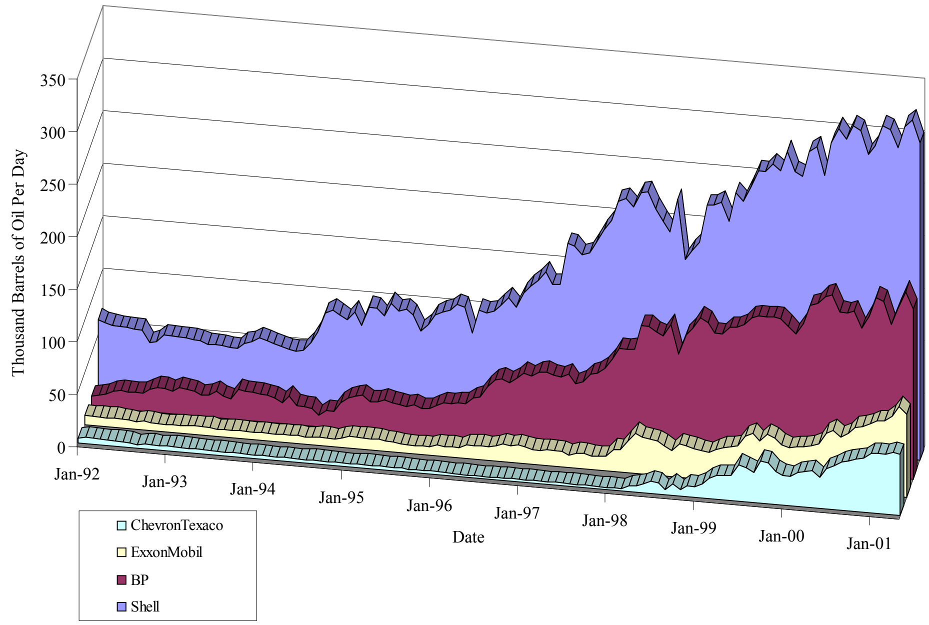
Figures 62a and 62b display production contributions from each major oil and gas company. Shell and BP were the driving forces behind increasing deepwater production, with Shell as the clear leader in both oil and gas production. Shell's dominance in deepwater oil production began before 1992 and has continued. Shell also led in deepwater gas production, including a dramatic increase in 1997. Although BP's deepwater oil production started slightly behind Shell's, their oil production increases paralleled one another throughout the 1990's (in part because Shell and BP have joint ownership in several large deepwater fields). Since mid-1999, however, Shell's deepwater oil production increase has outpaced that of other major companies. ExxonMobil currently runs a distant third in terms of deepwater GOM oil production, but is slightly ahead of BP in deepwater GOM gas production.

Production Rates

High well production rates have been a driving force behind the success of deepwater operations. Figure 63a illustrates the highest deepwater oil production rates (daily averages from a full month of production). 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. Since mid-1999, the maximum production rates have declined. Note that there is currently no production in water depths greater than 7,500 ft and only minimal liquid production in water depths greater than 5,000 ft (from Shell's Mensa field, which primarily produces gas). Figure 63b shows similar production rates for gas. Maximum deepwater gas production 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 deeper waters have yielded even higher maximum production rates. In 1997, Shell's Mensa field showed the excellent potential for ultra-deepwater production rates. Note that the steep fluctuations in production rates within the 5,000-7,499 ft water depths probably relate to the limited number of wells producing in this depth range. That is, when the only well on production is shut in for a short period of time, there are no other wells to become the maximum producer during the lull. Since the third Mensa well commenced production in late 1998, the maximum production rates in the 5,000-7,499 ft water-depth range have stabilized at approximately 90 MMCFPD. The record daily oil and gas production rates (for a single well) remain at 36,520 BOPD (Ursa) and 196 MMCFPD (Mensa), respectively. Although excellent production rates are characteristic of deepwater reservoirs, record production rates are not expected to change significantly.

Figures 64 (oil) and 65 (gas) compare maximum historical production rates for each lease in the GOM. That is, 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 ever encountered in the GOM. Figure 64 also shows that maximum oil rates were significantly higher off the southeast Louisiana coast than off the Texas coast. Figure 65 illustrates the high

(a)



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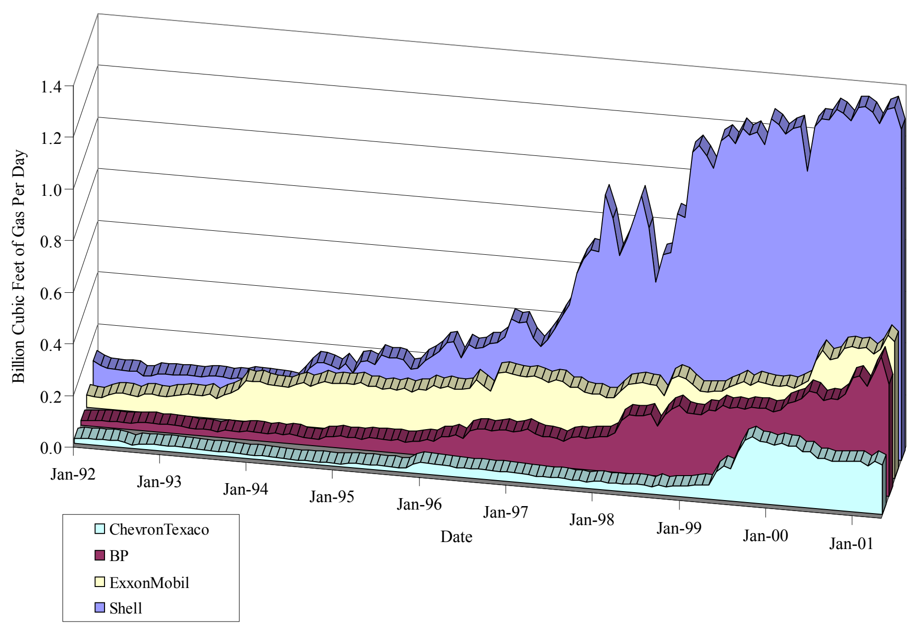
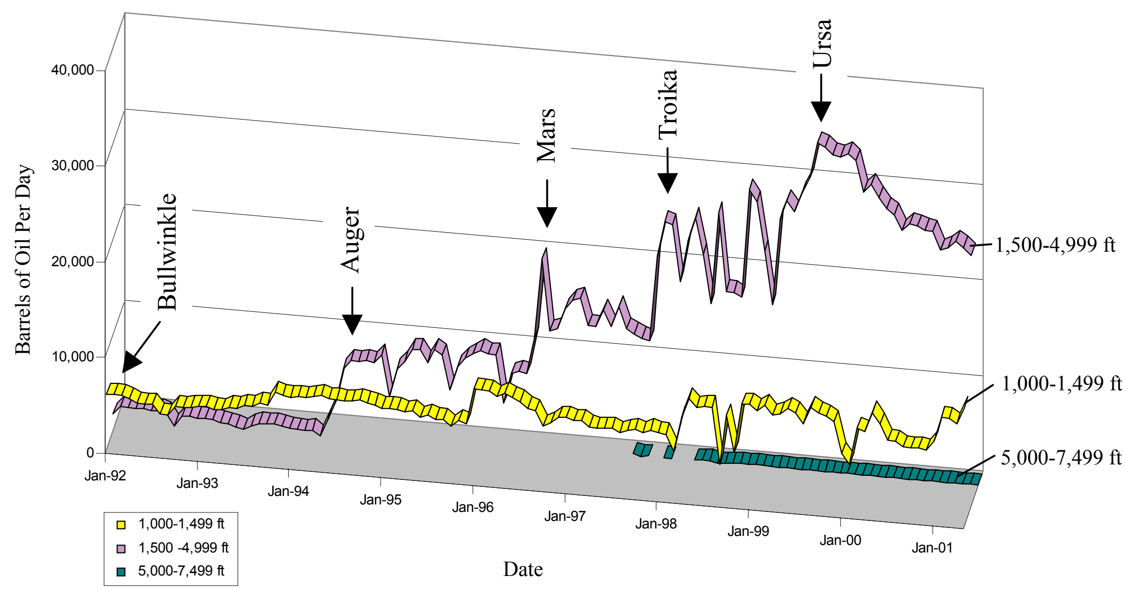


Figure 62. - Contributions from each major oil company toward total deepwater (a) oil production and (b) gas production.

(a)



(b)

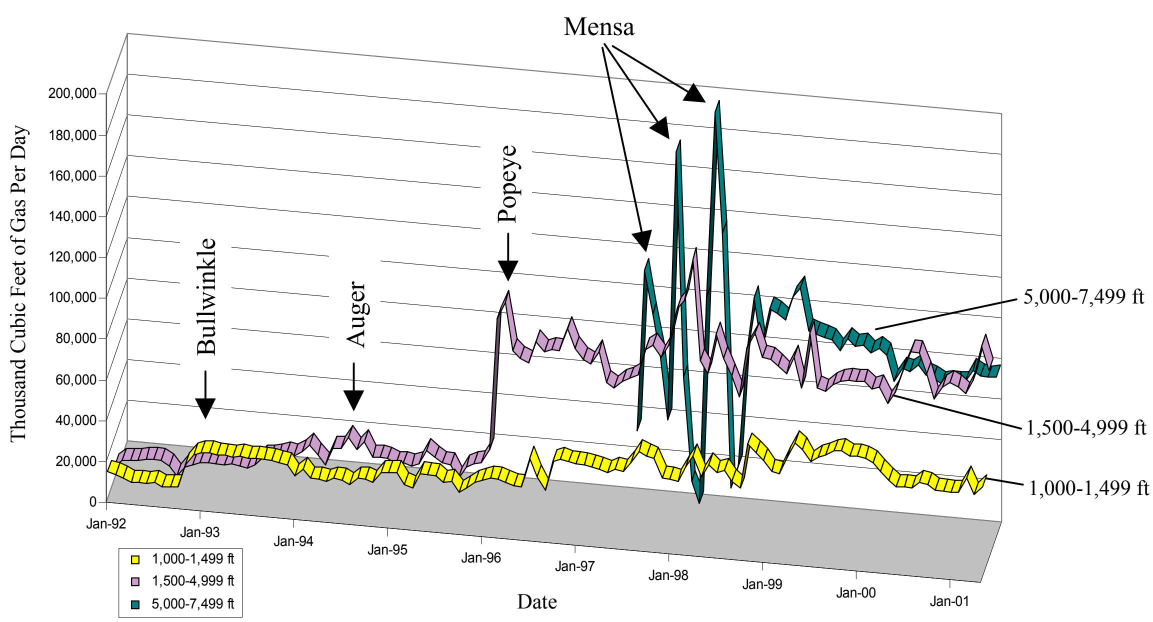


Figure 63. - Maximum production rates for a single well within each water-depth category for deepwater (a) oil production and (b) gas production.

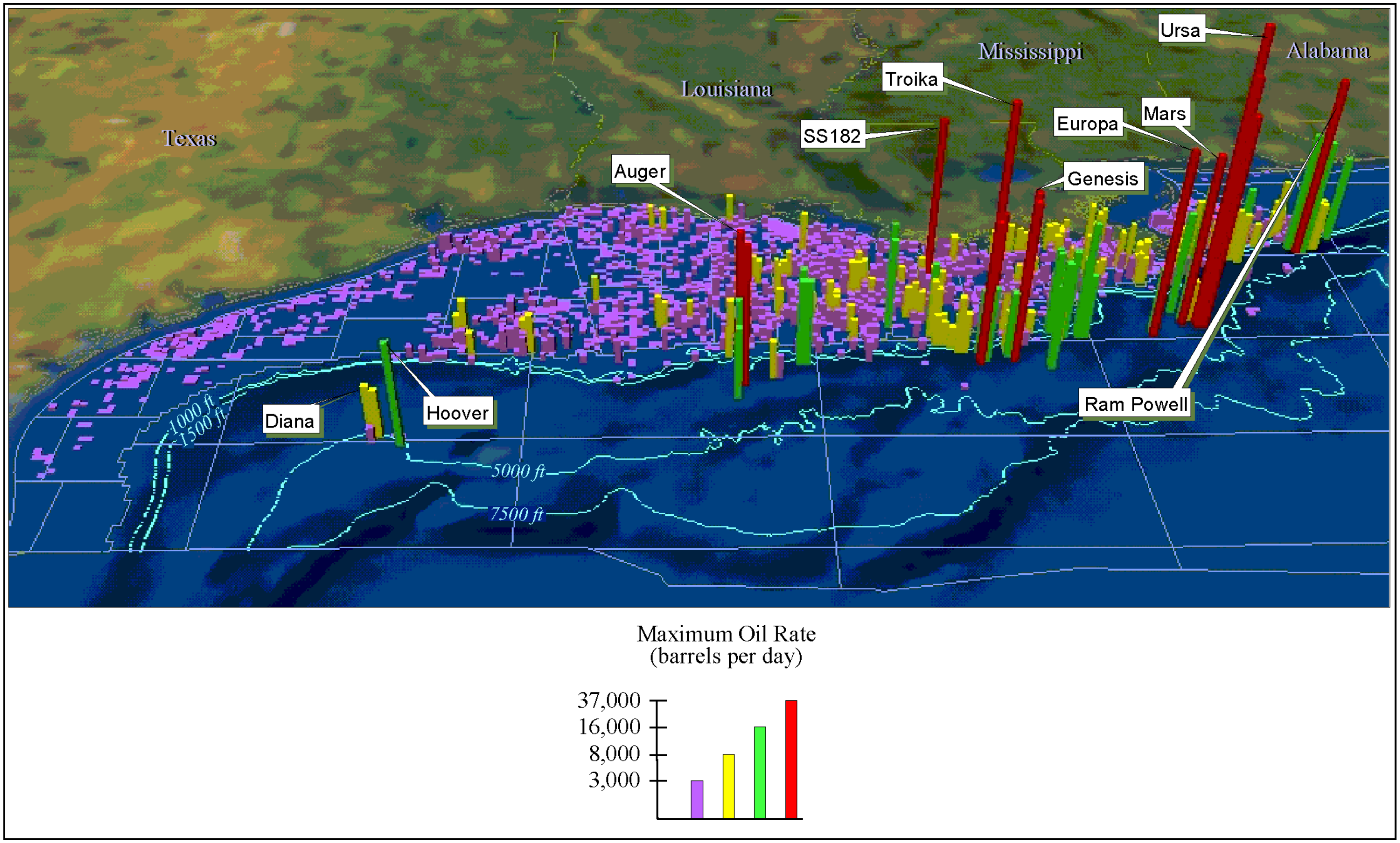


Figure 64. - Maximum historical oil production rates for Gulf of Mexico wells.

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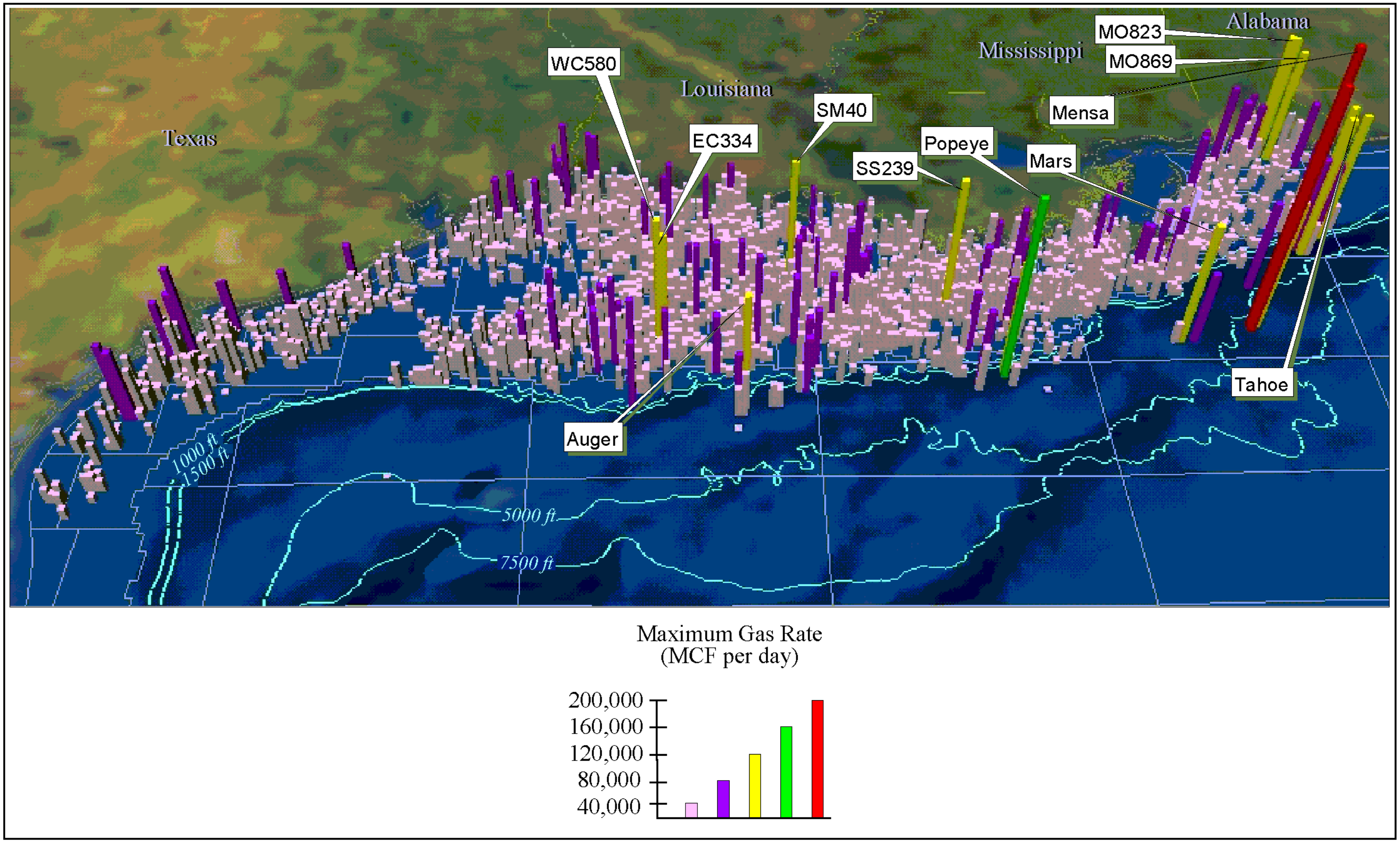

Figure 65. - Maximum historical gas production rates for Gulf of Mexico wells.

TM02019

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).

Figures 66 (oil) and 67 (gas) highlight the most prolific fields and illustrate that, since 1996, deepwater oil and gas fields comprise the majority of these fields. Note that in 2000-2001, high production rates occur off the Texas coast at the Diana and Hoover fields.

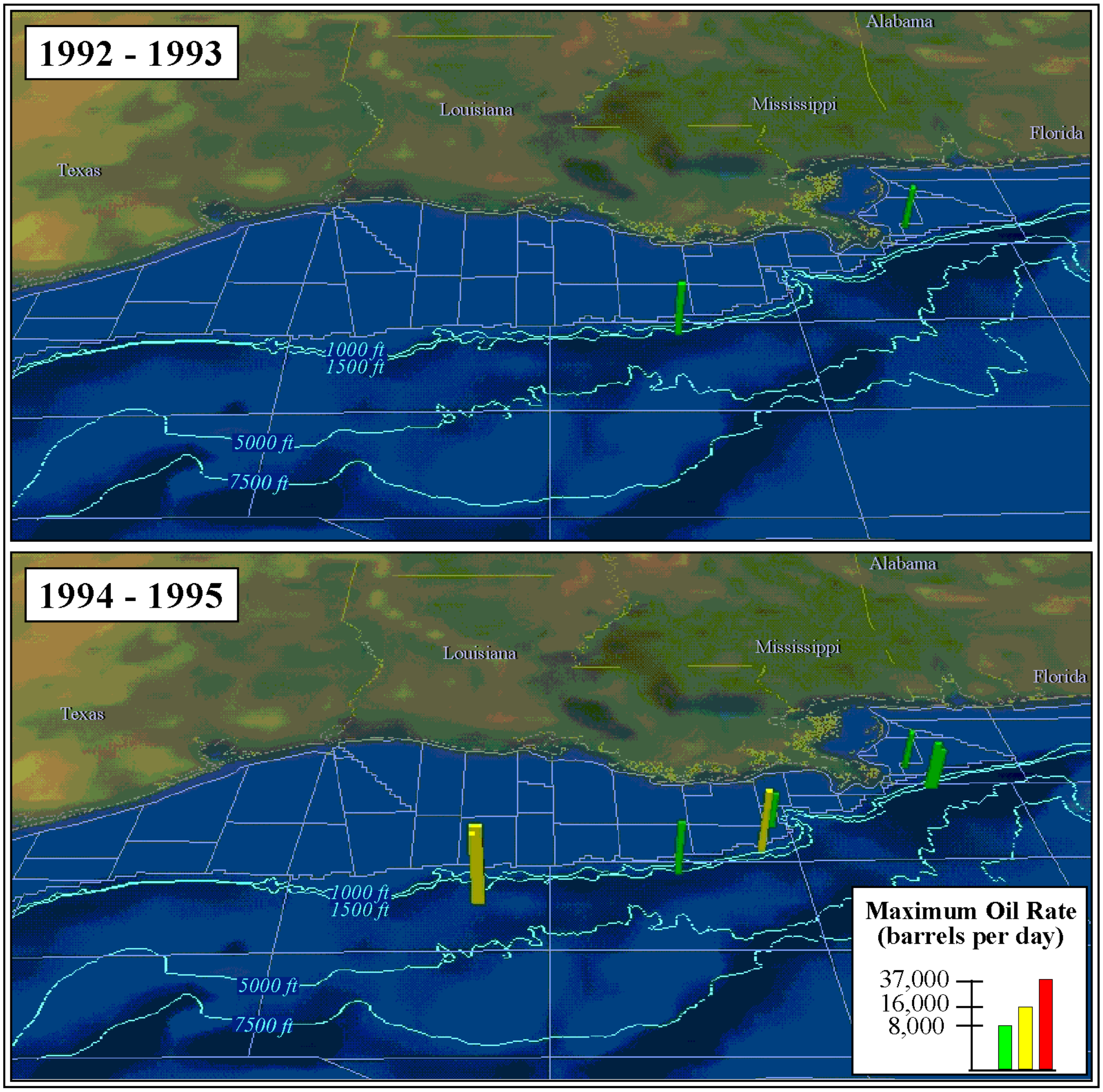

Figure 66. - Maximum oil production rates for Gulf of Mexico wells that produced over 5,000 BOPD.

TM02020A

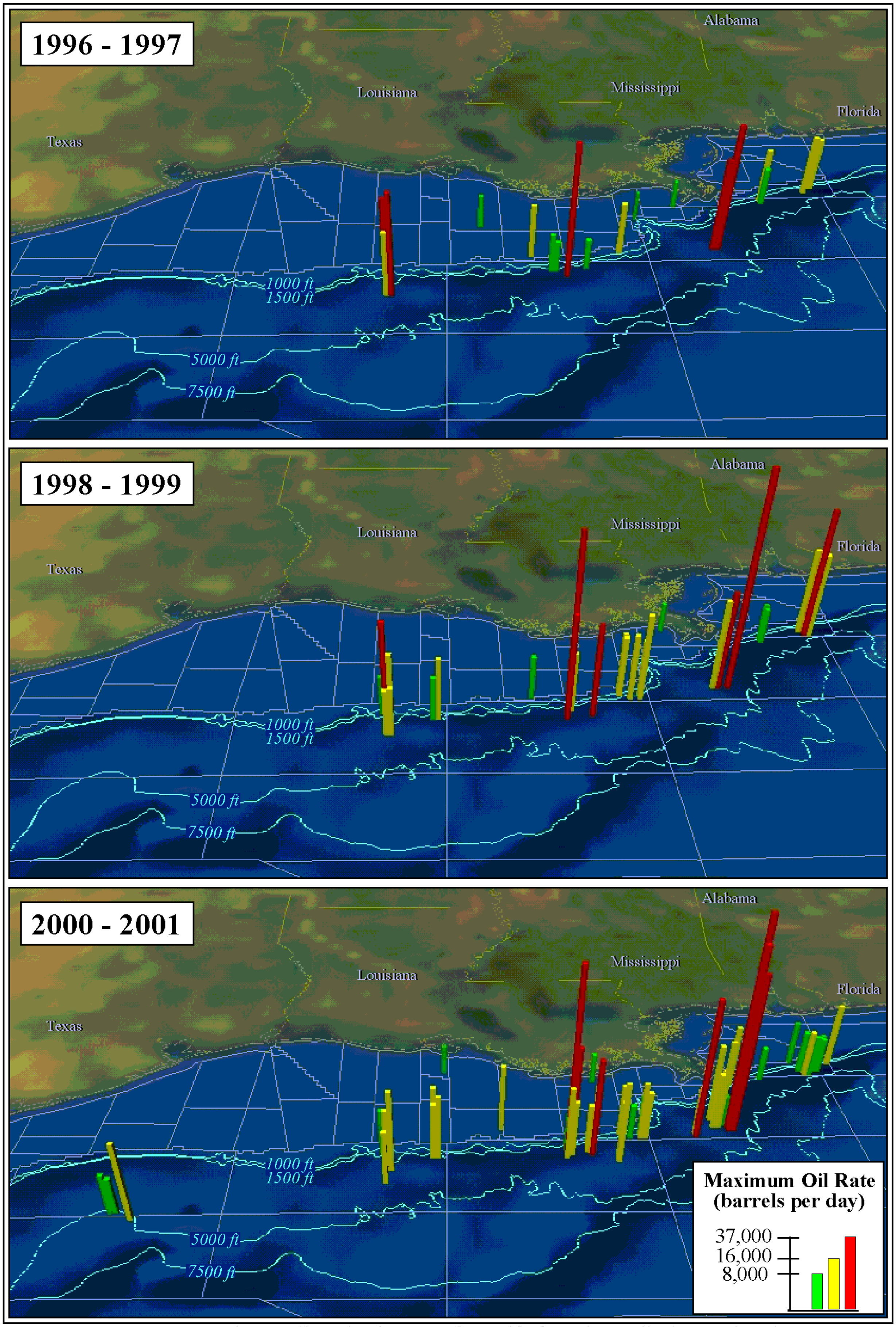

Figure 66. - *continued* - Maximum oil production rates for Gulf of Mexico wells that produced over 5,000 BOPD.

TM02020B

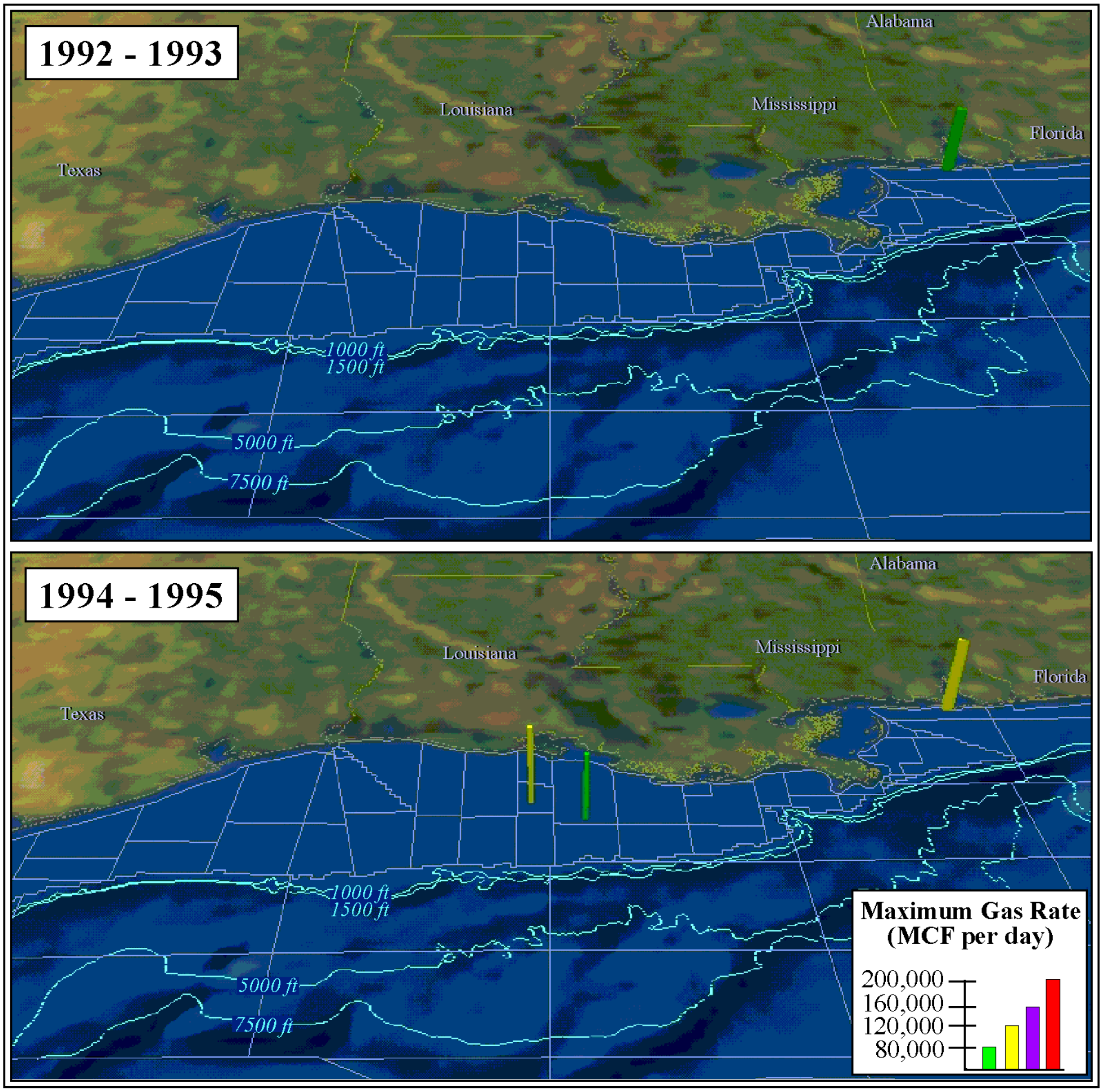

Figure 67. - Maximum gas production rates for Gulf of Mexico wells that produced over 75,000 MCFPD.

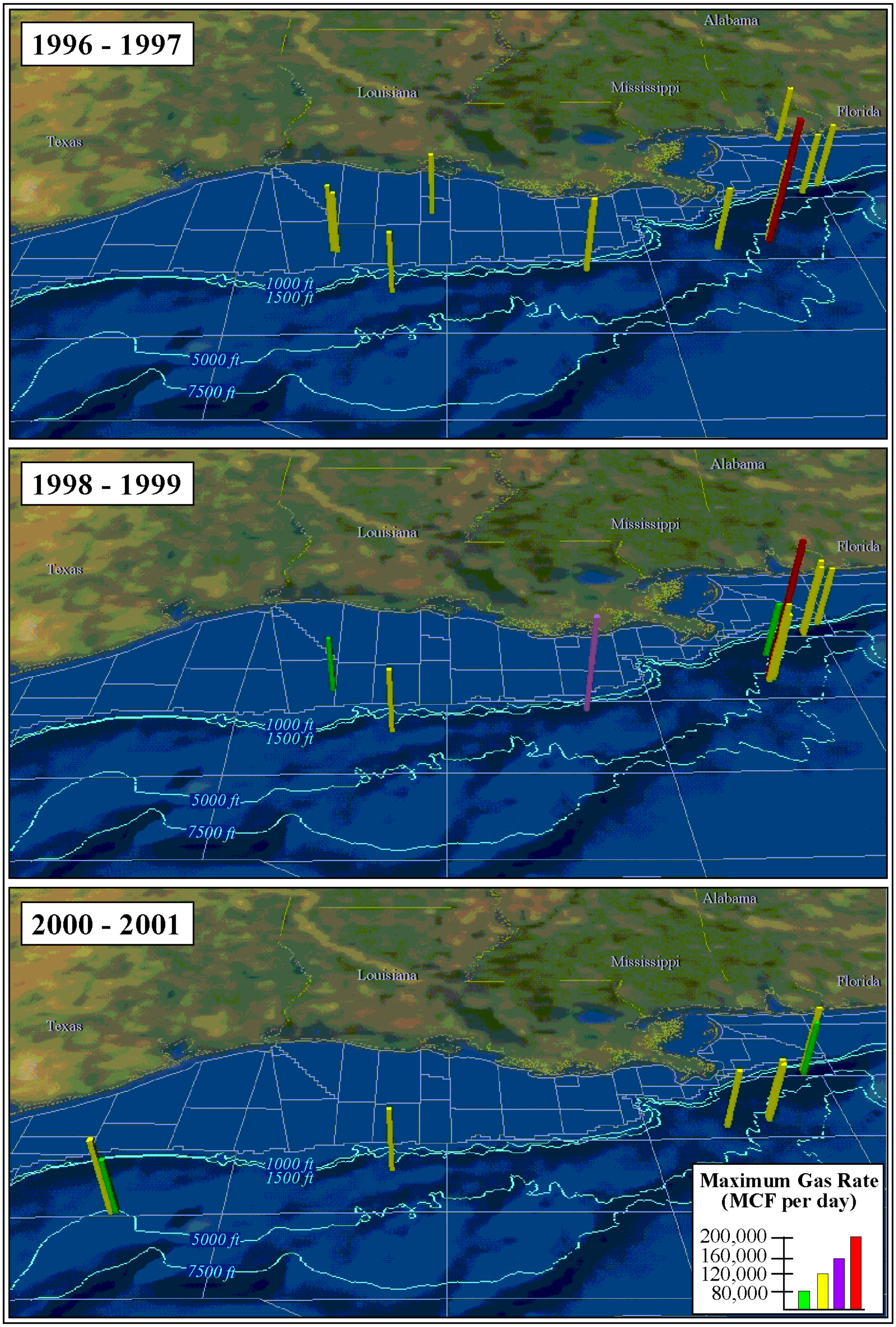

Figure 67. - *continued* - Maximum gas production rates for Gulf of Mexico wells that produced over 75,000 MCFPD. TM02021B

Summary and Conclusions

This report has discussed

- the importance of the deepwater to overall Gulf of Mexico (GOM) oil and gas production,
- the historical trend in deepwater leasing toward increasing water depths and increased bid values,
- deepwater lease holdings of major oil and gas companies compared with nonmajor companies, showing the increased presence of nonmajor companies,
- the impact of company mergers on deepwater lease holdings,
- future deepwater lease availability and anticipated lease expirations,
- substantial increases in deepwater rig activity leading to significant increases in deepwater drilling and rapid leaps toward deeper waters,
- the increase in deepwater development activity,
- the progression of infrastructure development, which includes hubs, pipelines, and subsea systems 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,
- the potential for numerous, 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 very high deepwater production rates compared with shallow-water production rates.

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

Figure 68 illustrates deepwater projects that began production in 2001 and those expected to commence production in the next four years. Fourteen deepwater projects began production in 2001, the largest single-year increase in history. Many more projects are expected to begin production in the next few years. Several are not shown in figure 68 because operators requested that the information remain confidential.

Development Cycle

Deepwater leasing activity accelerated in the late 1990's after Congress enacted the Deep Water Royalty Relief Act. The full effect of this leasing, however, will not be realized for several years because there can be considerable lags between leasing and first production, as illustrated in figure 69. There was considerable lease activity in the late 1980's. (Note that historic deepwater leasing shows no clear relation to average oil prices.) Acreage at Auger (Garden Banks 426 field) was acquired in 1985 as part of this early activity. The first Auger well was drilled soon

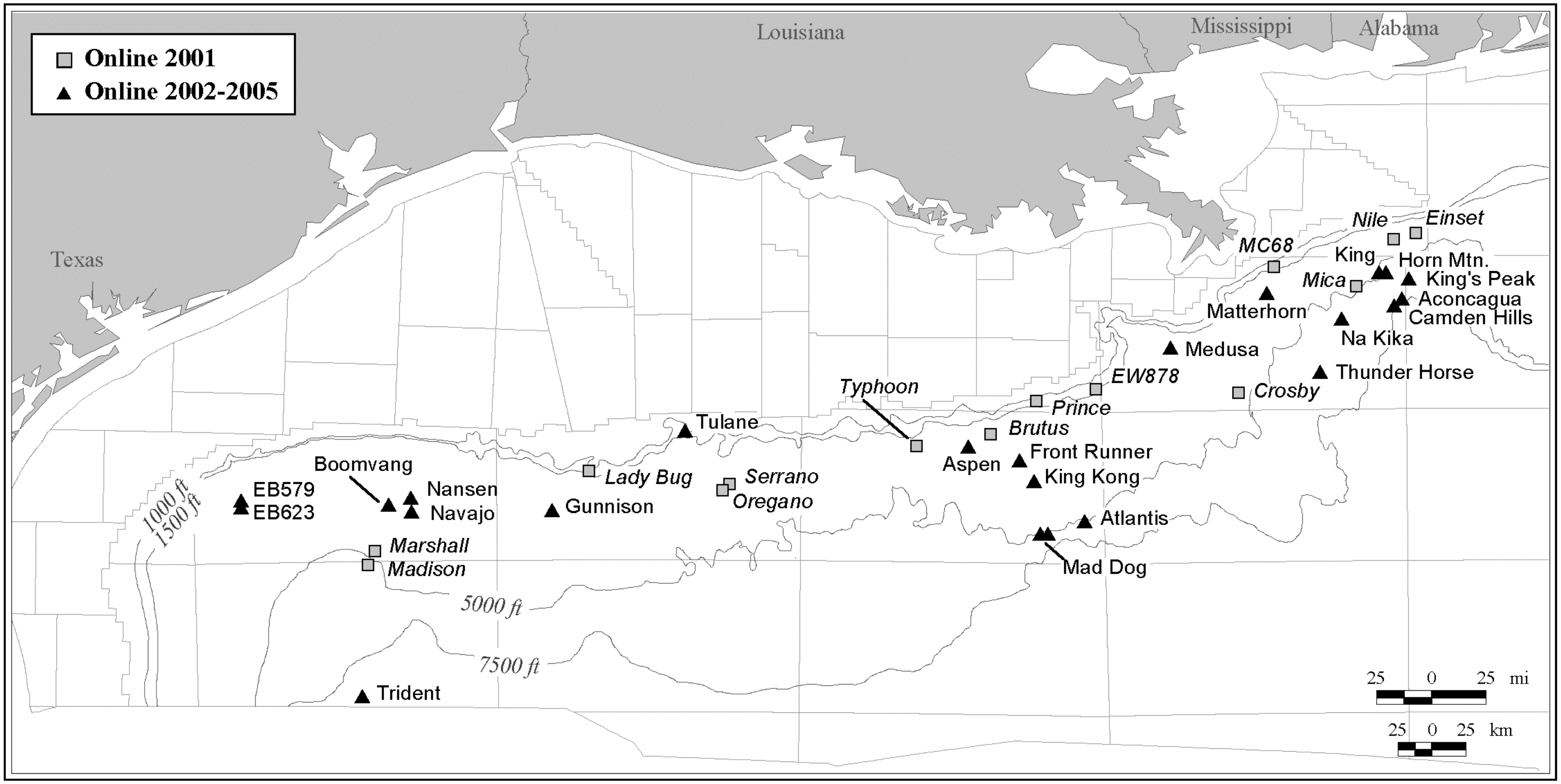

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Figure 68. - Deepwater projects that began production in 2001 and those expected to begin production by yearend 2005.

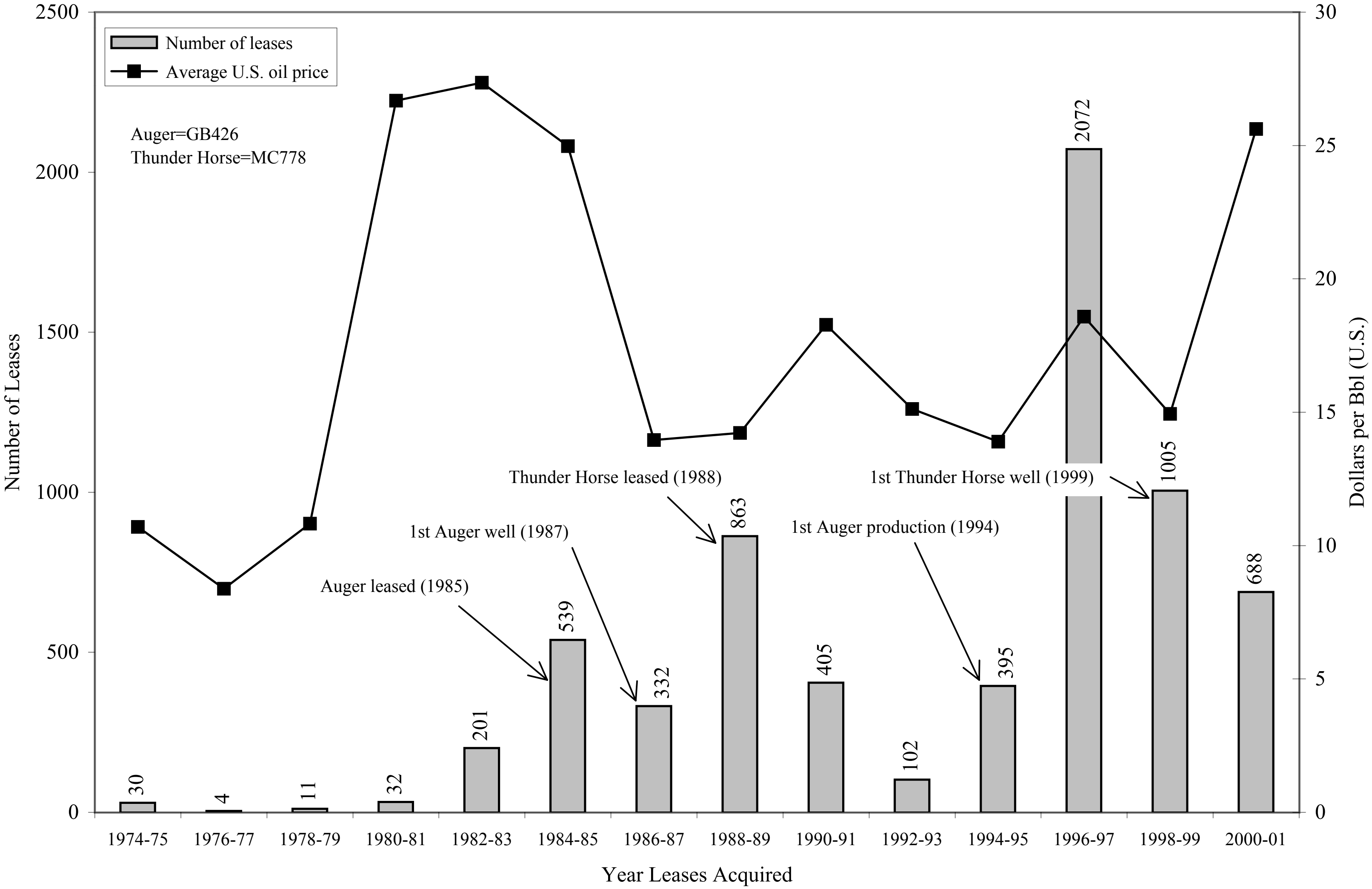

Figure 69. - Deepwater lease activity and oil prices (oil prices from Monthly Energy Review, April 1997 and February 2002; Basic Petroleum Data Book, 1996).

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 778) was acquired in 1988; however, the discovery was not drilled until 1999, and production is not anticipated until 2005. These lags are not unusual with complex deepwater developments. In contrast, other deepwater fields such as Typhoon (Green Canyon 236) have achieved short cycle times, a product of infrastructure location and use of proven development technologies.

Figures 70a-c demonstrate average lags associated with deepwater operations. These figures use data only from deepwater leases that have become productive. Figure 70a shows the average number of years it took to drill a well from the time the lease was issued. Figure 70b shows the average length of time from lease issue to qualification[3] of the lease as productive. Figure 70c illustrates the lags between leasing, qualification, and first production. Figure 71 uses a slightly different population; it plots the lag for all leases drilled, all leases that qualified, and productive leases. There is a declining number of leases in each succeeding category in figure 71 because the number of leases drilled is higher than the number qualified, and the number of qualified leases is higher than the number of productive leases. The bar heights in figure 71 represent the total time elapsed since the leases were awarded.

There are two lags represented in figures 70a–c and 71. 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 70a-c and 71 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 1991. The apparent decreasing lags for leases issued after 1991 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 70a). 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 area-wide leasing, the drop in minimum required bid from $150/acre to $25/acre, and the advent of 3-D seismic technology). Figure 70b shows similar trends in the lags between lease issue and lease qualification. Exceptions include the long lags between first drilling and qualifying from 1974 to 1979. During the 1980's there was also a gradual increase in the lag between drilling of the first well and qualifying the lease. During most of the 1980's, it took 10 to 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 ten 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. Note that the time from lease to first production

[3] 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.

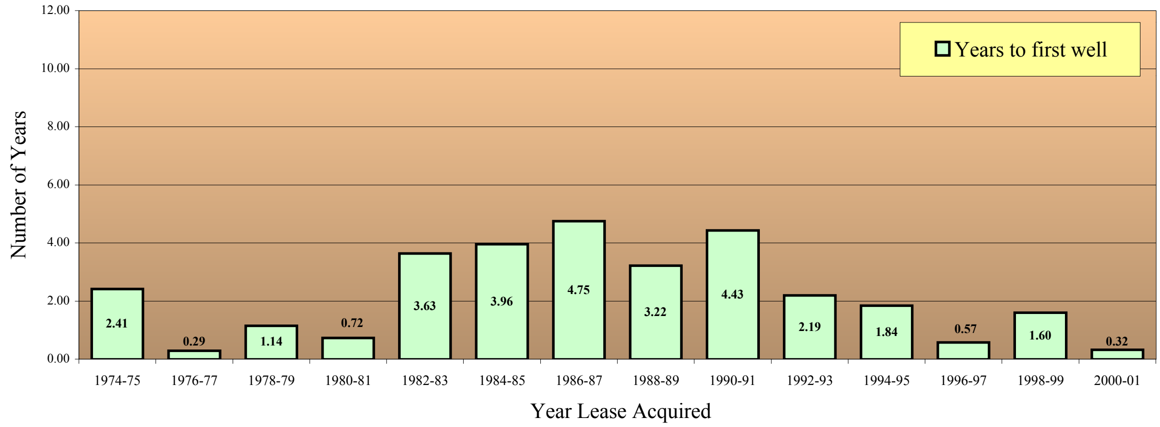

Figure 70a. - Lag from leasing to first well for producing deepwater fields.

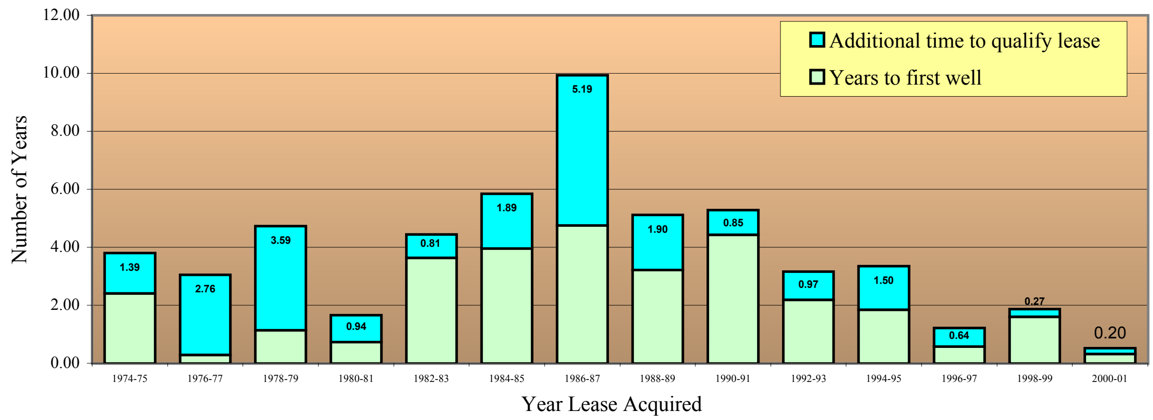

Figure 70b. - Lag from leasing to qualifying for producing deepwater fields.

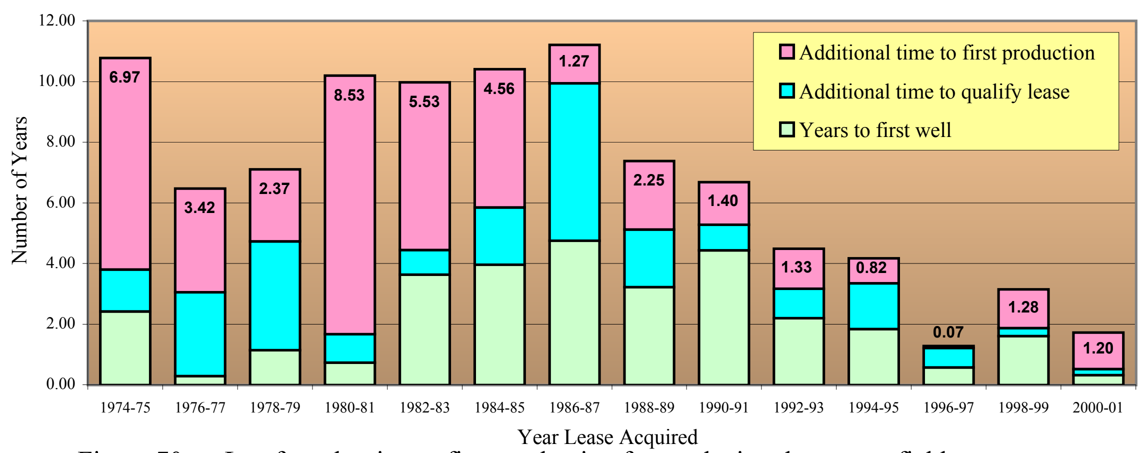

Figure 70c. - Lag from leasing to first production for producing deepwater fields.

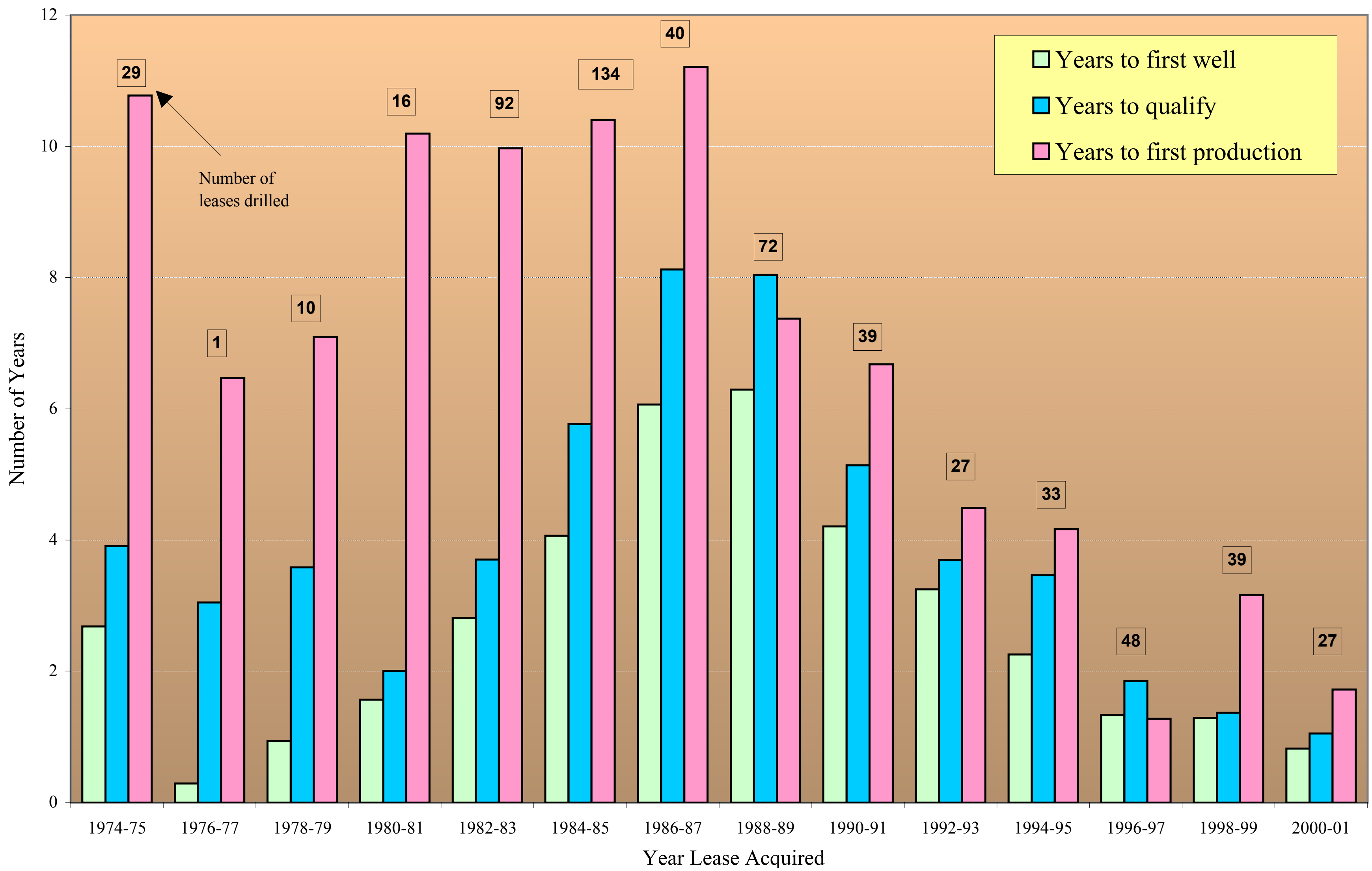

Figure 71. - Lag from leasing to first well, lease qualification, and first field production for all drilled deepwater leases.

has decreased from ten to seven years, based on the latest complete data (1988-1991)—leases that have exceeded their primary terms.

Figures 70a and 71 show early indications of interesting trends in the deepwater development cycle, defined here as the time necessary to drill and develop acquired leases. One example is that the first wells on deepwater leases were drilled about four years into their lease terms during the late 1980's and through 1991. The trends resulting from the large lease sales from 1996 through 1998 will not become evident for several more years.

In summary, the latest complete data indicate a four-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 seven years from lease issuance until production begins.

Drilling the Lease Inventory

The combination of huge deepwater lease inventories and a limited rig fleet dedicated to the GOM means that numerous leases remain untested when their terms expire. Figure 72 shows historical lease activity trends. As mentioned previously, these data are complete only through 1991, since most deepwater leases beyond that time are still under their primary terms and still under evaluation. Over 90 percent of leases acquired in 1974-1975 and 1978-1979 were drilled. About 70 percent of leases acquired in 1974-1975 later qualified (indicating they discovered hydrocarbons) and about 50 percent came on production. Although less than 15 percent of the leases issued in 1976-1977 were ever drilled, all those drilled came on production. The percentage of leases drilled decreased rapidly throughout the 1980's as lease inventories swelled. As the percentage of leases drilled decreased, so did the percentage of issued leases that qualified and the percentage that actually produced. Through 1991, less than 10 percent of issued deepwater leases were drilled and less than 5 percent produced.

Deepwater economics differ significantly today from the economics of the late 1980's. Deepwater development technology was then still in its infancy and the extraordinary deepwater production rates were yet to be realized.

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 73a-d. These figures use the same data set as in figures 70a-c, that is, two-year intervals of leases that have produced and are past their primary terms. Figures 73a-b show that the number of leases issued correlates poorly with the number drilled and the number produced. In contrast, the number of deepwater leases drilled correlates well with the number of those leases that later produced (figure 73c). Similarly, the number of leases that qualified as capable of production relates strongly with the number of those that eventually produced (figure 73d).

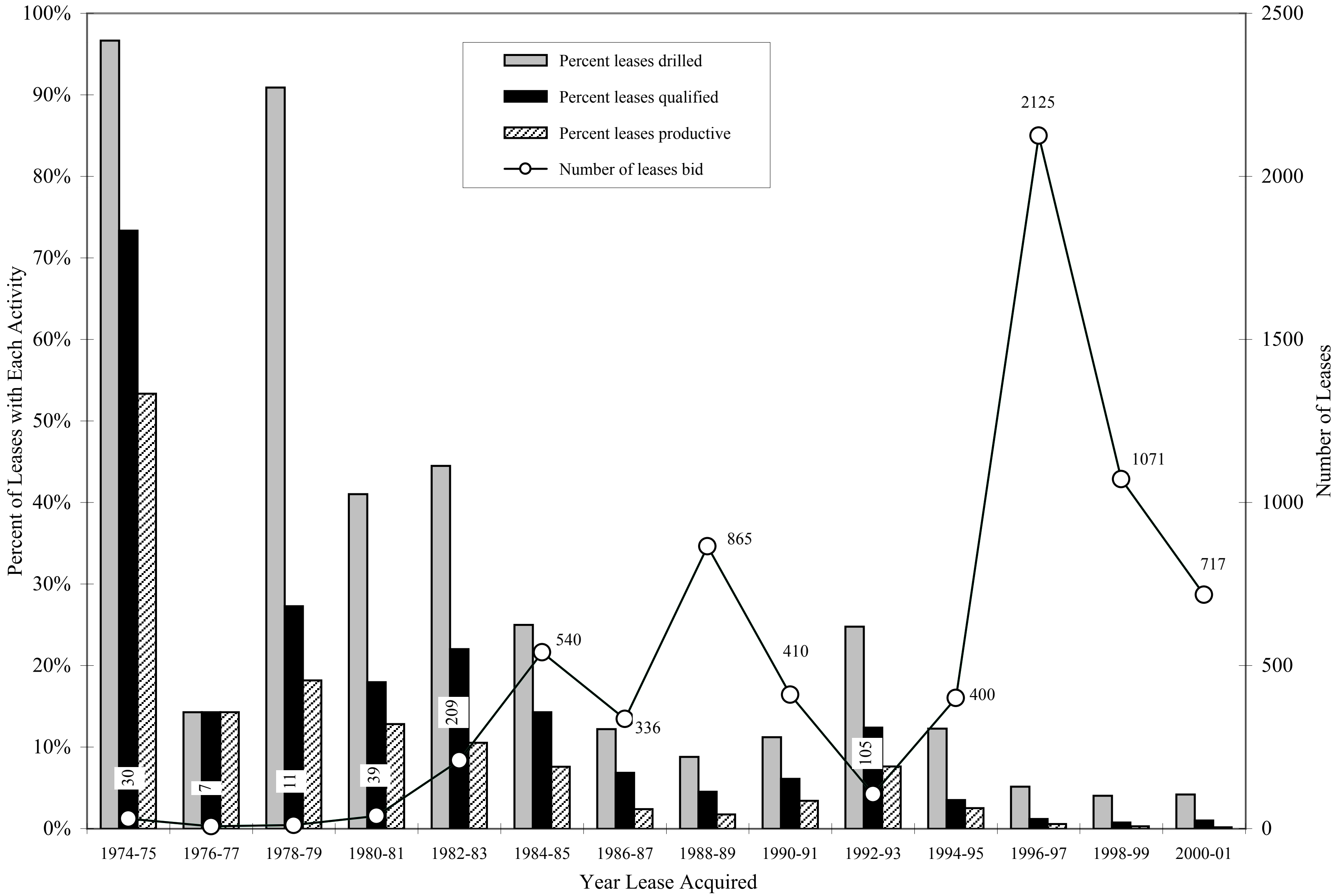

Figure 72. - Activity on deepwater leases.

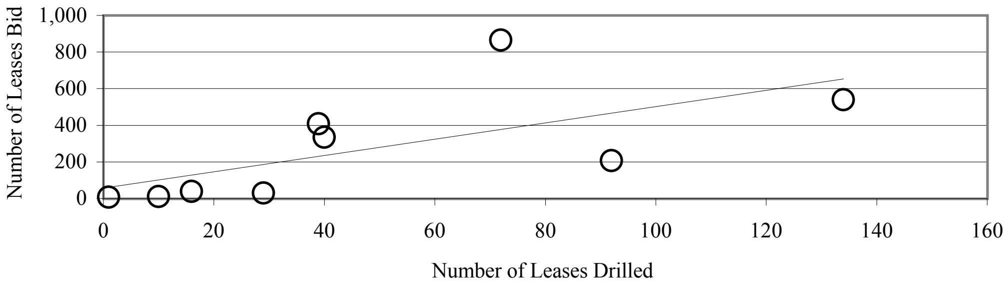

Figure 73a. - Relationship between number of leases bid and number of leases drilled, 1974-1991.

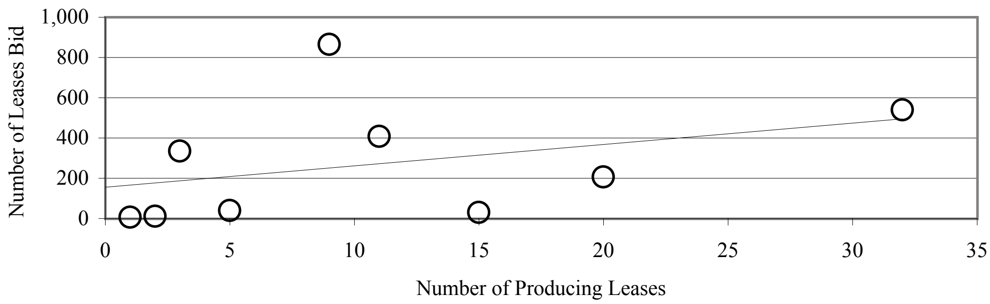

Figure 73b. - Relationship between number of leases bid and number of resulting producing leases, 1974-1991.

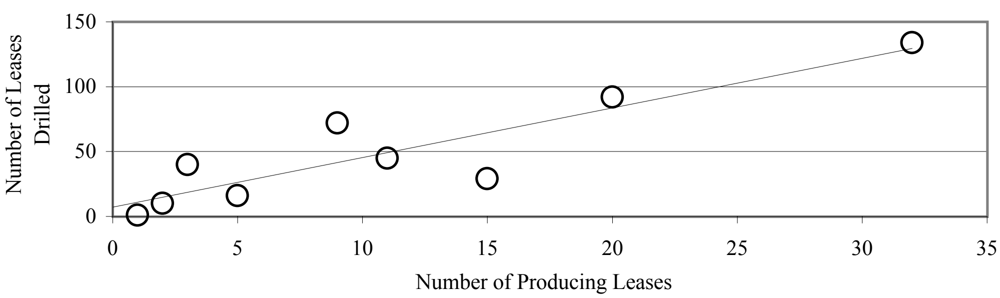

Figure 73c. - Relationship between number of leases drilled and number of resulting producing leases, 1974-1991.

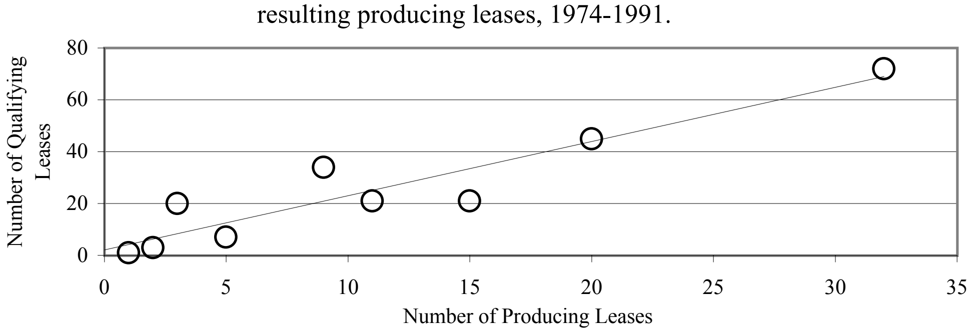

Figure 73d. - Relationship between number of qualifying leases and number of resulting producing leases, 1974-1991.

Figure 74 shows the number of deepwater leases issued each year since 1992. This figure also projects the exploratory evaluation of these leases, assuming that

- each lease is drilled four years into its primary lease term (average from figure 74),
- 10 to 20 percent of these leases are eventually drilled (estimates from figure 72),
- future lease acquisitions will not significantly impact drilling of the existing lease inventory, and
- 67 untested deepwater leases can be drilled each year.[4]

History indicates that approximately 10 percent of the deepwater leases are evaluated, yet only 5 percent of the leases issued from 1996 through 1997 have been drilled. The effect of a limited rig fleet on the ability to evaluate leases challenges operators to test their lease inventory. 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 personnel qualified to work on new drilling rigs.

Expanding Frontier

The future of deepwater GOM exploration and production is very promising. As shown in figure 74, industry is in the heart of the exploratory evaluation of the exceptional number of leases acquired in 1996 through 1998, and the frontier is expanding. The high number of wells drilled on previously undrilled leases is likely to result in numerous deepwater discoveries. Traditional deepwater minibasin plays are far from mature, as several recent discoveries attest, and new deepwater plays near and even beyond the Sigsbee Escarpment show that the deepwater GOM is an expanding frontier. As shown in figure 55, 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).

[4]Deepwater drilling reached record levels in 2001 with an average 43 rigs active, 208 wells drilled, and a total of 67 leases initially drilled.

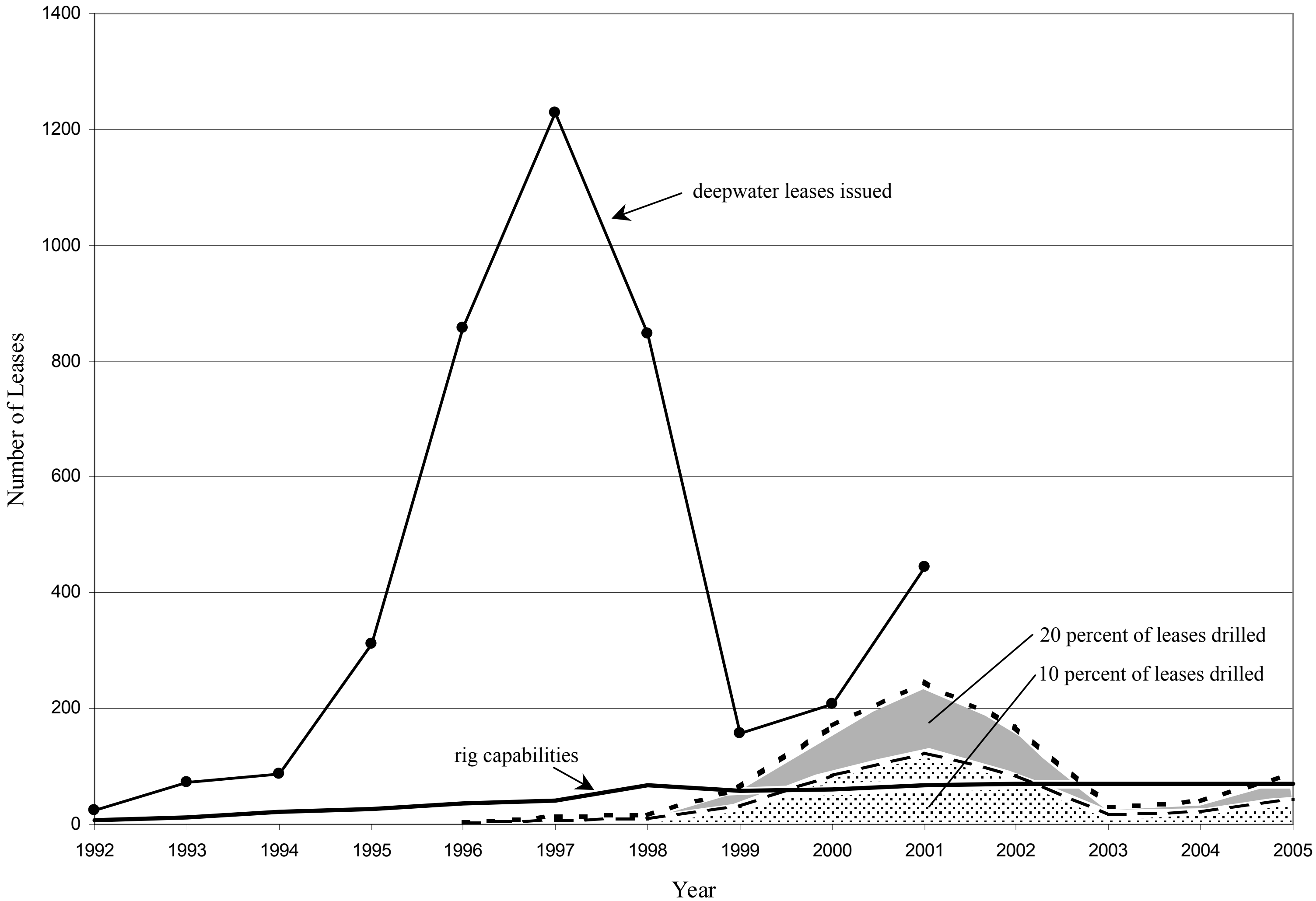

Figure 74. - Anticipated effect of rig constraints on lease evaluations.

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., 2000) documented the advancements made in deepwater exploration and development since 1974. Several remarkable achievements have been made since this report was last published.

- The number of drilling rigs working in deepwater has increased from 28 to 43.
- The number of ultra-deepwater capable rigs has increased from 18 to 26 (44 %) and the number of ultra-deepwater wells increased from 37 to 59 (59%).
- There was a 59 percent increase in the number of producing deepwater fields.
- Deepwater production rates rose more than 100 MMBOPD and 400 MMCFPD each year since 1997.
- Deepwater oil production is rapidly approaching the all-time shallow-water oil production record established in 1971.
- New deepwater drilling added over 4 billion BOE, a 49 percent increase, to the GOM oil and gas inventory.
- Several deepwater discoveries were made in very lightly tested plays. The Trident (AC 903) well is the first significant discovery in the Perdido Foldbelt play.

The large volume of active deepwater leases, the increased drilling program, and the growing deepwater infrastructure all indicate that the deepwater GOM will increase in importance as an integral part of this Nation's energy supply and will remain one of the world's premier oil and gas basins.

Contributing Personnel

This report includes contributions from the following individuals.

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Appendix A – Announced Deepwater Discoveries and Fields (sorted by project name).

Project Name	Block	Water Depth (ft)	Field Discovery Date*	Month of First Production	Year of Last Production
ACONCAGUA	MC 305	7,377	21-Feb-99		
ALABASTER	MC 397	1,551		Apr-92	
ALLEGHENY	GC 254	3,411	01-Jan-85	Oct-99	
AMBERJACK	MC 109	1,532	01-Jul-84	Oct-91	
ANGUS	GC 112	2,034	08-Jun-97	Sep-99	
ANSTEY	MC 607	6,704	12-Nov-97		
ARIEL	MC 429	6,288	20-Nov-95	Oct-93	
ARNOLD	EW 963	1,971	12-Jun-96	May-98	
ASPEN	GC 243	3,149			
ATLANTIS	GC 699	5,432	12-May-98		
AUGER	GB 426	2,883	01-May-87	Apr-94	
BAHA	AC 600	10,975	23-May-96		
BALDPATE	GB 260	1,758	01-Nov-91	Sep-98	
BISON	GC 166	2,555	01-Mar-86		
BLIND FAITH	MC 696	6,941			
BOURBON	MC 311	1,466		Mar-80	
BRUTUS	GC 158	3,090	01-Mar-89		
BULLWINKLE	GC 65	1,404	01-Oct-83	Jul-89	
CAMDEN HILLS	MC 348	7,528	04-Aug-99		
CERVEZA LIGERA	EB 160	1,358			
CHAMPLAIN	AT 63	4,631	11-Feb-00		
COGNAC	MC 194	1,345	01-Jul-75	Aug-79	
COOPER/LLANO	GB 387	2,706	01-Mar-89	Sep-95	1999
COULOMB	MC 657	7,767	01-Nov-87		
CYCLOPS	AT 008	3,392	26-Apr-97		
DEVIL'S TOWER	MC 773	5,701	13-Dec-99		
DIAMOND	MC 445	1,633	05-Dec-92	Oct-93	1999
DIANA	EB 945	4,746	01-Aug-90	May-00	
DIONYSIS	VK 864	1,597	01-Oct-81		
DULCIMER	GB 367	1,112	09-Feb-98	Apr-99	
DURANGO	GB 667	3,014			
EAST BOOMVANG	EB 688	3,847	01-May-88		
EINSET	VK 873	4,107	01-Mar-88	Apr-01	
EL TORO	GC 69	2,263	13-Sep-84		
ENTRADA	GB 782	4,642			
EUROPA	MC 935	4,070	22-Apr-94	Feb-00	
FIREBIRD	MC 705	1,266			
FOURIER/HERSCHEL	MC 522	7,137	01-Jul-89		
FRONT RUNNER	GC 338	3,447			
FRONT RUNNER S	GC 339	3,539			
FUJI	GC 506	4,326	30-Jan-95		
GEMINI	MC 292	4,786	07-Sep-95	May-99	
GENESIS	GC 205	2,827	01-Sep-88	Jan-99	
GOMEZ	MC 755	3,123	19-Mar-86		

Project Name	Block	Water Depth (ft)	Field Discovery Date*	Month of First Production	Year of Last Production
GUNNISON	GB 668	3,205	29-May-00		
HAWKES	MC 509	4,174			
HOLSTEIN	GC 644	4,418	11-Feb-99		
HOOVER	AC 25	4,907			
JOLLIET	GC 184	2,083	01-Jul-81	Nov-89	
K2	GC 562	4,231	21-Sep-99		
KEPLER	MC 383	5,920	01-Aug-87	Apr-92	
KING	MC 84	5,622			
KING KONG	GC 472	3,943	01-Feb-89		
KING'S PEAK	DC 133	6,665	01-Mar-93		
LADY BUG	GB 409	1,591	13-May-97		
LENA	MC 281	1,624	01-May-76	Jan-84	
LEO	MC 546	2,945	01-Feb-86		
LOST ARK	EB 421	2,740			
MACARONI	GB 602	3,759	21-Jan-96	Aug-99	
MAD DOG	GC 826	7,137	24-Nov-98		
MADISON	AC 24	4,923	25-Jun-98		
MAGNOLIA	GB 783	4,717	03-May-99		
MARATHON	GC 153	2,463	01-Apr-84		
MARCO POLO	GC 608	4,320			
MARIA	VK 739	1,096		Mar-01	
MARLIN	VK 915	4,100	01-Jun-93	Feb-01	
MARQUETTE	GC 52	1,027		May-90	
MARS	MC 807	3,326	01-Apr-89	Jul-96	
MARSHALL	EB 949	4,526	30-Jul-98		
MATTERHORN	MC 243	3,323	01-Sep-90		
MEDUSA	MC 582	2,880	17-Oct-99		
MENSA	MC 731	5,546	01-Dec-86	Jul-97	
MICA	MC 211	4,549	01-May-90		
McKINLEY	GC 416	4,221	14-Jul-98		
MIGHTY JOE YOUNG	GC 737	4,429			
MIRAGE	MC 941	4,346			
MORGUS	MC 942	4,376			
MORPETH/KLAMATH	EW 921	1,860	01-May-86	Mar-99	
MOSQUITO HAWK	GB 269	1,246	06-Mar-96		
MUSTIQUE	GB 240	1,027		Jan-96	
NANSEN	EB 602	3,913	25-Sep-99		
NARCISSUS	MC 630	4,250			
NEPTUNE (AT)	AT 575	6,373	26-Sep-95		
NEPTUNE/THOR	VK 825	1,932	01-Nov-87	Mar-97	
NILE	VK 914	3,910	30-Apr-97	Apr-01	
NIRVANA	MC 162	4,169	30-Nov-94		
NORTH BOOMVANG	EB 642	3,933	13-Dec-97		
NORTHWESTERN	GB 200	1,935	14-May-98	Nov-00	
OREGANO	GB 559	3,582	27-Mar-99		
PETRONIUS	VK 786	2,539	14-Jul-95	Jul-00	

Project Name	Block	Water Depth (ft)	Field Discovery Date*	Month of First Production	Year of Last Production
PIMENTO	GB 236	1,315			
PLUTO	MC 718	3,004	20-Oct-95	Dec-99	
POMPANO	VK 990	1,670	01-May-81	Oct-94	
POPEYE	GC 116	2,545	01-Feb-85	Jan-96	
POSEIDON	GC 691	4,595	27-Feb-96		
PRINCE	EW 958	1,522	20-Jul-94		
PRINCESS	MC 765	3,880			
PROSPERITY	VK 742	1,551	08-Aug-97	Sep-98	
PTOLEMY	GB 412	1,515	01-Jul-84		
RAM-POWELL	VK 956	4,057	01-May-85	Sep-97	
RED HAWK	GB 877	5,334			
ROCKEFELLER	EB 992	4,848	28-Nov-95		
ROCKY	GC 110	1,788	07-Aug-87	Jan-96	
SALSA	GB 171	1,427	18-Apr-84	Aug-98	
SANGRIA	GC 177	1,879	27-Oct-99	Nov-89	
SEATTLE SLEW	EW 914	1,019	01-Aug-84	Aug-93	1997
SERRANO	GB 516	3,454	23-Jul-96		
SHASTA	GC 136	1,289		Nov-95	
SNAPPER	EB 165	1,148			
SPEND-A-BUCK	GB 161	1,328			
SPIRIT	VK 780	1,250		Sep-98	
SUPERTRAMP	MC 026	1,433	27-May-94		
TAHOE	VK 783	1,689	01-Dec-84	Jan-94	
THUNDER HORSE	MC 778	6,442	01-Apr-99		
THUNDER HORSE NORTH	MC 776	5,700			
TICK	GB 189	1,135			
TIMBER WOLF	MC 555	4,749			
TRIDENT	AC 903	9,687			
TROIKA	GC 244	3,175	30-May-94	Nov-97	
TULANE	GB 158	1,358			
TYPHOON	GC 236	2,539	01-Oct-84		
URSA	MC 810	4,077	01-Oct-90	Mar-99	
VIRGO	VK 823	1,637	02-May-97	Nov-99	
WEST BOOMVANG	EB 643	3,929	31-Oct-99		
YUKON	GC 60	1,135		Sep-96	
ZINC	MC 354	1,515	01-Aug-77	Jul-93	
	EB 157	1,194			
	EB 158	1,368			
	EB 377	2,555	01-Oct-85		
	EW 1006	1,952	26-Jan-88	Mar-99	
	EW 871	1,000			
	EW 878	1,850	03-Jul-00		
	EW 991	1,355			
	GB 208	1,506	01-Sep-91		
	GB 224	1,069			
	GB 254	1,942	23-Jul-93	Sep-98	
	GB 302	2,430	01-Feb-91		

Project Name	Block	Water Depth (ft)	Field Discovery Date*	Month of First Production	Year of Last Production
	GB 379	2,227	01-Jul-85		
	GC 141	1,715			
	GC 147	1,364	01-May-88		
	GC 162	2,804	01-Jul-89		
	GC 21	1,401	01-Oct-84		
	GC 228	2,713	01-Jul-85		
	GC 27	0	01-Jul-89		
	GC 29	1,837	01-Jan-84	Nov-88	1990
	GC 39	2,434	01-Apr-84		
	GC 463	4,136	01-Dec-98		
	GC 70	2,280	01-Jun-84		
	GC 75	2,670	01-May-85	Nov-88	1989
	MC 68	1,604	09-Dec-75	Jan-01	
	MC 113	2,473	01-Jan-76		
	MC 285	3,280	01-Sep-87		
	MC 455	1,633	01-Feb-86	Nov-90	
	MC 486	1,463		Nov-90	
	MC 709	2,680	01-Feb-87		
	MC 929	2,430	01-Nov-87		
	PI 525	3,506	30-Apr-96		
	VK 741	1,345			
	VK 827	2,739	08-Nov-98		
	VK 862	1,184	01-Oct-76	Dec-95	

Appendix B – Announced Deepwater Discoveries and Fields (sorted by discovery date).

Project Name	Block	Water Depth (ft)	Field Discovery Date*	Month of First Production	Year of Last Production
COGNAC	MC 194	1,345	01-Jul-75	Aug-79	
	MC 068	1,604	09-Dec-75	Jan-01	
	MC 113	2,473	01-Jan-76		
LENA	MC 281	1,624	01-May-76	Jan-84	
	VK 862	1,184	01-Oct-76	Dec-95	
ZINC	MC 354	1,515	01-Aug-77	Jul-93	
POMPANO	VK 990	1,670	01-May-81	Oct-94	
JOLLIET	GC 184	2,083	01-Jul-81	Nov-89	
DIONYSIS	VK 864	1,597	01-Oct-81		
BULLWINKLE	GC 65	1,404	01-Oct-83	Jul-89	
	GC 29	1,837	01-Jan-84	Nov-88	1990
	GC 39	2,434	01-Apr-84		
MARATHON	GC 153	2,463	01-Apr-84		
SALSA	GB 171	1,427	18-Apr-84	Aug-98	
	GC 70	2,280	01-Jun-84		
AMBERJACK	MC 109	1,532	01-Jul-84	Oct-91	
PTOLEMY	GB 412	1,515	01-Jul-84		
SEATTLE SLEW	EW 914	1,019	01-Aug-84	Aug-93	1997
EL TORO	GC 69	2,263	13-Sep-84		
	GC 21	1,401	01-Oct-84		
TYPHOON	GC 236	2,539	01-Oct-84		
TAHOE	VK 783	1,689	01-Dec-84	Jan-94	
ALLEGHENY	GC 254	3,411	01-Jan-85	Oct-99	
POPEYE	GC 116	2,545	01-Feb-85	Jan-96	
	GC 75	2,670	01-May-85	Nov-88	1989
RAM-POWELL	VK 956	4,057	01-May-85	Sep-97	
	GB 379	2,227	01-Jul-85		
	GC 228	2,713	01-Jul-85		
	EB 377	2,555	01-Oct-85		
	MC 455	1,633	01-Feb-86	Nov-90	
LEO	MC 546	2,945	01-Feb-86		
BISON	GC 166	2,555	01-Mar-86		
GOMEZ	MC 755	3,123	19-Mar-86		
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	MC 285	3,280	01-Sep-87		
	MC 929	2,430	01-Nov-87		
COULOMB	MC 657	7,767	01-Nov-87		
NEPTUNE/THOR	VK 825	1,932	01-Nov-87	Mar-97	
	EW 1006	1,952	26-Jan-88	Mar-99	
EINSET	VK 873	4,107	01-Mar-88	Apr-01	

Project Name	Block	Water Depth (ft)	Field Discovery Date*	Month of First Production	Year of Last Production
	GC 147	1,364	01-May-88		
EAST BOOMVANG	EB 688	3,847	01-May-88		
GENESIS	GC 205	2,827	01-Sep-88	Jan-99	
KING KONG	GC 472	3,943	01-Feb-89		
BRUTUS	GC 158	3,090	01-Mar-89		
COOPER/LLANO	GB 387	2,706	01-Mar-89	Sep-95	1999
MARS	MC 807	3,326	01-Apr-89	Jul-96	
	GC 162	2,804	01-Jul-89		
	GC 27	0	01-Jul-89		
FOURIER/HERSCHEL	MC 522	7,137	01-Jul-89		
MICA	MC 211	4,549	01-May-90		
DIANA	EB 945	4,746	01-Aug-90	May-00	
MATTERHORN	MC 243	3,323	01-Sep-90		
URSA	MC 810	4,077	01-Oct-90	Mar-99	
	GB 302	2,430	01-Feb-91		
	GB 208	1,506	01-Sep-91		
BALDPATE	GB 260	1,758	01-Nov-91	Sep-98	
DIAMOND	MC 445	1,633	05-Dec-92	Oct-93	1999
KING'S PEAK	DC 133	6,665	01-Mar-93		
MARLIN	VK 915	4,100	01-Jun-93	Feb-01	
	GB 254	1,942	23-Jul-93	Sep-98	
EUROPA	MC 935	4,070	22-Apr-94	Feb-00	
SUPERTRAMP	MC 026	1,433	27-May-94		
TROIKA	GC 244	3,175	30-May-94	Nov-97	
PRINCE	EW 958	1,522	20-Jul-94		
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PETRONIUS	VK 786	2,539	14-Jul-95	Jul-00	
GEMINI	MC292	2,539	07-Sep-95	May-99	
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ARIEL	MC 429	6,288	20-Nov-95	Oct-93	
ROCKEFELLER	EB 992	4,848	28-Nov-95		
MACARONI	GB 602	3,759	21-Jan-96	Aug-99	
POSEIDON	GC 691	4,595	27-Feb-96		
MOSQUITO HAWK	GB 269	1,246	06-Mar-96		
	PI 525	3,506	30-Apr-96		
BAHA	AC 600	10,975	23-May-96		
ARNOLD	EW 963	1,971	12-Jun-96	May-98	
SERRANO	GB 516	3,454	23-Jul-96		
CYCLOPS	AT 008	3,392	26-Apr-97		
NILE	VK 914	3,910	30-Apr-97	Apr-01	
VIRGO	VK 823	1,637	02-May-97	Nov-99	
LADY BUG	GB 409	1,591	13-May-97		
ANGUS	GC 112	2,034	08-Jun-97	Sep-99	
PROSPERITY	VK 742	1,551	08-Aug-97	Sep-98	
ANSTEY	MC 607	6,704	12-Nov-97		

Project Name	Block	Water Depth (ft)	Field Discovery Date*	Month of First Production	Year of Last Production
NORTH BOOMVANG	EB 642	3,933	13-Dec-97		
DULCIMER	GB 367	1,112	09-Feb-98	Apr-99	
ATLANTIS	GC 699	5,432	12-May-98		
NORTHWESTERN	GB 200	1,935	14-May-98	Nov-00	
MADISON	AC 24	4,923	25-Jun-98		
McKINLEY	GC 416	4,221	14-Jul-98		
MARSHALL	EB 949	4,526	30-Jul-98		
	VK 827	2,739	08-Nov-98		
MAD DOG	GC 826	7,137	24-Nov-98		
	GC 463	4,136	01-Dec-98		
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ACONCAGUA	MC 305	7,377	21-Feb-99		
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THUNDER HORSE	MC 778	6,442	01-Apr-99		
MAGNOLIA	GB 783	4,717	03-May-99		
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K2	GC 562	4,231	21-Sep-99		
NANSEN	EB 602	3,913	25-Sep-99		
MEDUSA	MC 582	2,880	17-Oct-99		
SANGRIA	GC 177	1,879	27-Oct-99	Nov-89	
WEST BOOMVANG	EB 643	3,929	31-Oct-99		
DEVIL'S TOWER	MC 773	5,701	13-Dec-99		
CHAMPLAIN	AT 63	4,631	11-Feb-00		
GUNNISON	GB 668	3,205	29-May-00		
	EW 878	1,850	03-Jul-00		
	EB 157	1,194			
	EB 158	1,368			
	EW 991	1,355			
	GB 224	1,069			
	GC 141	1,715			
	MC 486	1,463		Nov-90	
	MC 68	1,604		Jan-01	
	VK 741	1,345			
ALABASTER	MC 397	1,551		Apr-92	
ASPEN	GC 243	3,149			
BLIND FAITH	MC 696	6,941			
BOURBON	MC 311	1,466		Mar-80	
CERVEZA LIGERA	EB 160	1,358			
CHAMPLAIN	AT 63	4,382			
DURANGO	GB 667	3,014			
ENTRADA	GB 782	4,642			
FIREBIRD	MC 705	1,266			
FRONT RUNNER	GC 338	3,447			
FRONT RUNNER S	GC 339	3,539			
HAWKES	MC 509	4,174			
HOOVER	AC 25	4,907			
KING	MC 84	5,622			

Project Name	Block	Water Depth (ft)	Field Discovery Date*	Month of First Production	Year of Last Production
LOST ARK	EB 421	2,740			
MARCO POLO	GC 608	4,320			
MARIA	VK 739	1,096		Mar-01	
MARQUETTE	GC 52	1,027		May-90	
MIGHTY JOE YOUNG	GC 737	4,429			
MIRAGE	MC 941	4,346			
MORGUS	MC 942	4,376			
MUSTIQUE	GB 240	1,027		Jan-96	
NARCISSUS	MC 630	4,250			
PIMENTO	GB 236	1,315			
PRINCESS	MC 765	3,880			
RED HAWK	GB 877	5,334			
SHASTA	GC 136	1,289		Nov-95	
SNAPPER	EB 165	1,148			
SPEND-A-BUCK	GB 161	1,328			
SPIRIT	VK 780	1,250		Sep-98	
THUNDER HORSE NORTH	MC 776	5,700			
TICK	GB 189	1,135			
TIMBER WOLF	MC 555	4,749			
TRIDENT	AC 903	9,687			
TULANE	GB 158	1,358			
YUKON	GC 60	1,135		Sep-96	

Appendix C – Companies Defined as Majors in this Report.

Group Name	Company Name	MMS Number
BP	Amoco Corporation	02244
	Amoco Foundation, Inc.	01679
	Amoco Pipeline Company	00751
	Amoco Production Company	00114
	ARCO Pipe Line Company	00486
	Atlantic Richfield Company	00967
	BP Amoco Corporation	02367
	BP Exploration & Oil Inc.	01680
	BP Exploration & Production Inc.	02481
	BP Prod. Corp.	02350
	Sohio Alaska Petroleum Company	00113
	Vastar Offshore, Inc.	02316
	Vastar Pipeline, LLC	02317
	Vastar Resources, Inc.	01855
	* Atlantic Richfield Company	00002
	* The Atlantic Refining Company	00002
	* Amoco Canyon Company	00735
	* BP Alaska Exploration Inc.	00301
	* BP Exploration Inc.	00593
	* BP Exploration U.S.A., Inc.	00120
	* BP Oil Company	01680
	* BP Oil Corporation	00120
	* Sohio Natural Resources	00113
	* Sohio Petroleum Company	00113
	* Sohio Petroleum Company	00593
ChevronTexaco**	Chevron Corporation	02335
	Chevron Oil Company of the Netherlands	01443
	Chevron Pipe Line Company	00400
	Chevron U.S.A. Inc.	00078
	Chevron U.S.A. LP	02544
	* Chevron Oil Company	00078
	* Chevron PBC, Inc.	01750
	* Gulf Oil Corporation	00112
	Equilon Pipeline Company LLC	01107
	Four Star Oil & Gas Company	00005
	Texaco Inc.	00040
	Texaco Exploration and Production Inc.	00771
	Texaco Trading and Transportation, Inc.	02020
	* Getty Oil Company	00005
	* Getty Pipeline, Inc.	01107
	* Getty Reserve Oil, Inc.	00578
	* Texaco Oils Inc.	00857
	* Texaco Pipeline Inc.	01107
	* Texaco Producing Inc.	00771
	* Texaco Seaboard Inc.	00025

Group Name	Company Name	MMS Number
Exxon Mobil	Exxon Asset Holdings LLC	02356
	Exxon Asset Management Company	02295
	Exxon Mobil Corporation	00276
	Exxon Mobil Oil Corporation	00039
	Exxon Mobil Pipeline 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 OIL EXPLORATION & PRODUCING SOUTHEAST INC.	00540
	Mobil Producing Texas & New Mexico Inc.	00565
	Mobil-TransOcean Company	00637
	* Exxon Corporation	00276
	* Exxon Pipeline Company	00103
	* Mobil GC Corporation	00565
	* Mobil NOC Inc.	00021
	* Superior Oil Company	00047
Shell	Mississippi Canyon Gas Pipeline, LLC	02254
	Shell Consolidated Energy Resources Inc.	01940
	Shell Frontier Oil & Gas Inc.	01728
	Shell Gas Gathering, LLC	02253
	Shell Gas Pipeline Company	01070
	Shell Land & Energy Company	01967
	Shell Offshore Inc.	00689
	Shell Offshore Properties and Capital II, Inc.	02128
	Shell Oil Company	00117
	Shell Pipe Line Corporation	00124
	Shell Seahorse Company	02147
	SWEPI LP	00832
	* Shell Deepwater Development Inc.	02139
	* Shell Deepwater Production Inc.	02140
	* Shell Energy Resources Inc.	00688
	* Shell Gas Gathering Company	02168
	* Shell Western E&P Inc.	00832

* Denotes companies that are no longer qualified with the MMS.
** The MMS has not received official documents for the Chevron-Texaco merger.

Appendix D – Subsea Completions.

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
BA	A 7	427044011600	Texaco	10/5/84	120
DC	133	608234000200	Amoco Production Company	9/12/01	6376
EB	112	608044015700	Agip Petroleum Co. Inc.	5/1/96	638
EB	117	608044016102	Vastar Offshore, Inc.	4/25/97	570
EB	157	608044015200	Agip Petroleum Co. Inc.	5/23/96	941
EB	161	608044022600	Union Oil Company of California	6/24/01	1107
EB	168	608044016600	Walter Oil & Gas Corporation	7/16/97	450
EB	168	608044023000	Walter Oil & Gas Corporation	12/6/01	500
EB	205	608044021800	Union Oil Company of California	5/2/01	1081
EB	948	608044017601	ExxonMobil Corporation	4/11/01	4376
EB	949	608044019301	ExxonMobil Corporation	3/12/01	4376
EC	235	177034047300	Chevron U.S.A. Inc.	11/16/86	121
EC	328	177044080800	Louis Dreyfus Natural Gas Corp.	2/13/97	243
EC	341	177044067100	Walter Oil & Gas Corporation	10/21/88	275
EC	378	608074015700	Sonat Exploration GOM Inc.	1/27/97	495
EC	380	177044102600	Walter Oil & Gas Corporation	6/15/01	538
EI	175	177090073200	Vastar Resources, Inc.	5/12/66	88
EI	175	177090073300	Vastar Resources, Inc.	2/15/66	90
EI	175	177090084200	Vastar Resources, Inc.	10/25/67	87
EI	175	177090086800	Vastar Resources, Inc.	11/13/73	83
EI	175	177090087100	Vastar Resources, Inc.	2/21/68	90
EI	175	177090088000	Vastar Resources, Inc.	8/8/69	87
EI	175	177090089700	Vastar Resources, Inc.	4/4/75	83
EI	175	177090090500	Vastar Resources, Inc.	6/25/68	90
EI	179	177094088700	Kerr-McGee Corporation	11/29/91	97
EI	215	177094016400	PennzEnergy	9/17/76	103
EI	248	177094112300	Walter Oil & Gas Corporation	1/25/97	155
EI	294	177104126801	TDC Energy Corporation	10/6/91	214
EI	300	177104102700	Amoco Production Company	3/18/83	212
EI	301	177104134000	Amoco Production Company	9/4/91	232
EI	301	177104136700	Amoco Production Company	5/2/94	231
EI	320	177104128700	Forest Oil Corporation	12/8/94	244
EI	322	177104134100	Amoco Production Company	8/21/96	242
EI	331	177104046800	Shell Offshore Inc.	8/17/75	242
EI	331	177104047700	Shell Offshore Inc.	1/30/76	242
EI	349	177104100500	Marathon Oil Company	11/23/90	337
EI	364	177104138000	LL&E Company	3/28/96	357
EW	868	608104011500	Walter Oil & Gas Corporation	9/1/01	685
EW	871	608104011300	Walter Oil & Gas Corporation	3/10/01	724
EW	878	608105009500	Walter Oil & Gas Corporation	7/3/00	1523
EW	878	608105009601	Walter Oil & Gas Corporation	8/25/00	1523
EW	914	608105002200	Tatham Offshore, Inc.	8/11/93	946
EW	917	608105006500	Marathon Oil Company	4/8/98	1195
EW	963	608105006000	Marathon Oil Company	5/25/98	1740
EW	963	608105006800	Marathon Oil Company	6/29/98	1758

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
EW	965	608105006200	British-Borneo Exploration, Inc.	5/13/98	1694
EW	989	608104008600	Kerr-McGee Corporation	11/2/94	565
EW	989	608104008701	Kerr-McGee Corporation	9/28/95	565
EW	999	608104003202	Placid Oil Company	7/20/89	1462
EW	1006	608105004100	Walter Oil & Gas Corporation	8/17/97	1884
GB	70	608074007000	Newfield Exploration Company	7/4/95	755
GB	70	608074007001	Newfield Exploration Company	9/29/97	750
GB	71	608074013000	Newfield Exploration Company	4/30/95	750
GB	108	608074020600	Kerr-McGee Oil & Gas Corporation	7/17/99	619
GB	117	608074013500	Flextrend Development Company	7/16/96	922
GB	117	608074014901	Flextrend Development Company	5/5/97	924
GB	134	608074062900	ATP	12/10/97	520
GB	152	608074020800	Kerr-McGee Oil & Gas Corporation	7/7/99	619
GB	161	608074015801	PennzEnergy E&P L.L.C.	9/20/99	972
GB	172	608074018200	Shell Offshore Inc.	7/31/98	693
GB	172	608074018401	Shell Offshore Inc.	1/25/99	693
GB	172	608074019700	Shell Offshore Inc.	4/27/99	663
GB	179	608074063700	Walter Oil & Gas Corporation	10/12/97	712
GB	216	608074081901	Amerada Hess Corporation	5/22/99	1456
GB	224	608074061800	Kerr-McGee Oil & Gas Corporation	5/22/91	742
GB	235	608074010600	LL&E Company	9/25/96	785
GB	240	608074013100	Mariner Energy, Inc.	1/29/96	832
GB	367	608074064100	Mariner Energy, Inc.	2/28/99	1122
GB	387	608074014001	EEX Corporation	3/3/96	2081
GB	388	608074005400	EEX Corporation	3/19/95	2097
GB	388	608074008401	EEX Corporation	7/11/97	2097
GB	388	608074015601	EEX Corporation	2/25/97	2096
GB	602	608074014401	Shell Deepwater Development Inc.	12/28/99	3708
GB	602	608074019401	Shell Deepwater Development Inc.	8/16/99	3693
GC	20	608114021300	Reading & Bates Development Co.	12/10/99	880
GC	29	608114009100	Placid Oil Company	6/17/89	1526
GC	31	608114004701	EP Operating Limited Partnership	8/7/88	2243
GC	31	608114009600	EP Operating Limited Partnership	5/17/89	2234
GC	60	608114019800	Mobil Oil E&P Southeast Inc	6/7/96	870
GC	60	608114020101	Mobil Oil E&P Southeast Inc	6/22/96	868
GC	72	608115008500	Shell Deepwater Production Inc.	1/11/96	2040
GC	110	608114020600	Shell Offshore Inc.	1/23/96	1730
GC	113	608115012701	Shell Deepwater Development Inc.	9/1/99	2045
GC	113	608115013100	Shell Deepwater Development Inc.	7/17/99	1968
GC	116	608115008600	Shell Deepwater Production Inc.	1/11/96	2046
GC	116	608115012200	Shell Deepwater Production Inc.	2/14/98	2046
GC	136	608114020000	Texaco	11/21/95	860
GC	136	608114020401	Texaco	12/20/95	1040
GC	200	608114020501	BP Exploration & Oil Inc.	6/29/98	2670

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
GC	200	608114021600	BP Exploration & Oil Inc.	12/7/97	2670
GC	200	608114021800	BP Exploration & Oil Inc.	11/10/97	2670
GC	200	608114021901	BP Exploration & Oil Inc.	2/27/99	2670
GC	200	608114028900	BP Exploration & Production Inc.	12/16/00	2672
GC	201	608114027501	BP Exploration & Production Inc.	6/5/00	2672
GC	254	608115008301	British-Borneo Exploration, Inc.	3/5/99	3225
GC	254	608115009000	British-Borneo Exploration, Inc.	8/1/99	3234
GI	41	177174009500	Vastar Resources, Inc.	11/8/78	91
GI	41	177174009600	Vastar Resources, Inc.	10/18/85	91
GI	41	177174009700	Vastar Resources, Inc.	10/8/78	91
GI	43	177174009800	Vastar Resources, Inc.	8/1/78	114
GI	47	177174009300	Vastar Resources, Inc.	5/14/78	88
GI	47	177174018500	Vastar Resources, Inc.	5/20/86	97
GI	109	177184009600	Walter Oil & Gas Corporation	6/7/00	280
HI	A 309	427114070100	Coastal Oil & Gas Corporation	1/24/95	213
HI	A 320	427114077400	Walter	3/17/97	237
HI	A 325	427114064000	Pennzoil E&P Company	7/11/89	231
HI	A 325	427114064100	Pennzoil E&P Company	8/6/89	231
HI	A 327	427114071200	Hall-Houston Oil Company	10/3/94	220
HI	A 370	427114065100	Kerr-McGee Oil & Gas Corporation	3/20/93	375
HI	A 373	427114065000	EOG Resources, Inc.	6/10/92	375
HI	A 378	427114075700	Kerr-McGee	7/28/96	360
HI	A 378	427114080601	Kerr-McGee	4/1/99	332
HI	A 441	427094109900	Remington Oil and Gas Corporation	8/29/00	168
HI	A 519	427094093200	Coastal Oil & Gas Corporation	5/20/91	220
HI	A 573	427094053700	Union Oil Company of California	9/17/80	350
HI	A 587	427094089602	PANACO, INC.	10/30/90	467
MC	335	608174084301	Exxon Corporation	7/2/99	1458
MC	28	608164018600	BP Exploration & Oil Inc.	4/21/95	1290
MC	28	608174051600	BP Exploration & Oil Inc.	8/16/96	1853
MC	28	608174051704	BP Exploration & Oil Inc.	4/7/01	1853
MC	28	608174051900	BP Exploration & Oil Inc.	6/30/96	1853
MC	28	608174052000	BP Exploration & Oil Inc.	4/24/98	1853
MC	29	608174052302	BP Exploration & Production Inc.	10/1/01	1853
MC	72	608174051500	BP Exploration & Oil Inc.	4/27/96	1853
MC	85	608174090100	Amoco Production Company	12/22/00	5173
MC	85	608174090801	BP Exploration & Production Inc.	4/8/01	5317
MC	217	608174090900	BP Exploration & Production Inc.	1/1/01	6390
MC	217	608174091001	Amoco Production Company	1/21/01	6420
MC	278	608174091502	Walter Oil & Gas Corporation	4/14/01	560
MC	292	608174050900	Texaco	5/25/99	3405
MC	292	608174083201	Texaco	8/25/99	3393
MC	292	608174083301	Texaco	9/24/99	3393
MC	321	608174089100	Walter Oil & Gas Corporation	8/27/00	567
MC	322	608174093800	Walter Oil & Gas Corporation	6/16/01	680
MC	322	608174094201	Walter Oil & Gas Corporation	7/24/01	680
MC	354	608174044700	Exxon Corporation	7/5/93	1460

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
MC	355	608174044800	Exxon Corporation	9/11/93	1458
MC	355	608174044900	Exxon Corporation	5/29/93	1460
MC	357	608174053801	Newfield Exploration Company	2/25/98	445
MC	401	608174032901	Kerr-McGee Oil & Gas Corporation	8/25/93	1367
MC	401	608174034600	Kerr-McGee Oil & Gas Corporation	7/25/93	1700
MC	441	608174037601	EEX Corporation	4/17/93	1438
MC	441	608174038400	EEX Corporation	11/20/92	1531
MC	441	608174040002	EEX Corporation	1/26/93	1531
MC	441	608174040100	EEX Corporation	12/27/92	1531
MC	441	608174041500	EEX Corporation	7/3/93	1438
MC	445	608174042900	Kerr-McGee Oil & Gas Corporation	10/4/93	2094
MC	445	608174047300	Kerr-McGee Oil & Gas Corporation	7/23/94	2095
MC	485	608174041600	EEX Corporation	5/24/93	1438
MC	686	608174054100	Shell Deepwater Production Inc.	7/12/97	5292
MC	687	608174054000	Shell Deepwater Production Inc.	11/20/98	5292
MC	730	608174054200	Shell Deepwater Production Inc.	11/4/97	5295
MC	807	608174038800	Shell Deepwater Production Inc.	3/25/96	2956
MC	837	608174092401	Walter Oil & Gas Corporation	5/19/01	1524
MC	899	608174058002	Shell Deepwater Development Inc.	3/25/01	4393
MC	899	608174087807	Shell Offshore Inc.	9/21/01	4389
MC	899	608174091600	Shell Deepwater Development Inc.	6/4/01	4393
MP	131	177254060100	ATP Oil & Gas Corporation	11/3/98	165
MP	145	177254047300	OXY USA Inc.	12/18/89	213
MP	149	177254058901	Walter Oil & Gas Corporation	9/6/94	220
MP	150	177254069600	Walter Oil & Gas Corporation	11/2/00	245
MP	260	177244081400	Santa Fe Snyder Corporation	4/26/99	315
MP	262	177244076100	CXY Energy Offshore Inc.	12/15/96	283
MP	281	177244069100	Walter Oil & Gas Corporation	7/28/94	293
MP	291	177244056600	Allied Natural Gas Corporation	4/5/95	272
MU	806	427024024500	Vastar Resources, Inc.	6/13/97	164
MU	A 124	427124010700	Walter Oil & Gas Corporation	9/20/93	381
PN	1010	427014005000	Walter	6/27/99	128
SM	61	177074029400	Chevron U.S.A. Inc.	5/26/84	130
SM	67	177074039000	Cockrell Oil Corporation	6/16/84	130
SS	176	177114099800	Chevron U.S.A. Inc.	9/29/90	100
SS	204	177110067000	Union Pacific Resources Company	5/18/95	103
SS	204	177110067200	Union Pacific Resources Company	3/28/83	100
SS	204	177110081400	Union Pacific Resources Company	2/10/69	103
SS	217	177110055500	Kerr-McGee Corporation	3/2/71	114
SS	269	177124010700	Union Oil Company of California	5/16/76	187
SS	274	177122001100	Apache Corporation	10/1/69	219
SS	274	177124008600	Apache Corporation	3/30/75	210
SS	276	177124058800	Forest Oil Corporation	6/17/98	215

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
SS	316	177124043400	Hall-Houston Oil Company	6/17/91	295
SS	317	177124038600	Newfield Exploration Company	12/13/90	295
SS	321	177124057000	ATP Oil & Gas Corporation	5/29/97	323
SS	326	177124058700	Walter Oil & Gas Corporation	5/11/98	364
SS	361	177124054900	Phillips Petroleum Company	7/8/98	405
ST	169	177154032600	Samedan Oil Corporation	4/27/80	88
ST	169	177154062300	Samedan Oil Corporation	6/1/85	102
ST	177	177154007800	Chevron U.S.A. Inc.	11/6/76	144
ST	231	177164019900	SOCO Offshore, Inc.	6/25/98	238
VK	783	608164013401	Shell Deepwater Production Inc.	11/10/93	1494
VK	783	608164021701	Shell Deepwater Production Inc.	7/18/96	1142
VK	784	608164023200	Shell Deepwater Production Inc.	6/30/96	1750
VK	825	608164033201	Kerr-McGee Oil & Gas Corporation	10/16/98	1722
VK	825	608164034400	Kerr-McGee Oil & Gas Corporation	8/29/99	1711
VK	862	608164021600	Walter Oil & Gas Corporation	11/15/95	1067
VK	915	608164038300	Amoco Production Company	4/2/01	3460
VK	944	608164032200	Elf Exploration, Inc.	12/5/97	730
VK	986	608164022800	Walter Oil & Gas Corporation	12/23/95	893
VR	215	177054028500	Newfield Exploration Company	10/10/79	140
VR	246	177054034600	Chevron U.S.A. Inc.	5/24/82	155
VR	302	177064021701	CXY Energy Offshore Inc.	2/20/77	197
VR	320	177064064200	ORYX Energy Company	11/12/91	206
WC	192	177004055500	Diamond Shamrock	7/11/82	54
WC	459	177024062900	Conoco Inc.	5/16/85	135
WC	548	177024106000	Walter Oil & Gas Corporation	6/14/94	185
WC	584	177024085700	Walter Oil & Gas Corporation	3/3/89	237
WC	592	177024106301	Walter Oil & Gas Corporation	12/17/95	252
WC	638	177024116900	Kerr-McGee Oil & Gas Corporation	11/6/98	373
WD	45	177190038200	CXY Energy Offshore Inc.	2/11/59	50
WD	45	177190038300	CXY Energy Offshore Inc.	2/26/59	72
WD	45	177190038402	CXY Energy Offshore Inc.	12/8/81	50
WD	62	177194027900	Mesa Operating	8/13/85	130
WD	70	177190062800	Vastar Resources, Inc.	2/2/58	143
WD	70	177190063000	Vastar Resources, Inc.	10/5/61	143
WD	71	177190061900	Vastar Resources, Inc.	7/24/61	142
WD	77	177194065504	ATP Oil & Gas Corporation	8/29/99	187
WD	106	177194056800	Walter Oil & Gas Corporation	1/5/95	234
WD	106	177194070300	Walter Oil & Gas Corporation	5/29/01	254
WD	107	177194056400	Walter Oil & Gas Corporation	1/2/96	222

Appendix E – Deepwater Studies Program.

<u>Active Studies</u> [MMS Study Number]

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

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

Deepwater Program: Assessment and Reduction of Taxonomic Error in Benthic Macrofauna Surveys: An Initial Program Focused on Shelf and Slope Polychaete Worms [16801 C]

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: Summary of the Northern Gulf of Mexico Continental Slope Studies [17037 C]

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: Offshore Petroleum Platforms: Functional Significance for Larval Fish Across Longitudinal and Latitudinal Gradients [19961 M]

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: Bluewater Fishing and Deepwater OCS Activity: Interactions Between the Fishing and Petroleum Industries in Deepwaters of the Gulf of Mexico [31011 M]

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]

Active Studies ***[MMS Study Number] (Continued)***

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: Offshore Data Search and Synthesis on Highly Migratory Species in the GOM and the Effects of Large Fish Attracting Devices (FADS) [BRD-M0202]

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*

Completed Studies ***[MMS Study Number] (Continued)***

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*

Study in the Procurement Process ***[MMS Study Number]***

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

Note: The * before the MMS publication number indicates that the report is available at our web site – http://www.gomr.mms.gov/homepg/regulate/environ/deepenv.html.

Appendix F - 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	152	0	152	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	373	0	373	2.0	0.0	2.0
1966	481	0	481	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	902	0	902	6.6	0.0	6.6
1971	1,030	0	1,030	7.5	0.0	7.5
1972	1,023	0	1,023	8.2	0.0	8.2
1973	1,003	0	1,003	9.1	0.0	9.1
1974	926	0	926	9.4	0.0	9.4
1975	849	0	849	9.4	0.0	9.4
1976	823	0	823	9.7	0.0	9.7
1977	777	0	777	10.3	0.0	10.3
1978	756	0	756	11.6	0.0	11.6
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	805	72	877	11.1	0.1	11.2
1984	904	68	972	12.4	0.1	12.5
1985	902	58	960	11.0	0.1	11.1
1986	922	52	974	11.0	0.1	11.1
1987	851	47	897	12.3	0.1	12.4
1988	790	36	825	12.4	0.1	12.5
1989	742	27	769	12.6	0.1	12.7
1990	719	33	752	13.4	0.1	13.4
1991	745	63	807	12.7	0.2	12.9

Year	Shallow-water Oil (MBOPD)	Deepwater Oil (MBOPD)	Total GOM Oil (MBOPD)	Shallow-water Gas (BCFPD)	Deepwater Gas (BCFPD)	Total GOM Gas (BCFPD)
1992	733	102	835	12.5	0.2	12.7
1993	745	101	845	12.4	0.3	12.8
1994	746	115	860	12.8	0.4	13.2
1995	794	151	945	12.6	0.5	13.1
1996	813	198	1,010	13.2	0.8	13.9
1997	830	297	1,128	13.1	1.0	14.1
1998	781	436	1,217	12.3	1.5	13.8
1999	741	617	1,357	11.5	2.3	13.9
2000	690	743	1,433	10.8	2.7	13.6
2001*	620	930	1,550	10.7	3.2	13.9

* estimated

Appendix G – Number of Deepwater Production Facilities Installed Each Year (including plans through 2004).

Year	Fixed Platform	Compliant Tower	TLP	Small TLP	Spar	Truss Spar	Other FPS	FPSO
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	1	0	0	0	0	0	0
1984	0	0	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	1	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0
1994	1	0	1	0	0	0	0	0
1995	0	0	0	0	0	0	1	0
1996	0	0	1	0	0	0	0	0
1997	0	0	1	0	1	0	0	0
1998	1	1	0	1	0	0	0	0
1999	1	0	2	1	1	0	0	0
2000	0	1	0	0	1	0	0	0
2001	0	0	1	2	0	2	0	0
2002	0	0	0	0	1	1	0	0
2003	0	0	0	0	0	3	1	0
2004	0	0	1	2	0	1	2	0

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.

20 Years of Service to America

MMS

Minerals Management Service

1982-2002