OCS Report
MMS 2006-022

Deepwater Gulf of Mexico 2006: America's Expanding Frontier

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

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Deepwater Gulf of Mexico 2006: America's Expanding Frontier

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The legend of the map on page 33 (Figure 21) has been emended in this electronic edition.

ON COVER — The Holstein truss spar facility, *Discoverer Deep Seas* drillship, and Magnolia tension-leg platform (photos courtesy of BP/Marc Morrison, Transocean, and ConocoPhillips).

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PREFACE

This publication is the sixth that the Minerals Management Service (MMS) has released recounting the impressive levels of deepwater exploration and development activity in the Gulf of Mexico (GOM). The GOM is in its eleventh year of sustained expansion in deepwater.

Since the first major deepwater leasing boom in 1995 and 1996, we have entered into a sustained, robust expansion of activity. The Central Gulf of Mexico Sale 198 held this past March garnered bids on 204 deepwater blocks, confirming continued enthusiasm for exploring the deepwater arena. Indeed, Amerada Hess placed a high bid of $42.7MM on the deepwater Block Green Canyon 287, the highest bid seen in 20 years. The total of the high bids in the sale, including shallow- and deepwater leases, was $588 million, the highest in eight years.

As of March 2006, there were 118 deepwater hydrocarbon production projects on line. Production from deepwater was an estimated 950 thousand barrels of oil per day and 3.8 billion cubic feet of natural gas per day by the end of 2004. Production would have been even greater if not for shut-in production caused by Hurricane Ivan. Production statistics from 2005 will be similarly impacted by Hurricanes Katrina and Rita.

More than 980 exploration wells have been drilled in the deepwater Gulf since 1995. At least 126 deepwater discoveries have been announced since then. Significantly, in the last seven years, there have been 22 industry-announced discoveries in water depths greater than 7,000 feet (2,134 meters), seven in 2004 alone.

The state-of-the-art technology that has been developed to drill and produce the Gulf of Mexico deepwater resources is at the leading edge of the world's engineering feats. Production from spars has increased so that fourteen spars were in production as of March 2006. Although most of the spars are either classic spars or truss spars, the world's first cell spar was installed by Kerr-McGee in 2004. The potential use of floating production, storage, and offloading (FPSO) systems is being discussed, and the first application to use this technology may be filed with MMS in 2006.

The MMS plays a critical role in this energy expansion by ensuring the receipt of fair market value for the sale of leases, evaluating and approving new technology, and facing new challenges regulating the drilling and production of prospects in ever deepening water depths. The MMS's development of environmental review procedures to ensure timely but thorough review of projects while continuing to protect the environment has been innovative and critical to keep deepwater project timelines minimized.

Chris C. Oynes

Regional Director

Minerals Management Service

INTRODUCTION

The deepwater Gulf of Mexico (GOM) is an integral part of the Nation's oil and gas supply and one of the world's most important oil and gas provinces. A major milestone was reached early in 2000 when more oil was produced from the deepwater GOM than from the shallow-water GOM. Deepwater oil production has nearly reached the all-time shallow-water GOM record set in 1971. In addition, the average size of a deepwater GOM field discovery is several times larger than the average shallow-water discovery. Deepwater fields are some of the most prolific producers in the GOM.

This report is divided into five sections.

The **Background** section discusses

- highlights of current deepwater GOM activity,
- new discoveries,
- technology concerns,
- the existing deepwater infrastructure, and
- LNG projects.

The **Leasing and Environment** section discusses

- historical water-depth and bidding trends in deepwater leasing,
- leaseholdings of major oil companies compared with those of nonmajor oil companies,
- future deepwater lease activity,
- royalty relief under Energy Policy Act of 2005, and
- environmental activity.

The **Drilling and Development** section discusses

- deepwater drilling activity,
- historical drilling statistics,
- the transition to deeper wells and deeper water,
- high-pressure, high-temperature environments,
- deepwater development systems,
- subsea trends,
- Independence Hub, and
- pipelines and HIPPS.

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,
- historical trends in deepwater production,

- comparison of shallow-water and deepwater production,
- effects of Hurricanes Ivan, Katrina, and Rita on production, 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 and drilling and between drilling and initial production,
- difficulties evaluating deepwater leases before their terms expire, and
- significant changes since the 2004 report.

Table 1
List of 2005 Deepwater Discoveries

Project Name	Area/Block	Water Depth (ft)	Operator
Anduin	MC 755	2,400	Nexen
Big Foot	WR 29	5,286	Chevron
Clipper	GC 299	3,452	Pioneer
Genghis Khan	GC 652	4,300	Anadarko
Jubilee Extension	LL 309	8,774	Anadarko
Knotty Head	GC 512	3,557	Chevron/Unocal
Mondo NW Extension	LL 1	8,340	Anadarko
Q	MC 961	7,925	Spinnaker
Stones	WR 508	9,556	BP
Wrigley	MC 506	3,700	Newfield

GC = Green Canyon
LL = Lloyd Ridge
MC = Mississippi Canyon
WR = Walker Ridge

BACKGROUND

DEFINITIONS

The GOM Outer Continental Shelf (OCS) is divided into the Western, Central, and Eastern Planning Areas (figure 1). Many of the data presented in this report are subdivided according to water depth. These divisions (1,000, 1,500, 5,000, and 7,500 ft) are illustrated in figure 1, along with the new royalty relief zones of the Energy Policy Act of 2005 (200, 400, 800, 1,600, and 2,000 m) for reference. Not all leases within a colored area are eligible for royalty relief because of the different vintage of leases included within the area. As a whole, the new relief zones have not been incorporated into the statistical analyses included in this report. Royalty relief volumes were changed with the passage of the Act. Details of these changes can be found in the Leasing and Environment section of this report.

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

A few other definitions are useful at this point:

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

More detailed definitions may be found in the annual *Estimated Oil and Gas Reserves, Gulf of Mexico Outer Continental Shelf, December 31, 2002* report (Crawford et al., 2005).

This report refers to deepwater developments as both fields (as defined above) and by operator-designated project names. A field name is assigned to a lease or a group of leases so that natural gas and oil resources, reserves, and production can be allocated on the basis of the unique geologic feature that contains the hydrocarbon accumulation. Appendix A provides locations of these fields and projects. The field's identifying block number corresponds to the first lease qualified by MMS as capable of production or the block where the primary structure is located.

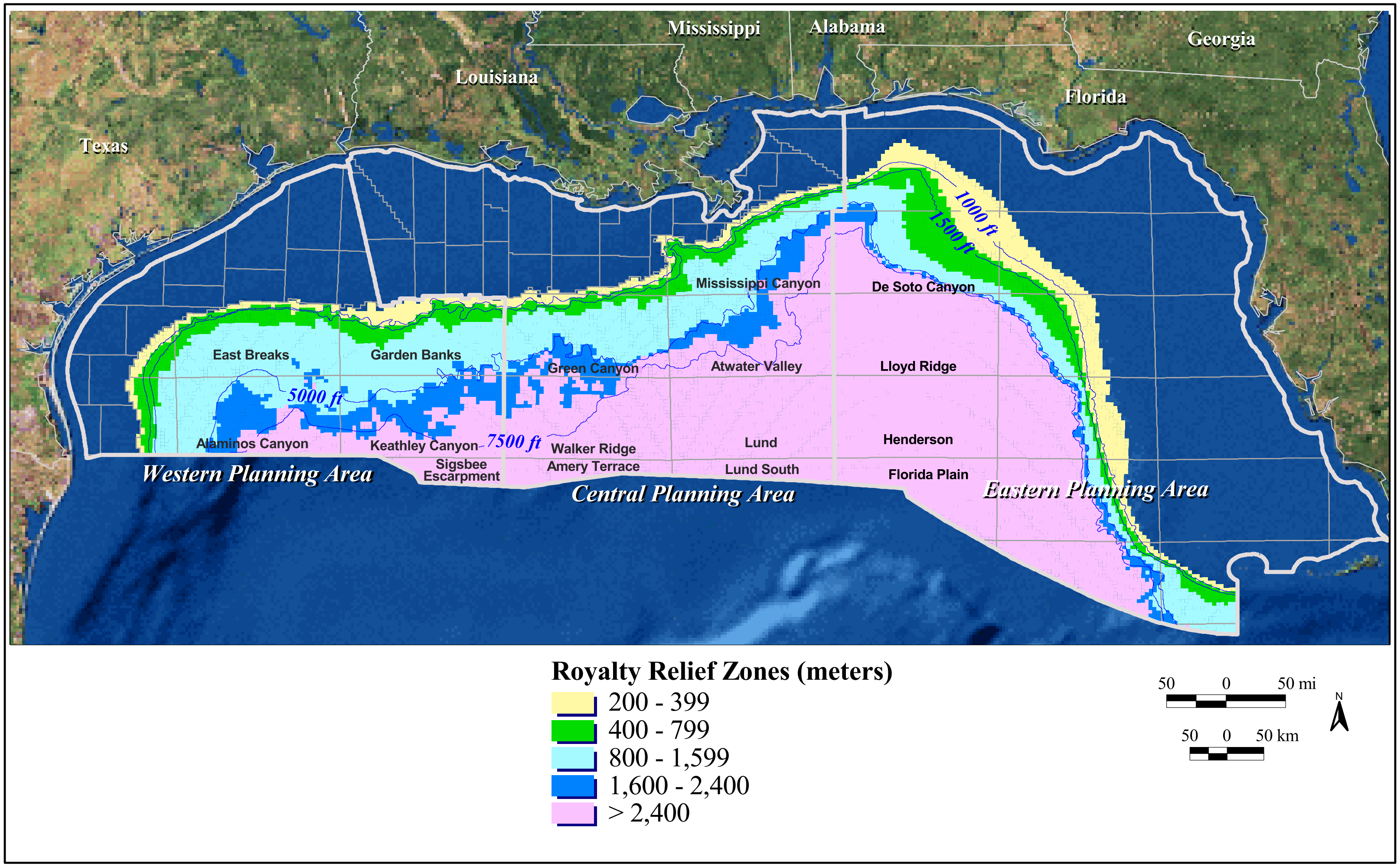

Figure 1. The Gulf of Mexico OCS is divided into Western, Central, and Eastern Planning Areas. Water-depth categories used in this report are shown in addition to royalty relief zones shaded according to the Energy Policy Act of 2005.

Note that the term “oil” refers to both oil and condensate throughout this report and “gas” includes both associated and nonassociated gas. All production volumes and rates reflect data through December 2004 (the most recent, complete data available at the time of this publication).

EXPANDING FRONTIER

When the original version of this report (Cranswick and Regg, 1997) was published in February 1997, a new era for the GOM had just begun with intense interest in the oil and gas potential of the deepwater areas. There were favorable economics, recent deepwater discoveries, and significant leasing at that time. In February 1997, there were 17 producing deepwater projects, up from only 6 at the end of 1992. Since then, industry has been rapidly advancing into deepwater, and many of the anticipated fields have begun production.

The previous version of this report (French et al., 2005) was an interim version of the biennial deepwater report published by Minerals Management Service (MMS). The interim report published in 2005 provided a review of the deepwater frontier and highlights of 2004. This report reverts to the biennial format of providing trend analyses as well as advancements since the last detailed report published in 2004 (Richardson et al.).

At the end of March 2006, there were 118 producing projects in the deepwater GOM, up 37 percent in the two years since Richardson et al. (2004). Deepwater production rates rose by well over 100,000 barrels of oil per day (BOPD) and 400 million cubic ft of gas per day (MMCFPD), respectively, each year from 1997 through 2002. Production rates have remained flat since 2002.

The dramatic shift toward high activity levels in the deepwater GOM occurred during the last few years, although it had been developing for over two decades. Deepwater production began in 1979 with Shell’s Cognac field, but it took another five years before the next deepwater field (ExxonMobil’s Lena field) came online. Both developments relied on extending the limits of platform technology used to develop the GOM shallow-water areas. Deepwater exploration and production grew with tremendous advances in technology since those early days. This report focuses on changes during the last 14 years, 1992-2005.

Over these last 14 years, there has been an overall expansion in all phases of deepwater activity. There are approximately 8,221 active leases in the Gulf of Mexico OCS, 54 percent of which are in deepwater. (Note that lease statuses may change daily, so the current number of active leases is an approximation.) Contrast this to approximately 5,600 active Gulf of Mexico leases in 1992, only 27 percent of which were in deepwater. On average, there were 30 rigs drilling in deepwater in 2005, compared with only 3 rigs in 1992. Likewise, deepwater oil production rose over 840 percent and deepwater gas production increased about 1,600 percent from 1992 to 2002.

Some measures of deepwater activity have declined while others have increased since the 2004 report. The average number of rigs operating, the number of deepwater plans submitted, and the average bid amount per block in the ultradeep water have increased. There have been, however, decreases in the average bid amount per block in water depths less than 5,000 ft and in the number of wells drilled.

All phases of exploration and development moved steadily into deeper waters over the past 14 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. Indeed, nonmajors are responsible for seven of the ten deepwater discoveries announced in 2005.

The OCS Deep Water Royalty Relief Act (DWRRA; 43 U.S.C. §1337) has had a significant impact on deepwater GOM activities. This legislation provided economic incentives for operators to develop leases in water depths greater than 200 m (656 ft). These incentives include the suspension of Federal royalty payments (for leases issued 1996-2000) on the initial 17.5 million barrels of oil equivalent (MMBOE) produced from a lease in 200-400 m (656-1,312 ft) of water, 52.5 MMBOE for a lease in 400-800 m (1,312-2,624 ft) of water, and 87.5 MMBOE for a lease 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 fixed suspension volume provision of the DWRRA (for new leases issued 1996-2000) expired on November 28, 2000. Leases acquired between November 28, 1995, and November 28, 2000, will retain the incentives until their expiration. Exploration and production incentives have continued since 2000 for leases in water depths greater than 400 m (1,312 ft). With the passage of the Energy Policy Act of 2005, lease terms for deepwater royalty relief were changed, eliminating the 1,600-m or deeper water-depth category and establishing two new royalty suspension categories: 1,600- to 2,000-m and greater than 2,000-m water depth.

SEISMIC ACTIVITY

A combination of factors, including the DWRRA, key deepwater discoveries, the recognition of high deepwater production rates, and the evolution of deepwater development technologies, spurred a variety of deepwater activities. One of the first impacts was a dramatic increase in the acquisition of 3-dimensional (3-D) seismic data (figure 2). (Note that figures 2 and 3 illustrate areas permitted for seismic acquisition. The actual coverage available may be slightly different than that permitted.) Three-dimensional seismic data are huge volumes of digital energy recordings resulting from the transmission and reflection of sound waves through the earth. These large "data cubes" can be interpreted to reveal likely oil and gas accumulations. The dense volume of recent, high-quality data may reduce the inherent risks of traditional hydrocarbon exploration and allow imaging of previously hidden prospects. Figure 2 illustrates the surge of seismic activity in the deepwater GOM during the last 14 years. Seismic acquisition has stepped into progressively deeper waters since 1992. Figure 3 shows the abundance of 3-D data now available. These data blanket most of the deepwater GOM, even beyond the Sigsbee Escarpment (a geologic and bathymetric feature in ultra-deep water). Note that many active deepwater leases were purchased before these 3-D surveys were completed (only the more sparsely populated 2-D datasets were available).

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

Time-lapse seismic surveys (also known as 4-D) will likely be the next significant seismic technology to be applied routinely in the deepwater GOM. The technique can be applied to characterize reservoir properties, monitor production efficiency, and estimate volumetrics from inception through the life of the field (Shirley, 2001). At Auger field (GB 426), Shell has identified deeper targets, stranded attic opportunities, and unswept bypassed reserves using 4-D technology (Shirley, 2004). The high cost of drilling deepwater wells and the challenges associated with reentry of deepwater wells may promote the increased use of 4-D technology in the deepwater GOM.

Improving seismic imaging below salt bodies is the impetus behind another technology being investigated, nodal seabed technology. This technology uses all-azimuth illumination to acquire seismic data by recording in all directions as opposed to conventional streamers, which routinely record data in a single direction (Durham, 2006). This new technology is currently being applied at Atlantis (GC 699) by Fairfield Industries and BP.

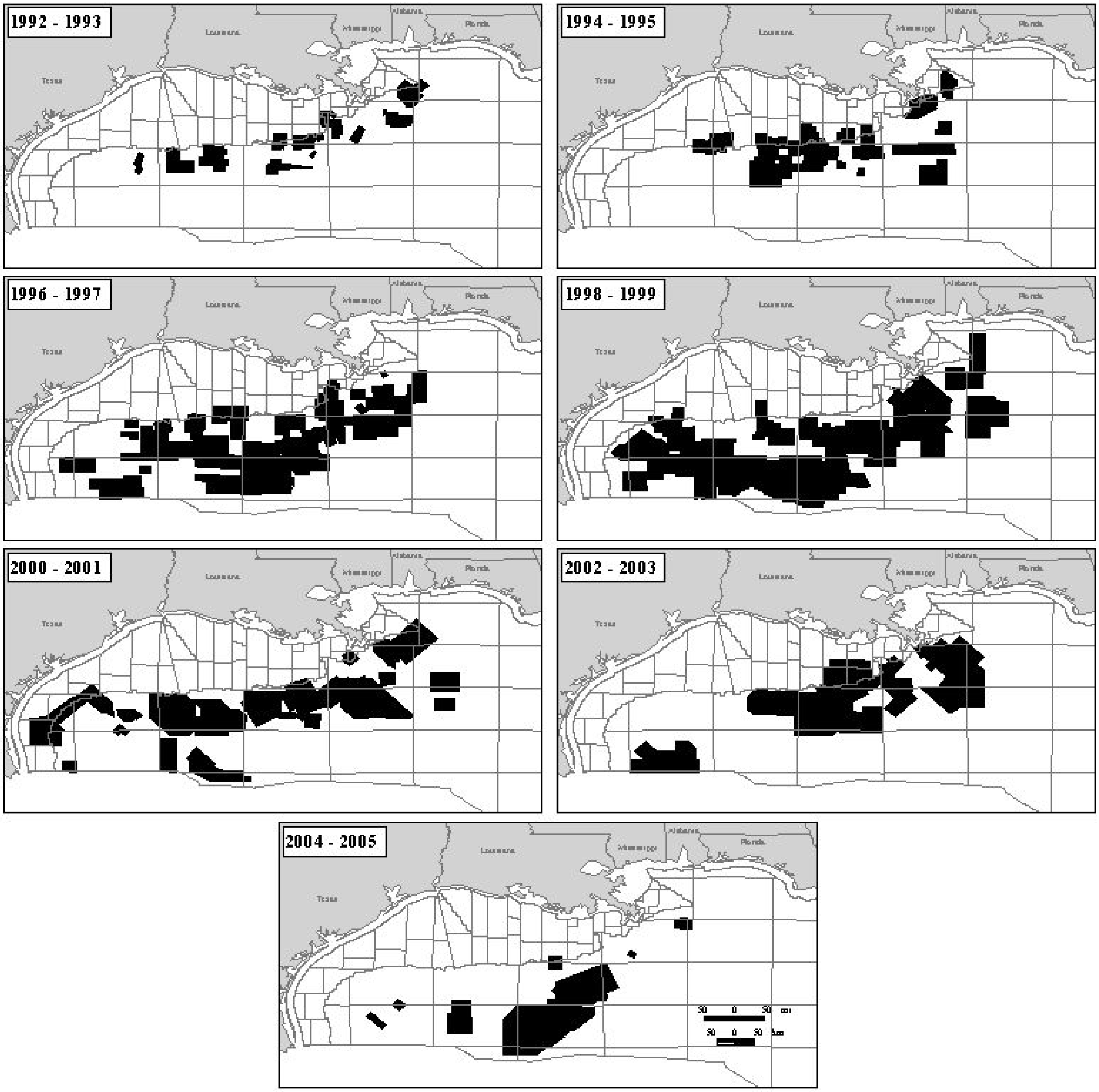

Figure 2. Progressive deepwater 3-D seismic permit coverage.

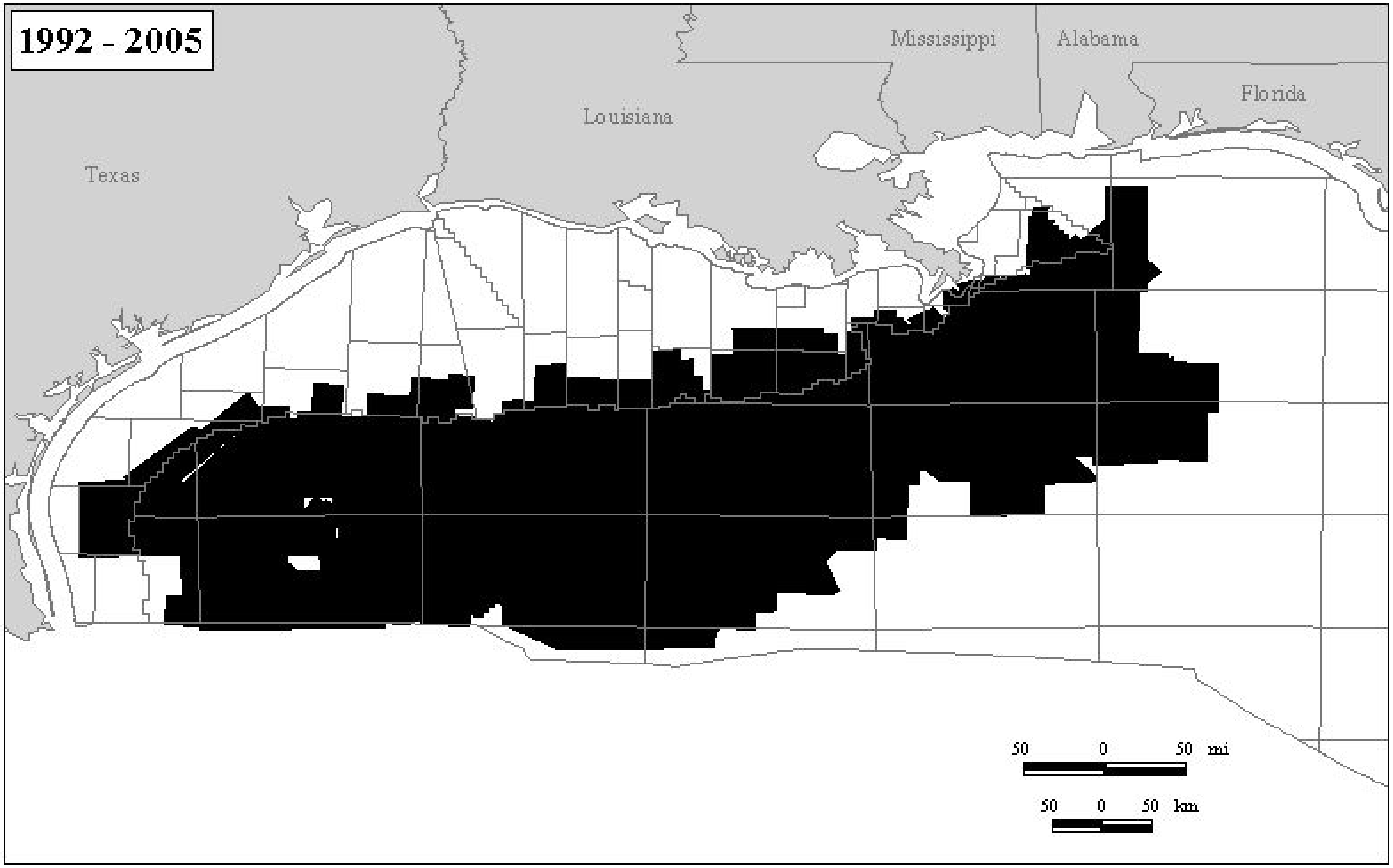

Figure 3. Deepwater Gulf of Mexico 3-D seismic permit coverage from 1992 to 2005.

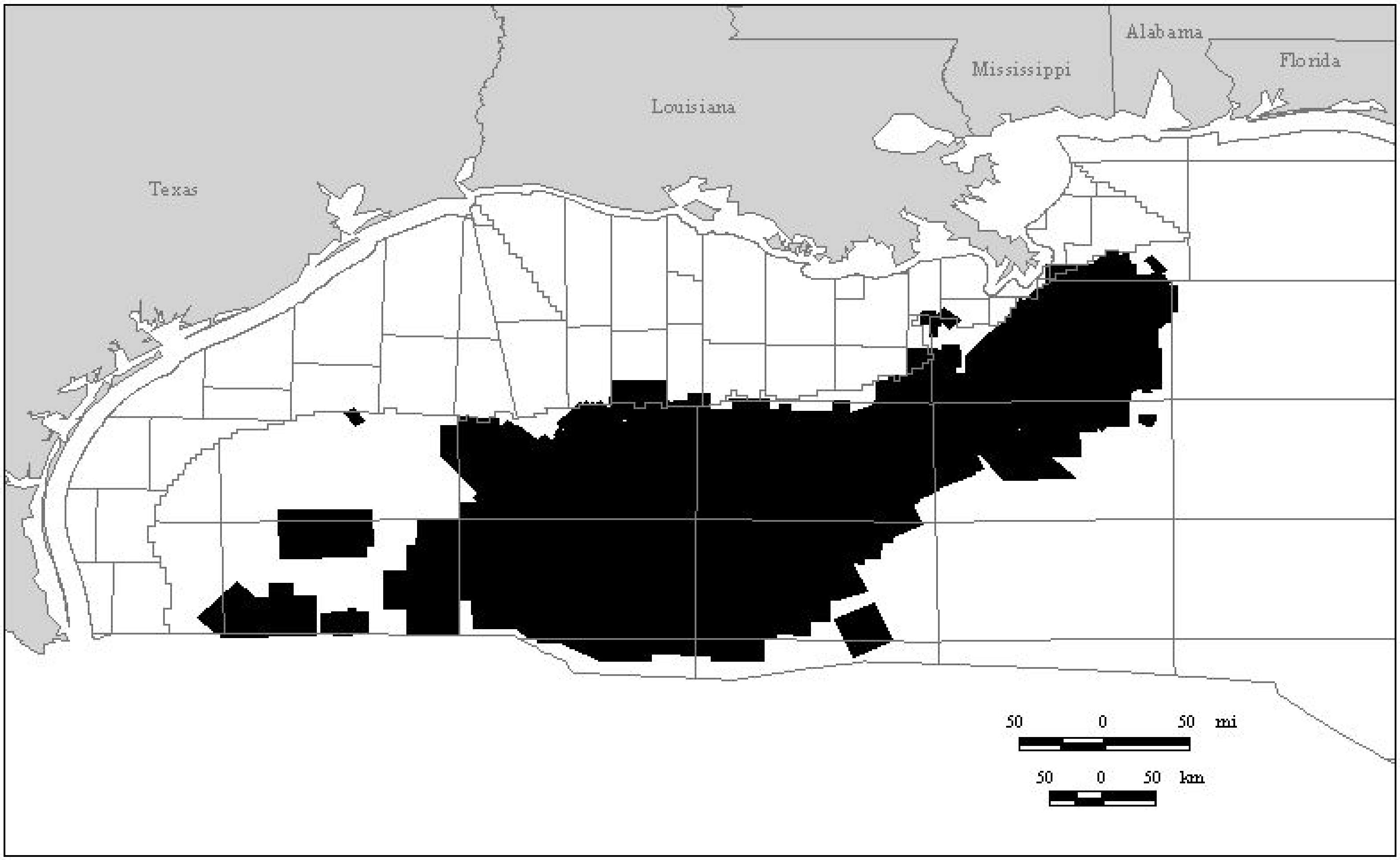

Figure 4. Pre-stack depth migration coverage from various industry sources.

EXPLORATION ACTIVITY

Recent discoveries in new deepwater plays continue to expand the exploration potential of the deepwater GOM. Figure 5 indicates that 99 percent of total GOM proved reserves are in Neogene-age and younger reservoirs (Pleistocene, Pliocene, and Miocene); however, several recent deepwater discoveries encountered large potential reservoirs in sands of Paleogene age (Oligocene, Eocene, and Paleocene).

Lower Wilcox

The discovery of these Paleogene-age reservoirs has opened wide areas of the GOM to further drilling. Figure 6 illustrates two frontier deepwater plays in the GOM, the Mississippi Fan Foldbelt and the Perdido Foldbelt, both of which include reservoirs of Paleogene age.

With the drilling of the Trident and Cascade discoveries (AC 903 and WR 206) in 2001 and 2002, respectively, the potential for areally extensive Lower Wilcox sand extending from Alaminos Canyon to Walker Ridge was established. Figure 7 is a schematic showing the depositional environments of the Wilcox from the sediment source in onshore Texas and Louisiana to the deepwater GOM. Deposition of the Lower Wilcox submarine fan complex appears to have been largely unaffected by salt tectonism, resulting in a thick amalgamated sand accumulation across a broad geographic area (Seitchik and Powell, 2006). The Cascade discovery established the existence of turbidite sands more than 350 miles down dip from the source deltas in south Texas (Meyer et al., 2005). Two subsalt discoveries have also been made in the Lower Wilcox, St. Malo (WR 678) and Jack (WR 759). Chevron is expected to conduct a flow test on its Jack prospect in the very near future. To date, there are five Lower Wilcox and/or Paleogene discoveries in Alaminos Canyon and four Lower Wilcox discoveries in Walker Ridge.

Although the Paleogene trend is a promising exploration target, there are many challenges to be met before production can begin. Appraisal wells must be drilled and wells tested to determine the reservoir quality and producibility of the Lower Wilcox. Other challenges include the completion and production of deep reservoirs in the ultradeep GOM, for which there is no existing infrastructure.

Eastern GOM

Figure 6 also shows a composite outline of numerous plays in the Eastern GOM; these range in age from Pleistocene through Jurassic. Note that the proposed change in the geographic boundary between the Central and Eastern GOM is not reflected here. There are three areas of interest in the Eastern GOM: allochthonous salt-related features, autochthonous salt-related features, and Mesozoic shelf carbonate plays (Denman and Adamick, 2000). These plays are within the eastern Mississippi Fan and the Florida carbonate shelf. Allochthonous salt-related plays are largely of early Pliocene or middle to late Miocene age and occur in proximity to and beneath horizontal salt features largely restricted to the upper Mississippi Fan.

Successful exploration has occurred in the Eastern GOM with announced discoveries in DeSoto Canyon (Spiderman/Amazon and San Jacinto) and in Lloyd Ridge (Atlas, Atlas NW, Cheyenne, and Mondo Northwest). These discoveries, along with discoveries in Atwater Valley (Vortex, Jubilee, and Merganser) and Mississippi Canyon (Q) to the west (Central GOM), will comprise the anchor fields for Independence Hub. At least six of these discoveries encountered Miocene-age reservoirs, and all ten are in water depths greater than 7,800 ft (2,378 m).

Lower Miocene

The Mississippi Fan fold belt trend saw three Lower Miocene oil discoveries in 2005: Knotty Head (GC 512), Genghis Khan (GC 652), and Big Foot (WR 29). A thick layer of Middle Jurassic Louann salt is interpreted to have deformed during the Early Cretaceous, forming a regional salt canopy. This allochthonous layer was critical to the formation of the fold belt (Morris et al., 2004). The folds are interpreted to be salt-cored and overlie the regional detachment of the Louann Salt.

Chevron's successful production test at their Tahiti discovery well (GC 640) in 2004 undoubtedly undergirded further exploration of the trend. Tahiti tested a three-way structural nose, trapped against a salt feeder/weld system, buried beneath an 11,000-ft (3,354-m) thick salt canopy (Yip, 2006). The discovery well produced at a restricted rate of 15 MBOPD. Rate and pressure analyses indicate that the well may be capable of sustained flow of as much as 30 MBOPD.

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

mya=million years ago

Figure 5. Stratigraphic chart highlighting new play potential.

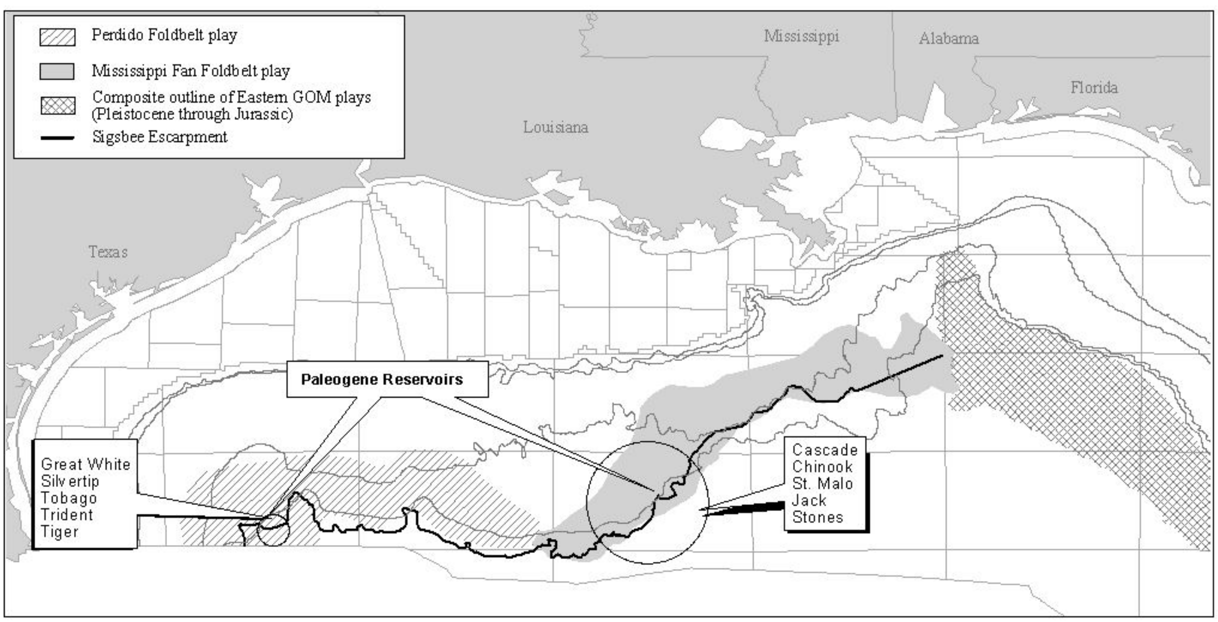

Figure 6. Frontier plays in the deepwater GOM.

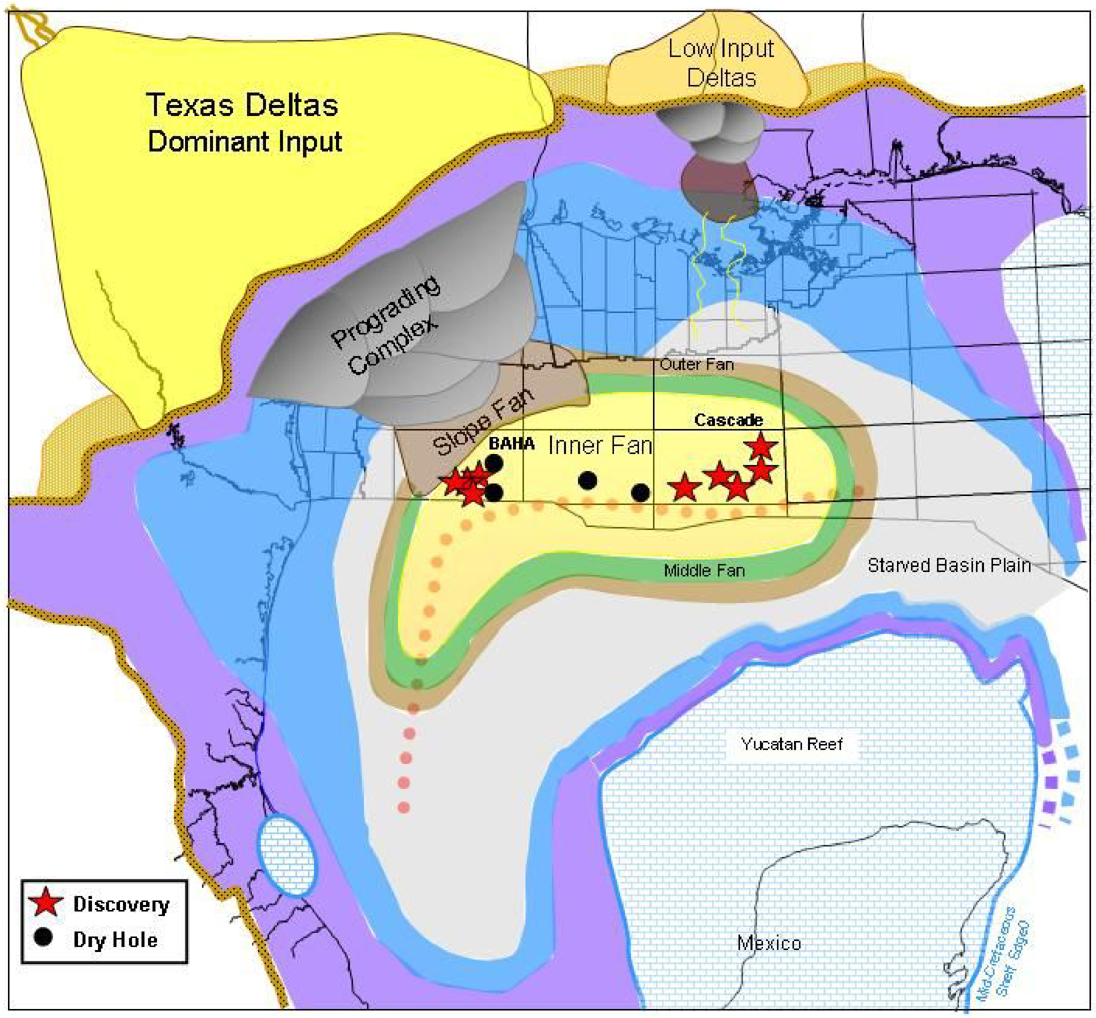

Figure 7. Schematic Wilcox depositional model with key trend wells (graphic courtesy of Chevron)

Although not a geologic play, the ultra-deepwater areas of the GOM can also be considered "frontier territory." During the last five years there have been 22 industry-announced discoveries in water depths greater than 7,000 ft (2,134 m), eleven of those discoveries in the last two years alone (table 2). Announced volumes for these discoveries are more than 1.8 billion BOE.

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

Hydrates

In addition to the traditional oil and gas plays in the deepwater GOM, there may be significant resources in gas hydrates (figure 8). These resources may be 30 to 300 times greater than conventional oil and gas reserves. A gas hydrate is a cage-like lattice of ice that traps molecules of natural gas, primarily methane. Hydrates are formed near the seafloor under conditions of low temperature, high pressure, and in the presence of natural gas. In the GOM, hydrates occur in water depths greater than 1,450 ft (442 m). Each cubic foot of hydrate yields approximately 160 ft^3 of gas at standard temperature and pressure.

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

Project Name	Area/Block	Water Depth (ft)	Discovery Year
Aconcagua	MC 305	7,379	1999
Camden Hills	MC 348	7,530	1999
Blind Faith	MC 696	7,116	2001
Merganser	AT 37	8,064	2001
St. Malo	WR 678	7,326	2001
Trident	AC 903	9,816	2001
Cascade	WR 206	8,143	2002
Great White	AC 857	7,425	2002
Vortex	AT 261	8,422	2002
Atlas	LL 50	9,180	2003
Chinook	WR 469	9,104	2003
Jubilee	AT 349	8,891	2003
Spiderman/Amazon	DC 621	8,100	2003
Atlas NW	LL 5	8,810	2004
Cheyenne	LL 399	8,987	2004
Mondo Northwest	LL 2	8,340	2004
San Jacinto	DC 618	7,850	2004
Silvertip	AC 815	9,226	2004
Tiger	AC 818	9,004	2004
Tobago	AC 859	9,627	2004
Jubilee Extension	LL 309	8,774	2005
Mondo NW Extension	LL 1	8,340	2005
Q	MC 961	7,925	2005
Stones	WR 508	9,556	2005

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

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

Many questions remain about the distribution, concentration, reservoir properties, and stability of hydrates. Conventional drilling operations do not allow sampling of the upper 3,000 ft (914 m) of sediment (where hydrates occur). Although conventional 3-D exploration and high-resolution seismic data are not specifically designed to detect hydrate deposits, interpretive techniques have been used to delineate possible hydrates.

To gather hydrate data for the Gulf of Mexico, a Joint Industry Project of MMS and seven oil and service companies, largely funded by the Department of Energy (DOE), conducted a 35-day expedition in the spring of 2005 to drill, log, and core sediments containing gas hydrates. Five separate boreholes were drilled near seafloor hydrate mounds in Atwater Valley and Keathley Canyon to depths as great as 1,509 ft (460 m). Two holes were cored on top a hydrate mound in Atwater Valley to a depth of 98 ft (30 m). Downhole log data and pressure cores revealed evidence of gas hydrates in all boreholes at levels approximating those predicted by pre-cruise seismic analysis. Sediment at both locations was fine grained with stratigraphically controlled hydrate-bearing intervals in Atwater Valley and steeply dipping, hydrate-filled fractures in Keathley Canyon. Because economically significant quantities of gas hydrate are probably limited to sandy reservoirs, a second hydrate drilling initiative with a multi-well program is planned for 2007. MMS will again play a major role on the site-selection team by using information from the sand studies done in the initial inventory of recoverable gas hydrates for the National Oil and Gas Assessment Program.

Leasing Activity

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

With the passage of the Energy Policy Act of 2005, lease terms for deepwater royalty relief were changed. The Act eliminated the existing 1,600-m or deeper water-depth category for royalty relief and established two new royalty suspension categories: 1,600- to 2,000-m and greater than 2,000-m water depth. Sale 196 (Western GOM Planning Area, August 17, 2005) was the first lease offering to implement these “new” royalty relief provisions.

Table 3 shows the approximate number of active leases for certain water-depth ranges. The geographic distribution of active leases in the GOM is shown in figure 10. The limited number of active leases in the eastern GOM is related to leasing restrictions. In 2001 and 2003, sales were held offshore of Alabama, approximately 100 miles from the coastline, which added 109 active leases. Appendix B provides a chronological listing of all Gulf of Mexico lease offerings arranged by sale number, location, and date.

Table 3
Number of Active Leases by Water-Depth Interval

Number of Active Leases*	Water Depth ft	m
3,826	<1,000	<305
173	1,000-1,499	305-457
1,960	1,500-4,999	457-1,524
1,516	5,000-7,499	1,524-2,286
746	>7,500	>2,286

*as of December 31, 2005

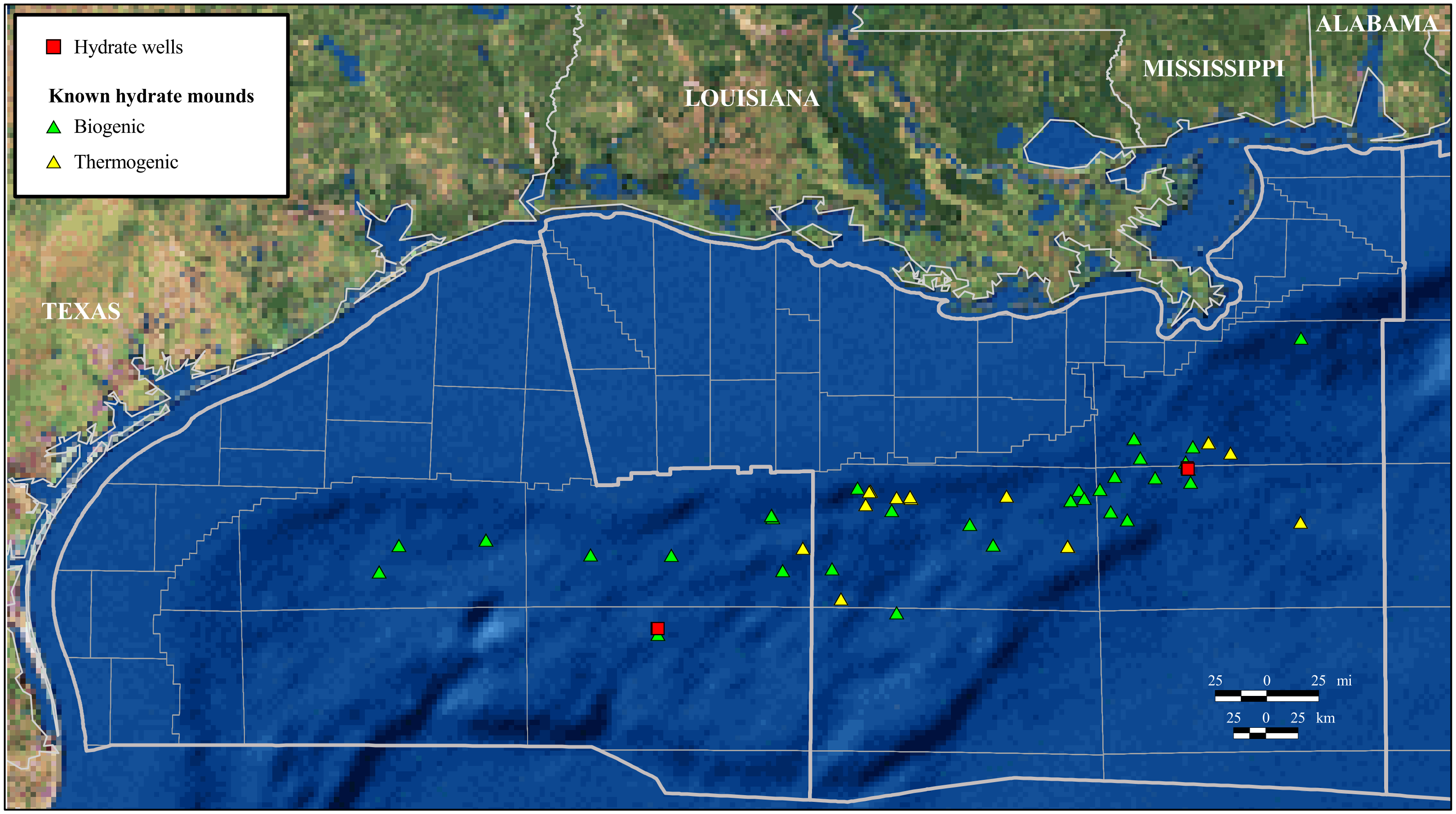

Figure 8. Location of known gas hydrates in the Gulf of Mexico.

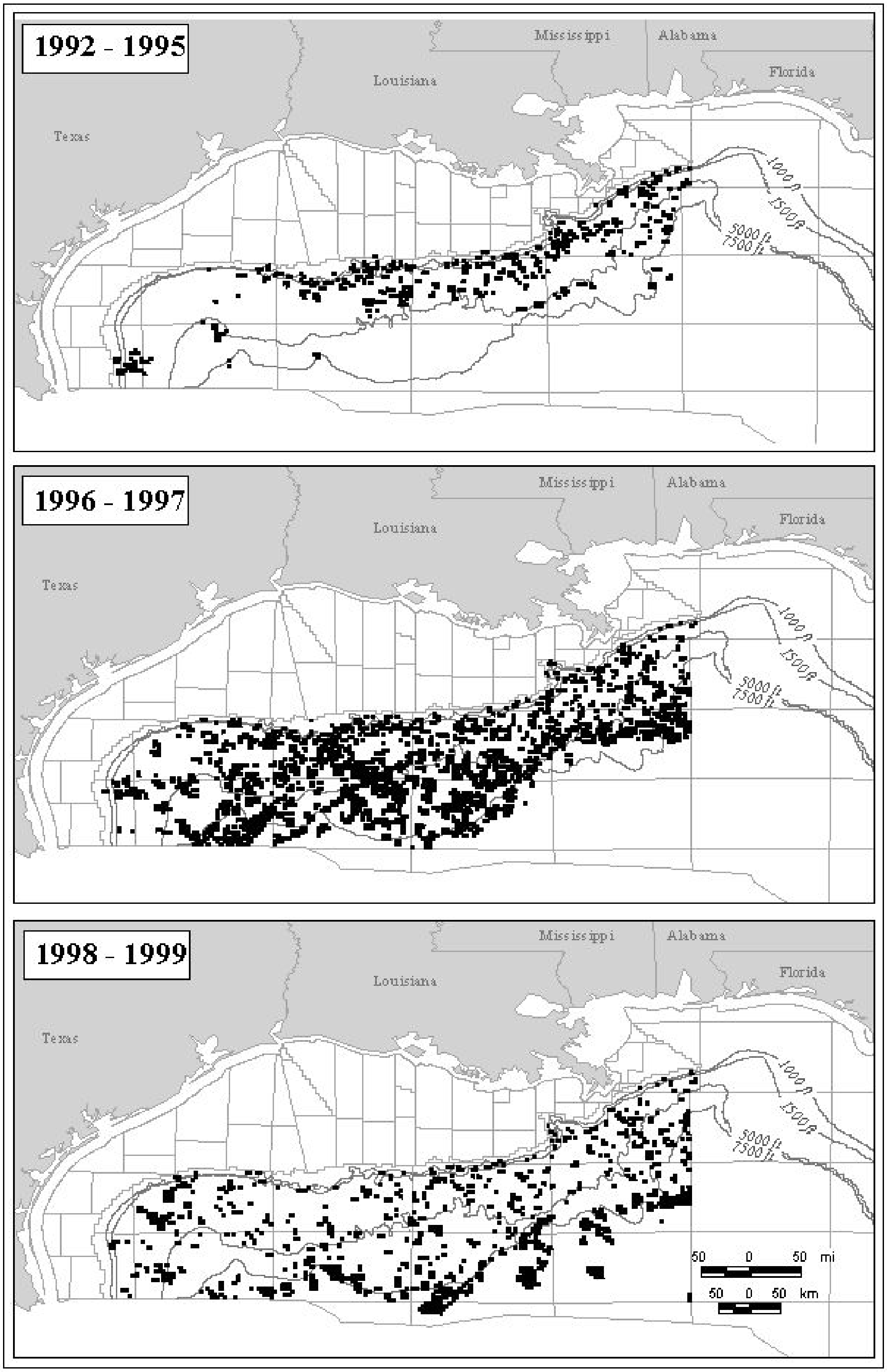

Figure 9. Deepwater leases issued in the Gulf of Mexico.

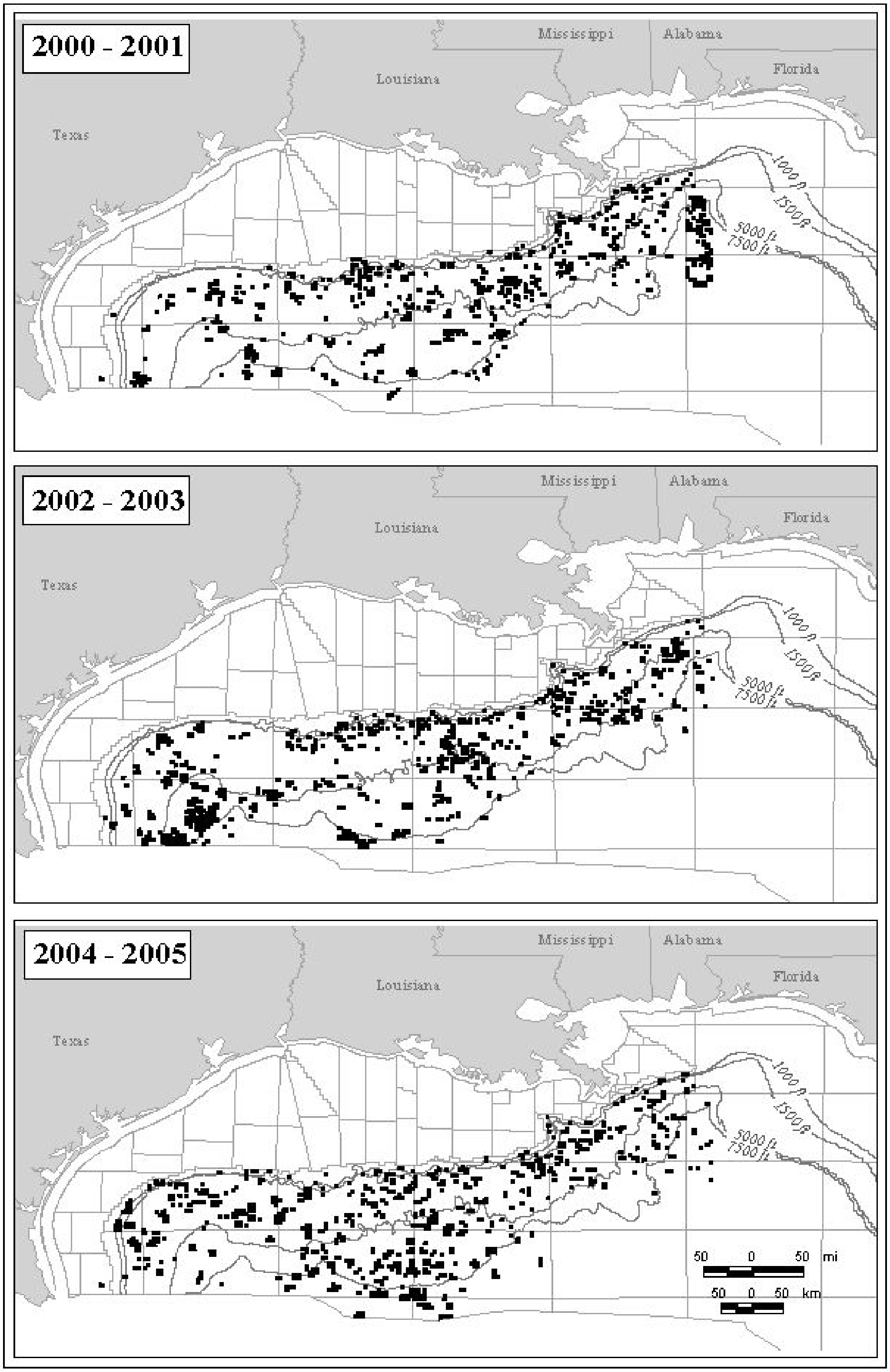

Figure 9. Deepwater leases issued in the Gulf of Mexico (*continued*).

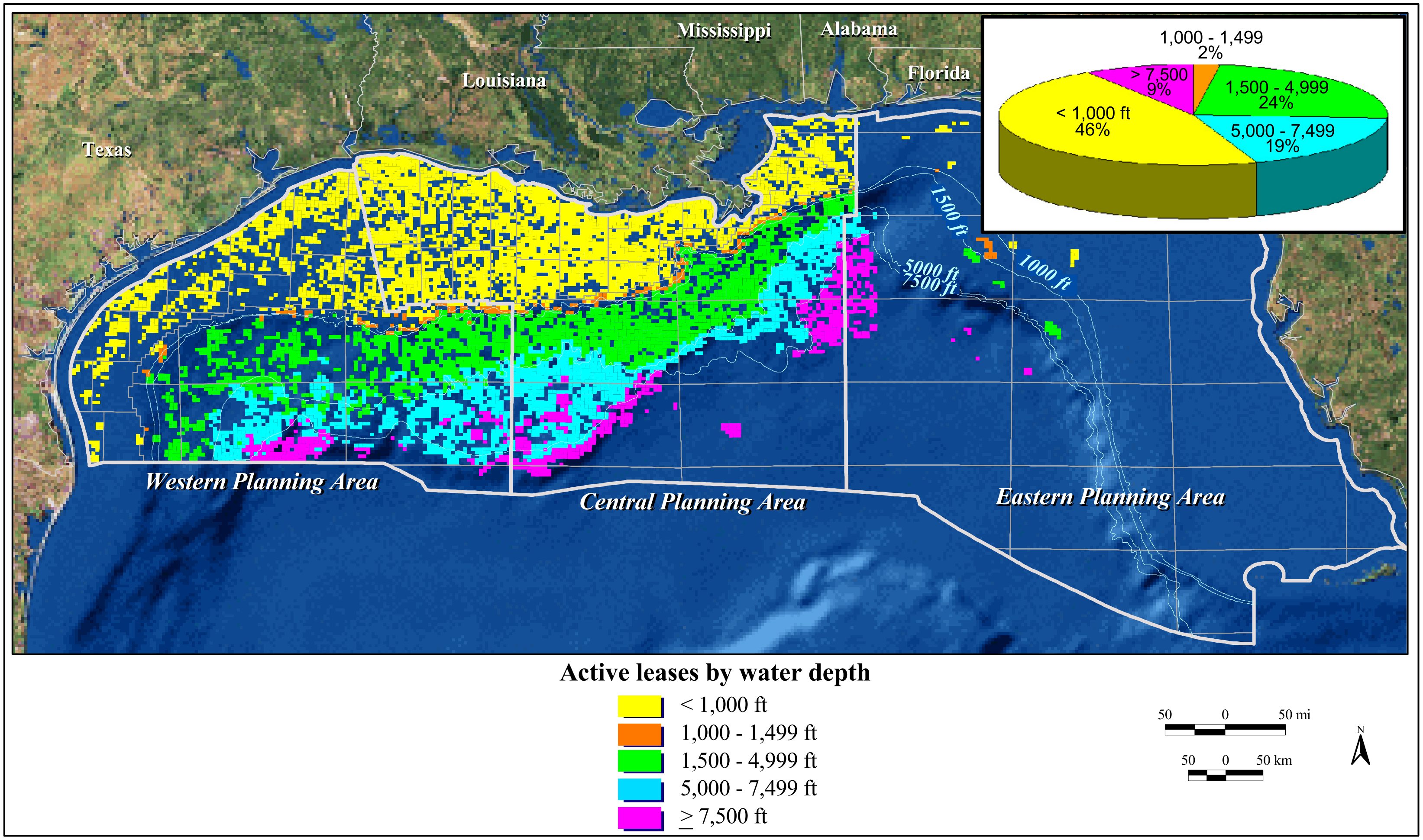

Figure 10. Active leases in the Gulf of Mexico.

OCEAN CURRENT MONITORING

The most energetic currents in the Gulf of Mexico are created by the Loop Current, which moves from the Caribbean Sea into the eastern part of the Gulf and exits between southern Florida and Cuba (figure 11). It affects the ocean from the surface to approximately 3,000-ft (914-m) water depth with varying speeds. Currents as high as 4 knots (kn) have been observed from the surface to 1,000-ft (305-m) water depths. These upper currents then taper off between 1,000- and 3,000-ft (305- and 914-m) depths. The loop current path may vary by hundreds of miles while the flow direction generally remains constant. Once it reaches its most northward position, a portion may break off and form an eddy current, a mass of clockwise-rotating water that traverses westward until it dissipates off the western coast of the Gulf.

Ocean currents disrupt offshore operations and reduce the working life of certain equipment. In an effort to understand currents in the Gulf of Mexico and to provide information for forecasting, hindcasting, and fatigue damage, the MMS created a program to monitor currents from all deepwater rigs and floating platforms. In 2005, the MMS issued Notice to Lessees and Operators (NTL) 2005-G05, "Deepwater Ocean Current Monitoring on Floating Facilities." This program requires operators to submit data in a standardized format to a publicly accessible website. This information is displayed real-time and can be downloaded for forecasting of currents and for historic reference.

Operators are encouraged to use the information from nearby facilities, as well as their own, for daily operations and for determining damage caused by severe currents. In addition, site-specific data must be used in the design of new floating production facilities and drilling rigs, and their ancillary equipment, such as steel catenary risers and mooring systems.

The NTL specifies that Acoustic Doppler Current Profiler (ADCP) systems or similar equipment should be used to measure currents to at least 1,000-m (3,280-ft) water depth and that the information be sent to the National Data Buoy Center for display and storage. Certain considerations are made for location and water depth and for systems that were in place prior to the NTL.

The MMS has used this information in investigations where ocean currents may have contributed to certain incidents. Industry is using the published information to substantiate computer models and to enhance their forecasts. Ocean currents are considered when scheduling operations such as installation and drilling programs to minimize downtime because of weather effects. Other studies such as long-term forecasting and environmental effects are being planned.

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 12 shows the history of discoveries in the deepwater GOM. There was a shift toward deeper water over time, and the number of deepwater discoveries continues at a steady pace. (The Reserves and Production section of this report explains how discovery dates are assigned.)

Figure 13 shows how major and nonmajor oil and gas companies compare in terms of deepwater project discoveries. In the past, major companies were responsible for the majority of discoveries and led the way into the deepest waters. However, the number of discoveries by nonmajor companies has surpassed that by major companies. In addition, nonmajor companies have made numerous recent discoveries in the deepest waters of the frontier.

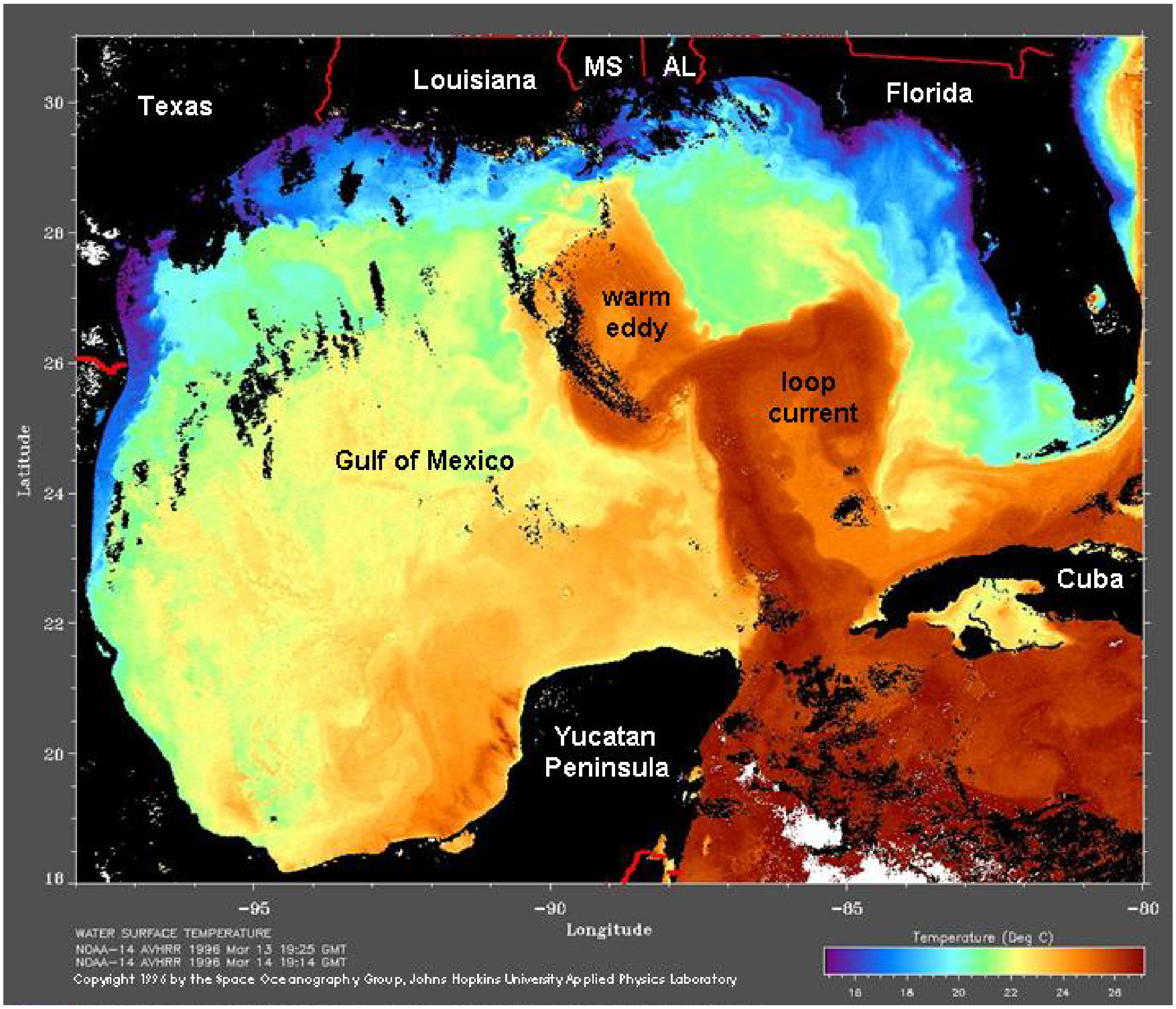

Figure 11. Loop and eddy currents in the Gulf of Mexico (image courtesy of Johns Hopkins University).

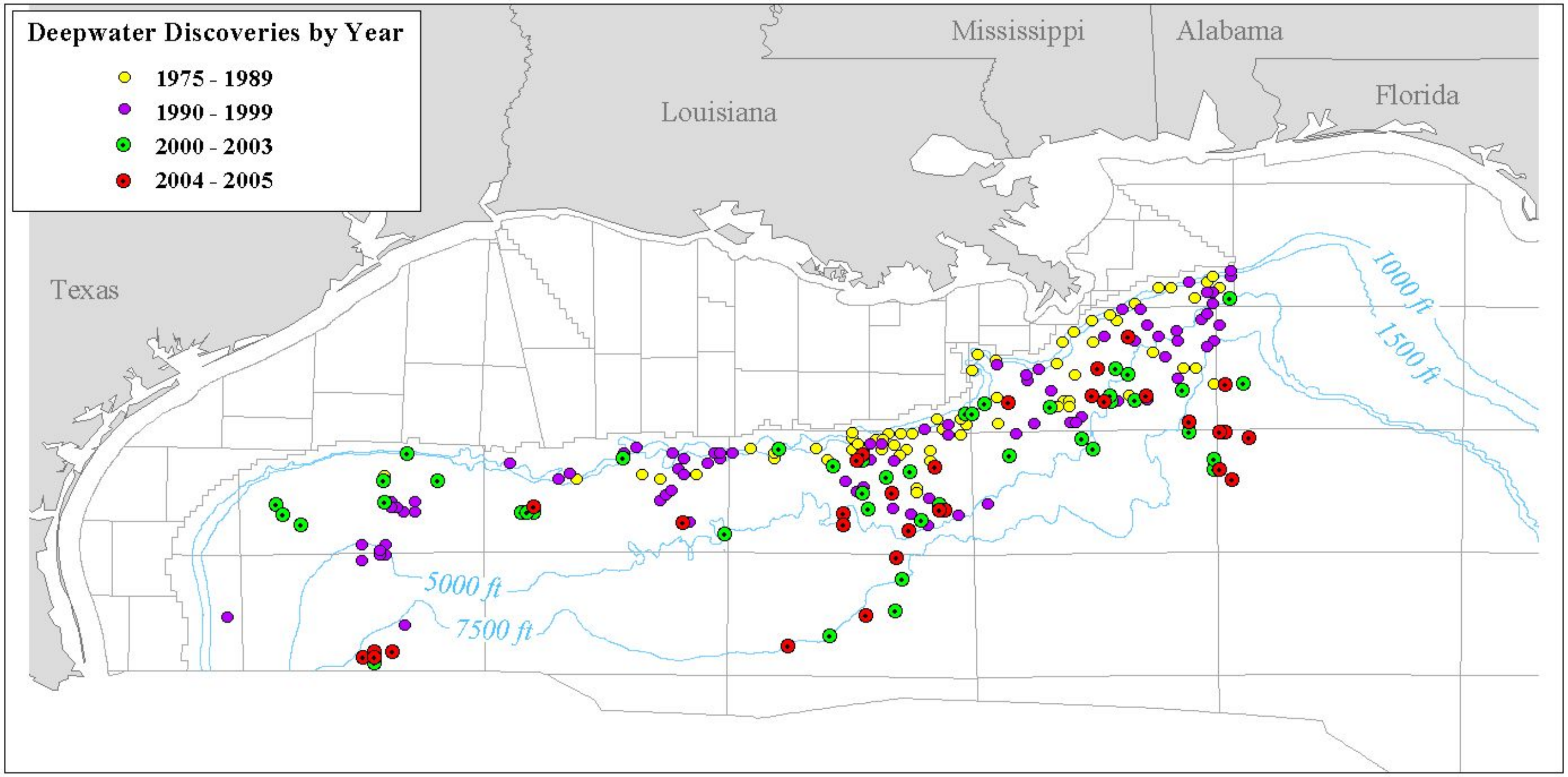

Figure 12. Deepwater discoveries in the Gulf of Mexico.

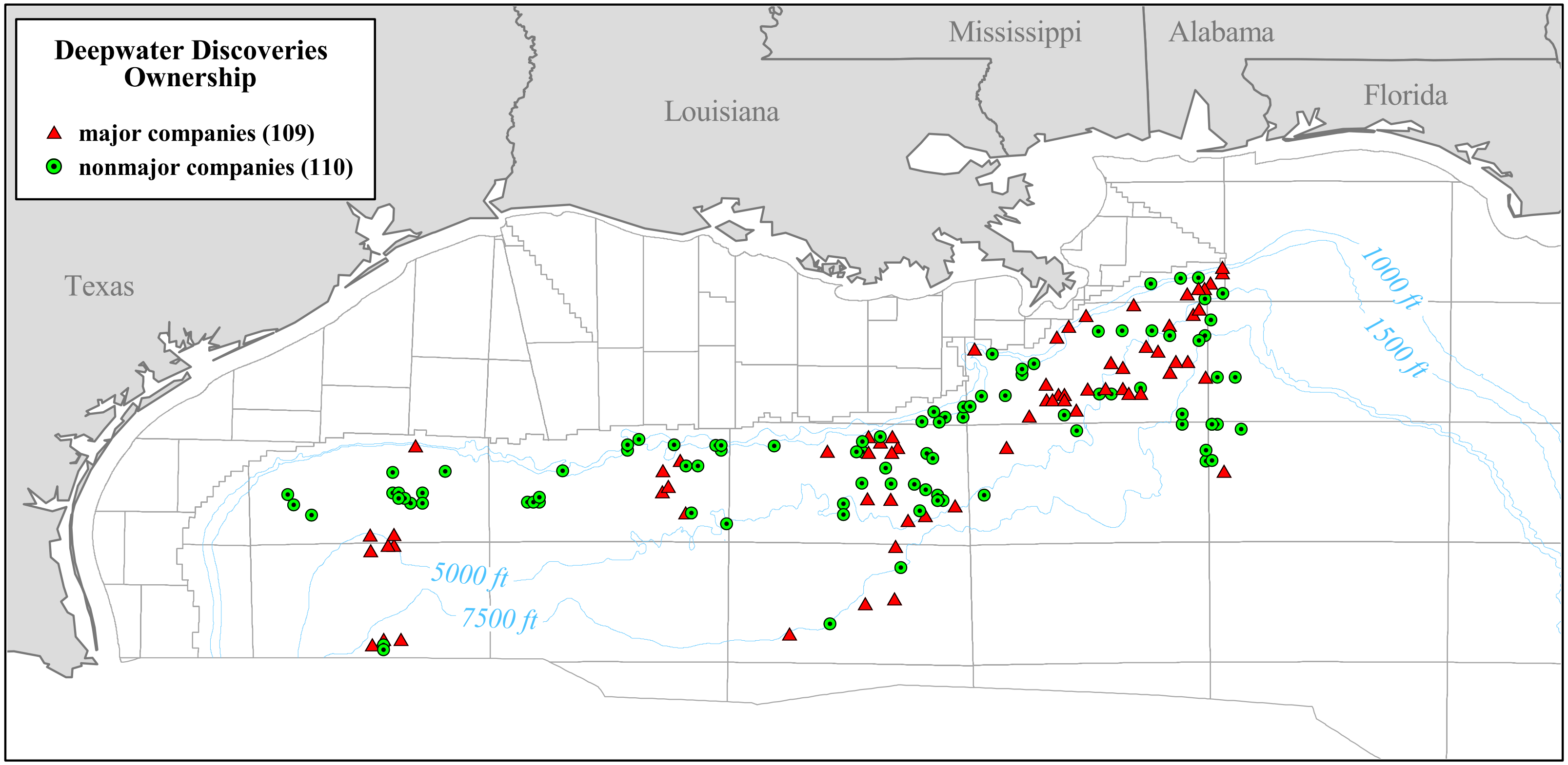

Figure 13. Ownership of deepwater discoveries (includes industry-announced discoveries).

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 14 illustrates the estimated sizes and distributions of 87 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 since 2001 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 15). Pending exploration plans (EP's) and development operations coordination documents (DOCD's) filed with MMS indicate that support from southeastern Louisiana will continue to grow and that additional support will come from southwest Louisiana, Mississippi, and the Texas coast (figure 16). Although expanding along the Gulf Coast, shore-based support for deepwater operations is likely to remain concentrated in southeastern Louisiana.

Figure 17 illustrates existing and potential hubs for deepwater production. For purposes of this report, deepwater hubs are defined as surface structures that host production from one or more subsea projects. These hubs represent the first location where subsea production surfaces and are the connection point to the existing pipeline infrastructure. Note that potential hubs are moving into deeper waters, expanding the infrastructure, and facilitating additional development in the ultra-deepwater frontier.

LNG PROJECTS

Offshore liquefied natural gas (LNG) terminals may bring significant additional gas into the GOM and may vie for pipeline capacity with future deepwater developments. Table 4 shows proposed and/or licensed LNG terminals in the GOM. Port Pelican LNG terminal (slated for Vermilion 140) has been permitted, but the licensee has put the project on hold indefinitely. The application for the Pearl Crossing LNG terminal (West Cameron 220) has been withdrawn.

Table 4
LNG Projects Proposed or Licensed in the Gulf of Mexico

Project Name	Company	Area and Block	Facility Type	Status
Gulf Gateway Energy Bridge	Excelerate Energy	West Cameron 603	Submerged Turret Buoy	commenced operations March 2005
Gulf Landing	Gulf Landing, LLC (subsidiary of Shell US Gas and Power, LLC)	West Cameron 213	Gravity-Based Structures	licensed June 2005
Compass Port	Compass Port, LLC (subsidiary of ConocoPhillips Company)	Mobile 910	Gravity-Based Structures	preliminary final EIS distributed
Main Pass Energy Hub	Freeport-McMoRan Energy, LLC	Main Pass 299	New and Existing Structures	DEIS and Public Hearings complete
Beacon Port	Beacon Port, LLC (subsidiary of ConocoPhillips Company)	West Cameron 167	Gravity-Based Structures	preliminary draft EIS complete
Bienville Offshore Energy Terminal	TORP Terminal LP	Main Pass 258	HiLoads with SALM Buoys	preparation of a DEIS underway

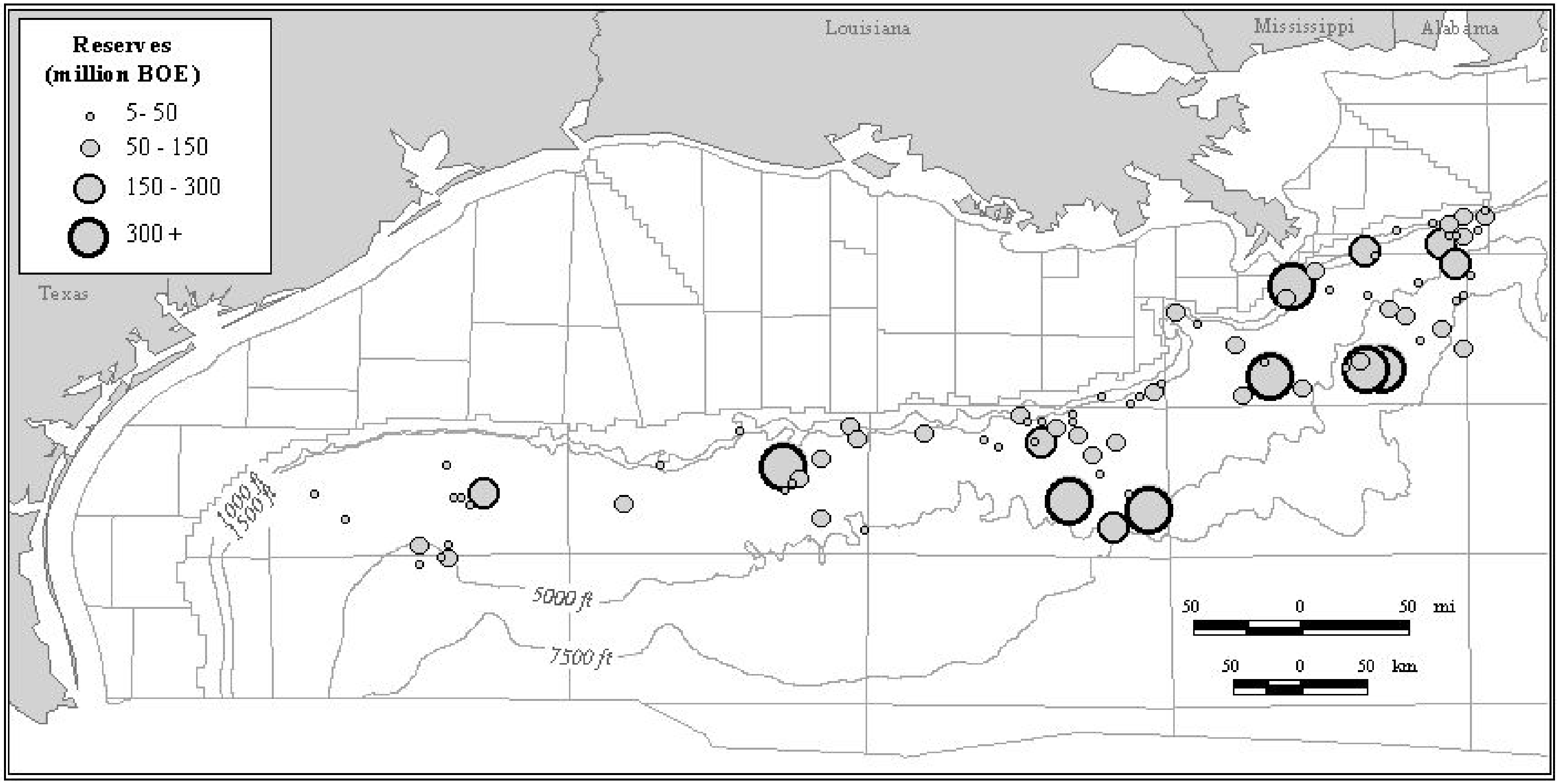

Figure 14. Estimated volume of 87 proved deepwater fields.

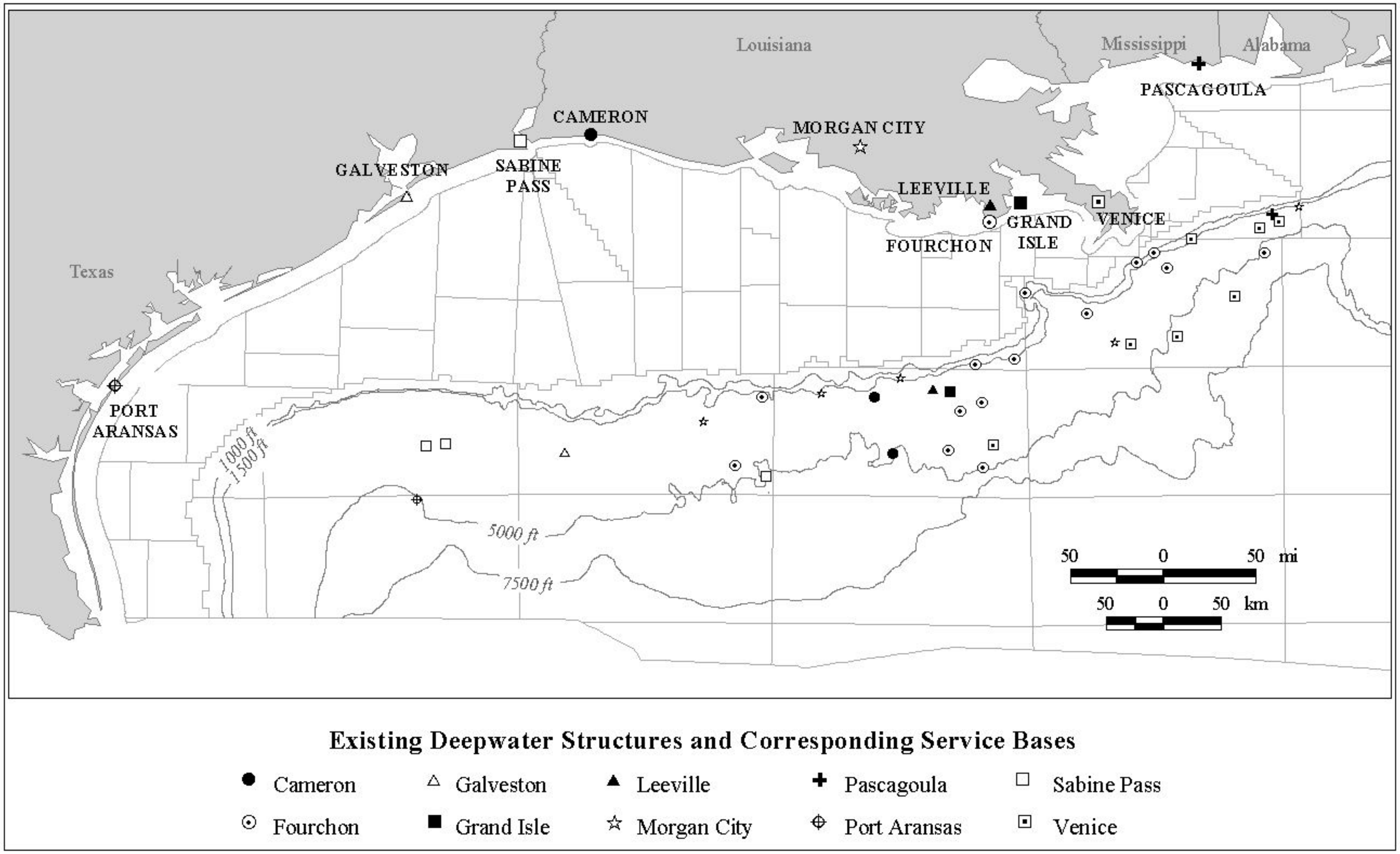

Figure 15. Onshore service bases for existing deepwater structures.

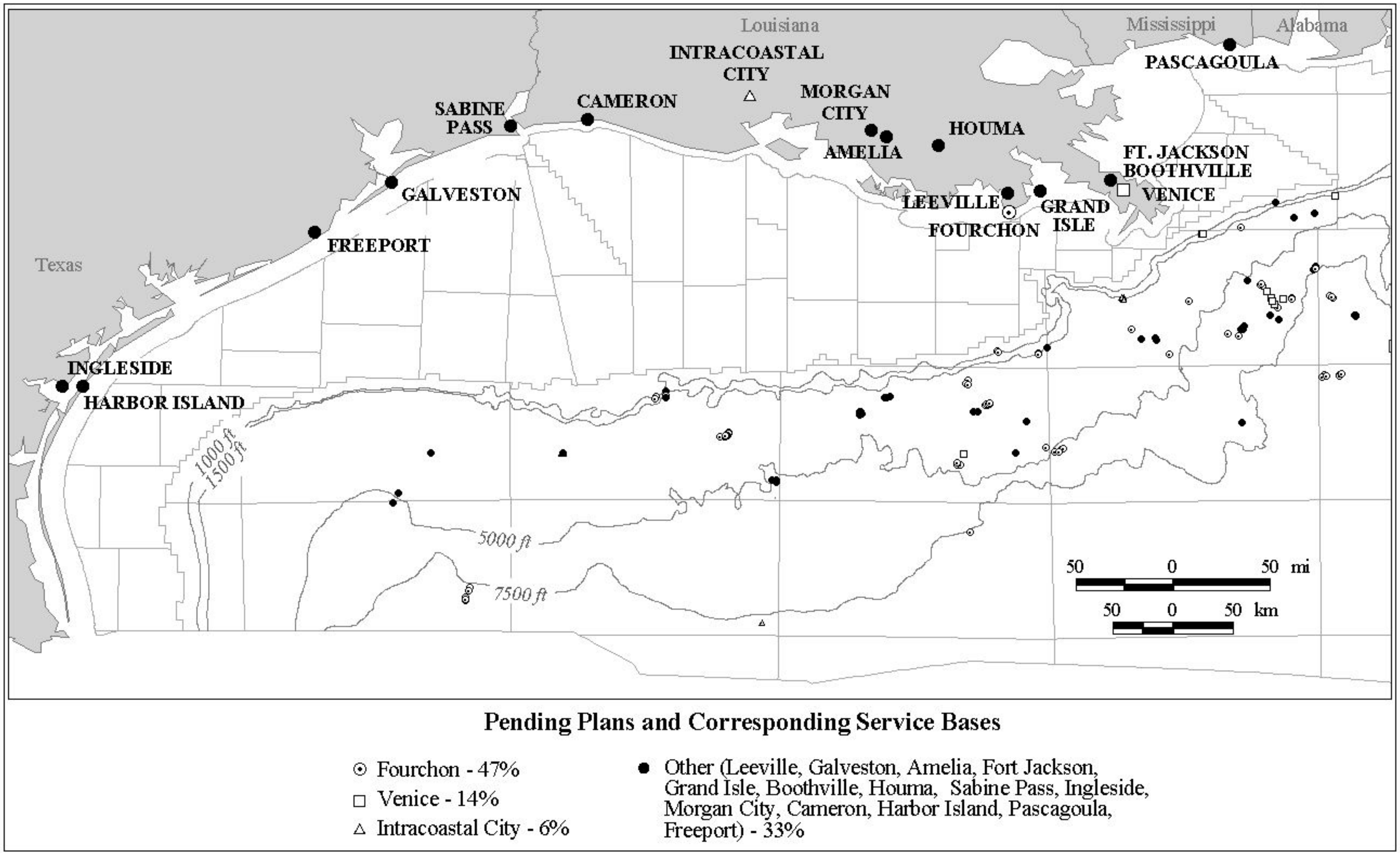

Figure 16. Onshore service bases for pending deepwater plans.

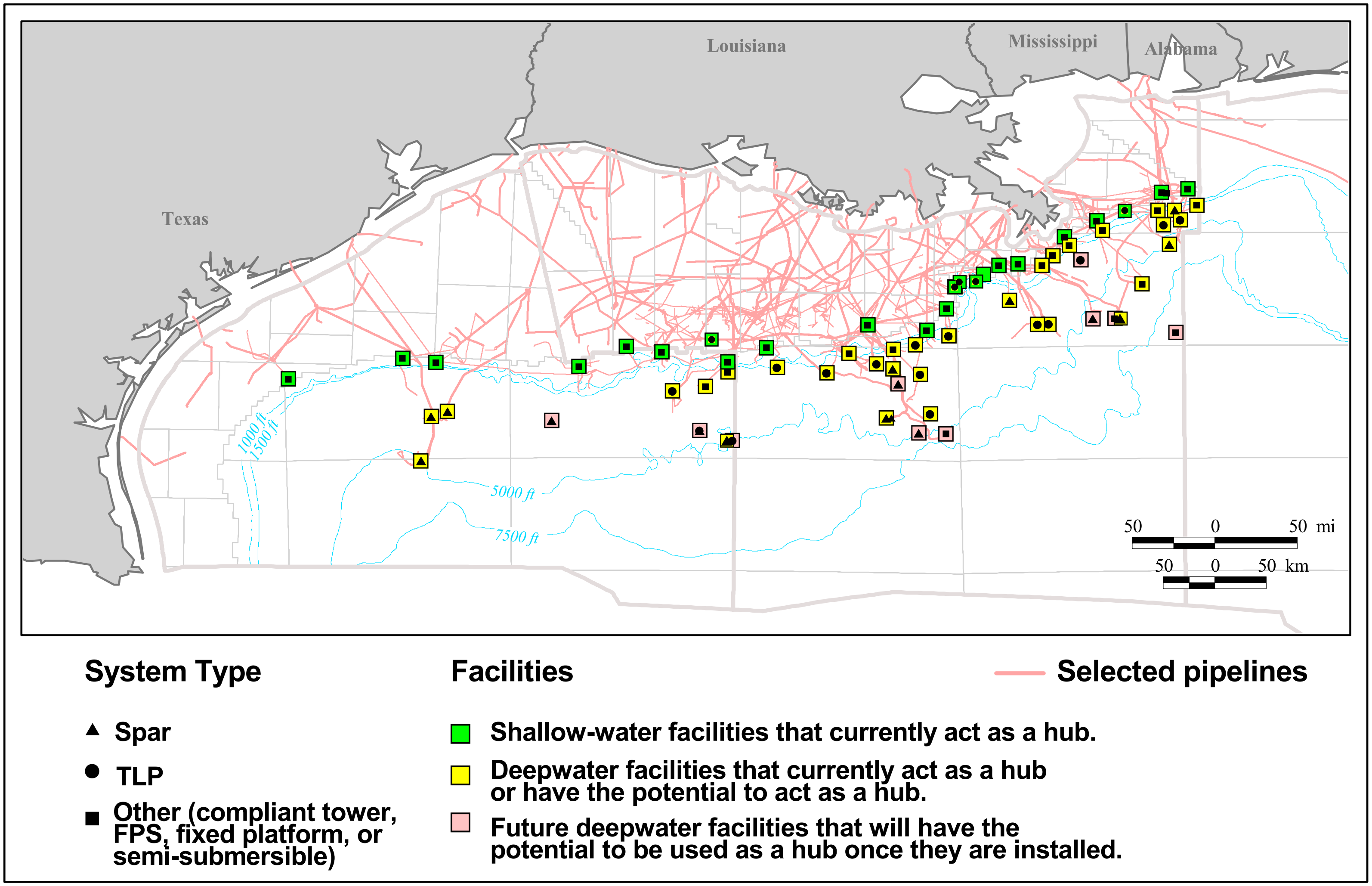

Figure 17. Current, potential, and future hub facilities in the Gulf of Mexico.

LEASING AND ENVIRONMENT

LEASING ACTIVITY

Until the mid-1990's, leasing activities in the Gulf of Mexico were focused on shallow-water blocks located on the continental shelf (water depths of approximately 650 ft [200 m] or less). With the passage of the DWRRA in 1995, royalty relief incentives were established for new leases on the basis of water-depth intervals (defined in meters). The water-depth categories depicted in figure 18 reflect the divisions set forth in the DWRRA. This figure shows the magnitude of the DWRRA impact, with tremendous deepwater leasing activity from 1996 through 1998 in water depths greater than 800 m (2,625 ft), where the greatest royalty relief was available. During this same period, interest in shallow-water blocks faded. The Gulf experienced a lull in leasing activities at all water depths in 1999. In 2000 and 2001, there was a rekindling of interest in blocks in the 200-m (650-ft) or less range. Some of this interest in the shelf blocks is likely attributable to the MMS's royalty suspension program for deep-gas development in water depths less than 200 m (650 ft).

With the passage of the Energy Policy Act of 2005, lease terms for deepwater royalty relief were changed. Paragraph (b) of Subtitle E, Section 345 of the Act detailed the possible royalty suspension volumes on the basis of water depths. The Act eliminated the existing 1,600-m or deeper water-depth category for royalty relief and established two new royalty suspension categories: 1,600 to 2,000-m and greater than 2,000-m water depth. Sale 196 (Western GOM Planning Area, August 17, 2005) was the first lease offering to implement these "new" royalty relief provisions. Table 5 shows the potential volume of hydrocarbons subject to suspension, according to the corresponding water-depth range.

Table 5
Deepwater Royalty Relief by Water-Depth Range

Water-Depth Range (in meters)	Royalty Suspension Volume Up To: (in BOE)
400 to 800	5,000,000
800 to 1,600	9,000,000
1,600 to 2,000	12,000,000
>2,000	16,000,000

Paragraph (c) of Subtitle E, Section 345 of the Act allows the Secretary of the Interior to place limitations on the royalty relief granted under the provision of the Act on the basis of market price.

From 2000 to 2003, there was a relatively steady increase in the number of leases issued in the greater than 800-m (2,625-ft) range. Of interest is the small peak that occurred in this range in 2001, the result of a lease offering (Sale 181) in a deepwater portion of the Eastern GOM. This area had not been offered for lease in 13 years. Leasing, operational activities, and discoveries in the easternmost portion of the Central GOM Planning area adjacent to the Sale 181 area spurred interest in the area. There were 95 leases issued in water depths 1,600-m (5,250-ft) or greater in this sale. The small peak resulted when these were added to the annual Central and Western GOM sales. Subsequent lease sales have occurred in the deepwater EGOM area, but the number of leases issued has been smaller than that for Sale 181.

From 2001 to 2004, the number of leases issued in water depths of 200-m (650-ft) or less remained fairly constant; however, this water-depth interval experienced a decrease in the number of leases issued in

2005. For the greater than 800-m (2,625-ft) range, the number of leases issued from 2002 to 2005 has remained relatively constant.

The data shown in figure 19 are a subset of figure 18 and include the new royalty-relief water-depth categories implemented by the Energy Policy Act of 2005. There has been a 40-percent increase in lease activity in the greater than 2,000-m (6,560-ft) water-depth category since 2003.

BIDDING AND LEASING TRENDS

Figure 20 was derived from the data in figure 18 but displays the deepwater categories used elsewhere in this report (shallow-water data are excluded from this figure). These deepwater data show the rapid increase in leasing activity that began in 1995 and continued through 1998. Leasing increased sequentially in deeper water depths with time. Lease activity in the 1,500 to 4,999-ft (457 to 1,524-m) range began its ascent in 1995. The following year there was a rise in leasing activity in the 5,000 to 7,500-ft (1,524 to 2,286-m) range in 1996. This range actually outpaced the 1,500 to 4,999-ft (457 to 1,524-m) interval in 1997. Note that the peak in leasing for the greater than 7,500 ft (>2,286 m) range occurred a year later in 1998. The 1,500 to 4,999-ft (457 to 1,524-m) and 5,000 to 7,499-ft (1,524 to 2,286-m) ranges decreased in 1998. Leasing activity plummeted in 1999, nearing 1994 levels. From 1999 to 2003, there was a steady increase in leases awarded in the 1,500 to 4,999-ft (457 to 1,524-m) range. The number of awarded leases has remained relatively constant since. The 5,000 to 7,499-ft (1,524 to 2,286-m) interval saw a similar rise; however, this range has experienced a decline from 2003 to 2005. With the exception of 2001, the greater than 7,500-ft (2,286-m) range remained level from 1999 through 2003. This was followed by a three-fold increase in leasing from 2003 to 2005.

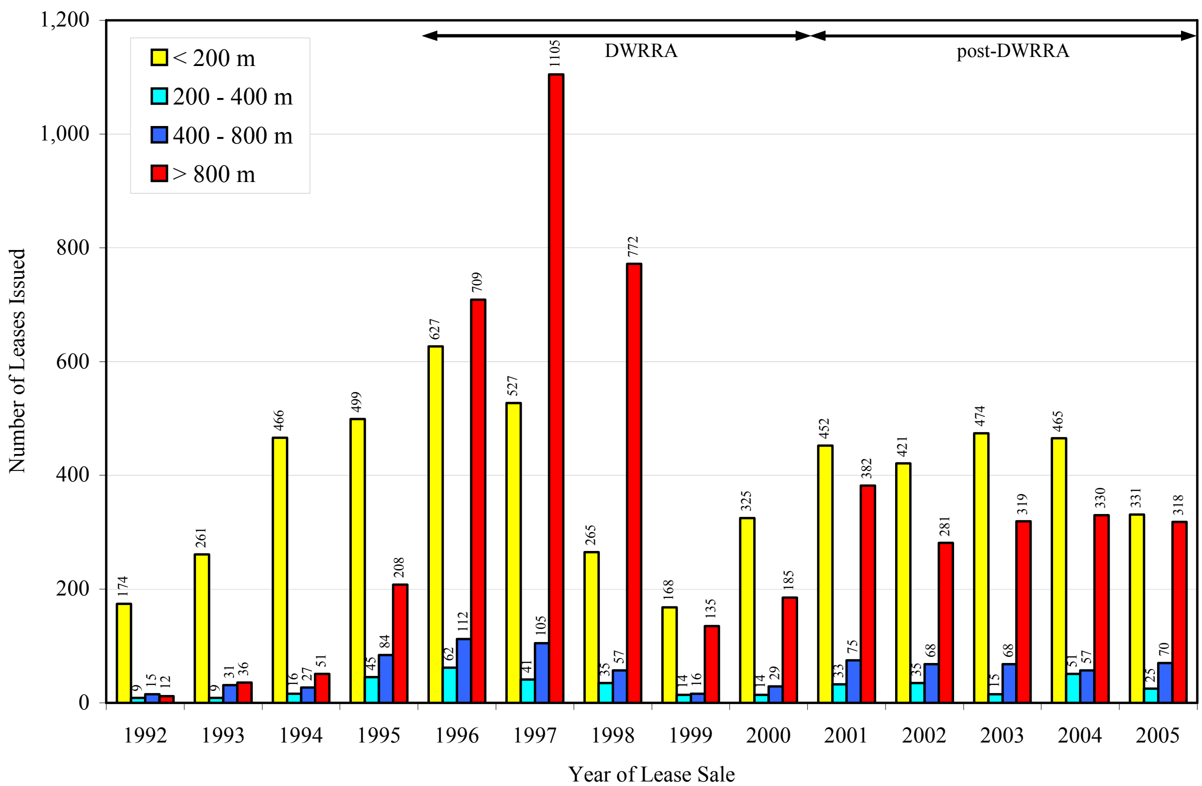

Figure 18. Number of leases issued each year, subdivided by DWRRA water-depth categories.

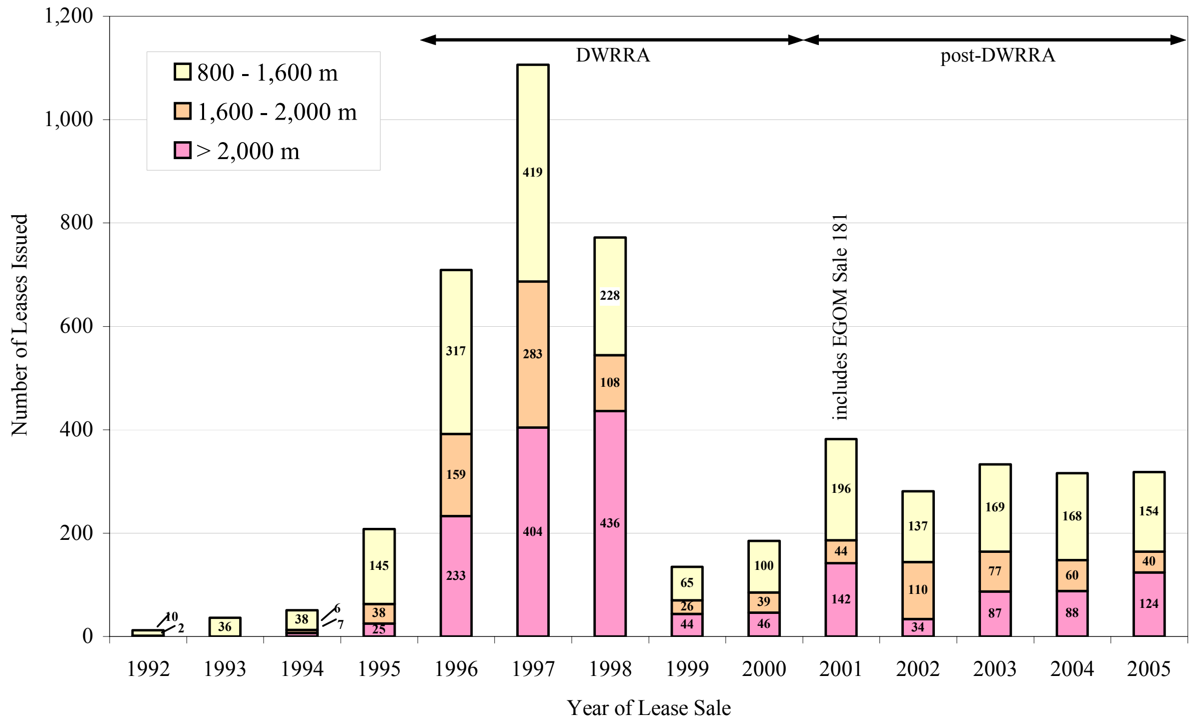

Figure 19. Number of leases issued each year in depths greater than 800 m, subdivided by water-depth categories specified in the Energy Policy Act of 2005.

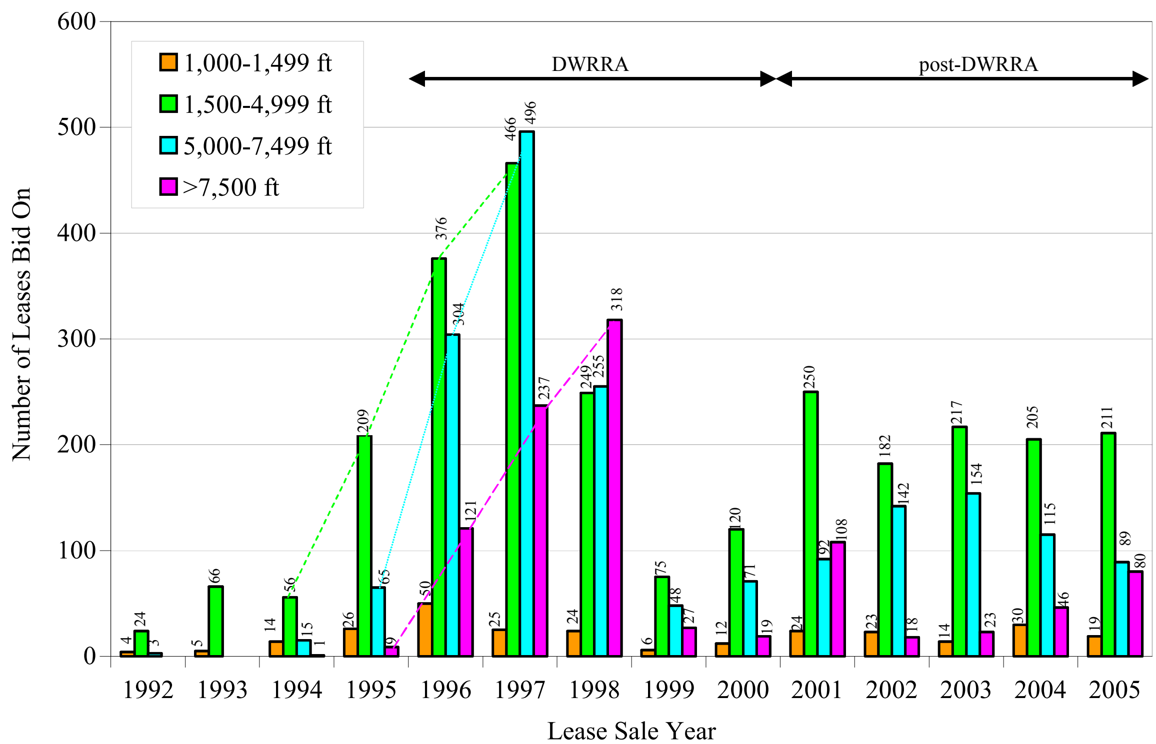

Figure 20. Number of leases bid on for each deepwater interval.

LEASE OWNERSHIP

A handful of major oil and gas companies blazed the trail into deepwater in the 1980's and early 1990's. In this report, we define major companies to include BP, ChevronTexaco, ExxonMobil, and Shell. 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 21 illustrates the relative leaseholding positions of majors versus nonmajors (as of December 31, 2005). Nonmajors began acquiring significant leaseholdings in the mid-1990's, a trend that continued through 2005.

Note also that, according to public records, Chevron and Unocal merged in August 2005. To date, papers to that effect have not been filed with MMS; therefore, the companies are considered herein as separate entities.

FUTURE DEEPWATER LEASE ACTIVITY

There are two remaining lease sales scheduled, in addition to Sale 198 (CGOM), which was held March 15, 2006, under the five-year program for 2002 to 2007. They include Sale 200 (WGOM) in 2006 and Sale 201 (CGOM) in 2007. The MMS is developing the five-year program for 2007 to 2012. The new program continues to schedule annual area-wide lease sales for the CGOM and WGOM Planning Areas for a total of 11 lease offerings. The new program for 2007 to 2012 reconfigures some planning areas to follow the new administrative lines. As such, some of the areas formerly included in the Eastern and Western Planning Areas are now scheduled to become part of the CGOM Planning Area.

There were a large number of deepwater leases issued from 1996 to 1998. Many of these leases are coming to the end of their primary lease term (most had 10-year lease terms). Challenges in the deepwater environment have made it difficult for the industry to test many of these leases. In recognition of this problem, the MMS recently published a Notice to Lessees and Operators (NTL No. 2006-G02) entitled, "Suspension of Operations Based on Rig Delays, Lack of Rig Availability and Procurement of Long Lead Equipment." The purpose of the NTL is to "…to provide guidance to our existing authority for approving requests for lease or unit Suspension of Operations (SOO) based on rig delays and to implement a temporary policy for granting SOO's based on a lack of rig availability and for unanticipated time frames needed to secure long lead equipment such as high-pressure/temperature tubulars and wellheads." Operators must meet established criteria listed within the NTL to request a suspension (Appendix C).

Lessees/operators who have conducted certain activities on a lease and have met the criteria established for a Suspension of Production (SOP) may request a suspension to maintain their lease until activities detailed in their SOP are accomplished. The key to the SOO and SOP provisions is to allow operators who have diligently attempted to explore and develop their lease(s) sufficient time to do so when circumstances beyond their control require more time than is allowed in their lease term. For example, certain high-pressure/high-temperature conditions within a well require equipment that requires a long lead time.

The overall effect of the NTL is the potential retention of leased blocks beyond their projected expiration date. Fewer deepwater blocks will be returned to the inventory for future lease sale offering or available for "farm outs" to other companies who are hoping to expand their interest in deepwater.

Figure 22 shows leases that may expire in the coming years, assuming each lease expires at the end of its primary lease term (without a lease-term extension). Note that lease terms vary according to water depth. Primary lease terms are five years for blocks in less than 400 m (1,312 ft), eight years for blocks in 400 to 799 m (1,312 to 2,622 ft), and ten years for blocks in 800 m (2,625 ft) or greater. Therefore, in the absence of primary lease-term extensions, all active shallow-water leases will expire before 2012 (explaining the absence of expiring shallow-water leases in certain frames of figure 22).

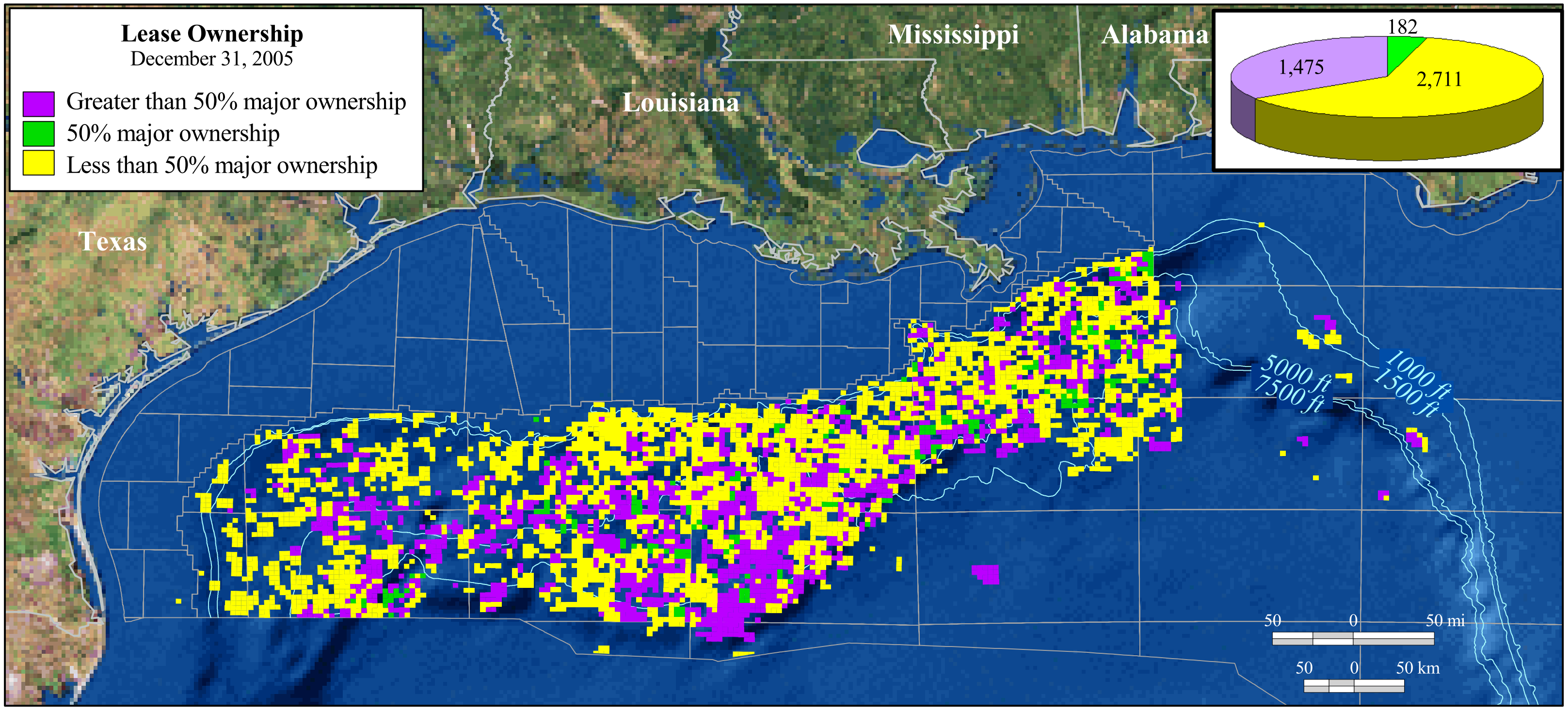

Figure 21. Ownership of deepwater leases.

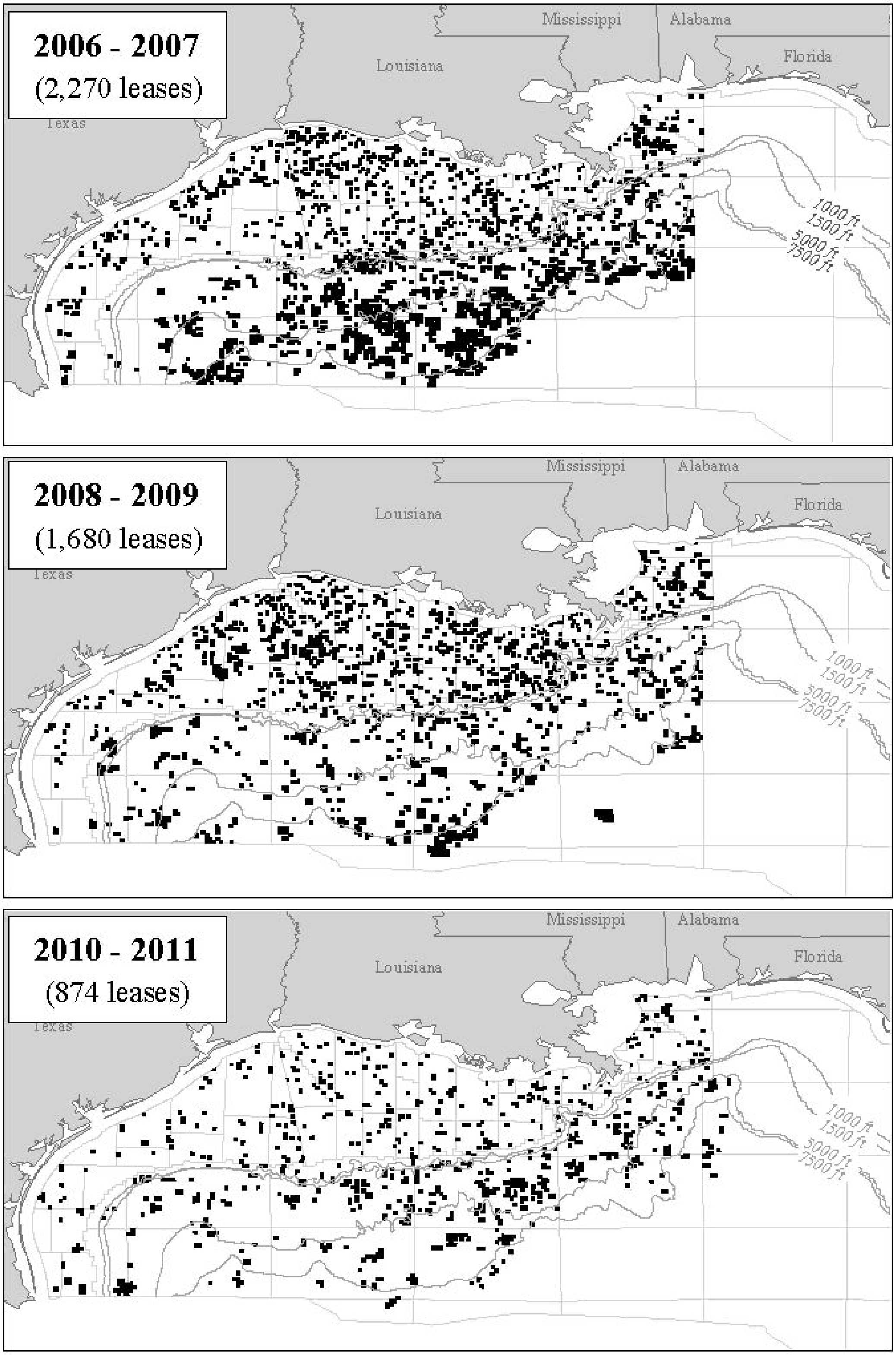

Figure 22. Anticipated lease expirations in the Gulf of Mexico.

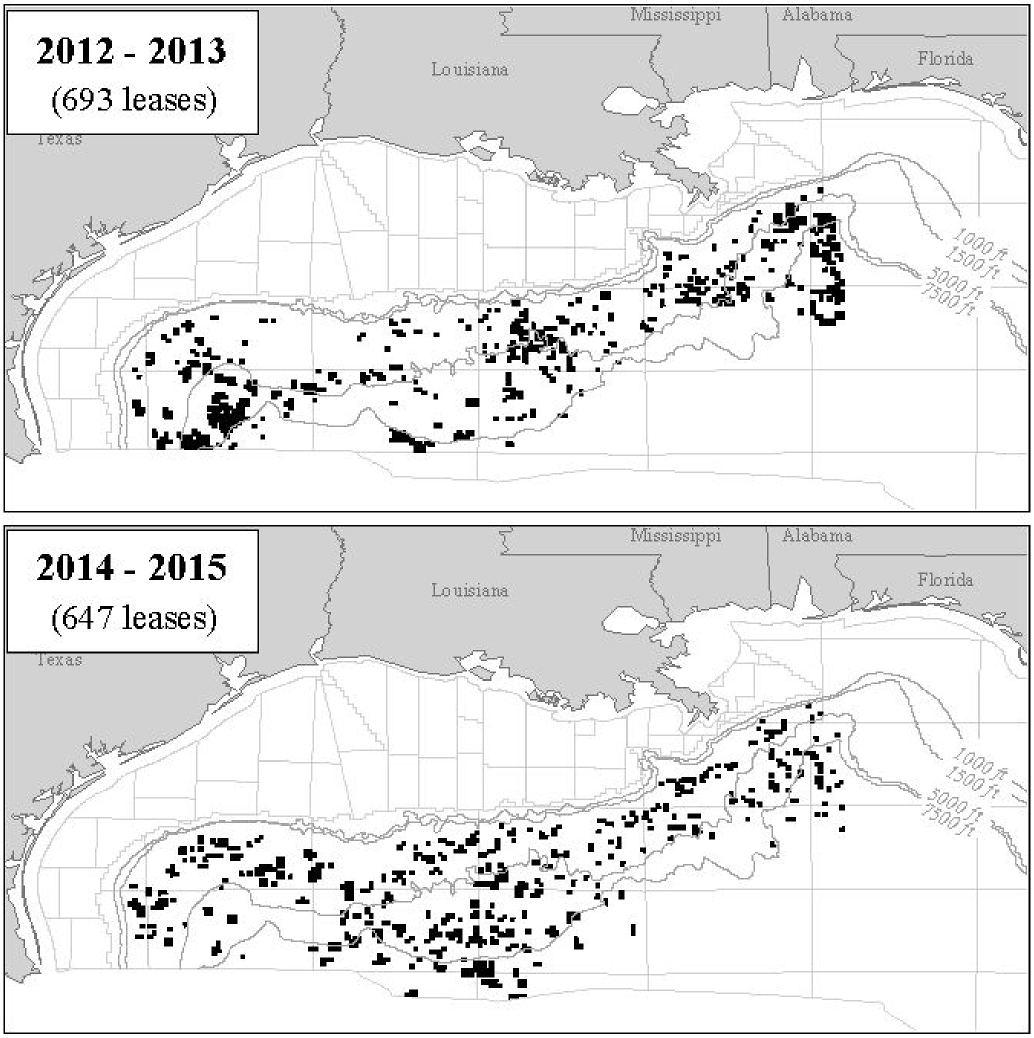

Figure 22. Anticipated lease expirations in the Gulf of Mexico (*continued*).

ENVIRONMENTAL ACTIVITY

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

A biologically based grid system was developed as part of a comprehensive strategy to address deepwater issues. The grid system divided the Gulf into 17 areas or "grids" of biological similarity (figure 23). 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

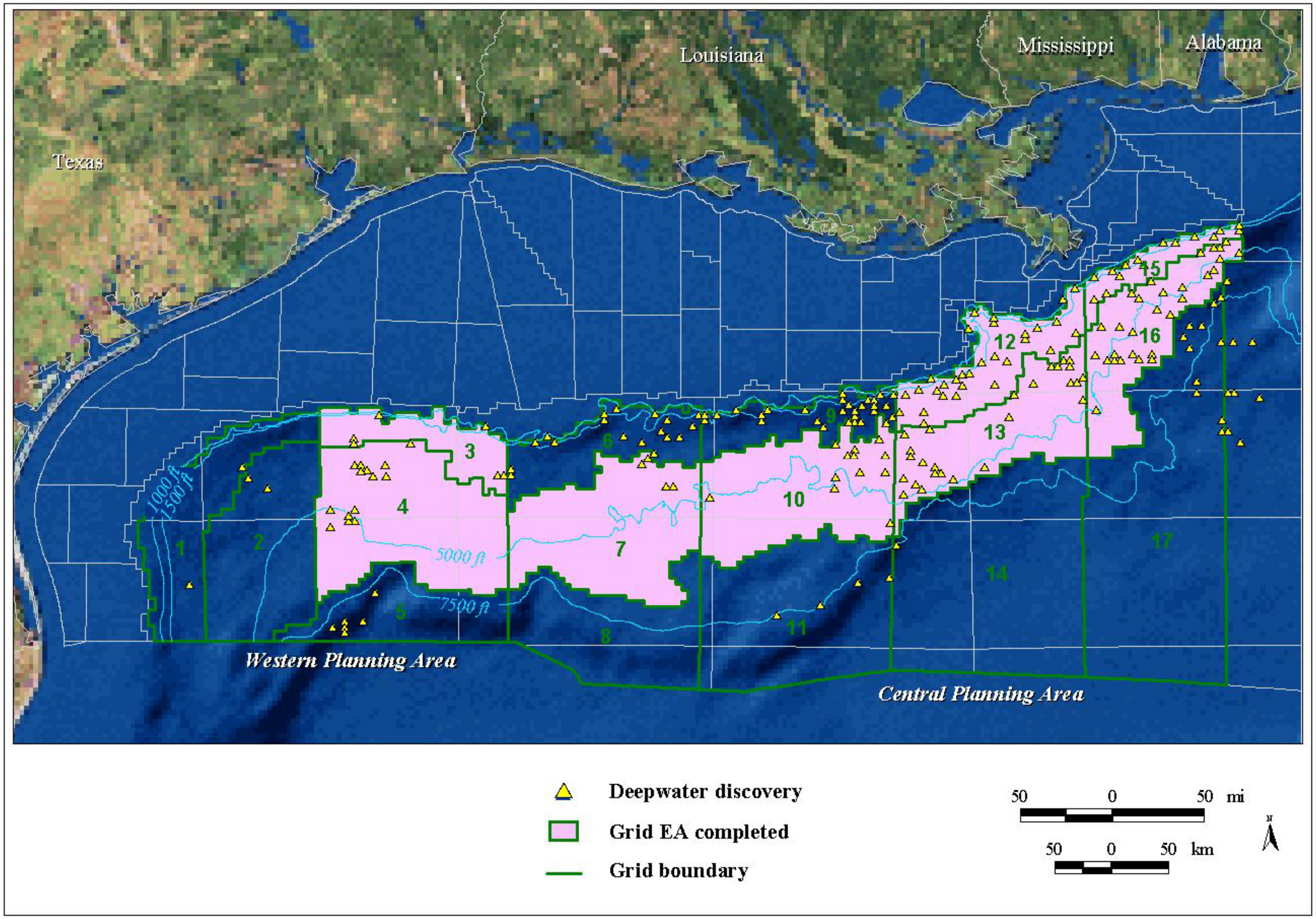

Figure 23. Grid EA status.

example, a good candidate for a grid PEA would be a proposed development of a new surface structure that might serve as a "hub" for future development within the grid.

Once a grid PEA has been completed, it will serve as a reference document to implement the "tiering" concept detailed in the implementing regulations of the National Environmental Policy Act (NEPA). 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 6 below shows the status of the grid PEA’s.

Table 6
Completed Grid PEA’s Within the Central and Western Planning Areas of the Gulf of Mexico

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

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

To continue implementation of its deepwater strategy, MMS issued Notice to Lessees and Operators (NTL) No. 2003-G03, “Remotely Operated Vehicle Surveys in Deepwater,” with an effective date of January 23, 2003. The NTL requirements apply to activities in water depths greater than 400 m (1,312 ft) in the Central and Western Planning Areas of the GOM. 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 proposes 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 24 shows the location of existing ROV surveys.

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

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

The new generation work-class ROV (WROV) is rated to 10,000 ft (3,049 m) and adaptable for depths to 19,500 ft (5,945 m), which will allow it to work in deep and ultra-deepwater areas of the GOM. Canyon Offshore recently announced a record-setting work dive to 9,024 ft (2,751 m) in Lloyd Ridge Block 399 with its Quest electric WROV. The dive, conducted in water depths of 9,000 ft (2,744 m) and deeper, lasted 30 hours. The WROV was deployed to perform pre-lay route surveys for 8-inch and 10-inch flowlines and to conduct array integrity checks.

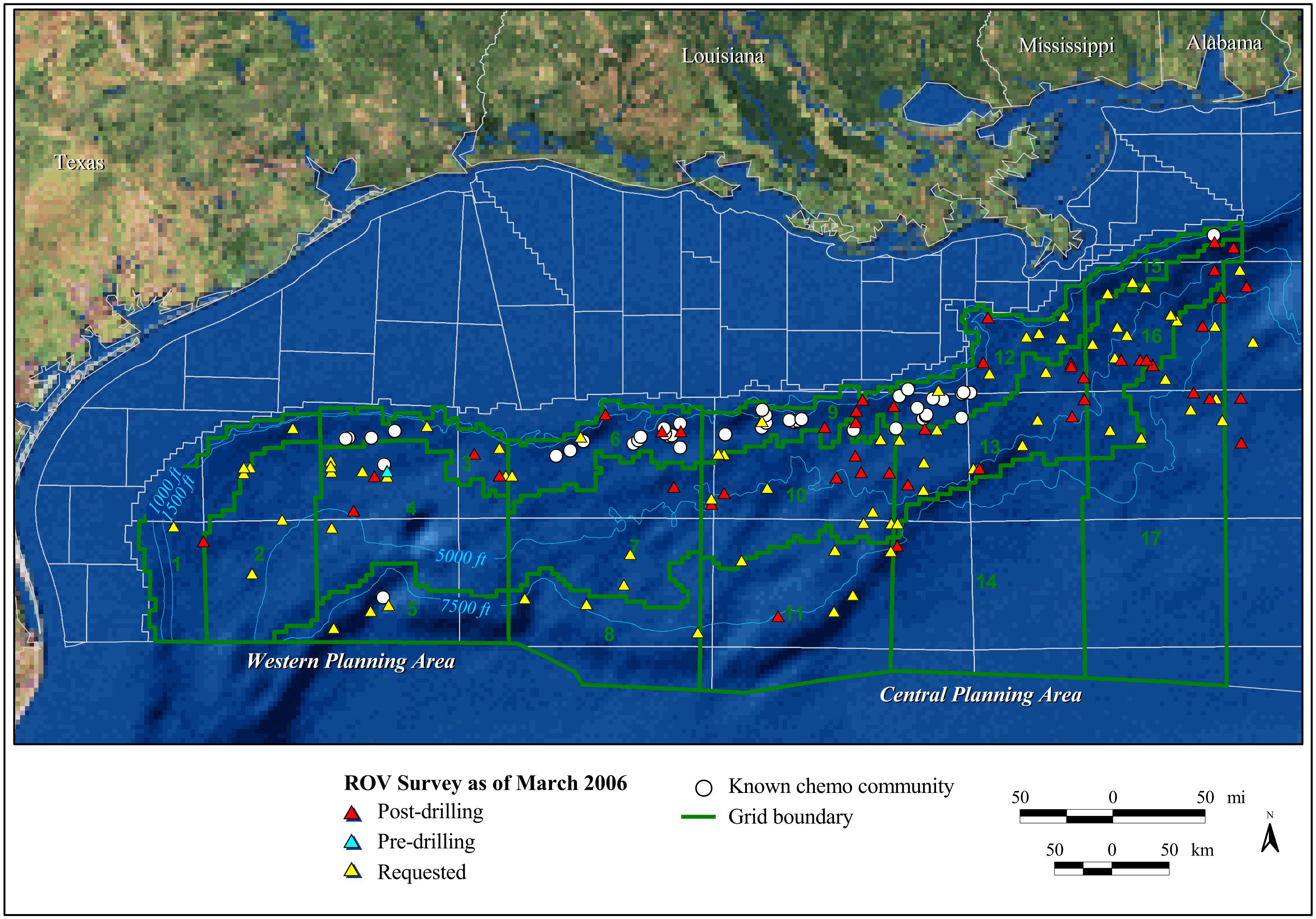

Figure 24. ROV surveys including known chemosynthetic communities.

DRILLING AND DEVELOPMENT

Deepwater drilling occurs from mobile offshore drilling units (MODU's), such as semisubmersible units or drillships (figures 25 and 26), and from rigs located on combination production/drilling platforms. Numerous deepwater prospects are waiting to be drilled, and many may remain undrilled as the primary lease terms expire because of the limited number of rigs available for deepwater drilling in the GOM. In addition, the increased depths to which some operators are increasingly drilling cause rigs to be under contract for longer periods. Industry responded to the limited rig availability by ordering 11 semisubmersibles and two drillships in 2005 (*Gulf of Mexico Newsletter*, January 2, 2006). Chevron has entered a drilling contract with Transocean Inc. that will initiate the construction of a new state-of-the-art drillship that will be dedicated exclusively to Chevron for five years. The new drillship, to be named *Discoverer Clear Leader*, is expected to be completed and in service by January 2009. The *Discoverer Clear Leader* will be a dynamically positioned, double-hull drillship that will feature dual-activity technology that utilizes two drilling systems in a single derrick. The drillship will be designed to drill wells up to 40,000 ft (12,195 m) in depth and in water depths up to 12,000 ft (3,658 m).

Figure 27 depicts deepwater rigs operating in the GOM from 1992 through 2005.[1] There was a steady increase in the average number of rigs operating from 1992 to a peak in 2001. The average number of rigs operating in the GOM decreased from 2002 through 2004 but increased in 2005.

Figure 28 shows the number of deepwater MODU's by water-depth categories in the GOM and worldwide. Approximately 32 percent of the world's fleet of deepwater drilling rigs is committed to GOM service. The pie chart within figure 28 shows the distribution of deepwater rigs by major operating area. Most, if not all, of the deepwater-capable drilling rigs are under long-term contractual arrangements. The reader is cautioned not to draw conclusions from the rig count differences between figures 27 and 28. As mentioned above, figure 27 includes platform rigs in addition to MODU's; figure 28 addresses MODU's only. Further, not all MODU's in figure 28 are operating at any given time, and upgrades to MODU's that increase their water-depth capability will alter the rig counts shown; consequently, year-to-year comparisons may not be valid.

DRILLING ACTIVITY

The number of deepwater wells drilled generally increased from 1992 through 2001; however, the activity has declined in three of the last four years. Only original boreholes and sidetracks are included in the well counts used in this report. Wells defined as "by-passes" are specifically excluded. A "by-pass" is a section of well that does not seek a new objective; it is intended to drill around a section of the wellbore made unusable by stuck pipe or equipment left in the wellbore. Figure 29 shows that most of the drilling has occurred in the 1,500- to 4,999-ft (457- to 1,524-m) water-depth range. In the last five years, twelve wells have been drilled in water depths exceeding 9,000 ft (2,744 m), and in December 2003, the first well in water depths over 10,000 ft (3,050 m) was drilled.

During three of the last four years, industry has experienced significant disruptions caused by major hurricane activity in the Gulf of Mexico. Within a six-month period in 2005, eight hurricanes disrupted offshore OCS activities. Figures 30 and 31 attempt to capture the possible effects on drilling caused by storm activity. Figure 30 depicts all deepwater wells drilled during the months of January through June, while figure 31 shows all deepwater wells drilled during July through December for 1992 through 2005. The data show a much steeper decline in drilling since 2001 during the last six months of the year. This is caused in part by the hurricane season, which runs from June 1st through November 30th. The last two

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

Figure 26. The *Discoverer Enterprise*, a double-hulled, dynamically positioned drillship (photo courtesy of Transocean).

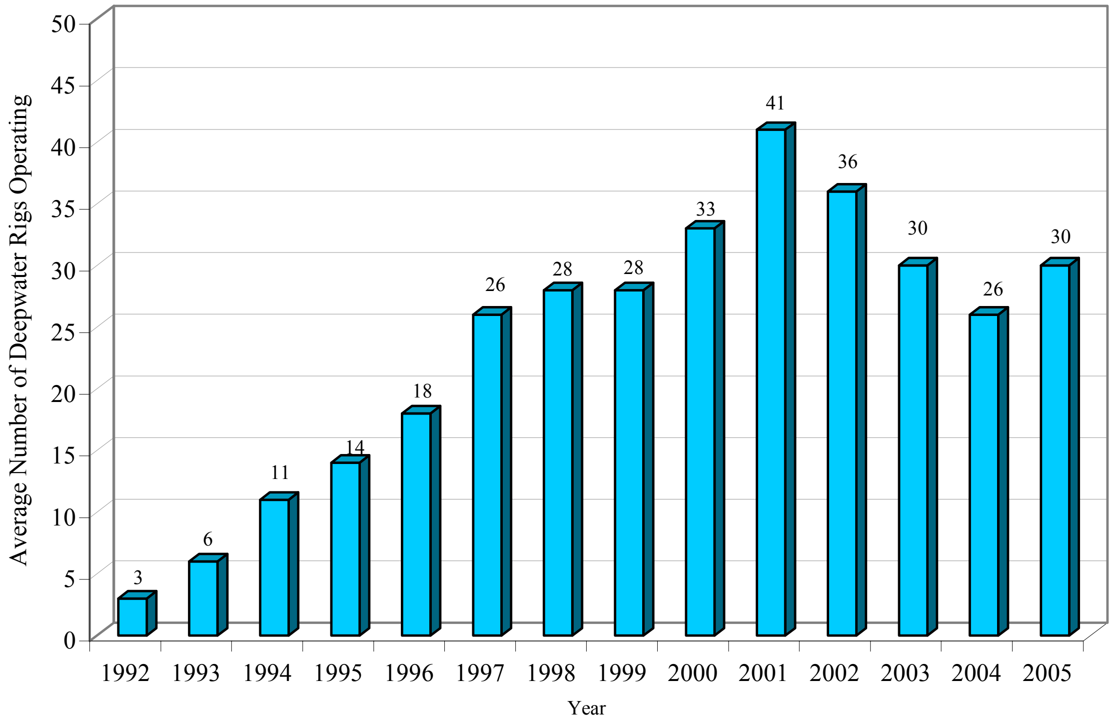

Figure 27. Average number of rigs operating in the deepwater GOM.

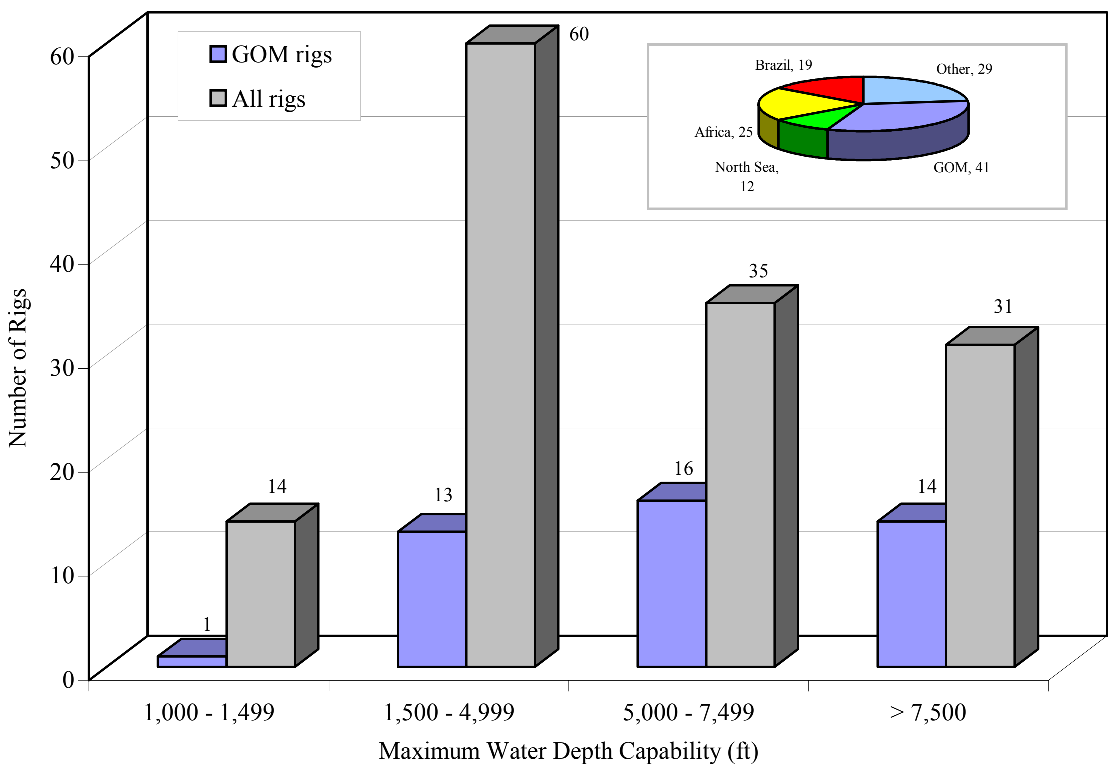

Figure 28. Approximate number of deepwater rigs (GOM and worldwide) subdivided according to their maximum water-depth capabilities. Inset shows the number of deepwater rigs in various locations.

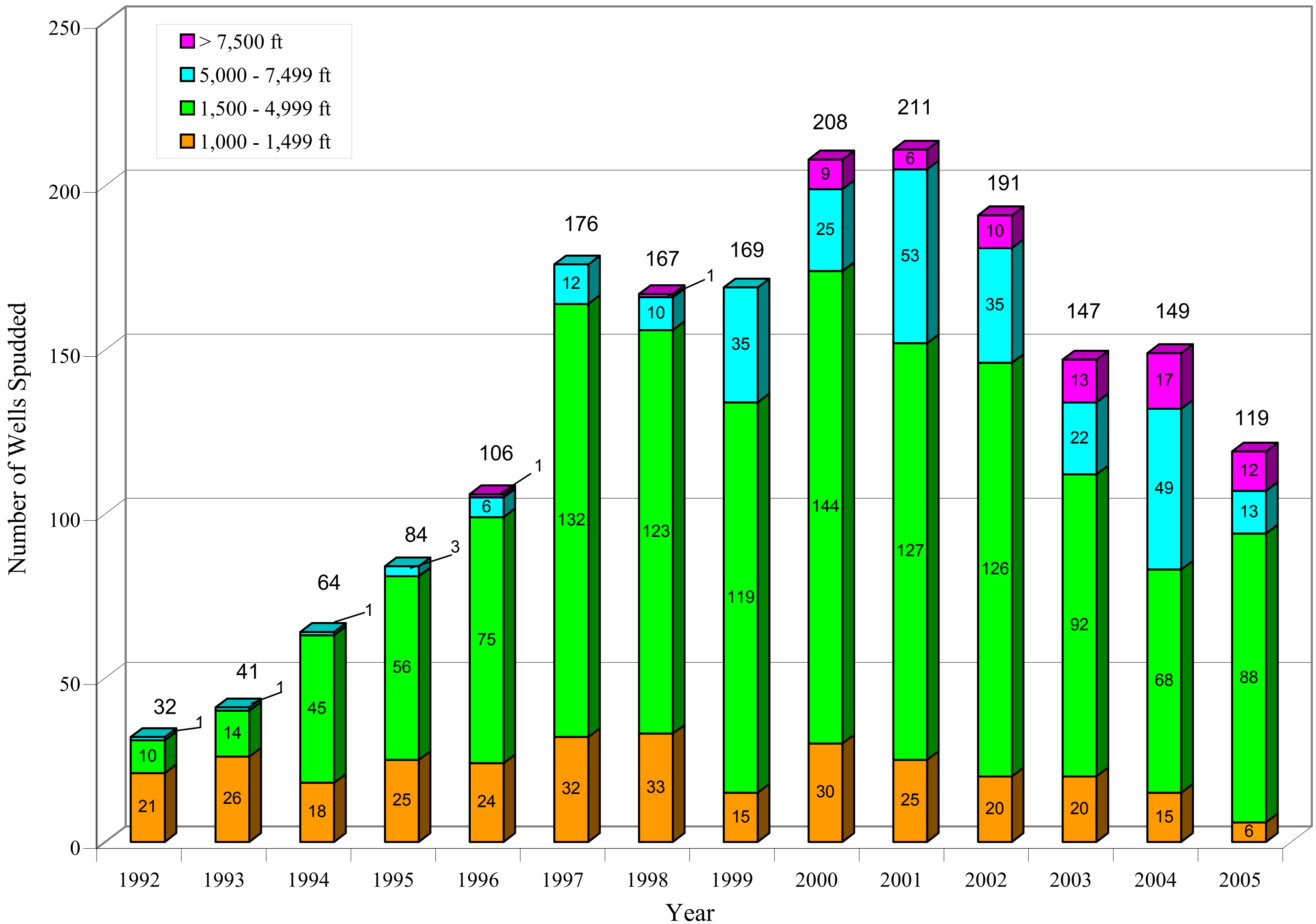

Figure 29. All deepwater wells drilled in the Gulf of Mexico, subdivided by water depth.

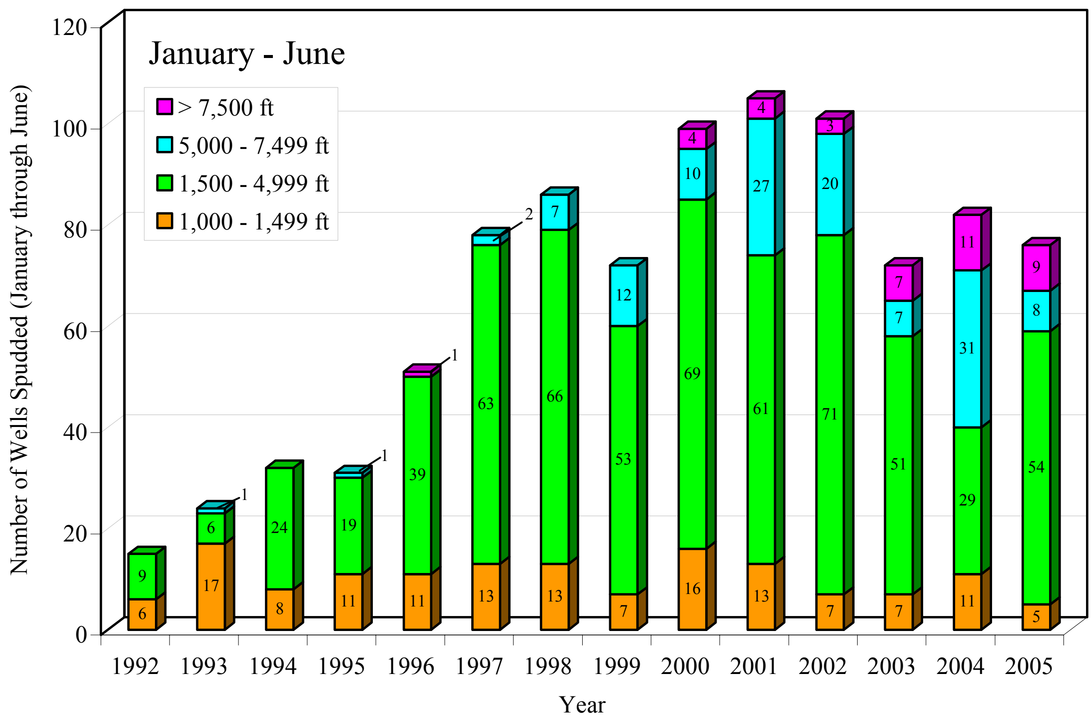

Figure 30. All deepwater wells drilled from January through June in the Gulf of Mexico by water depth.

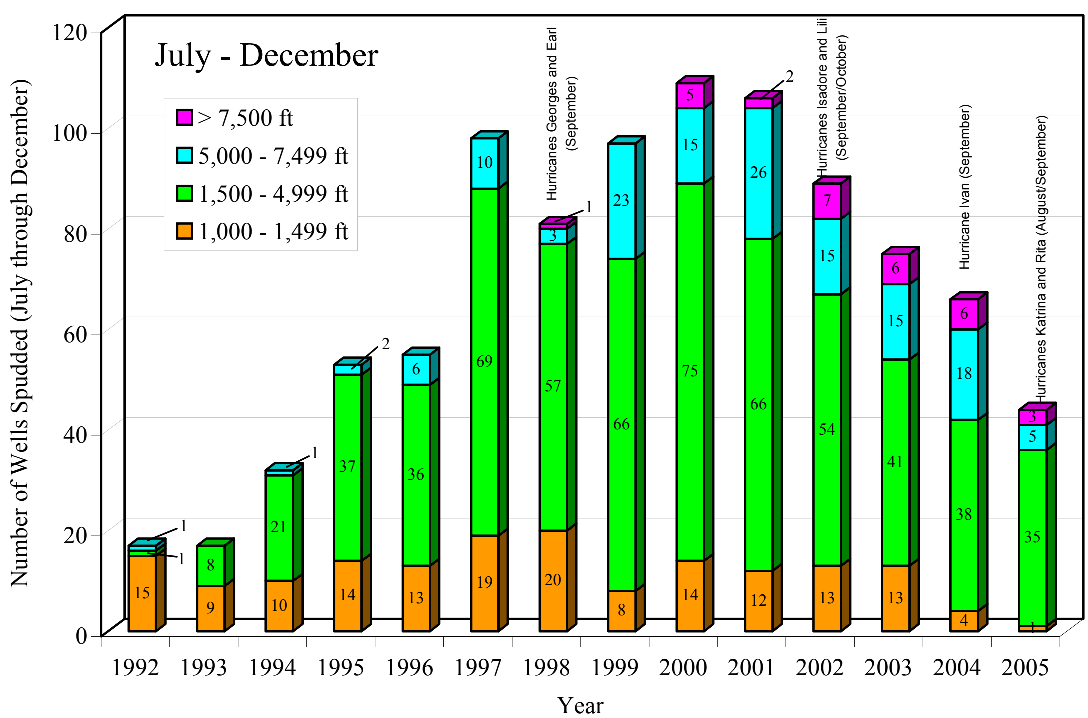

Figure 31. All deepwater wells drilled from July through December in the Gulf of Mexico by water depth.

years were particularly active with several major hurricanes entering the GOM, including Hurricanes Ivan, Katrina, and Rita.

Figures 32 and 33 break down the annual deepwater well counts (shown in Figure 29) into exploratory and development wells, respectively. This report uses the designation of exploratory and development wells provided by the operators. The data reflect the variations among operators in classifying wells as either development or exploratory. After decreasing in 2002 and 2003, the number of exploratory wells drilled in 2004 increased, followed by a slight decrease in 2005. Exploratory drilling in the 1,500- to 4,999-ft (457- to 1,524-m) water-depth range remained the same from 2002 through 2004 but increased in 2005. There has been a decrease in the number of development wells drilled since 2002. 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 in 2005 was in the 1,500- to 4,999-ft (457- to 1,524-m) water-depth range.

Figure 34 illustrates the geographic distribution of deepwater exploratory wells. Note the progression 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),
- file a DWOP,
- drill development wells, then
- begin production.

30 CFR 250 and 282: Oil and Gas and Sulfur Operations in the Outer Continental Shelf – Plans and Information; Final Rule was completed on August 30, 2005. These changes will be reflected in the submittal process and requirements for plans received after January 1, 2006, but were not taken into account for this report.

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, DOCD's, and DWOP's includes only the initial plans. Some shallow-water activities are included in the DWOP data because DWOP's must be filed and approved for developments in greater than 1,000-ft (305 m) water depths and for all subsea developments regardless of water depth. The discussion of subsea wells later in this report will address the significance of shallow-water subsea tiebacks—the effective use of deepwater technologies in marginal developments.

There was a marked increase in EP's, DOCD's, and DWOP's beginning in 1996. After reaching a peak of 92 in 1999, the number of submittals of EP's decreased and then hovered near 70 per year

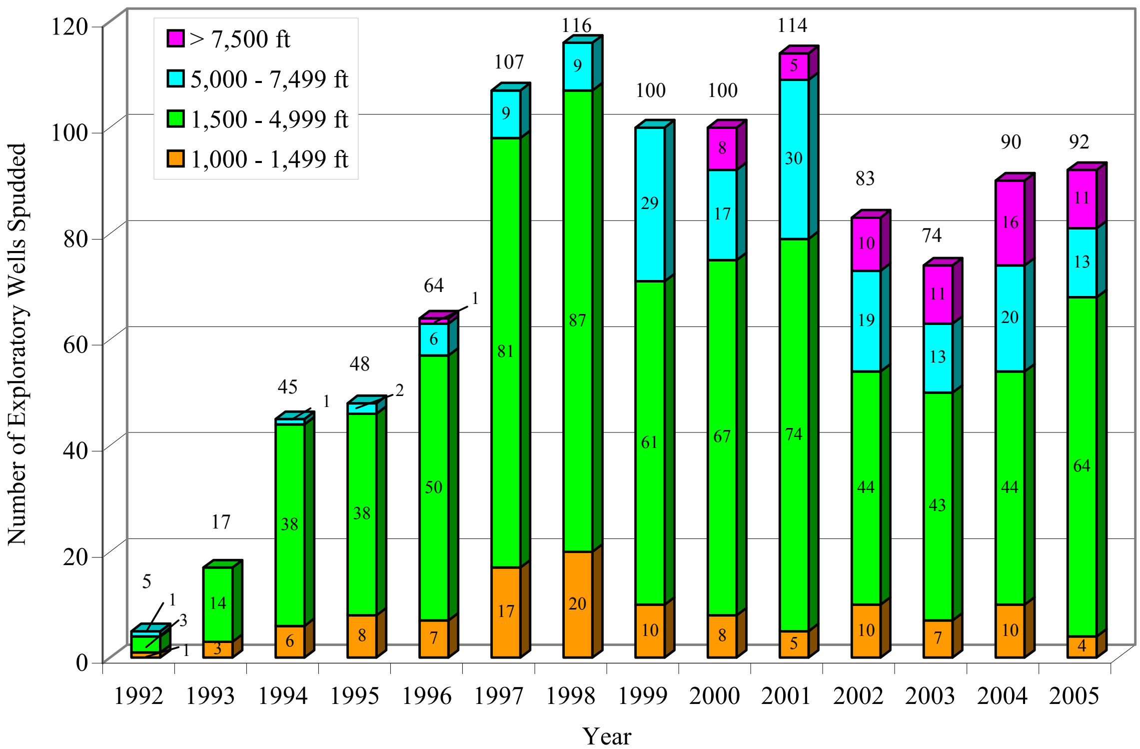

Figure 32. All deepwater exploratory wells drilled in the Gulf of Mexico by water depth.

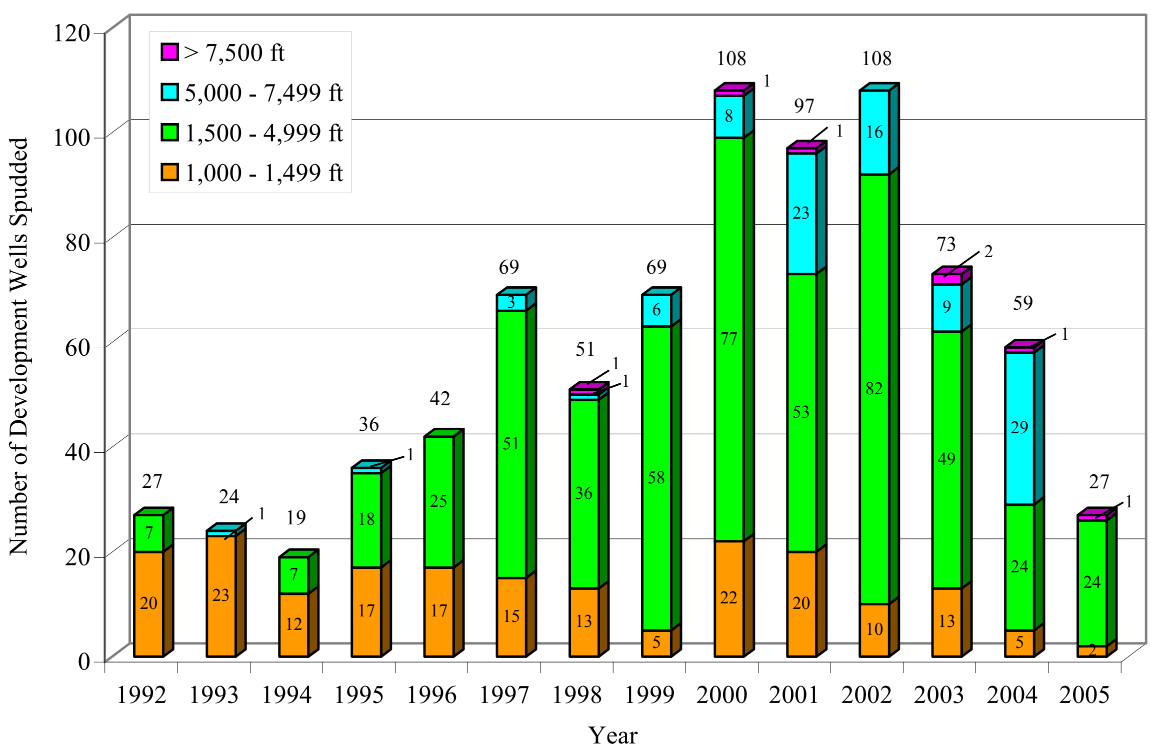

Figure 33. All deepwater development wells drilled in the Gulf of Mexico by water depth.

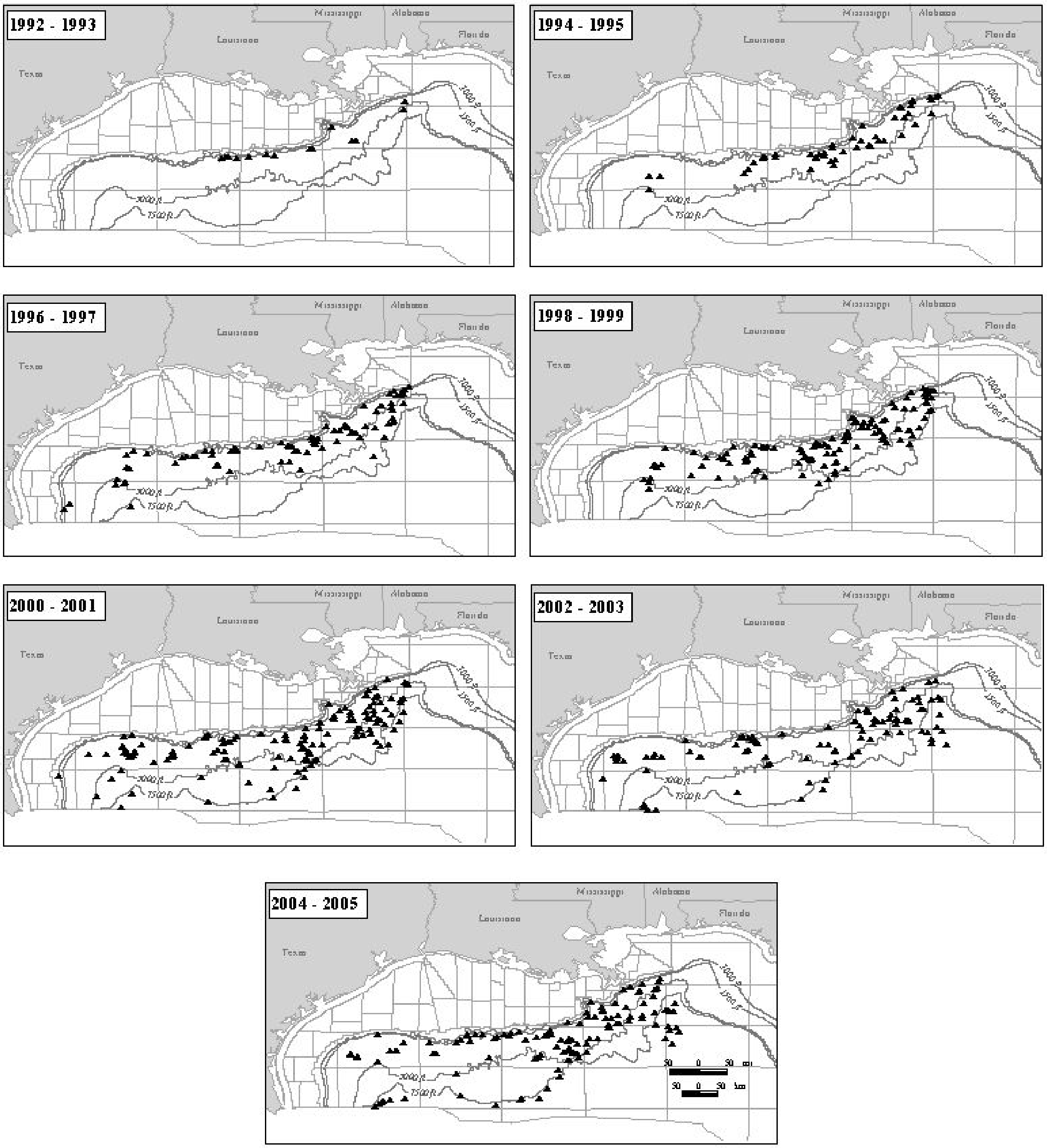

Figure 34. Deepwater exploratory wells drilled in the Gulf of Mexico.

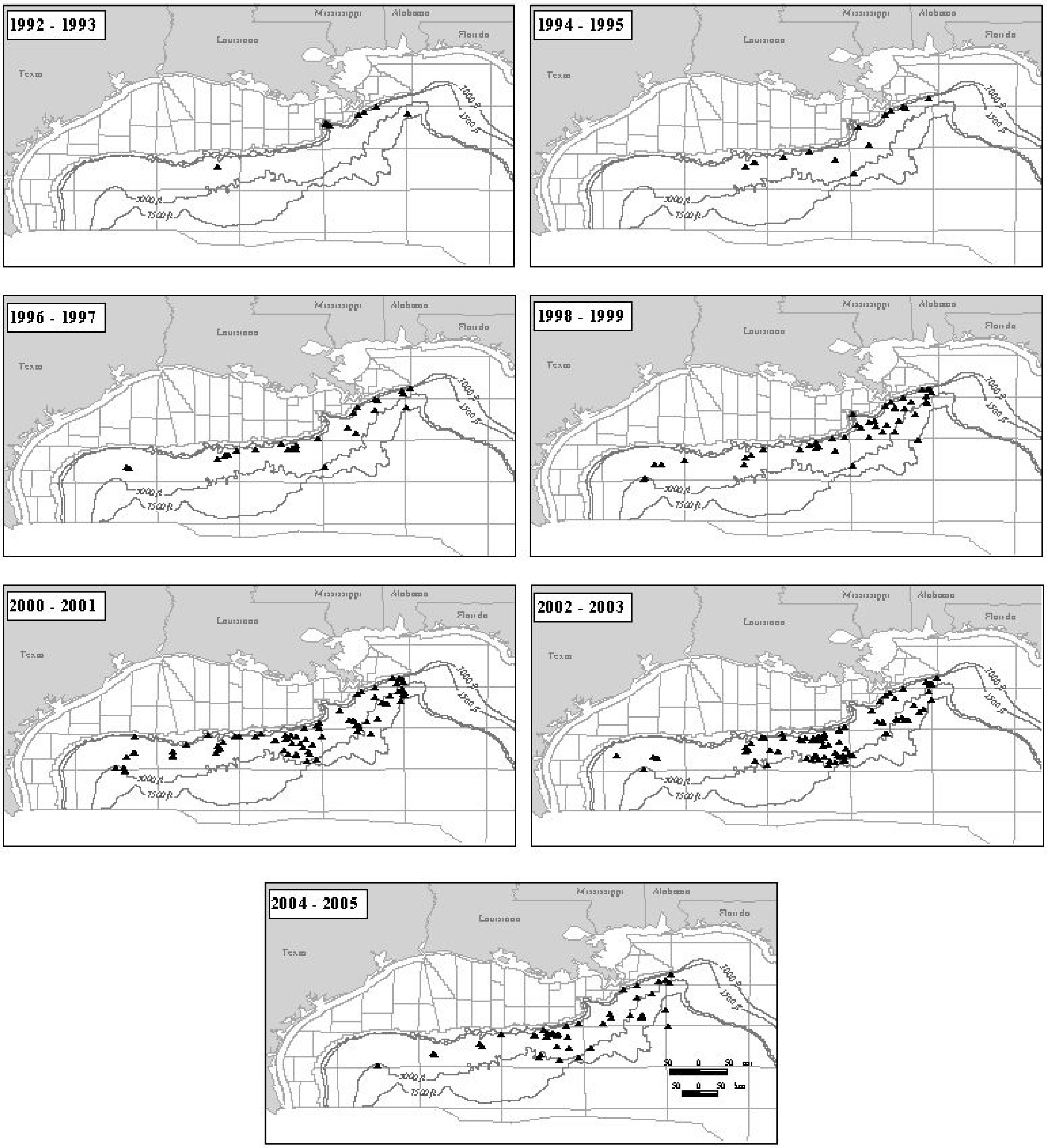

Figure 35. Deepwater development wells drilled in the Gulf of Mexico.

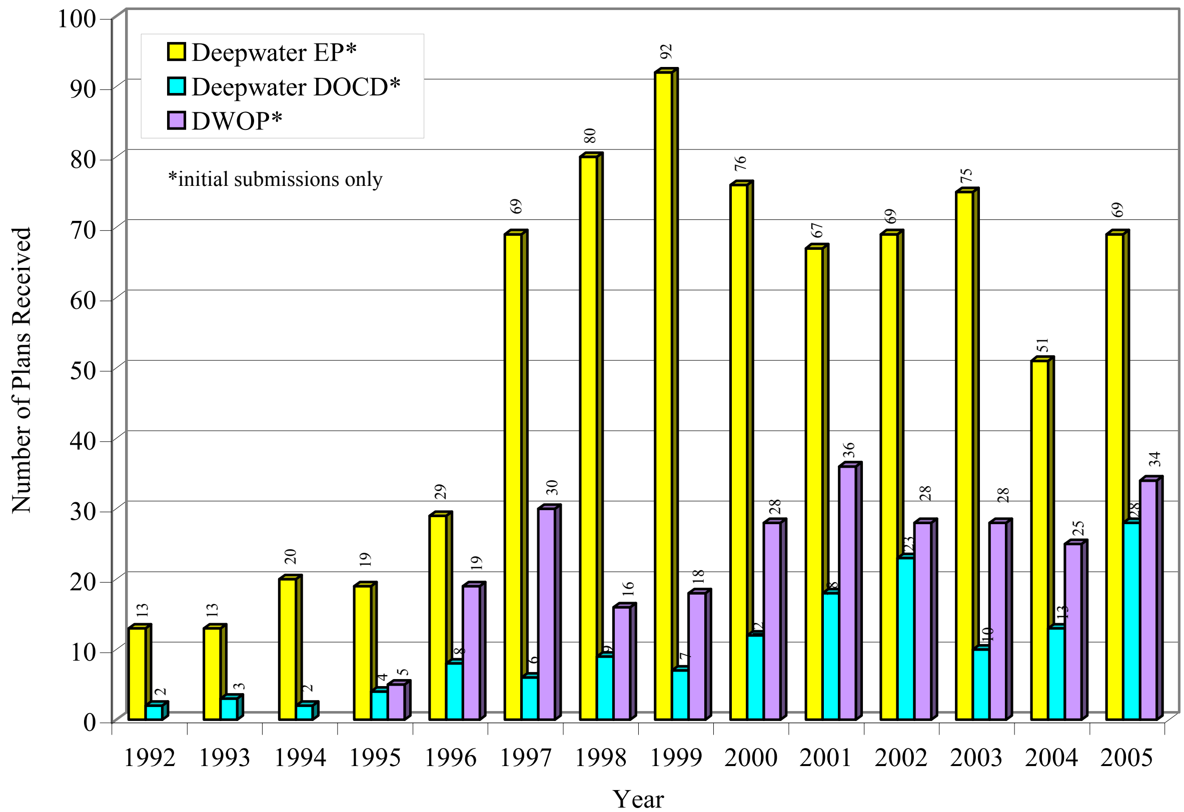

Figure 36. Deepwater EP's, DOCD's, and DWOP's received in the Gulf of Mexico since 1992.

with the exception of 2004. The number of DOCD submittals reached a high of 28 in 2005. There was an increase in the number of initial DWOP's submitted from 2004 to 2005.

Until recently, there had been a gradual increase of drilling depth (as measured in true vertical depth [TVD]). Beginning in 1996, the maximum drilling depth increased rapidly, reaching depths below 30,000 ft (9,144 m) in 2002. The Transocean *Discoverer Spirit* drilled the deepest well in the GOM to date, Chevron/Unocal's Knotty Head discovery in Green Canyon Block 512, reaching a TVD of 34,157 ft (10,411 m) in December 2005. The recent dramatic increase in TVD may be attributed to several factors, including enhanced rig capabilities, deeper exploration targets, and the general trend toward greater water depths. Chevron holds another world record – drilling in 10,011 ft (3,051 m) of water at its Toledo prospect in Alaminos Canyon Block 951 in November 2003.

HIGH PRESSURE, HIGH TEMPERATURE

High-pressure, high-temperature (HPHT) development is the greatest technological and regulatory challenge to the oil and gas industry today. The basic building blocks of structural integrity are being challenged. Metals and elastomers that have been in use for many years now face unique environmental conditions. MMS is working with industry to evaluate the risks and set limits to mitigate these potential hazards. MMS is also sponsoring research and participating in internal and industry-related conferences to stay at the forefront of new technology and is actively involved in developing options that will best promote human safety and environmental integrity. Figures 37 and 38 demonstrate that MMS and industry are already exploring the HPHT condition and illustrate the importance of developing safe, reliable methods of drilling and producing under these harsh conditions. The figures show that, as deepwater wells are drilled to greater and greater depths, they begin to encounter the same HPHT conditions that shallow-water wells see at shallower drilling depths. HPHT compounds the technological

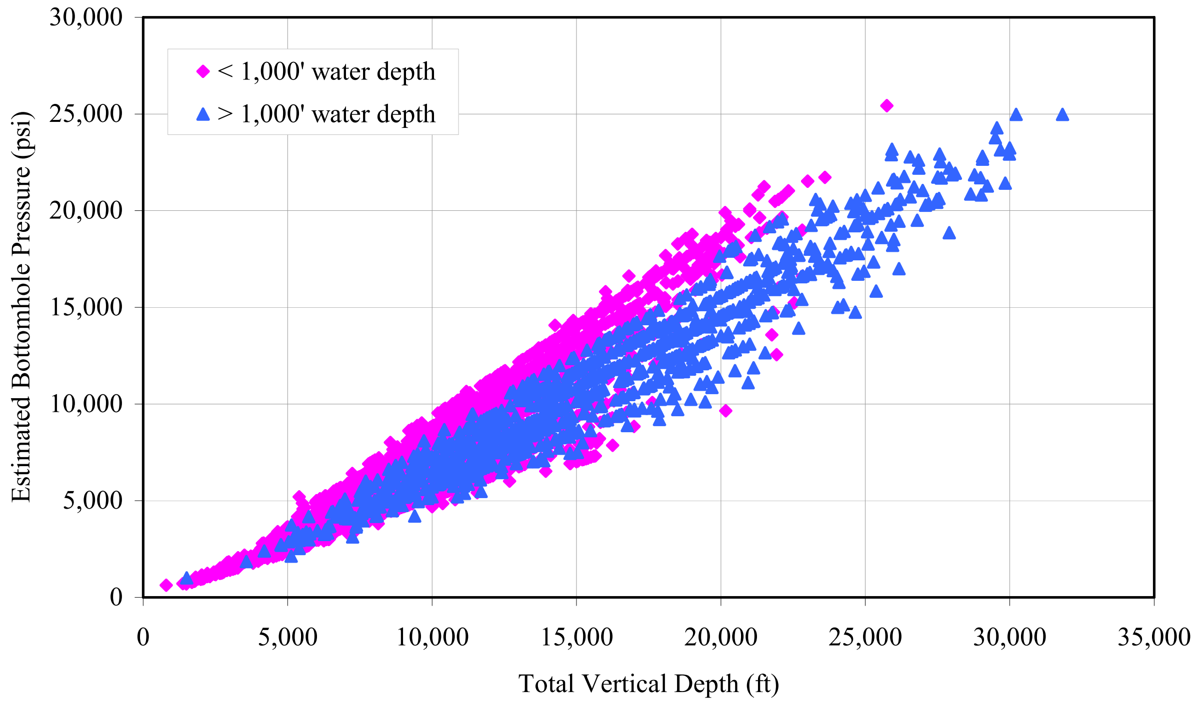

Figure 37. Estimated bottomhole pressure (psi) versus total vertical depth.

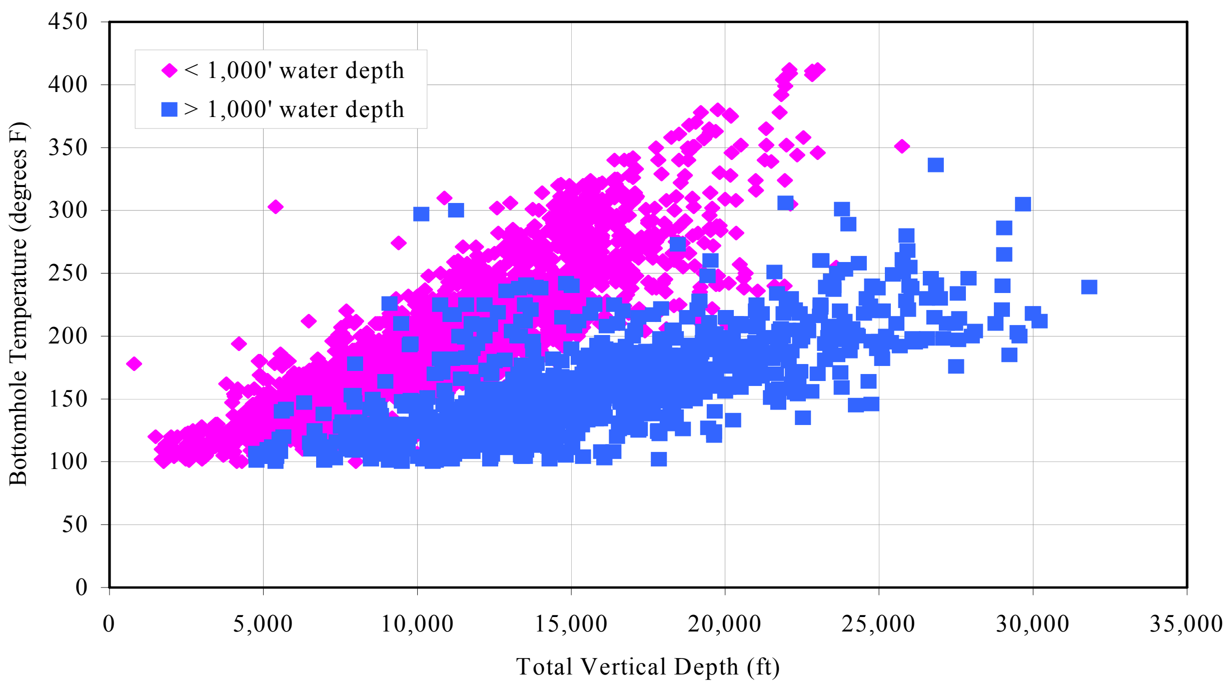

Figure 38. Bottomhole temperature (^{o}F) versus total vertical depth.

challenges faced in deepwater exploration and especially in deepwater completion and production. Consequently, there is tremendous potential for growth and development in the HPHT area.

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 7 lists the systems that have begun production. Fixed platforms (e.g., Bullwinkle) have economic water-depth limits of about 2,000 ft (610 m). Compliant towers (e.g., Petronius) may be considered for water depths of approximately 1,000 to 2,000 ft (305 to 610 m). Tension-leg platforms (TLP's) (e.g., Brutus, Magnolia, and Marco Polo) are frequently used in 1,000- to 5,000-ft (305- to 1,524-m) water depths. Spars (e.g., Genesis and Red Hawk), semisubmersible production units (e.g., Na Kika), and floating production, storage, and offloading (FPSO) systems (none in GOM) may be used in water depths ranging up to and beyond 10,000 ft (3,048 m). Figure 40 shows three of these development systems: a TLP, a semisubmersible, and a spar.

Fixed Platform

A fixed platform consists of a welded tubular steel jacket, deck, and surface facility. The jacket and deck make up the foundation for the surface facilities. The jacket is secured by piles driven into the seafloor. The height of the platform is dictated by the water depth at the intended location. Once the jacket is secured and a deck installed, additional modules are added for drilling, production, and crew operations. Large barge-mounted cranes are used in positioning and securing the jacket and the installation of the topside modules. Economic considerations hinder development of fixed (rigid) platforms in water depths greater than 2,000 ft (610 m).

Compliant Tower

A compliant tower consists of a narrow tower and a piled foundation. Unlike a fixed platform, a compliant tower has greater flexibility and can withstand large lateral forces by sustaining significant lateral deflections. It is usually deployed in water depths between 1,000 ft (305 m) and 2,000 ft (610 m).

Tension-Leg Platform

A tension-leg platform (TLP) is a compliant structural system vertically moored and uses buoyant components to maintain tension in the mooring system. ConocoPhillips successfully installed the deepest TLP in the world at Magnolia (GB 783) in December 2004 in 4,674 ft (1,425 m) of water.

Semisubmersible Production Unit

A semisubmersible production platform is a floating system that may have drilling capabilities. It comprises the following major components: pontoons, columns, and a large deck. The pontoons and columns provide buoyancy to the system. Production equipment, living quarters, and storage space are assembled on the deck. Semisubmersibles are permanently moored, using various anchoring techniques, and can be operated in a wide range of water depths.

The world's largest semisubmersible production unit, the 59,500-ton Thunder Horse production, drilling, and quarters (PDQ) unit, arrived in the GOM in 2004 from Korea. The topside modules, fabricated in Morgan City, Louisiana, were installed in Ingleside, Texas. The sheer size of the Thunder Horse project has garnered worldwide interest. The distance from the base of the hull to top of the drill rig is just over 450 ft (137 m). The immense deck area is approximately three acres in area. The Thunder Horse unit was nearly four years in the making and will develop the largest discovery ever made in the GOM. When fully operational, the unit will be capable of producing an astounding 250 MBOPD and 200 MMCFPD. The installation of Thunder Horse (MC 778) was delayed by Hurricane Dennis in 2005 and is now slated for 2006.

The semisubmersible at Atlantis is scheduled to be moored in the fourth quarter of 2006 in Green Canyon 787 in a record water depth of 7,074 ft (2,156 m). Atlantis is the second largest semisubmersible in the world, smaller only than Thunder Horse. The Atlantis mooring system includes the longest continuous wire mooring ropes ever built. Twelve large steel canisters, called suction piles, are embedded in the ocean floor to anchor the platform in place. Part of the chain used in this mooring system is the largest of its type in the world.

ATP Oil & Gas is planning to upgrade the *Rowan Midland* semisubmersible drilling rig rather than build a new floating production facility to develop its Gomez field (MC 711). The *Rowan Midland* will be moored on location as a production facility in an effort to minimize costs and make development more economical.

The Independence Hub, currently under construction, will be a state-of-the-art 105-foot, deep-draft, semisubmersible platform with a two-level production deck to be located in Mississippi Canyon Block 920. Details on the Independence Hub semisubmersible are included later in this section.

Spar

A spar is a vessel with a circular cross-section that sits vertically in the water and is supported by buoyancy chambers (hard tanks) at the top, a flooded mid-section structure hanging from the hard tanks, and a stabilizing keel section at the bottom. A spar is held in place by a catenary mooring system, providing lateral stability. Currently, there are three competing versions of spars used in the GOM: classic spar, truss spar, and cell spar (figure 41). Some unique features of a spar include

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

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

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

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

In 2001, the first truss spar was installed over the Nansen field in 3,680 ft (1,122 m) of water. Four deepwater projects began production in 2004 by using spar development systems in the GOM: Front Runner (GC 338/339), Devil's Tower (MC 773), Red Hawk (GB 877), and Holstein (GC 645). Mad Dog (GC 782) went on production in 2005, followed by Constitution (GC 680) in early 2006, using truss spar development systems.

The world's deepest dry-tree spar was installed in 2004 at Devil's Tower in 5,610 ft (1,710 m) of water. It is designed to produce as much as 60 MBOPD and 110 MMCFPD. BP began production from the world's largest spar at Holstein in December 2004. Holstein has a hull diameter of 149 ft (45.5 m) and slot dimensions of 75 ft by 75 ft (22.9 m x 22.9 m). The hull diameter is twice that of Neptune, the first spar installed in the GOM. Holstein is expected to produce more than 100 MBOPD and 90 MMCFPD.

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

In July 2004, Kerr-McGee began production from the world's first cell spar at Red Hawk (GB 877) in 5,334 ft (1,626 m) of water. Red Hawk is capable of producing 120 MMCFPD, with the flexibility to expand to 300 MMCFPD.

The economics of deepwater development have improved by connecting multiple subsea projects to a single hub. For example, Independence Hub will comprise ten separate fields. The rapid growth of subsea production systems is illustrated in figure 42. Note the substantial increase in subsea developments in the last five years in the 800 to 1,599-m (2,624 to 5,246-ft) water depths. There is a corresponding increase in the number of hubs at this same water-depth interval. Figure 43 shows production systems for currently producing fields including subsea systems.

Subsea systems, as shown in figure 44, are capable of producing hydrocarbons from reservoirs covering the entire range of water depths that industry is exploring. Subsea systems continue to be a key component in the success in deepwater to date. These systems are generally multi-component seafloor facilities that allow 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.

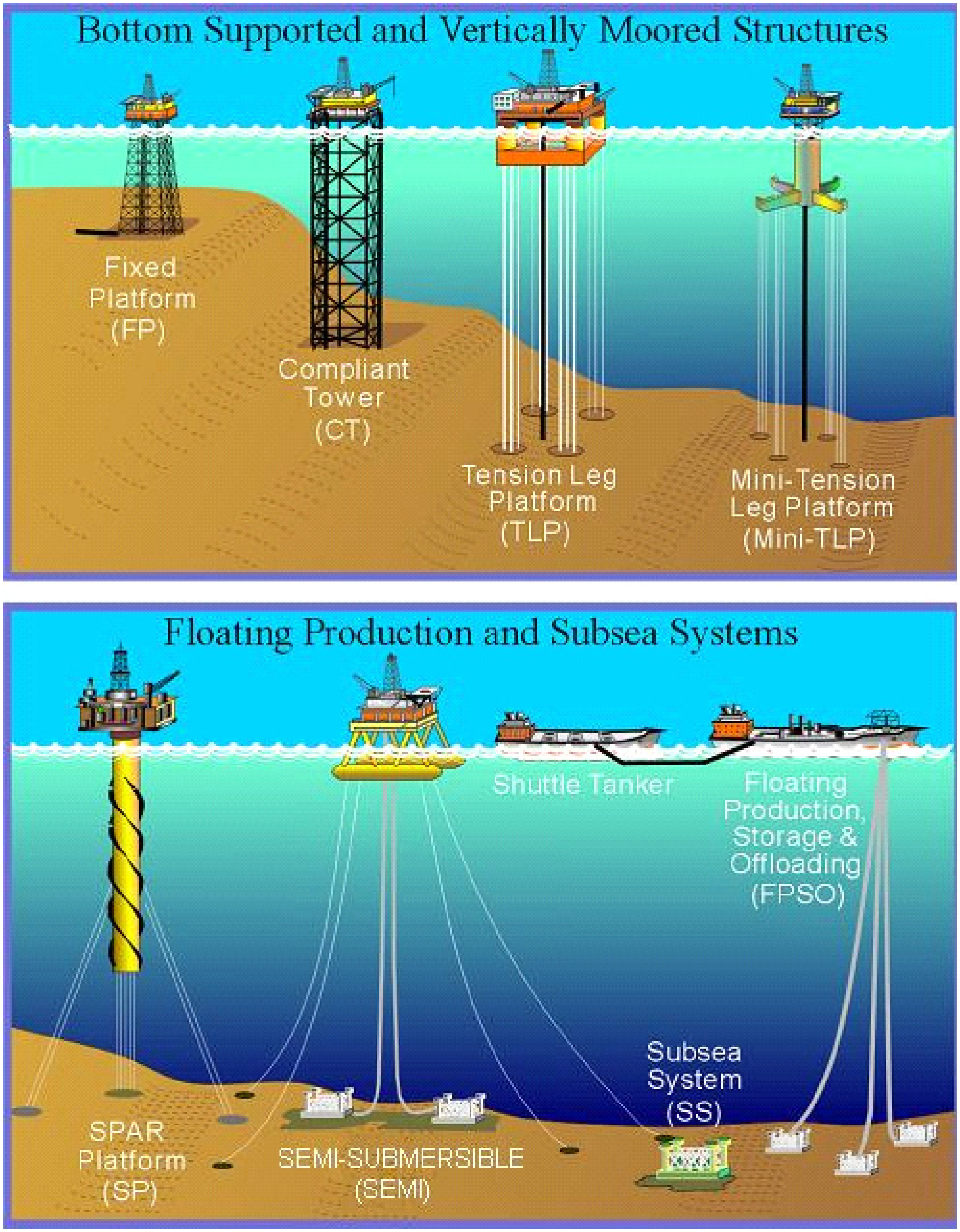

Figure 39. Deepwater development systems.

Table 7
Development Systems of Productive Deepwater GOM Projects

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

Table 7
Development Systems of Productive Deepwater GOM Projects

Year of First Production	Project Name[2]	Operator	Block	Water Depth (ft)	System Type	DWRR[3]
1999	Genesis	ChevronTexaco	GC 205	2,590	Spar	
1999	Macaroni	Shell	GB 602	3,600	Subsea	
1999	Penn State	Amerada Hess	GB 216	1,450	Subsea	
1999	Pluto	Mariner	MC 674	2,828	Subsea	Yes
1999	Ursa	Shell	MC 809	3,800	TLP	
1999	Virgo	TotalFinaElf	VK 823	1,130	Fixed Platform	Yes
2000	Black Widow	Mariner	EW 966	1,850	Subsea	Yes
2000	Conger	Amerada Hess	GB 215	1,500	Subsea	
2000	Diana	ExxonMobil	EB 945	4,500	Subsea	
2000	Europa	Shell	MC 935	3,870	Subsea	
2000	Hoover	ExxonMobil	AC 25	4,825	Spar	
2000	King	Shell	MC 764	3,250	Subsea	
2000	Marlin	BP	VK 915	3,236	TLP	
2000	Northwestern	Amerada Hess	GB 200	1,736	Subsea	Yes
2000	Petronius	ChevronTexaco	VK 786	1,753	Compliant Tower	
2001	Brutus	Shell	GC 158	3,300	TLP	
2001	Crosby	Shell	MC 899	4,400	Subsea	
2001	Einset	Shell	VK 872	3,500	Subsea	Yes
2001	EW 878	Walter	EW 878	1,585	Subsea	Yes
2001	Ladybug	ATP	GB 409	1,355	Subsea	Yes
2001	Marshall	ExxonMobil	EB 949	4,376	Subsea	
2001	MC 68	Walter	MC 68	1,360	Subsea	
2001	Mica	ExxonMobil	MC 211	4,580	Subsea	
2001	Nile	BP	VK 914	3,535	Subsea	
2001	Oregano	Shell	GB 559	3,400	Subsea	
2001	Pilsner	Unocal	EB 205	1,108	Subsea	Yes
2001	Prince	El Paso	EW 1003	1,500	TLP	Yes
2001	Serrano	Shell	GB 516	3,153	Subsea	
2001	Typhoon	ChevronTexaco	GC 237	2,679	TLP	Yes
2002	Aconcagua	TotalFinaElf	MC 305	7,100	Subsea	Yes
2002	Aspen	BP	GC 243	3,065	Subsea	Yes
2002	Boomvang North	Kerr-McGee	EB 643	3,650	Truss Spar	Yes
2002	Camden Hills	Marathon	MC 348	7,216	Subsea	Yes
2002	Horn Mountain	BP	MC 127	5,400	Truss Spar	Yes

Table 7
Development Systems of Productive Deepwater GOM Projects

Year of First Production	Project Name[2]	Operator	Block	Water Depth (ft)	System Type	DWRR[3]
2002	King	BP	MC 84	5,000	Subsea	
2002	King Kong	Mariner	GC 472	3,980	Subsea	Yes
2002	King's Peak	BP	DC 133	6,845	Subsea	Yes
2002	Lost Ark	Samedan	EB 421	2,960	Subsea	Yes
2002	Madison	ExxonMobil	AC 24	4,856	Subsea	
2002	Manatee	Shell	GC 155	1,939	Subsea	Yes
2002	Nansen	Kerr-McGee	EB 602	3,675	Truss Spar	Yes
2002	Navajo	Kerr-McGee	EB 690	4,210	Subsea	Yes
2002	Princess	Shell	MC 765	3,600	Subsea	
2002	Sangria	Spinnaker	GC 177	1,487	Subsea	Yes
2002	Tulane	Amerada Hess	GB 158	1,054	Subsea	Yes
2002	Yosemite	Mariner	GC 516	4,150	Subsea	Yes
2003	Boomvang East	Kerr-McGee	EB 668	3,795	Subsea	Yes
2003	Boomvang West	Kerr-McGee	EB 642	3,678	Subsea	Yes
2003	Boris	BHP	GC 282	2,378	Subsea	Yes
2003	Dawson	Kerr-McGee	GB 669	3,152	Subsea	Yes
2003	Durango	Kerr-McGee	GB 667	3,105	Subsea	Yes
2003	East Anstey/ Na Kika	Shell	MC 607	6,590	FPS/Subsea[4]	
2003	Falcon	Pioneer	EB 579	3,638	Subsea	Yes
2003	Fourier/Na Kika	Shell	MC 522	6,950	FPS/Subsea[4]	
2003	Gunnison	Kerr-McGee	GB 668	3,100	Truss Spar	Yes
2003	Habanero	Shell	GB 341	2,015	Subsea	
2003	Herschel/Na Kika	Shell	MC 520	6,739	FPS/Subsea[4]	
2003	Matterhorn	TotalFinaElf	MC 243	2,850	TLP	Yes
2003	Medusa	Murphy	MC 582	2,223	Spar	Yes
2003	Medusa North	Murphy	MC 538	2,223	Subsea	Yes
2003	Pardner	Anadarko	MC 401	1,139	Subsea	Yes
2003	Tomahawk	Pioneer	GB 623	3,412	Subsea	Yes
2003	Zia	Devon	MC 496	1,804	Subsea	
2004	Ariel/Na Kika	BP	MC 429	6,274	Subsea[4]	
2004	Coulomb/Na Kika	Shell	MC 657	7,591	Subsea[4]	Yes
2004	Devil's Tower	Dominion	MC 773	5,610	Truss Spar	Yes
2004	Diana South	ExxonMobil	AC 65	4,852	Subsea	

Table 7
Development Systems of Productive Deepwater GOM Projects

Year of First Production	Project Name[2]	Operator	Block	Water Depth (ft)	System Type	DWRR[3]
2004	Front Runner	Murphy	GC 338	3,330	Truss Spar	Yes
2004	Glider	Shell	GC 248	3,440	Subsea	
2004	Hack Wilson	Kerr-McGee	EB 598	3,650	Subsea	Yes
2004	Harrier	Pioneer	EB 759	4,114	Subsea	Yes
2004	Holstein	BP	GC 645	4,344	Truss Spar	
2004	Kepler/Na Kika	BP	MC 383	5,759	Subsea[4]	
2004	Llano	Shell	GB 386	2,663	Subsea	Yes
2004	Magnolia	Conoco-Phillips	GB 783	4,674	TLP	
2004	Marco Polo	Anadarko	GC 608	4,320	TLP	Yes
2004	Raptor	Pioneer	EB 668	3,710	Subsea	Yes
2004	Red Hawk	Kerr-McGee	GB 877	5,334	Cell Spar	Yes
2005	Citrine	LLOG	GC 157	2,614	Subsea	Yes
2005	GC 137	LLOG	GC 137	1,168	Subsea	Yes
2005	K2	Eni	GC 562	4,006	Subsea	
2005	Mad Dog	BP	GC 782	4,428	Truss Spar	
2005	Swordfish	Noble	VK 962	4,677	Subsea	
2005	Triton/Goldfinger	Dominion	MC 728	5,610	Subsea	Yes
2006	Constitution	Kerr-McGee	GC 680	5,071	Truss Spar	
2006	Gomez	ATP	MC 711	3,098	Semisubmersible/ Subsea	
2006	K2 North	Anadarko	GC 518	4,049	Subsea	
2006	Rigel	Dominion	MC 296	5,229	Subsea	
2006	Seventeen Hands	Dominion	MC 299	5,881	Subsea	
2006	Ticonderoga	Kerr-McGee	GC 768	5,272	Subsea	Yes

[1] Indicates projects which are no longer on production.
[2] Editions of this report prior to 2004 listed deepwater fields rather than projects.
[3] Indicates projects with one or more leases approved to receive DWRR.
[4] Na Kika FPS is located in Mississippi Canyon Block 474 in 6,340 ft (1,932 m) of water.

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

Figure 40. Three development systems: a TLP installed at Magnolia field, a semisubmersible at Thunder Horse field, and a truss spar installed at Holstein field (images courtesy of ConocoPhillips and BP/Marc Morrison).

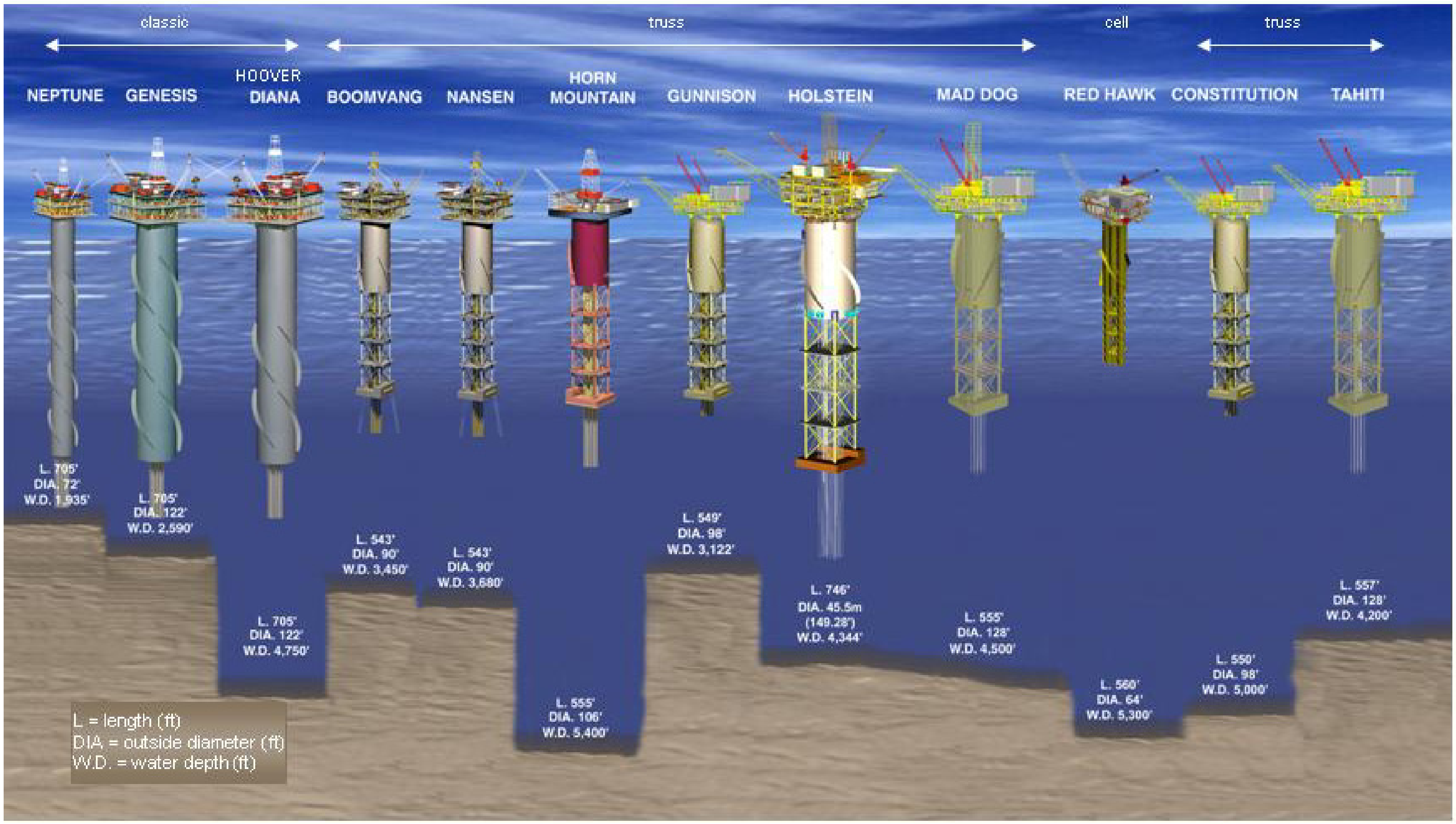

Figure 41. Progression of spar deepwater development systems (image courtesy of Technip).

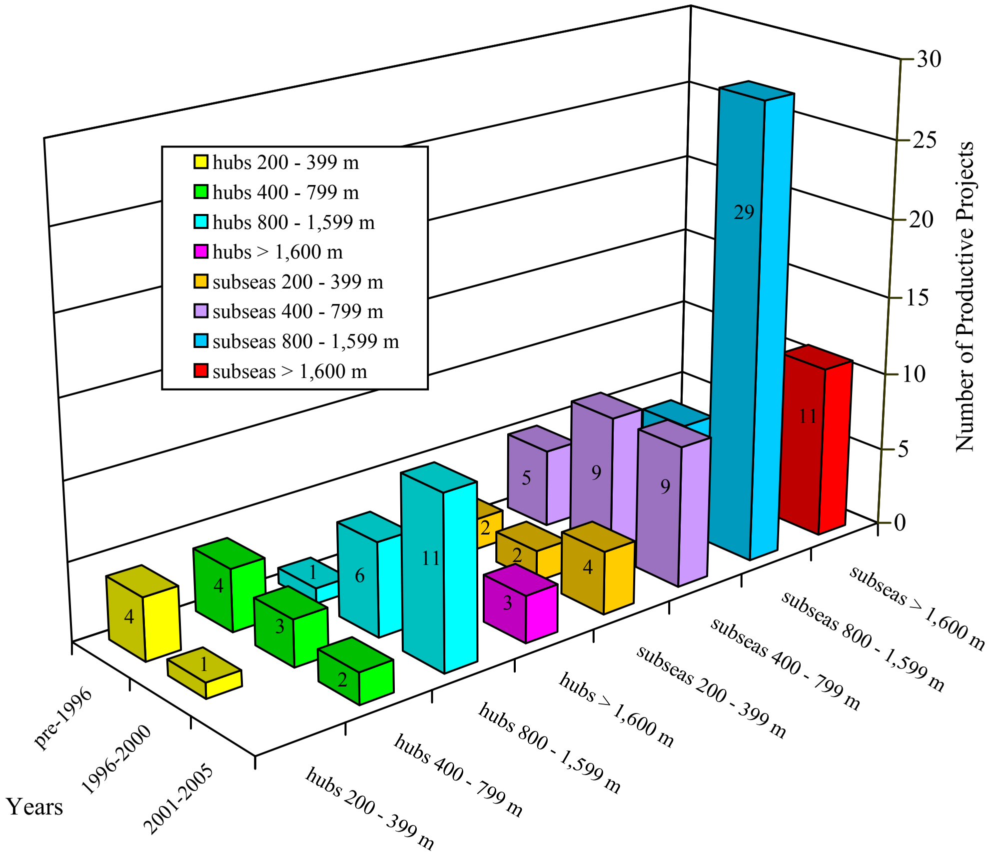

Figure 42. The number of subsea projects and hubs for 5-year periods by water-depth category.

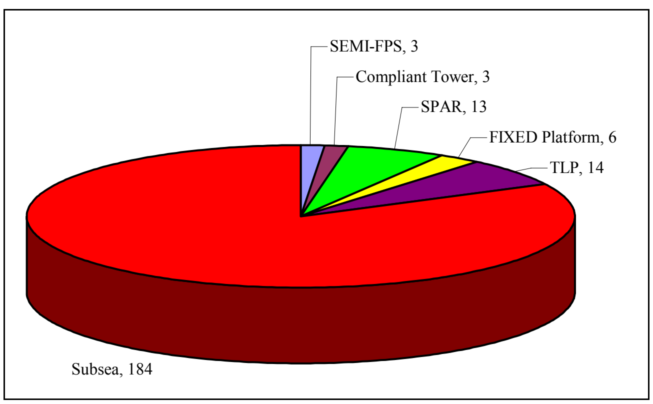

Figure 43. Production systems for currently producing fields, including subsea systems.

SUBSEA TRENDS

Figure 45 shows the number of subsea completions each year since 1955 (only productive wells were counted). There were fewer than ten subsea completions per year until 1993. This number increased dramatically throughout the 1990's. The pie chart in figure 45 shows that shallow-water subsea wells are a significant contribution to the subsea well population in the GOM. Shallow-water subsea wells accounted for 151 of the 348 total subsea wells in the GOM by yearend 2005. Operators have found subsea tiebacks to be valuable for shallow-water marginal fields because of the extensive infrastructure of platforms and pipelines. Non-major companies have installed nearly all of these shallow-water subsea wells, led by Walter Oil and Gas Corporation with 26 wells. Figure 45 demonstrates the increasing reliance of industry on subsea technology to develop shallow-water and deepwater fields, beginning in the late 1980's.

The technology required to implement subsea production systems in deepwater evolved significantly in the last seventeen years. This evolution is apparent in figure 46, which shows that the deepest subsea completion was in 350 ft (107 m) of water until 1988, when the water depth record (GOM) jumped to 2,243 ft or 684 m (Green Canyon 31 project). In 1996, another record was reached with a subsea completion in 2,956 ft (901 m) of water (Mars project), followed by a 1997 subsea completion in 5,295 ft (1,614 m) of water (Mensa project). Coulomb has the deepest production in the GOM to date, in a water depth of 7,591 ft (2,313 m). A listing of productive subsea and temporarily abandoned completions on the GOM Outer Continental Shelf can be found in Appendix E.

Figure 47 further breaks down the subsea completion count into specific water-depth ranges. This figure shows that nearly 70 percent of the subsea completions are in water depths less than 2,500 ft (762 m).

For subsea wells to continue to advance to greater water depths and harsher environments, improvements in technology are necessary. Currently MMS is working with industry to ensure that new advancements are developed in a safe and environmentally conscientious manner. Some concepts currently under evaluation include high integrity pressure protection systems (HIPPS), high-pressure, high-temperature (HPHT) materials, and subsea processing.

INDEPENDENCE HUB

Independence Hub, LLC, an affiliate of Enterprise Products Partners L.P., has entered into agreements with the Atwater Valley Producers Group to gather natural gas from ten fields in the deepwater GOM. Atwater Valley Producers Group includes Anadarko Petroleum Corporation, Dominion Exploration & Production, Inc., Kerr-McGee Oil & Gas Corporation, Hydro Gulf of Mexico, LLC (formerly Spinnaker), Devon Energy Corporation, and Energy Resources Technology, Inc. (subsidiary of Cal Dive International, Inc.). Enterprise Products Partners will design, construct, install, and own the Independence Hub; Anadarko will operate it.

Independence Hub will be located on unleased Mississippi Canyon Block 920 in a water depth of approximately 8,000 ft (2,438 m). The selection of the location for the permanently moored host facility was based on seafloor conditions and proximity to the anchor fields: Atlas (LL 50), Atlas NW (LL 5), Cheyenne (LL 399), Jubilee (AT 349), Merganser (AT 37), Mondo Northwest (LL 2), San Jacinto (DC 618), Q (MC 961), Spiderman (DC 621), and Vortex (AT 261) (see table 8). The 105-ft (32-m) deep-draft, semisubmersible platform will have capacity to produce 1.0 BCFPD. The platform is designed to process production from the initial 10 anchor fields, with excess payload capacity to tie-back up to nine additional subsea pipelines. Installation is slated for late 2006 and first production is expected in mid-2007.

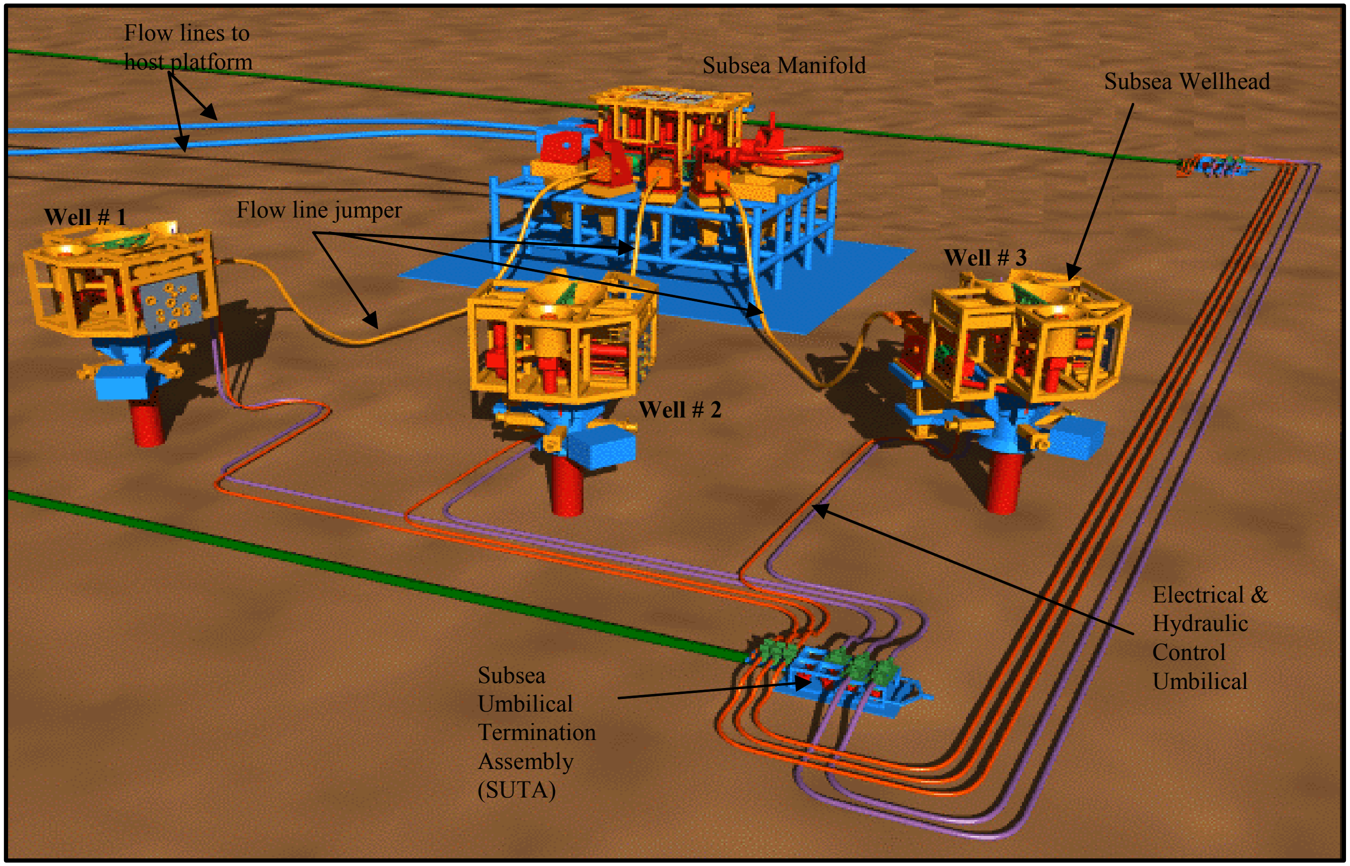

Figure 44. Crosby Project (MC 899) subsea equipment layout (image courtesy of Shell International Exploration and Production Inc.).

Table 8
Independence Hub Anchor Fields

Discovery	Area/Block	Water Depth (ft)	Sale No.	Sale Year	1st Well Spud	Years to Spud*
Mondo NW	LL 2	8,340	116	1988	2004	14.53
Vortex	AT 261	8,422	157	1996	2002	6.28
Jubilee	AT349	8,891	166	1997	2003	5.58
Merganser	AT 37	8,064	175	2000	2001	1.35
Atlas	LL 50	9,180	181	2001	2003	1.19
Atlas NW	LL 5	8,810	181	2001	2003	1.81
San Jacinto	DC 618	7,850	181	2001	2004	2.17
Spiderman	DC 621	8,100	181	2001	2003	1.66
Cheyenne	LL 399	8,987	181	2001	2004	2.30
Q	MC 961	7,925	190	2004	2005	1.04

* based on lease effective date

NEW PIPELINES

The pipeline infrastructure to bring deepwater oil and gas onshore also expanded during the 1990's. The pipeline from a subsea completion to the host platform is commonly referred to as the *tieback*. The tieback length varies considerably, as shown in figure 48. Most subsea wells are within 10 mi (16 km) of the host platform, with the Mensa field remaining the current world record holder for a subsea tieback length of 62 mi (100 km) from the host platform. The second longest subsea tieback in the world (55 mi or 88 km) is Canyon Express, linking Aconcagua, Camden Hills, and King's Peak projects to their host platform.

Deepwater pipelines approved for installation are shown in figures 49a and 49b. The data include the total length of all pipelines originating at a deepwater development, including any shallow-water segments (control umbilicals are excluded). Figure 49a shows deepwater pipelines that are less than or equal to 12 inches (30.5 cm) in diameter. The dominance of gas pipeline miles approved in deepwater is surprising — 62 percent of the total since 1990. The large increase in 2001 in 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. Last year saw the approval of the largest number of miles of pipelines less than or equal to 12 inches in diameter since the peak year of 2001. Pipelines for the facilities at Gomez, Triton, and Independence Hub account for the significant increase.

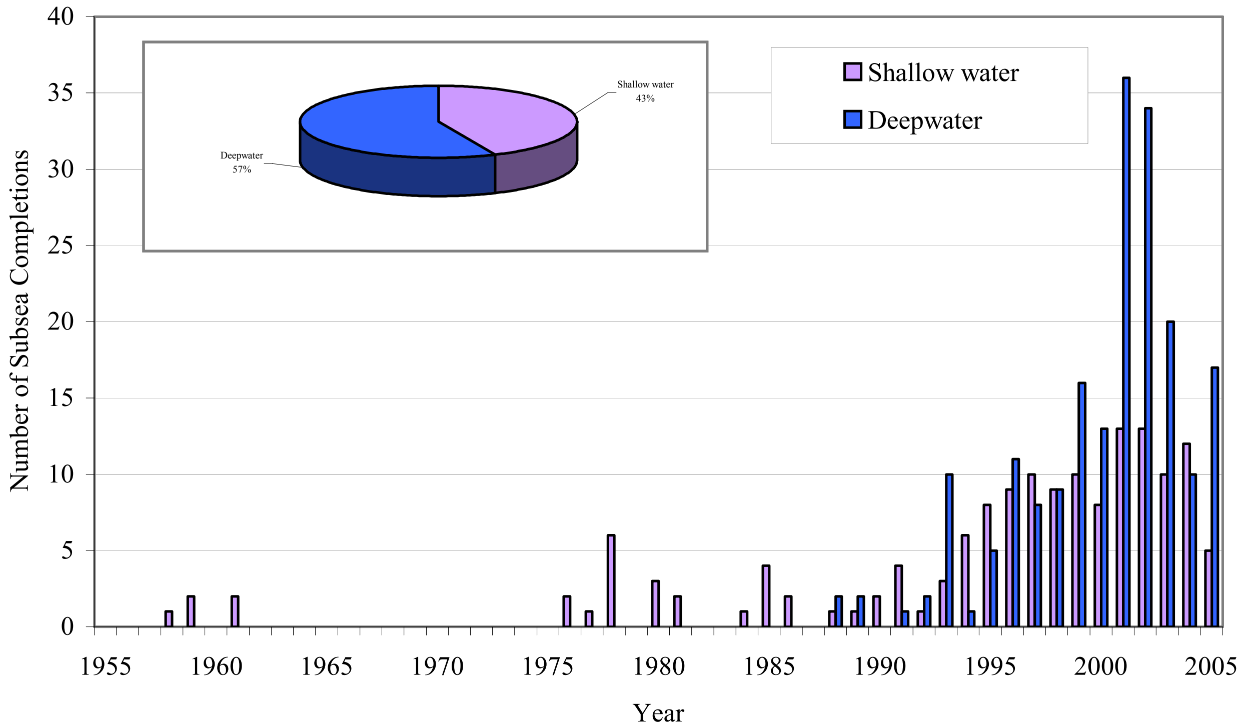

Figure 45. Number of shallow- and deepwater subsea completions each year.

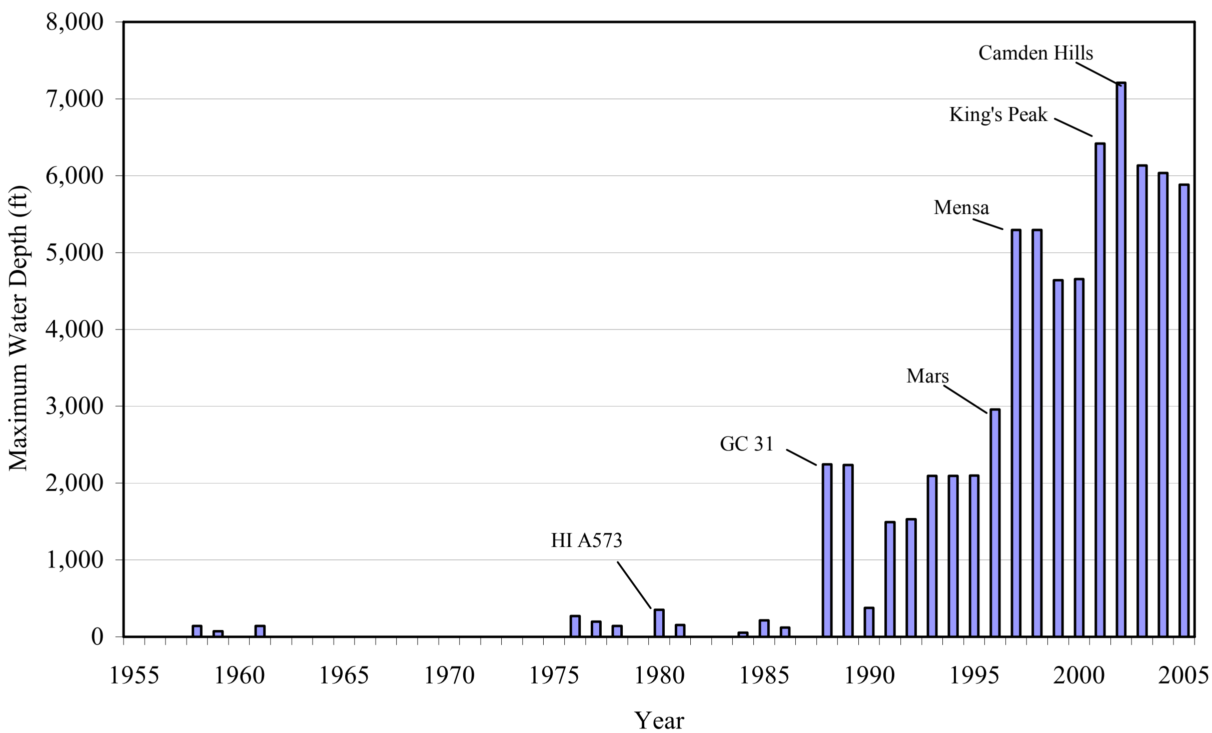

Figure 46. Maximum water depth of subsea completions installed each year.

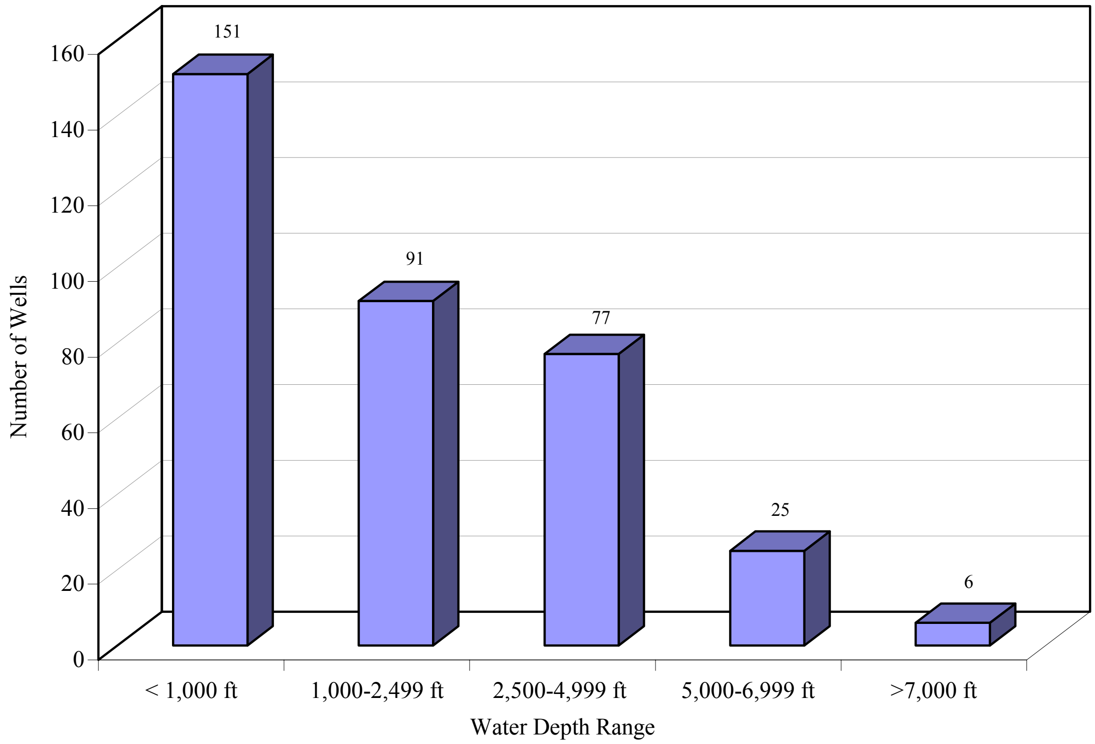

Figure 47. Water depth of subsea completions.

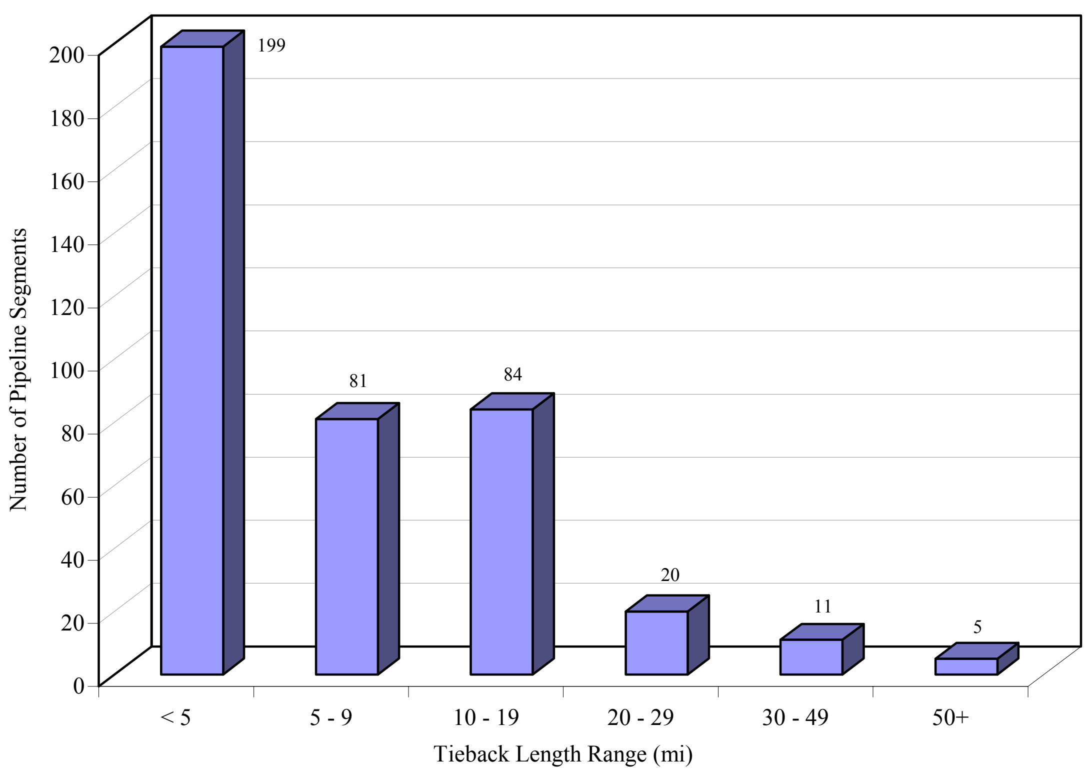

Figure 48. Length of subsea tiebacks.

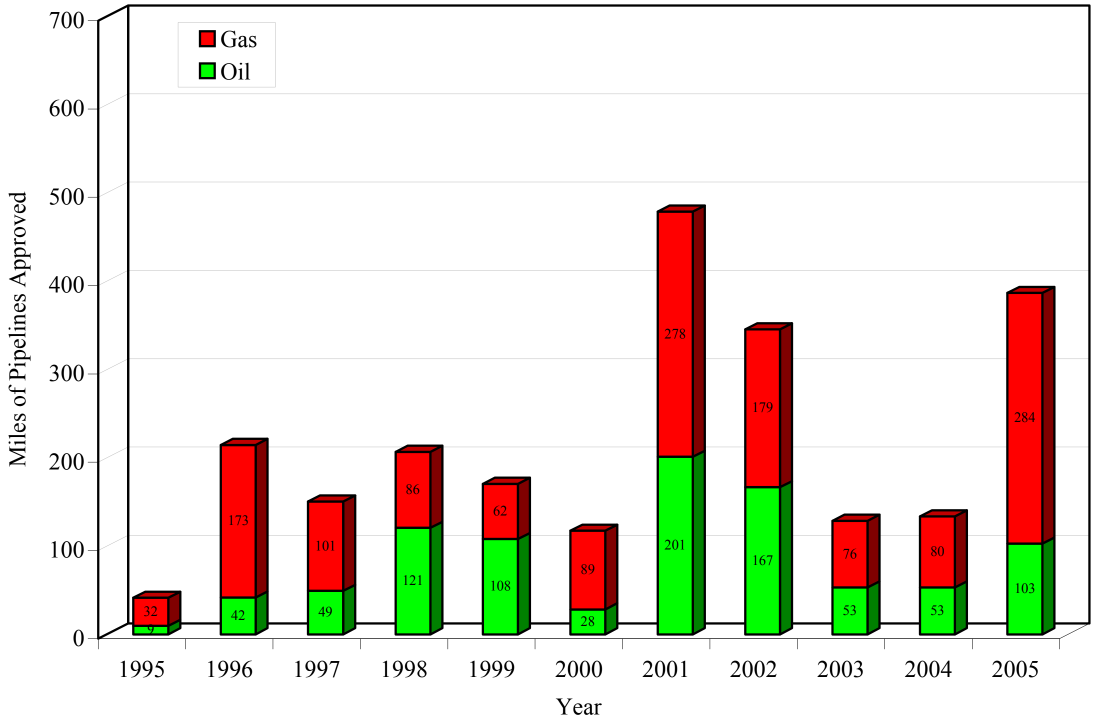

Figure 49a. Approved deepwater oil and gas pipelines less than or equal to 12 inches in diameter.

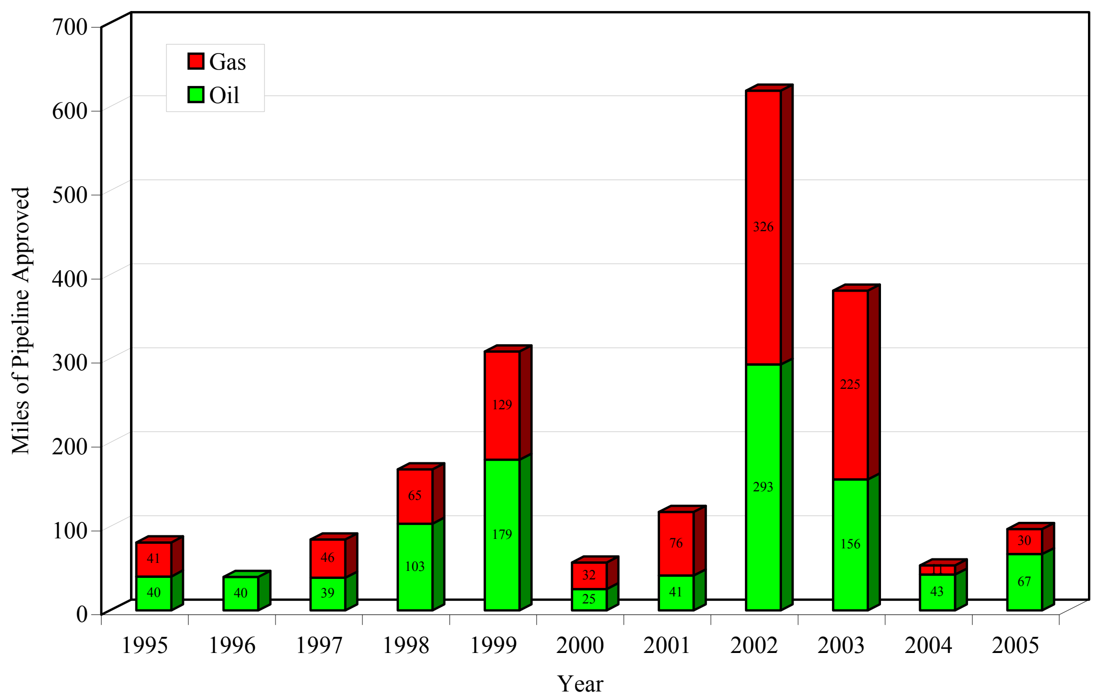

Figure 49b. Approved deepwater oil and gas pipelines greater than 12 inches in diameter.

Installation of large pipelines (greater than 12 inches [30.5 cm] in diameter) dramatically increased in 2002 after a brief downturn in activity in 2000 and 2001 (figure 49b). The peak in 2002 was driven by the approval of the Mardi Gras system. Gas and oil from the Mardi Gras system is delivered to onshore processing facilities via the new Cameron Highway pipeline system, which has been a very important development in pipeline infrastructure. In addition, Kerr-McGee's Constitution and Red Hawk facilities have installed export pipelines, both oil and gas, which have added significantly to the overall pipeline system. The newest approved transportation lines are from the Independence Hub facility. These lines will be installed in the near future.

The infrastructure needed to bring deepwater production online continues to develop over time. Figure 50 shows the framework of major oil and gas pipelines in the GOM. Figure 51 illustrates the existing network of deepwater pipelines. These figures highlight new and proposed pipelines since the 2004 report.

HIGH INTEGRITY PRESSURE PROTECTION SYSTEM (HIPPS)

The longer subsea tiebacks being used to develop marginal deepwater fields pose another challenge for industry, namely in the design and installation of pipelines rated for the HPHT well's shut-in tubing pressure (SITP) of 15,000 pounds per square inch (psi) and/or 350° F (177° C). Rather than relying on the physical strength of steel to withstand the SITP, a high integrity pressure protection system (HIPPS) provides alternate over-pressure protection for a pipeline or flowline. HIPPS employs valves, logic controllers, and pressure transmitters to shut down the system before a pipeline is overpressured and/or ruptured.

The MMS has been working with the American Petroleum Institute (API) and DeepStar to formulate the regulatory framework for the installation of an HIPPS in the GOM. DeepStar is a joint industry technology development project representing large and mid-size operators to help address common deepwater business challenges.

DeepStar is expected to finish its HIPPS study in 2006, and API will address HIPPS in its *Recommended Practice API RP 17 O* in late 2006 or early 2007. However, it is anticipated that the GOM Region will receive applications for the use of an HIPPS in 2006. Once design specifications for each section of the HIPPS system are finalized, MMS will hold operators to the design codes.

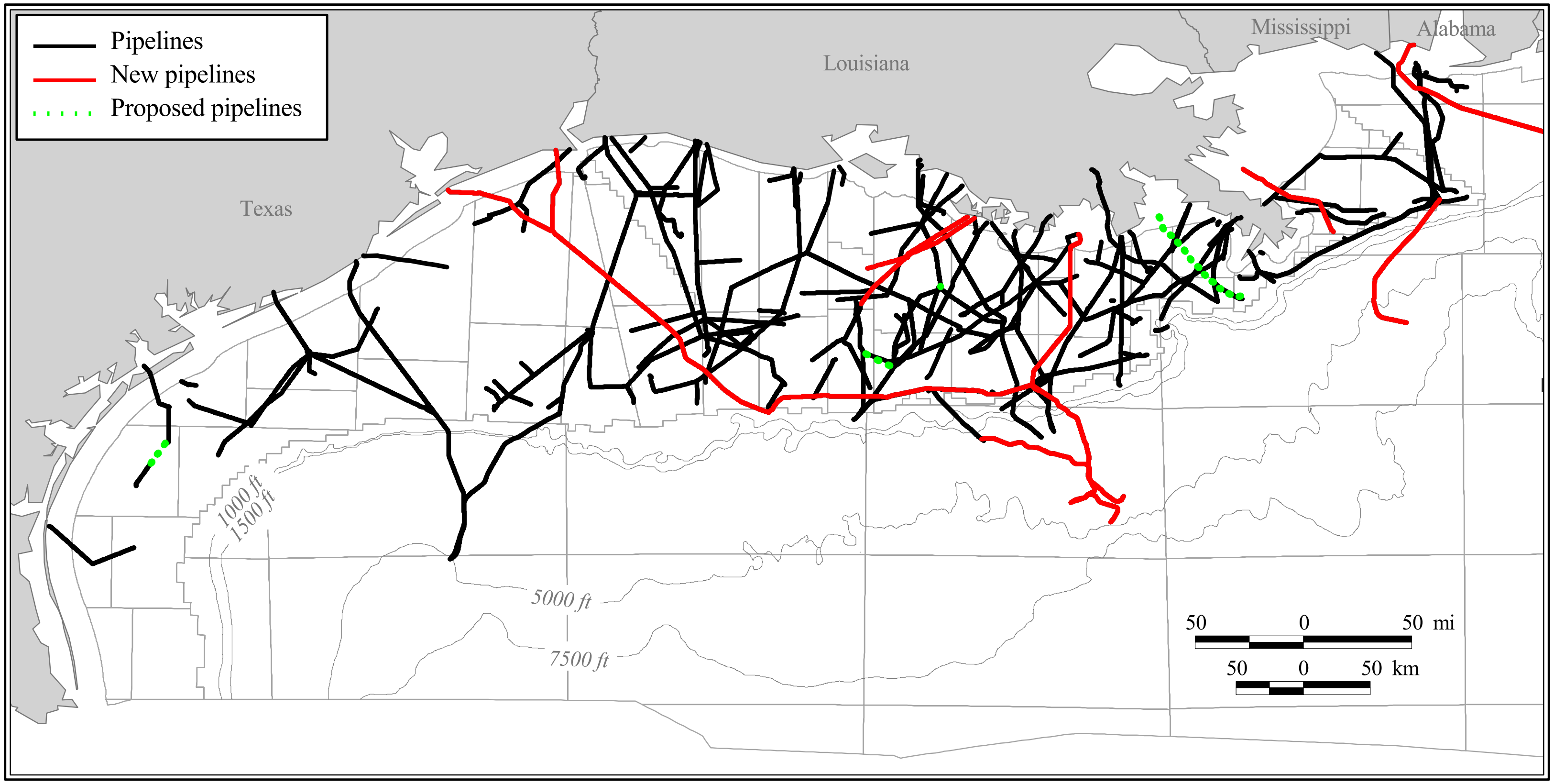

Figure 50. Oil and gas pipelines with diameters greater than or equal to 20 inches.

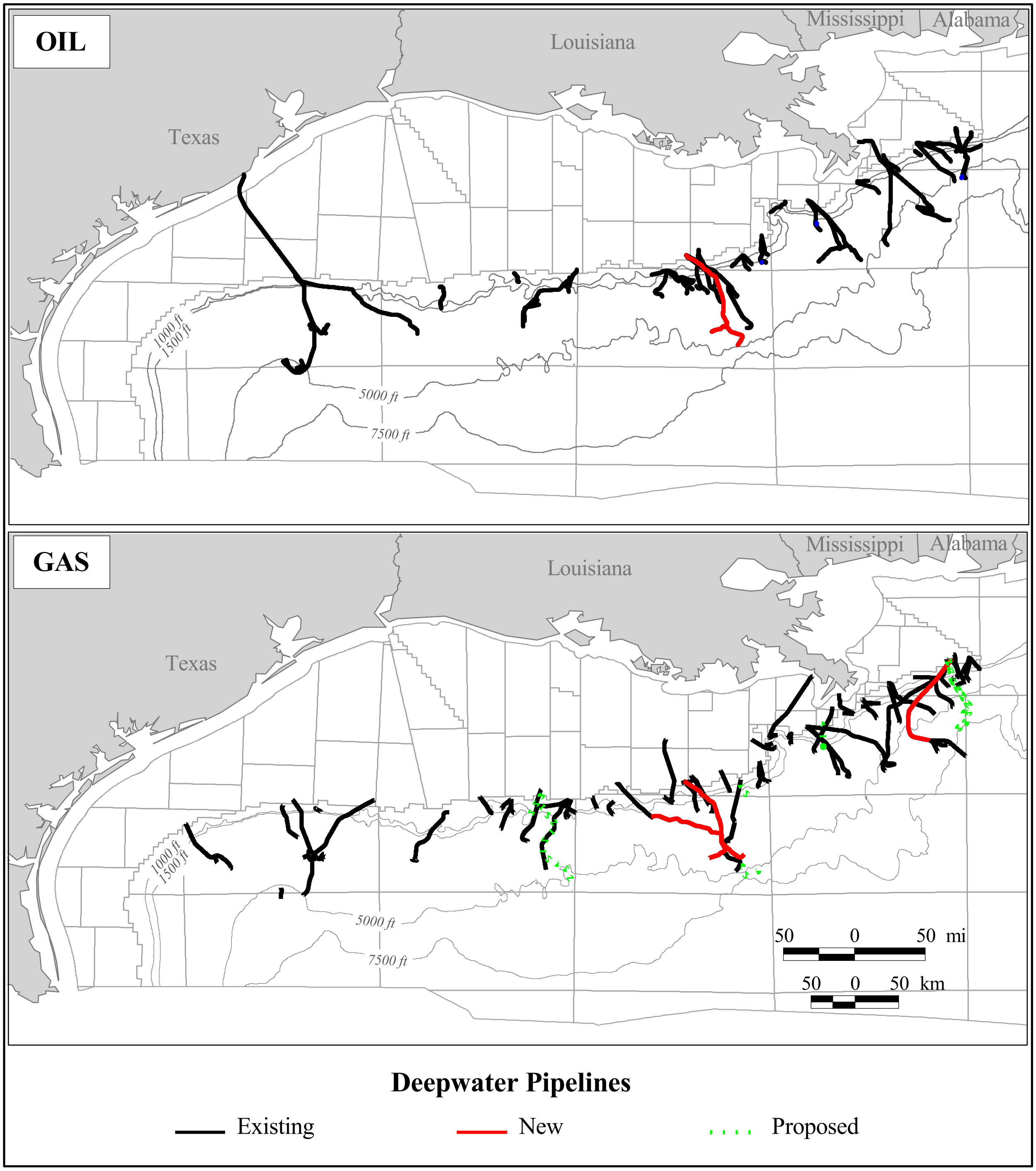

Figure 51. Deepwater oil and gas pipelines in the Gulf of Mexico.

RESERVES AND PRODUCTION

The deepwater GOM has contributed major additions to the total reserves in the GOM. Figure 52 shows the proved reserves added each year by water-depth category. Additions from the shallow waters of the GOM declined in recent years but, beginning in 1975, the deepwater area started contributing significant new reserves. Between 1975 and 1983, the majority of these additions were from discoveries in slightly more than 1,000 ft (305 m) of water. It was not until 1985 that major additions came from water depths greater than 1,500 ft (457 m).

There is often a significant lag between a successful exploratory well and its hydrocarbons being produced. The success of an exploratory well may remain concealed from the public for several years until the operator requests a "Determination of Well Producibility" from MMS. A successful MMS determination then "qualifies" the lease as producible and the discovery is placed in a field. The discovery date of that field is then defined as the TD (total depth) date of the field's first well that encountered significant hydrocarbons. Hydrocarbon reserves are still considered unproved until it is clear that the field will go on production. Then the reserves move into MMS's proved category. Figure 53 includes both proved and unproved reserves for each water-depth category. This figure shows declining reserve additions in shallow water, similar to figure 52, but reveals significantly more deepwater reserve additions and large significant unproved reserve additions in water depths greater than 5,000 ft (1,524 m) beginning in 1998.

Figure 54 illustrates the most important feature of the deepwater field discoveries, that their average size is many times larger than the average size of shallow-water fields. During the last 10 years, the average shallow-water field added approximately 5 MMBOE of proved and unproved reserves. In contrast, the average deepwater field added over 67 MMBOE of proved and unproved reserves.

DISCOVERIES

Figure 55 shows the number of deepwater fields discovered each year, according to MMS criteria, since 1975. (See appendix A for a listing of deepwater projects and discoveries.) The number of field discoveries for any given year is usually greater than the number of fields that actually go on production. The difference between the number of field discoveries and the number of those that actually produce increased in the early 2000's, since these recent field discoveries have had little time to reach production. Because of this lag between exploratory drilling and first production, the true impact of recent, large deepwater exploratory successes is not yet reflected in MMS proved and unproved reserve estimates.

In an attempt to capture the impact of these deepwater exploratory successes, figure 56 adds MMS-known resource estimates and industry-announced discoveries to the proved and unproved reserve volumes. The industry-announced discovery volumes contain considerable uncertainty, are based on limited drilling, include numerous assumptions, and have not been confirmed by independent MMS analyses. They do, however, illustrate recent activity better than using only MMS proved reserve numbers. The apparent decline of proved reserve additions in recent years is caused by the previously mentioned developmental lag.

Figure 57 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.

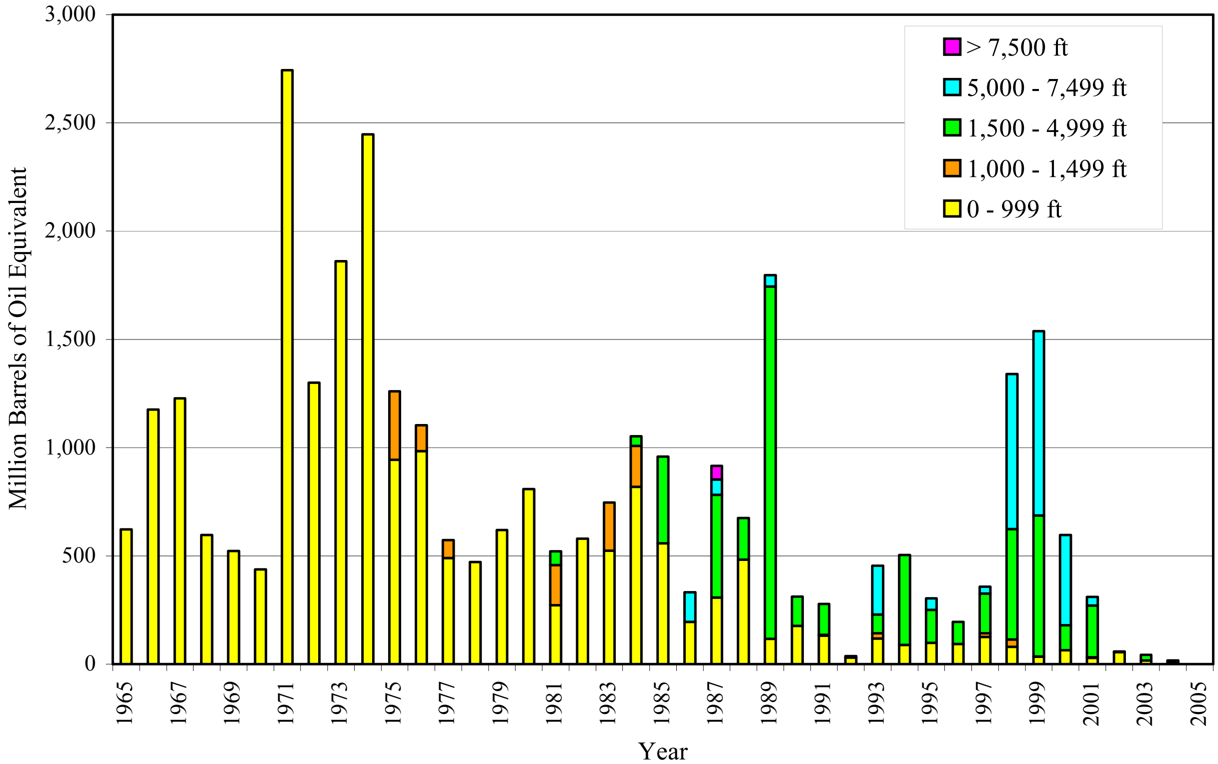

Figure 52. Proved reserve additions.

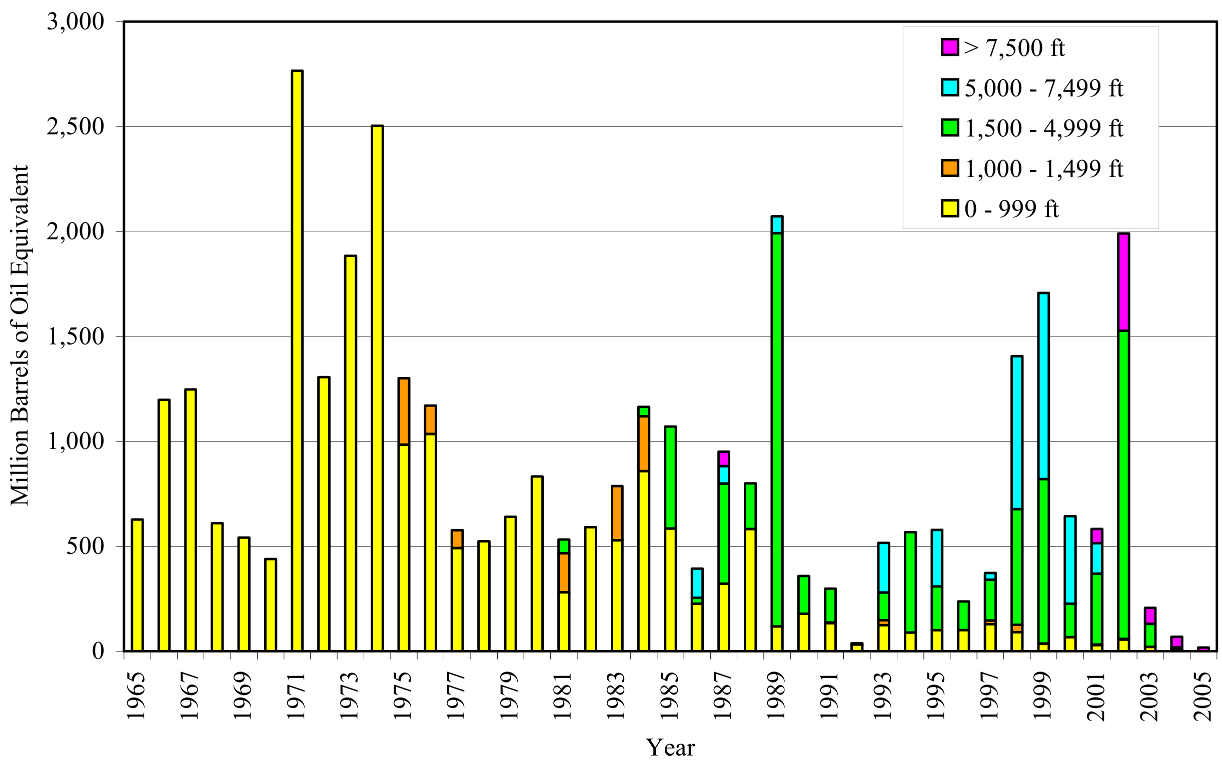

Figure 53. Proved and unproved reserve additions.

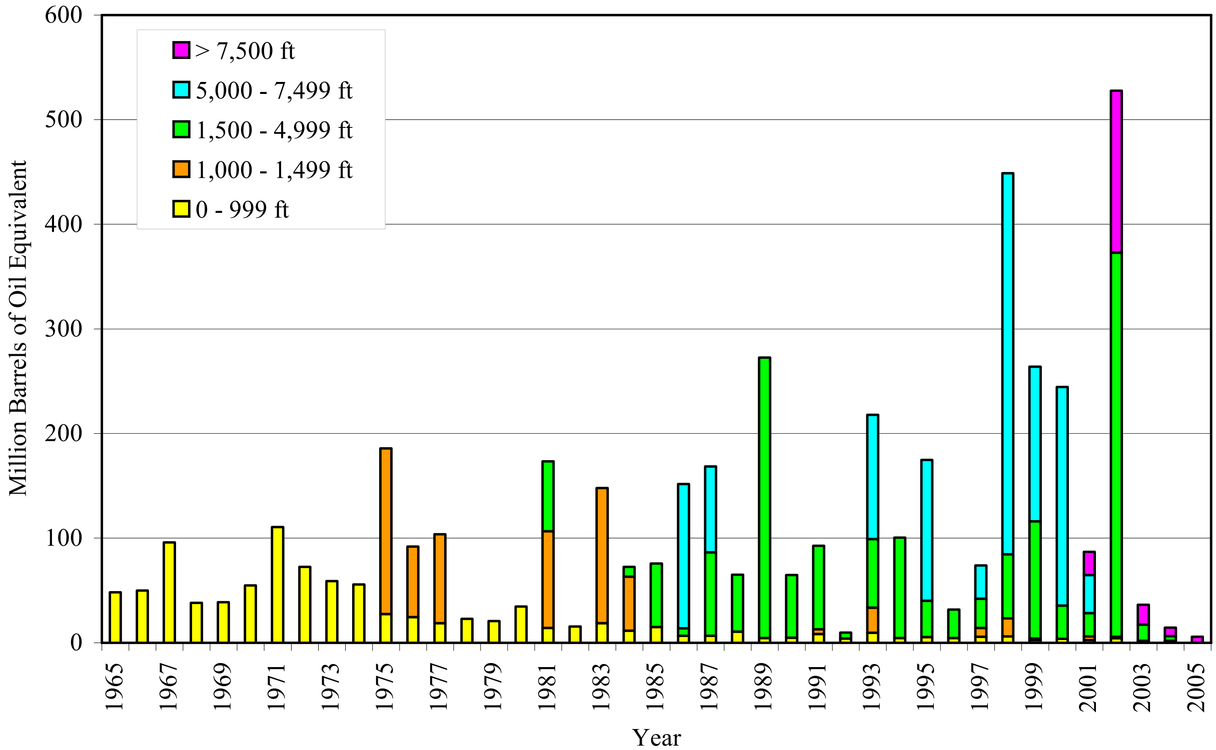

Figure 54. Average field size using proved and unproved reserves.

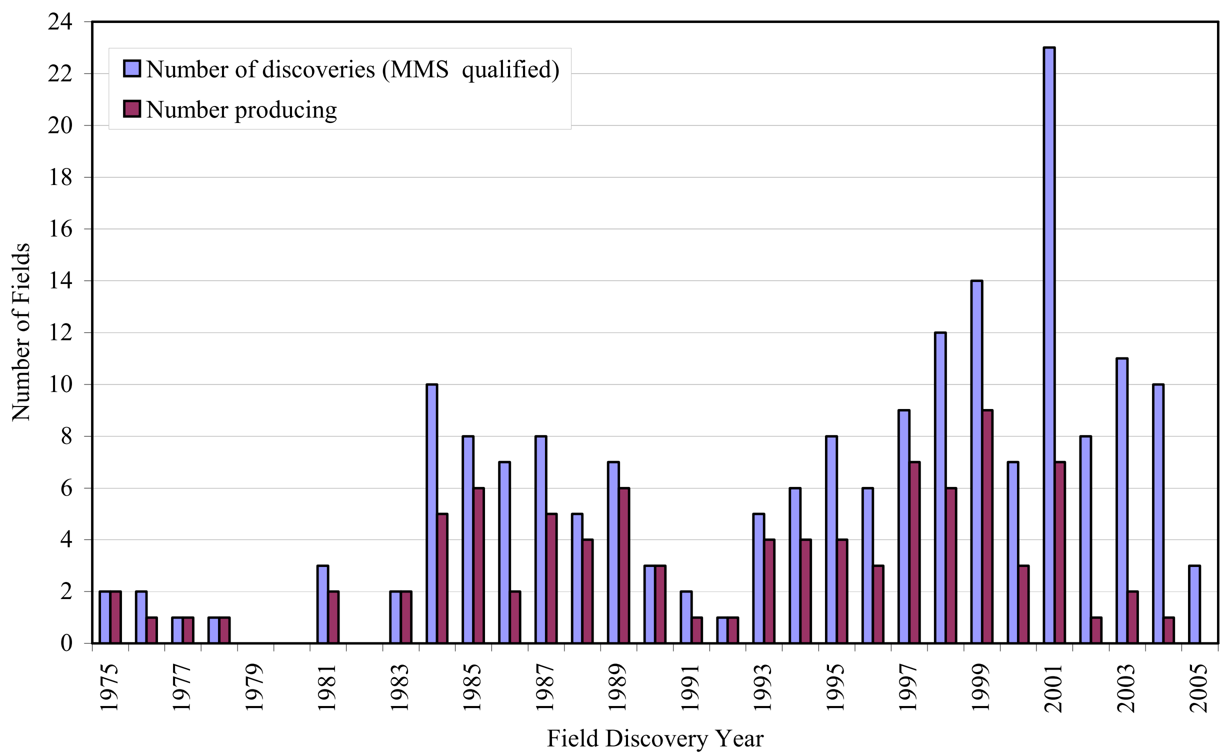

Figure 55. Number of deepwater field discoveries and resulting number of producing fields.

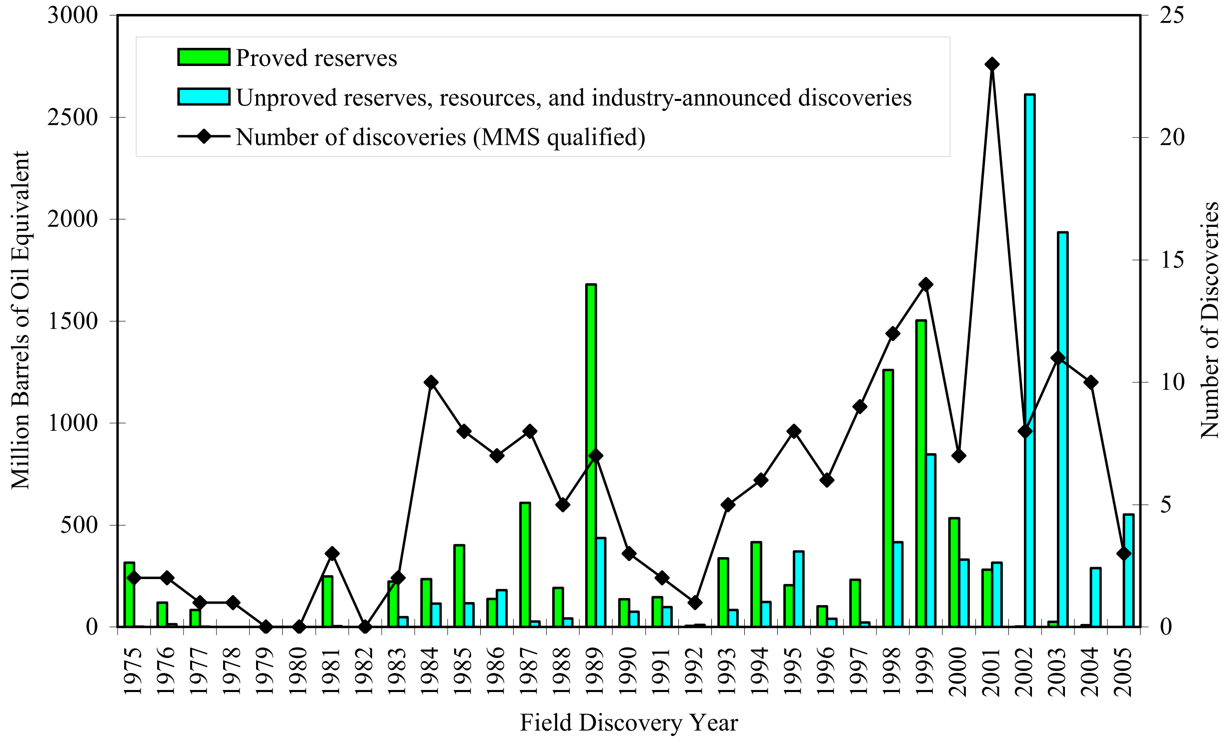

Figure 56. Number of deepwater field discoveries and new hydrocarbons found (MMS reserves, MMS resources, and industry-announced discoveries).

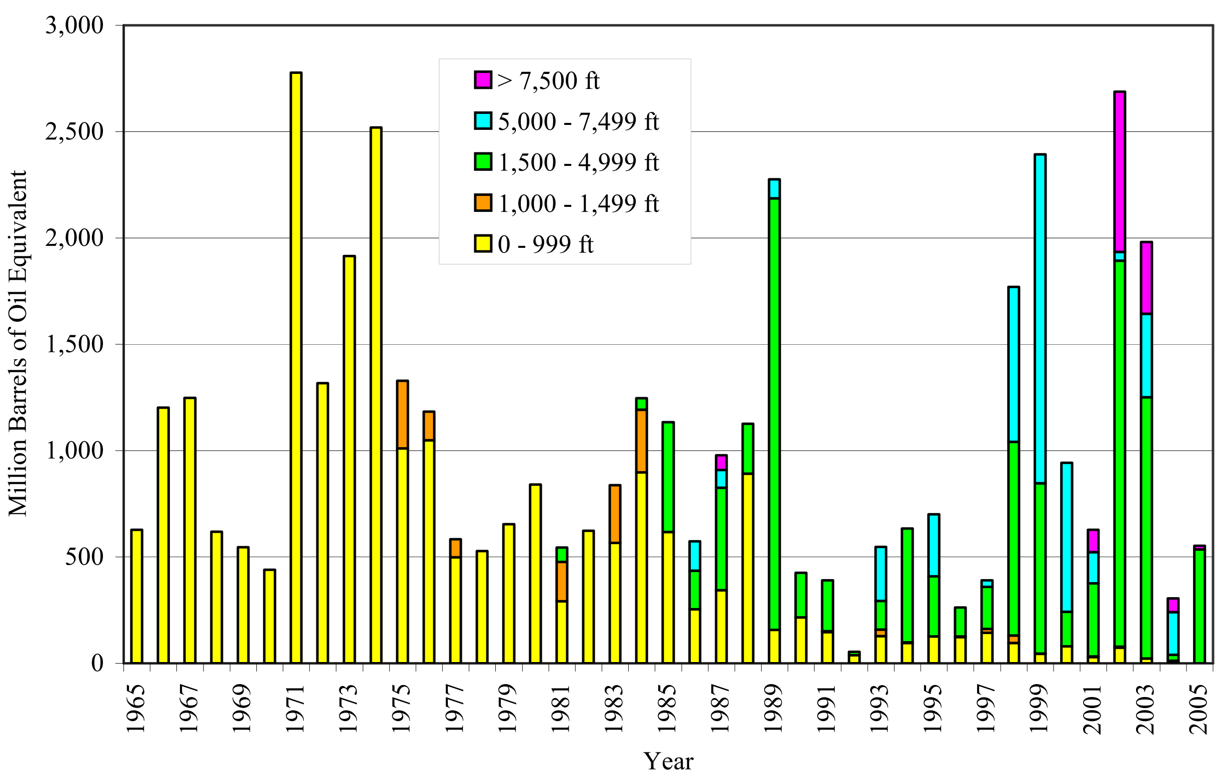

Figure 57. BOE added (reserves, known resources, and industry-announced discoveries).

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 58 illustrates the relative volume of production from each GOM block through time. Notice the large deepwater volumes that first appear in 1996 and 1997. More recent production continues to expand over a larger area and into deeper waters. Table 9 shows that the most prolific blocks (on a BOE basis) are currently in the deepwater GOM.

Table 9
Top 20 Producing Blocks for the Years 2003–2004

Block	Project Name	Owner	Water Depth (ft)	Production (BOE)*
MC 807	Mars	Shell	2,933	93,697,105
MC 809	Ursa	Shell	3,800	55,745,876
MC 127	Horn Mountain	BP	5909	41,587,128
MC 763	Mars	Shell	3,261	34,808,598
GB 215	Conger	Amerada Hess	1,500	32,908,596
VK 786	Petronius	ChevronTexaco	1,753	28,140,012
MC 765	Princess	Shell	3,600	26,557,440
EB 602	Nansen	Kerr-McGee	3,675	25,711,854
MC 686	Mensa	Shell	5,364	24,876,468
EB 643	Boomvang	Kerr-McGee	3,650	24,650,727
MC 305	Aconcagua	Total	7,100	22,071,492
GC 202	Brutus	Shell	3,327	21,938,285
EB 945	Diana	ExxonMobil	4,500	21,857,743
MC 85	King	BP	5,689	18,400,654
MC 899	Crosby	Shell	4,259	18,135,470
GC 243	Aspen	Nexen	3,065	18,111,481
VK 915	Marlin	BP	3,236	17,746,359
VK 912	Ram Powell	Shell	3,216	17,278,987
ST 37	Unnamed	ChevronTexaco	59	15,834,599
MP 61	Unnamed	POGO	151	15,201,087

*cumulative production from January 2003 through December 2004

Figure 59 illustrates the importance of the GOM to the Nation's energy supply. The GOM supplies approximately 28 percent of the Nation's domestic oil and 20 percent of the Nation's domestic gas production. A significant portion of these volumes comes from the deepwater.

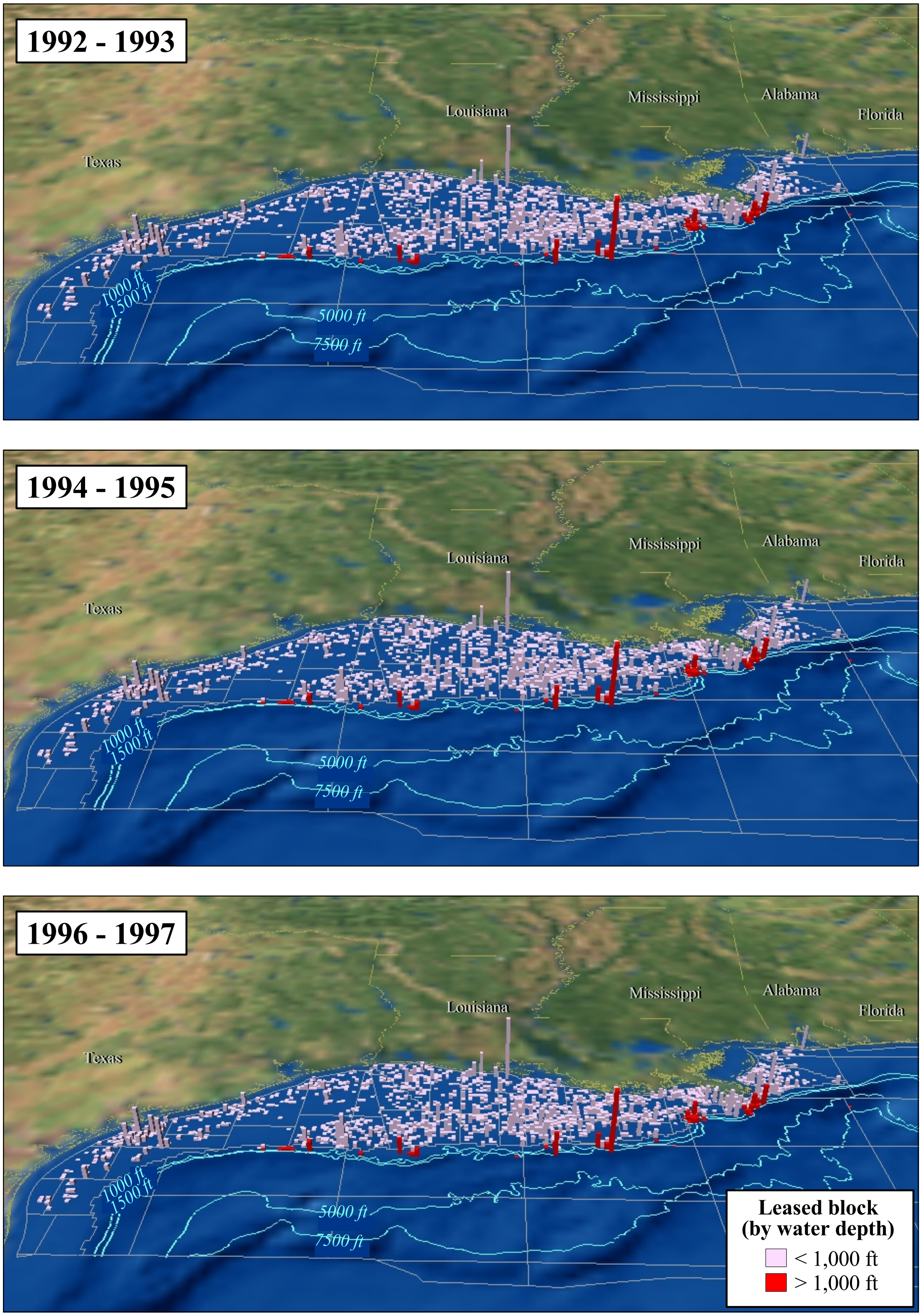

Figure 58. Relative volume of production from each GOM lease. Bar heights are proportional to total lease production (barrels of oil equivalent) during that interval.

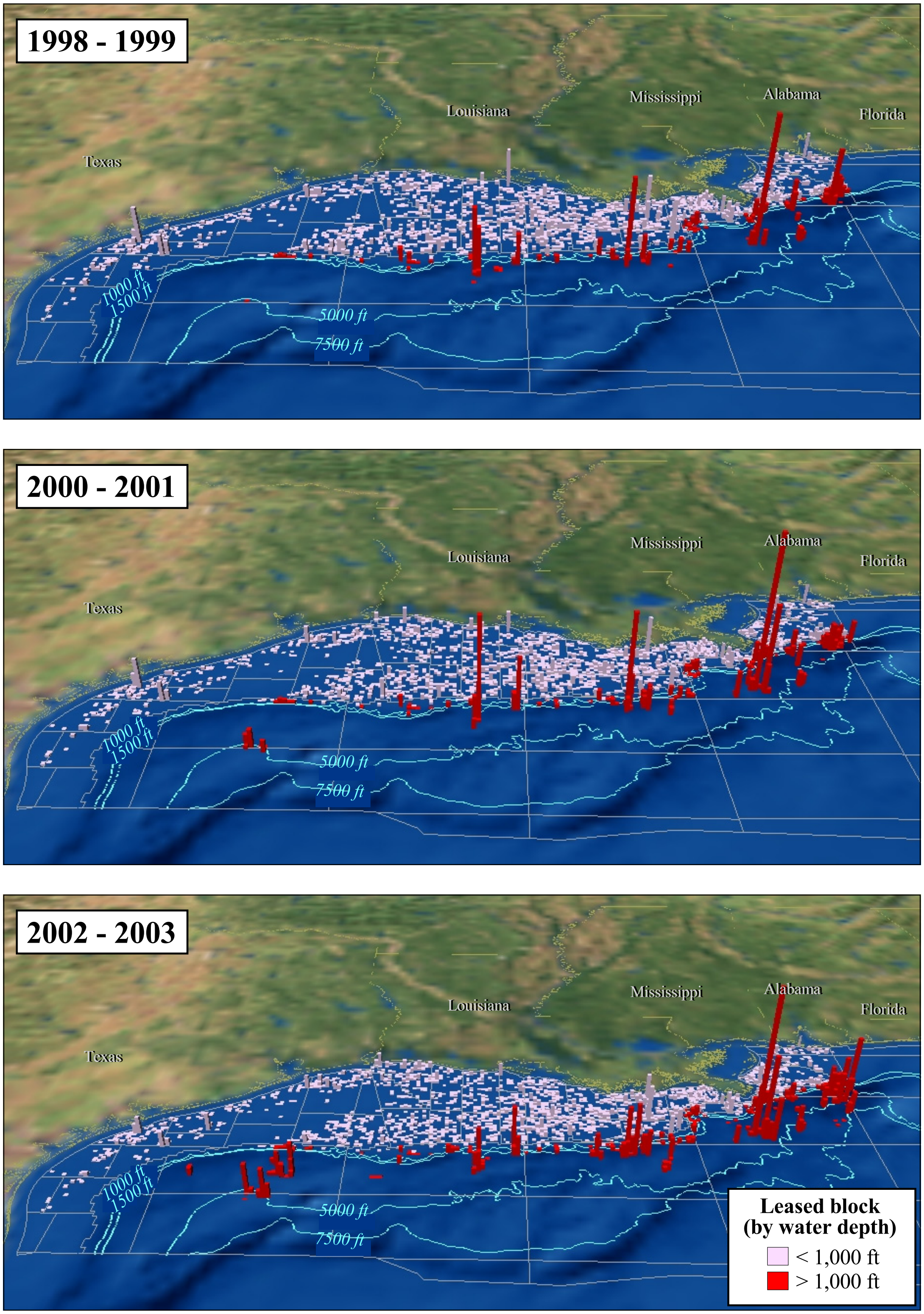

Figure 58. Relative volume of production from each GOM lease. Bar heights are proportional to total lease production (barrels of oil equivalent) during that interval (*continued*).

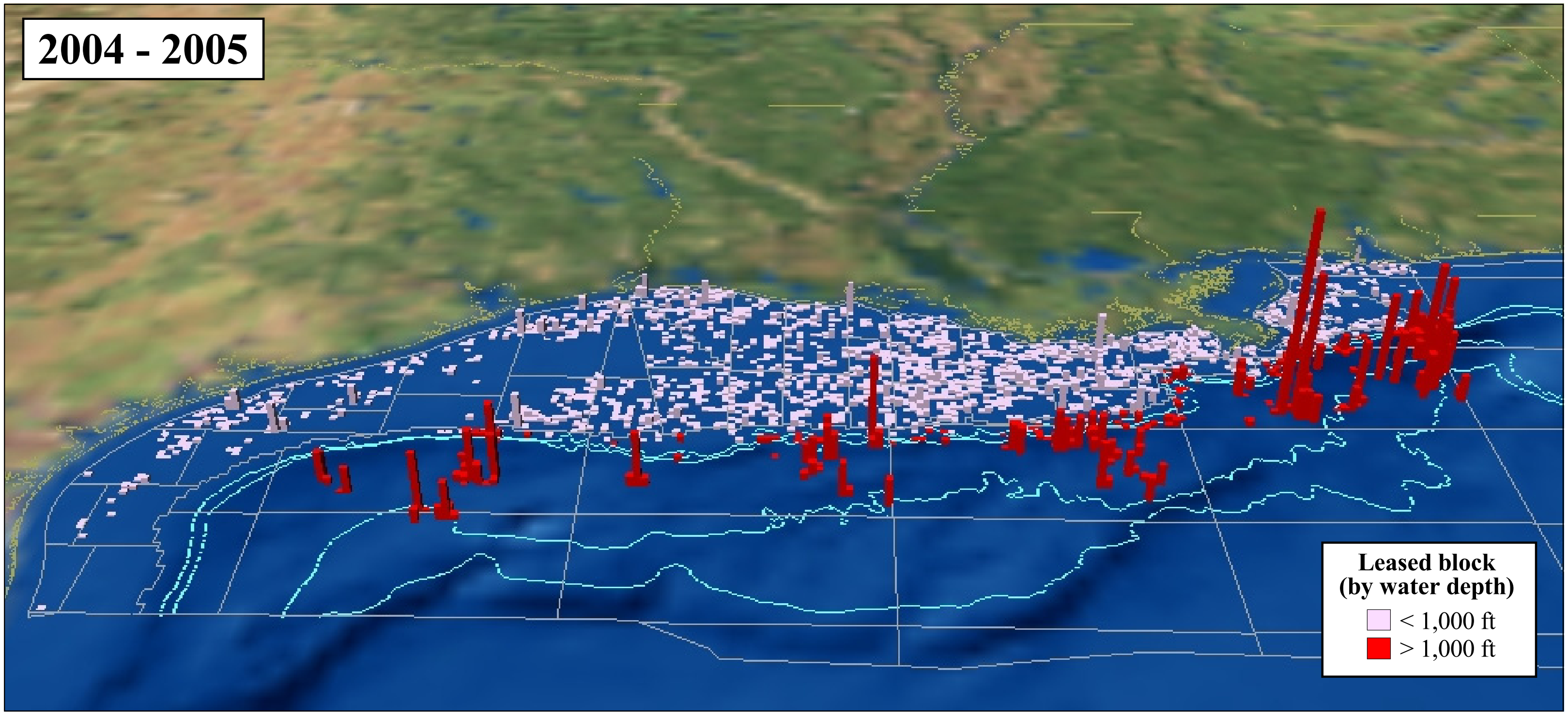

Figure 58. Relative volume of production from each GOM lease. Bar heights are proportional to total lease production (barrels of oil equivalent) during that interval (*continued*).

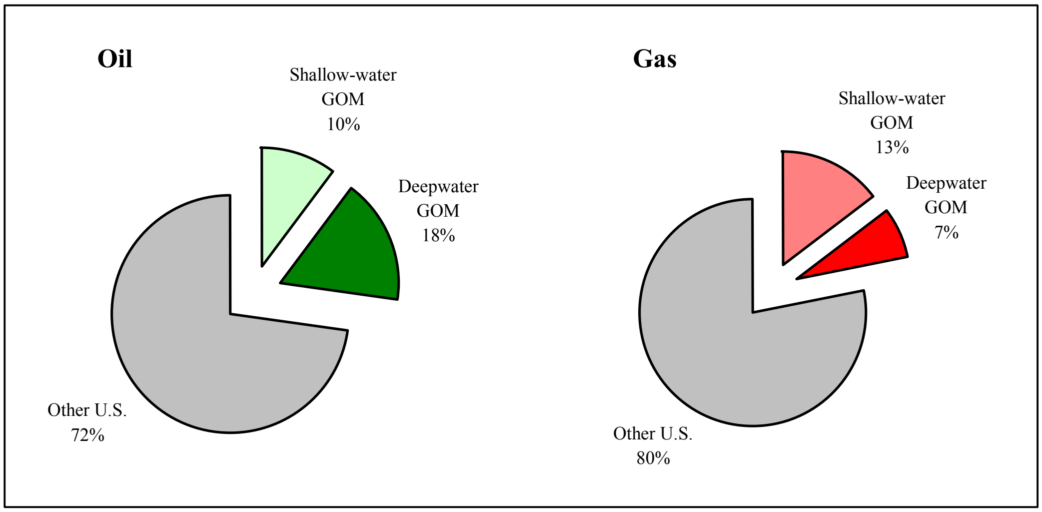

Figure 59. Estimated U.S. oil and gas production in 2004.

Figure 60a illustrates historic trends in oil production. Shallow-water oil production rose rapidly in the 1960's, peaked in 1971, and has undergone cycles of increase and decline since then. Since 1997, the shallow-water GOM oil production has steadily declined and, at the end of 2004, was at its lowest level since 1967. From 1995 through 2003, deepwater oil production experienced a dramatic increase similar to that seen in the shallow-water GOM during the 1960's, offsetting recent declines in shallow-water oil production. Starting in 2003, deepwater oil production levelled off. In 2004, deepwater oil production accounted for approximately 64 percent of GOM oil production.

Figure 60b shows similar production trends for gas. Shallow-water gas production rose sharply throughout the 1960's and 1970's, and then remained relatively stable over the next 15 years before declining steadily from 1996 through today. Although the deepwater gas production increase has not been as dramatic as with oil, the increase in deepwater gas production that occurred in the past few years helped to offset the shallow-water decline. Similar to deepwater oil production, gas production levelled off beginning in 2003. Appendix F lists historic GOM oil and gas production. These trends in oil and gas production indicate that the deepwater GOM frontier continues to expand.

As discussed previously, the Deepwater Royalty Relief Act (DWRRA) had a significant effect on deepwater leasing and drilling. Numerous projects with royalty relief eligibility have come online in recent years (table 7), but the impact of the DWRRA on deepwater production began to show in 2002. Figure 61a shows the contribution of Deepwater Royalty Relief (DWRR) oil production to total "deepwater" GOM oil production, where "deepwater" is defined as 200 m (656 ft), the minimum water depth for which DWRR incentives are offered, instead of 1,000 ft (305 m), the definition used elsewhere in this report. Since the 2004 report (Richardson et al.), the amount of oil production subject to royalty suspension increased significantly to 21 percent of the total "deepwater" production. Figure 61b displays total "deepwater" gas production along with gas production subject to royalty relief. The volume of natural gas subject to royalty relief under the DWRRA increased rapidly in 2002, reaching 29 percent of total "deepwater" production by March 2004. Note that pre-DWRRA production refers to production from leases that have been approved to receive royalty relief but were issued before November 28, 1995.

Approximately 350,000 barrels of oil and 1.7 billion cubic feet of gas come from deepwater subsea completions each day. Subsea completions currently account for about 34 percent of deepwater oil

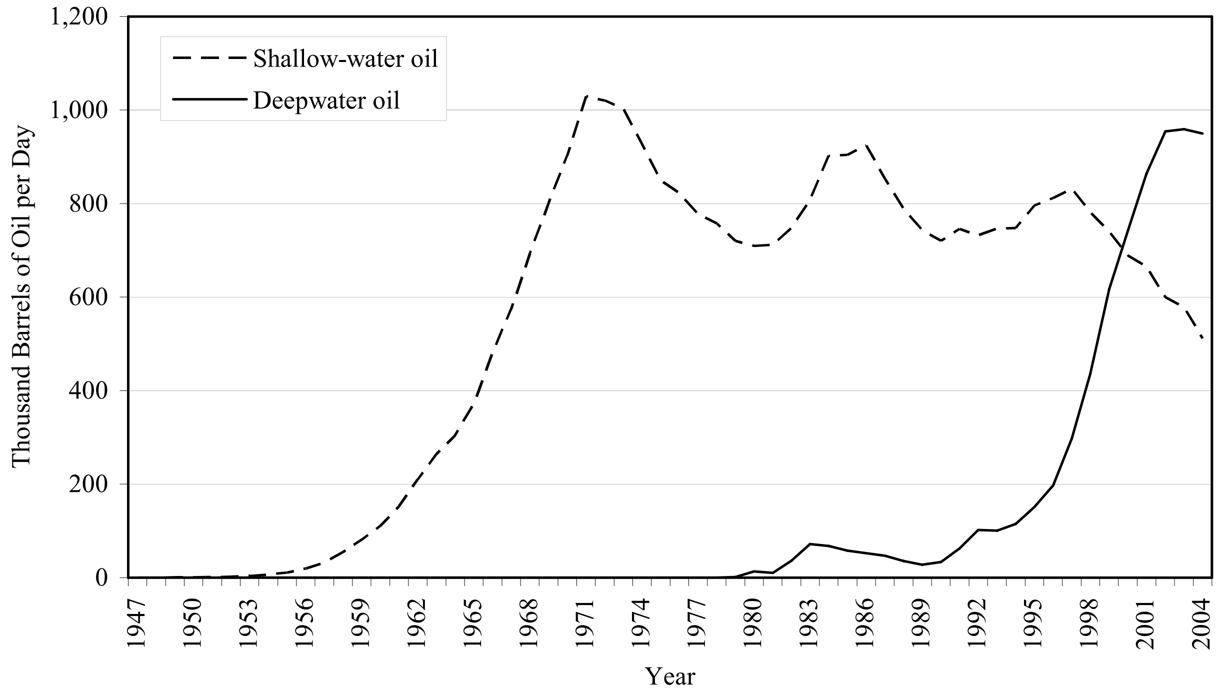

Figure 60a. Comparison of average annual shallow- and deepwater oil production.

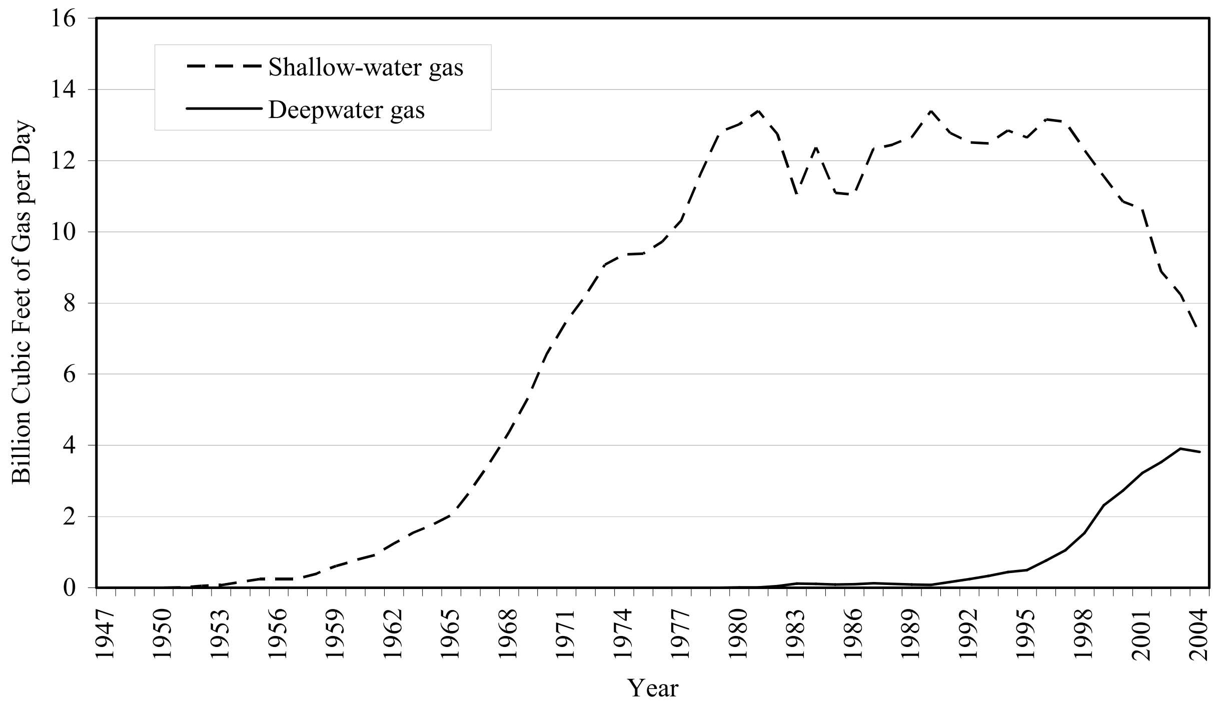

Figure 60b. Comparison of average annual shallow- and deepwater gas production.

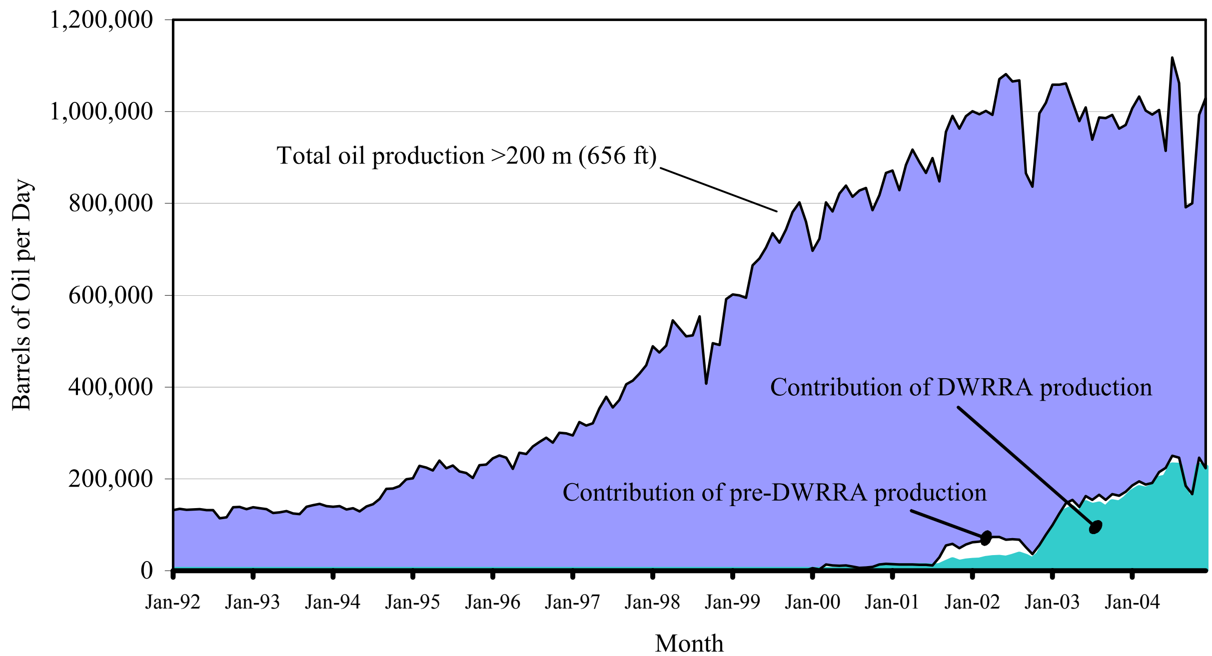

Figure 61a. Contribution of DWRRA oil production to total oil production in water depths greater than 200 m (656 ft).

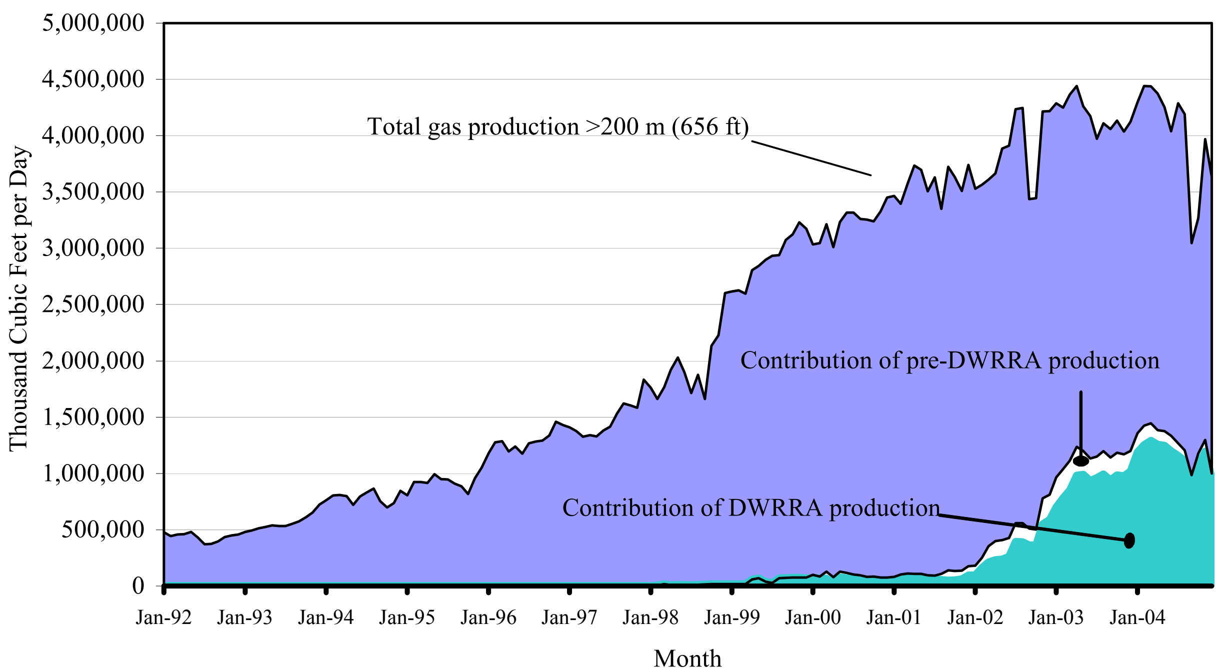

Figure 61b. Contribution of DWRRA gas production to total gas production in water depths greater than 200 m (656 ft).

production and about 50 percent of deepwater gas production. Figure 62a shows that very little deepwater oil production came from subsea completions until mid-1995, but by the fall of 1996 that production had risen to about 20 percent. Since 2000, subsea oil production has increased slightly, whereas total deepwater oil production has increased dramatically. Deepwater gas production from subsea completions began in early 1993, and by mid-1994 it accounted for over 40 percent of deepwater GOM gas production (Figure 62b). Gas production from subsea completions increased from 1996 through 1999, remained constant in 2000, and increased rapidly after 2000.

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 (monthly production divided by actual production days). For example, a well within Shell's Bullwinkle field produced about 5,000 BOPD in 1992. In 1994, a well within Shell's Auger field set a record, producing about 10,000 BOPD. From 1994 through mid-1999, maximum deepwater oil production rates continued to climb, especially in water depths between 1,500 and 4,999 ft (457 and 1,524 m). Horn Mountain came online in early 2002 in 5,400-ft (1,646-m) water depth with a single well maximum rate of more than 30,000 BOPD. Since mid-2002, oil production rates have declined in the 1,500 to 4,999-ft (457 to 1,524-m) water-depth interval; however, production rates have increased steeply in the greater than and equal to 5,000-ft (1,524-m) water-depth interval. The record daily oil production rate (for a single well) is 41,532 BOPD (Troika). Figure 63b shows maximum production rates for gas. These rates hovered around 25 MMCFPD until a well in Shell's Popeye field raised the deepwater production record to over 100 MMCFPD in 1996. Since then, the deepwater has yielded even higher maximum production rates. In 1997, Shell's Mensa field (5,379-ft [1,640-m] water depth) showed the excellent potential for deepwater production rates beyond the 5,000-ft (1,524-m) water-depth interval. The record daily gas production rate is 158 MMCFPD (Mensa).

Figure 64a shows that the average deepwater oil completion currently produces at about 25 times the rate of the average shallow water (less than 1,000 ft [305 m]) oil completion. The average deepwater gas completion currently produces at about 8 times the rate of the average shallow-water gas completion (figure 64b). Deepwater oil production rates increased rapidly from 1996 through 2000 and remained steady since that time. Deepwater gas production rates rose from 1996 to mid-1997 and then stabilized at the current high rates.

Two trends are readily apparent in figures 65a-b. First, average oil production rates per well for deepwater are more than 10 times greater than the rates for shallow water, especially in the later years. In addition, rates are declining from their peak production more rapidly in deepwater after 1998. These figures show monthly average oil production rates for all wells that began production in a specific year. For example, in figure 65a, the 1992 line represents oil well production for deepwater oil wells completed in 1992 divided by the number of oil wells which began production in that year. The 1992 line tracks production from these completions in successive years.

Figures 66a (oil) and 66b (gas) compare maximum historic production rates for each lease in the GOM, i.e., the well with the highest historic production rate is shown for each lease. These maps show that many deepwater fields produce at some of the highest rates encountered in the GOM. Figure 66a also shows that maximum oil rates were significantly higher off the southeast Louisiana coast than off the Texas coast. Figure 66b illustrates the high deepwater gas production rates relative to the rest of the GOM. Note also the excellent production rates from the Norphlet trend (off the Alabama coast) and the Corsair trend (off the Texas coast).

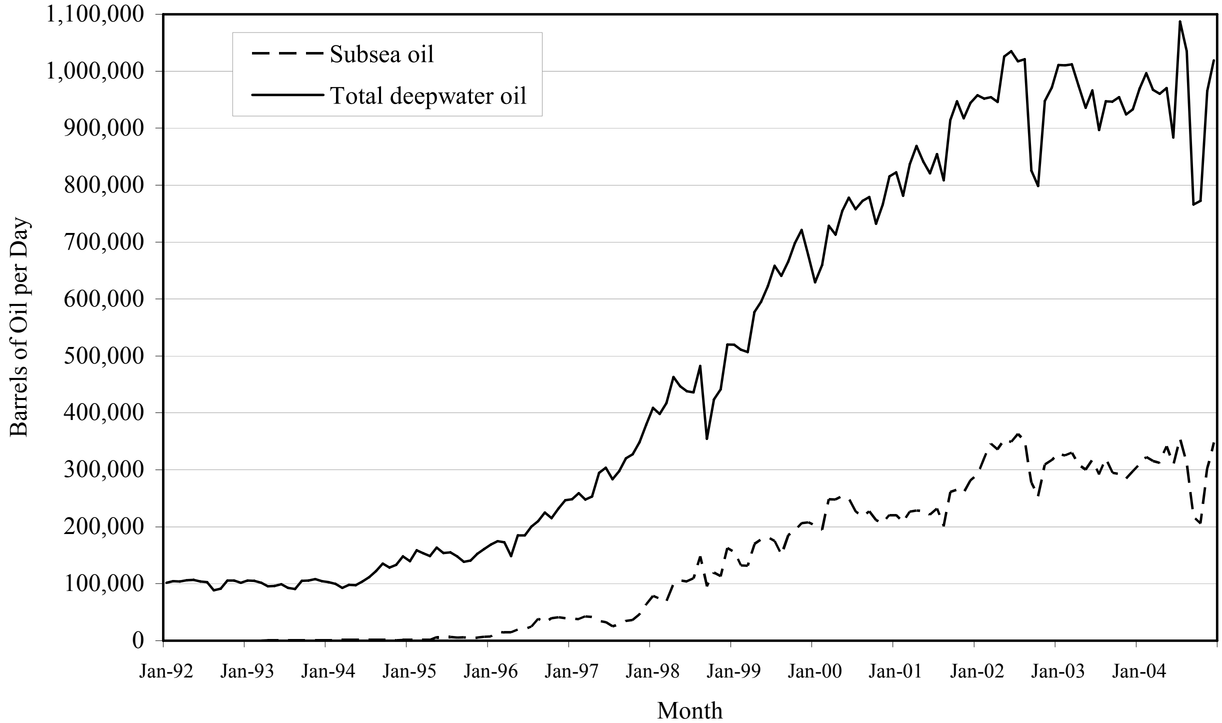

Figure 62a. Contributions from subsea completions toward total deepwater oil production.

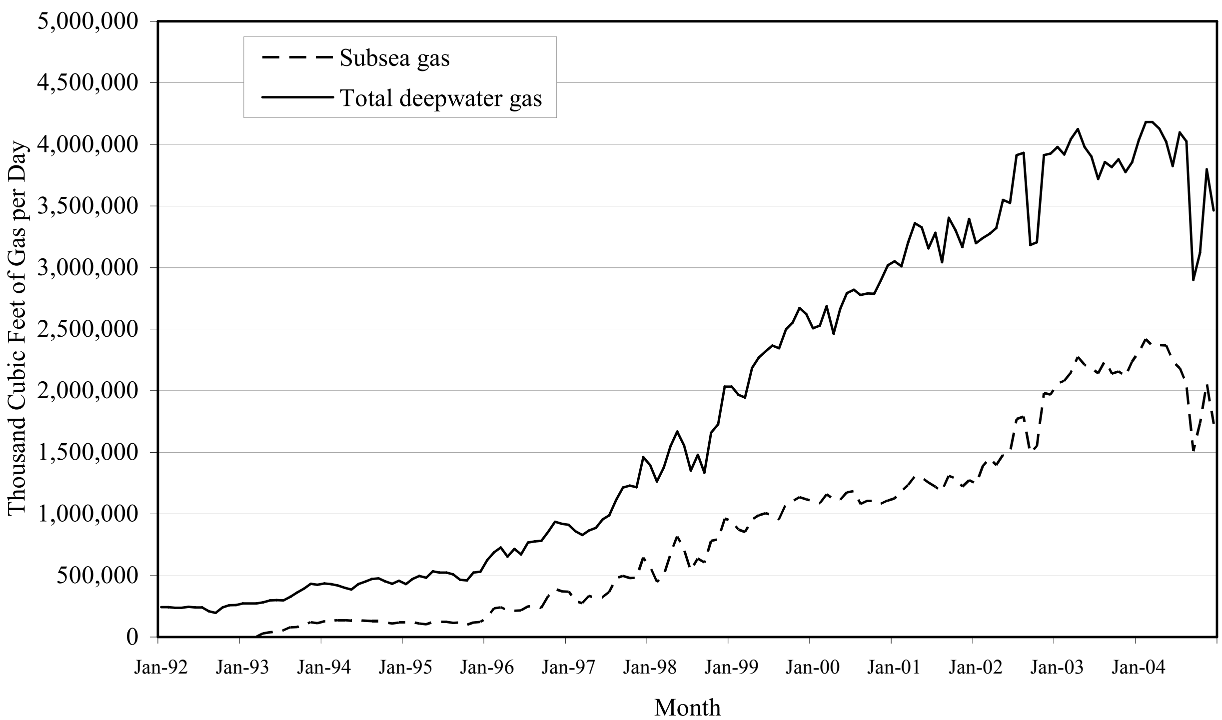

Figure 62b. Contributions from subsea completions toward total deepwater gas production.

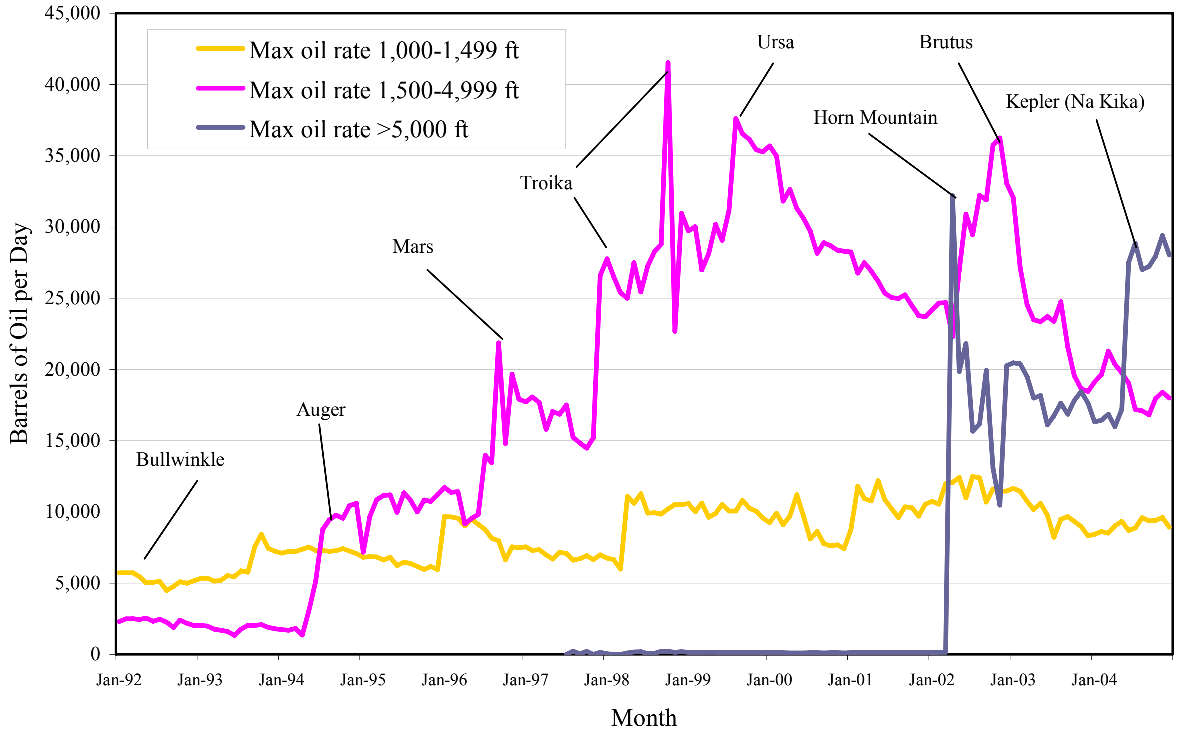

Figure 63a. Maximum production rates for a single well within each water-depth category for deepwater oil production.

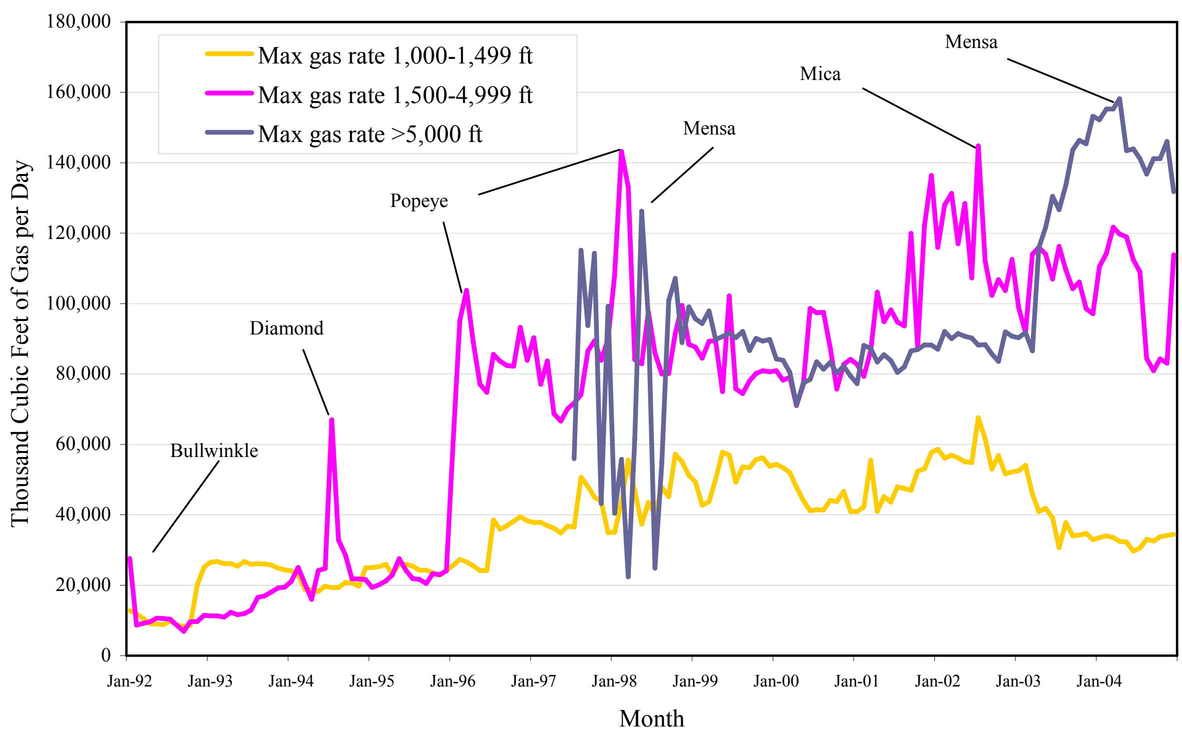

Figure 63b. Maximum production rates for a single well within each water-depth category for deepwater gas production.

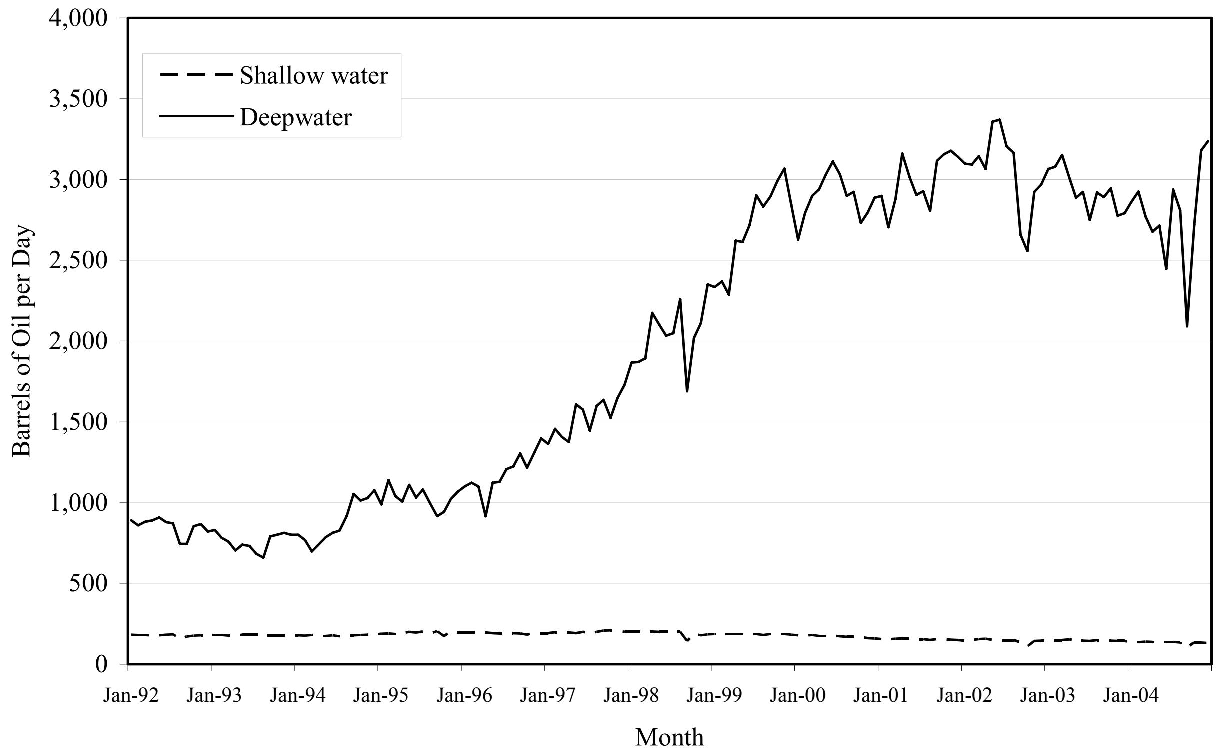

Figure 64a. Average production rates for shallow-water and deepwater oil well completions.

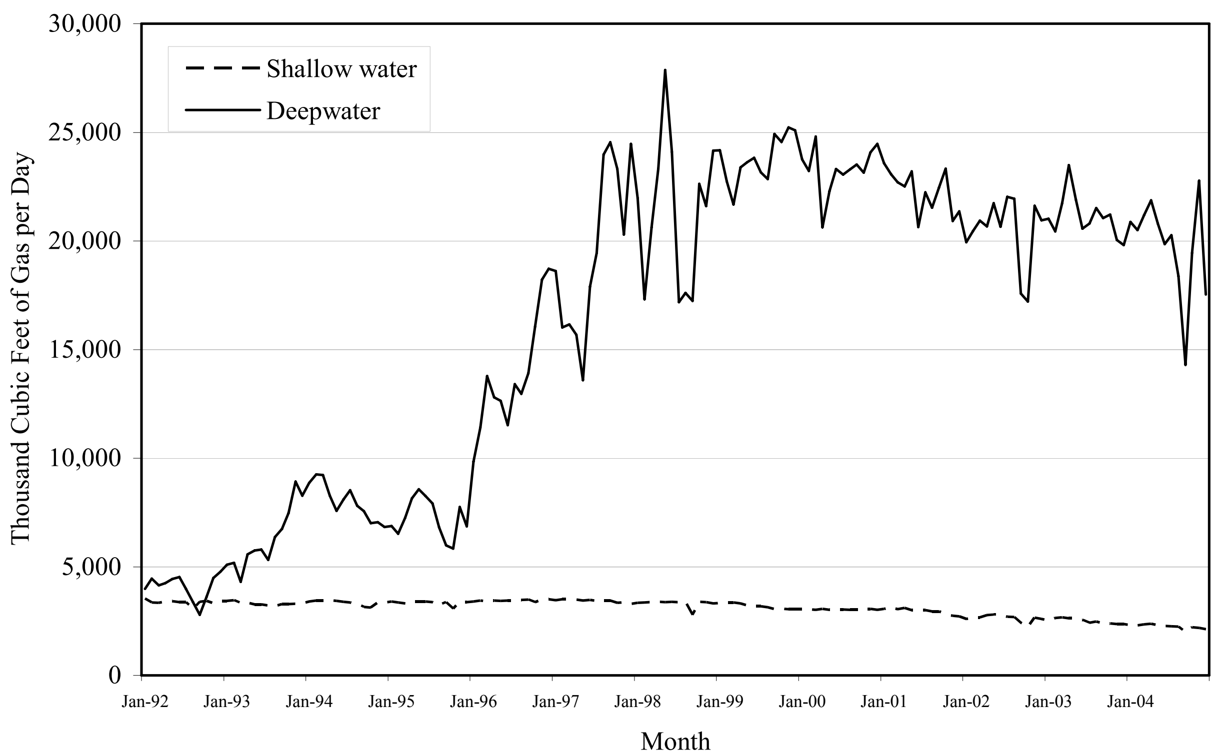

Figure 64b. Average production rates for shallow-water and deepwater gas well completions.

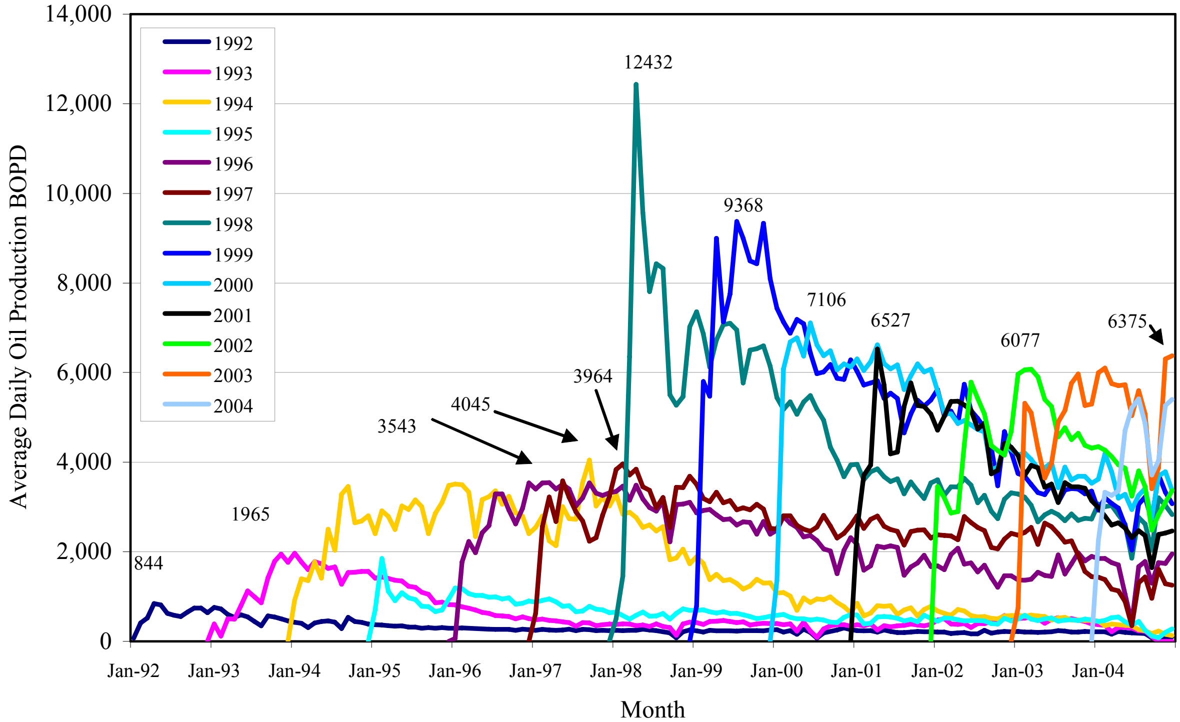

Figure 65a. Deepwater oil production profiles (oil wells coming onstream between 1992 and 2004).

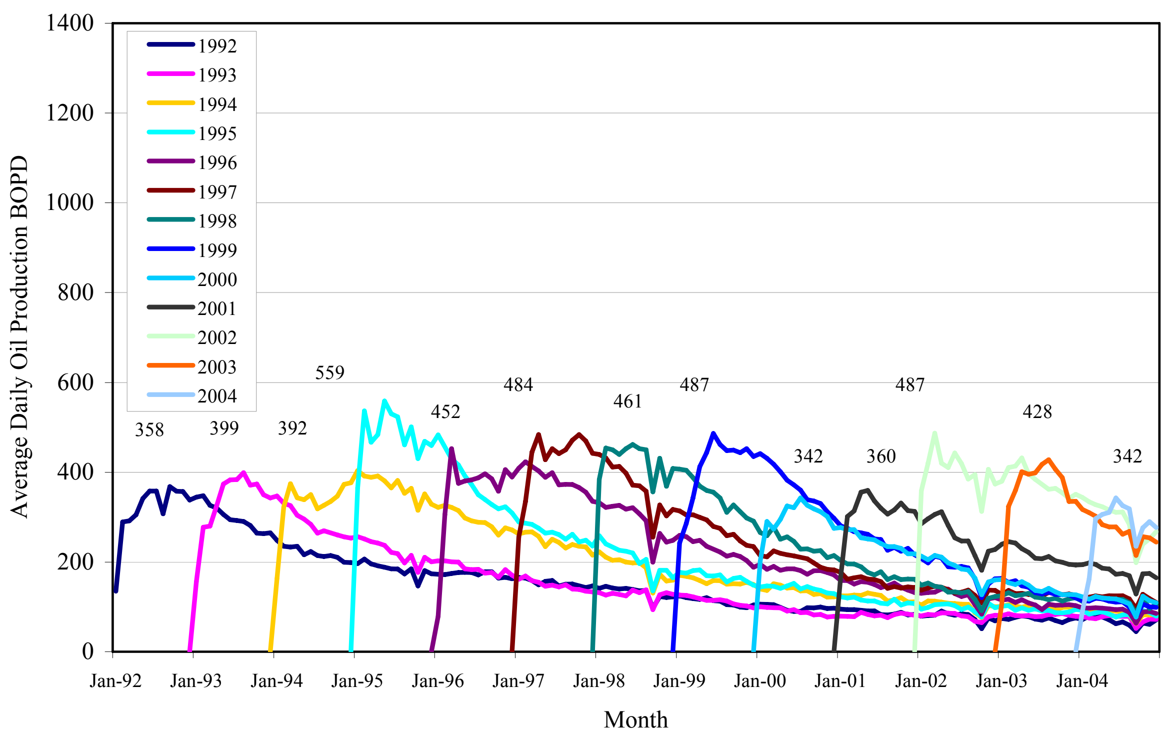

Figure 65b. Shallow-water oil production profiles (oil wells coming onstream between 1992 and 2004).

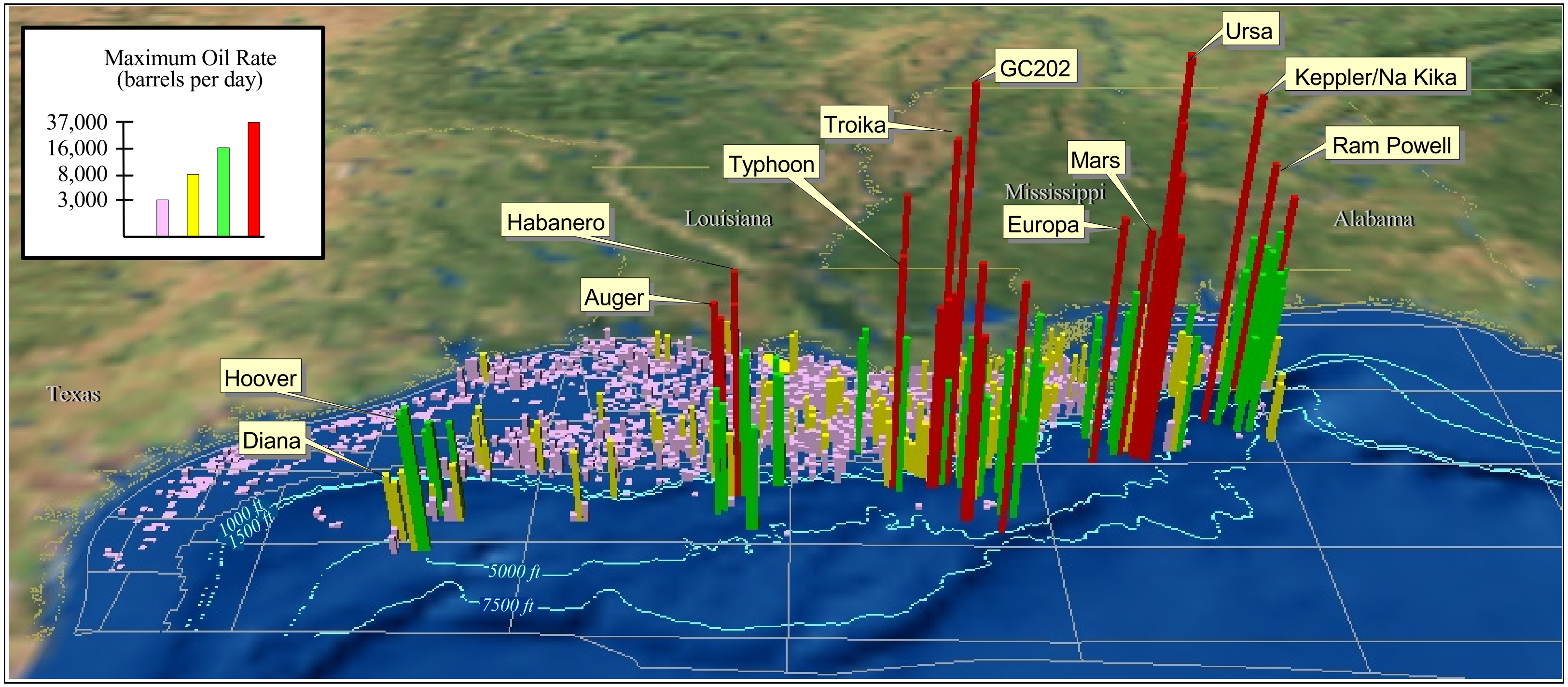

Figure 66a. Maximum historic oil production rates for Gulf of Mexico wells.

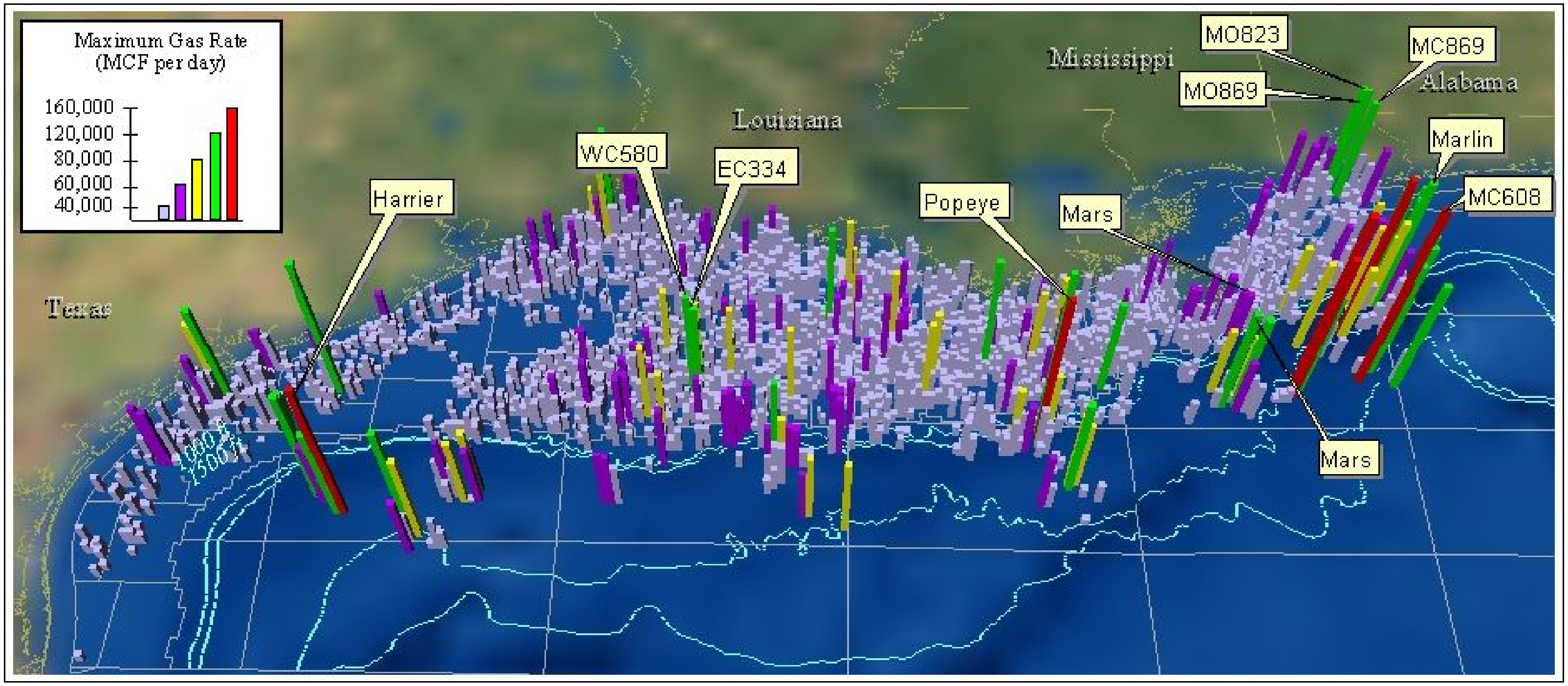

Figure 66b. Maximum historic gas production rates for Gulf of Mexico wells.

SHALLOW-WATER FIELD VERSUS DEEPWATER FIELD PERFORMANCE

A comparison of the performance of shallow-water fields and deepwater fields is admittedly tenuous because today's advances in technology were not available during the heyday of shallow-water development. However, empirical comparisons may be revealing. Figures 67a and 67b compare cumulative production and total recoverable reserves for four deepwater fields and four shallow-water fields. Each of the fields is still on production. The deepwater fields represent the top four in the deepwater GOM in terms of cumulative production through 2004: Mars-Ursa (MC 807), Auger (GB 426), Troika (GC 244), and Pompano (VK 990). These fields are compared to shallow-water fields with similar cumulative production and/or recoverable reserves.

Cumulative oil production and total recoverable oil are shown in figure 67a. The number of years for which the fields have been on production is annotated at the top of the histograms. The figure shows that deepwater fields have produced similar amounts of oil significantly faster than shallow-water fields. Cumulative gas production and recoverable gas are shown in figure 67b. To date, Eugene Island 330 (EI 330) field has produced more than twice the amount of gas as Mars-Ursa (MC 807). Of that total production, EI 330 field produced approximately 800 BCF in 9 years, comparable to the amount produced in 8.5 years at Mars-Ursa. However, the other shallow-water fields took much longer to reach cumulative levels of gas production than deepwater fields of similar size.

HURRICANE ACTIVITY

Ivan

On Monday, September 13, 2004, Hurricane Ivan entered the GOM after crossing the western tip of Cuba. It was projected to make landfall on the northern Gulf coast early Thursday, September 16, 2004, with sustained winds up to 130 miles per hour (mph). In anticipation of its arrival, 69 rigs (~60% of the rigs currently drilling in the GOM) and 575 manned platforms (~75% of the Gulf's manned platforms) were evacuated. All evacuations were completed without injury to personnel. By Thursday afternoon, over 70 percent of the GOM's daily oil production and about 60 percent of its daily gas production were shut in. Approximately 150 platforms and 10,000 mi of pipeline were in the projected path of Ivan. The hurricane accounted for the destruction of 7 platforms (all in shallow water) by mudslides, significant damage to another 24 major platforms (shallow and deepwater), and damage to at least 102 pipelines. The eye of Hurricane Ivan passed almost directly over the Petronius facility (VK 786), resulting in significant damage to the crew quarters, production equipment, and deck structures. The facility was back online by mid-March 2005. Appendix G lists all platforms destroyed by Hurricanes Ivan, Katrina, and Rita.

Katrina and Rita

On Friday, August 26, 2005, Hurricane Katrina entered the GOM after crossing southeastern Florida. By August 28th, Katrina had grown from a category 3 to a category 5 hurricane. It made landfall on the northern Gulf coast Monday, August 29, 2005, as a category 3 hurricane with sustained winds up to 120 miles per hour (mph). Hurricane Rita followed quickly on the heels of Katrina, entering the GOM on September 20, 2005. Rita grew to a category 5 hurricane over the warm waters of the GOM, finally making landfall on the Texas/Louisiana border on September 24, 2005 as a category 3 storm. Over 90 percent of the manned platforms and over 85 percent of working rigs were evacuated at the onset of these two monstrous storms. One hundred percent of the oil production (1.5 MMBOPD), along with 94 percent of the gas production (10 BCFPD), was shut in during Hurricanes Katrina and Rita. Figure 68 shows the paths of Katrina and Rita in the GOM and the platforms within the storm tracks. Approximately 3,050 platforms and 22,000 mi of pipeline were in the projected paths of these storms. These two hurricanes accounted for the destruction of more than 100 platforms (all in shallow water except Typhoon in GC 237).

Of the total shut-in GOM production caused by Hurricanes Katrina and Rita, deepwater represented the greater percent (figures 69a-b). As of March 22, 2006, 23 percent of the daily oil production and 14 percent of the daily gas production was shut in.

Restoring production in the deepwater Gulf of Mexico has unique challenges. As of first quarter 2006, repairs of the damage to the oil and gas pipelines caused by Hurricane Katrina were underway at Shell's Mars facility (MC 807). This constitutes a world record in water depth for pipeline repair (approximately 3,000 ft [914 m] of water).

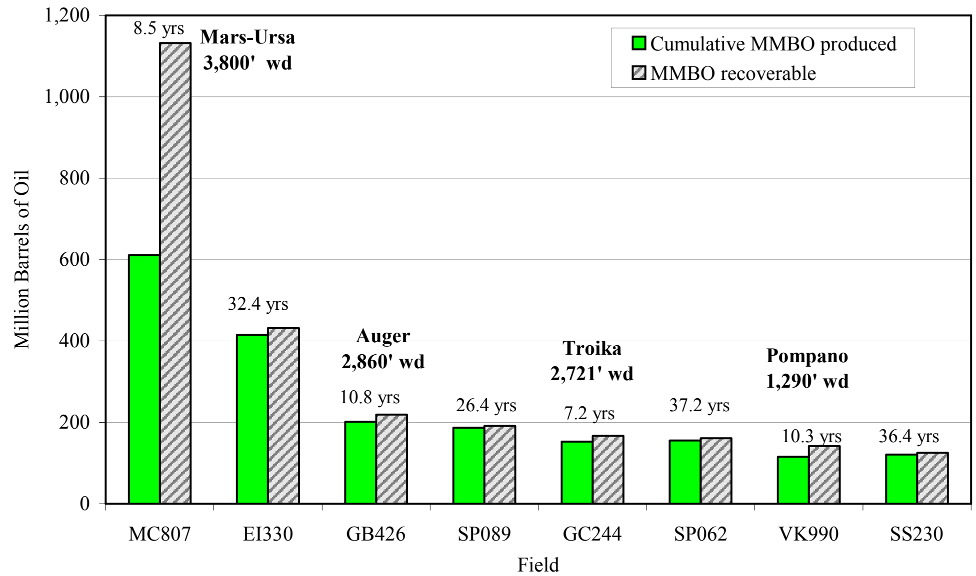

Figure 67a. Cumulative oil production and ultimate recoverable reserves for selected shallow-water and deepwater fields.

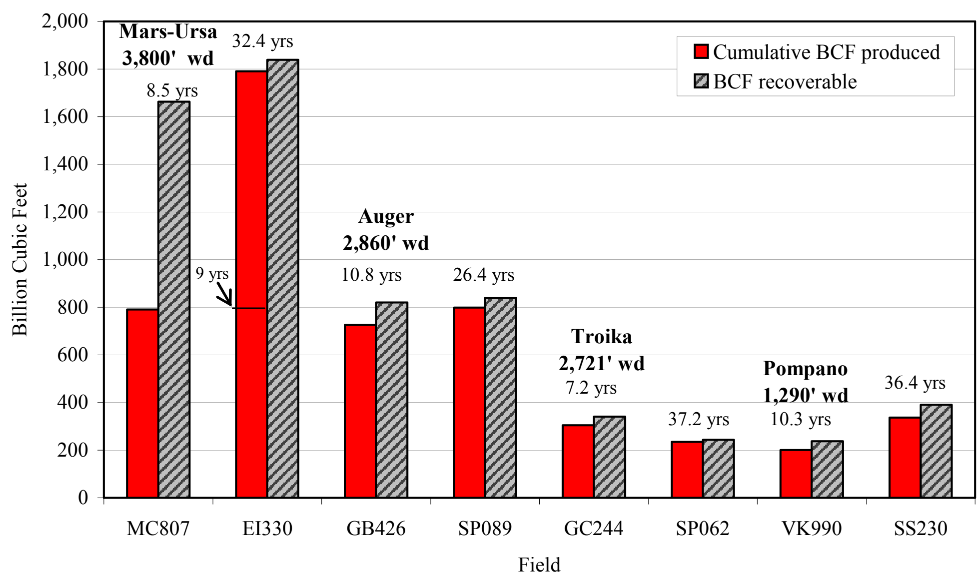

Figure 67b. Cumulative gas production and ultimate recoverable reserves for selected shallow-water and deepwater fields.

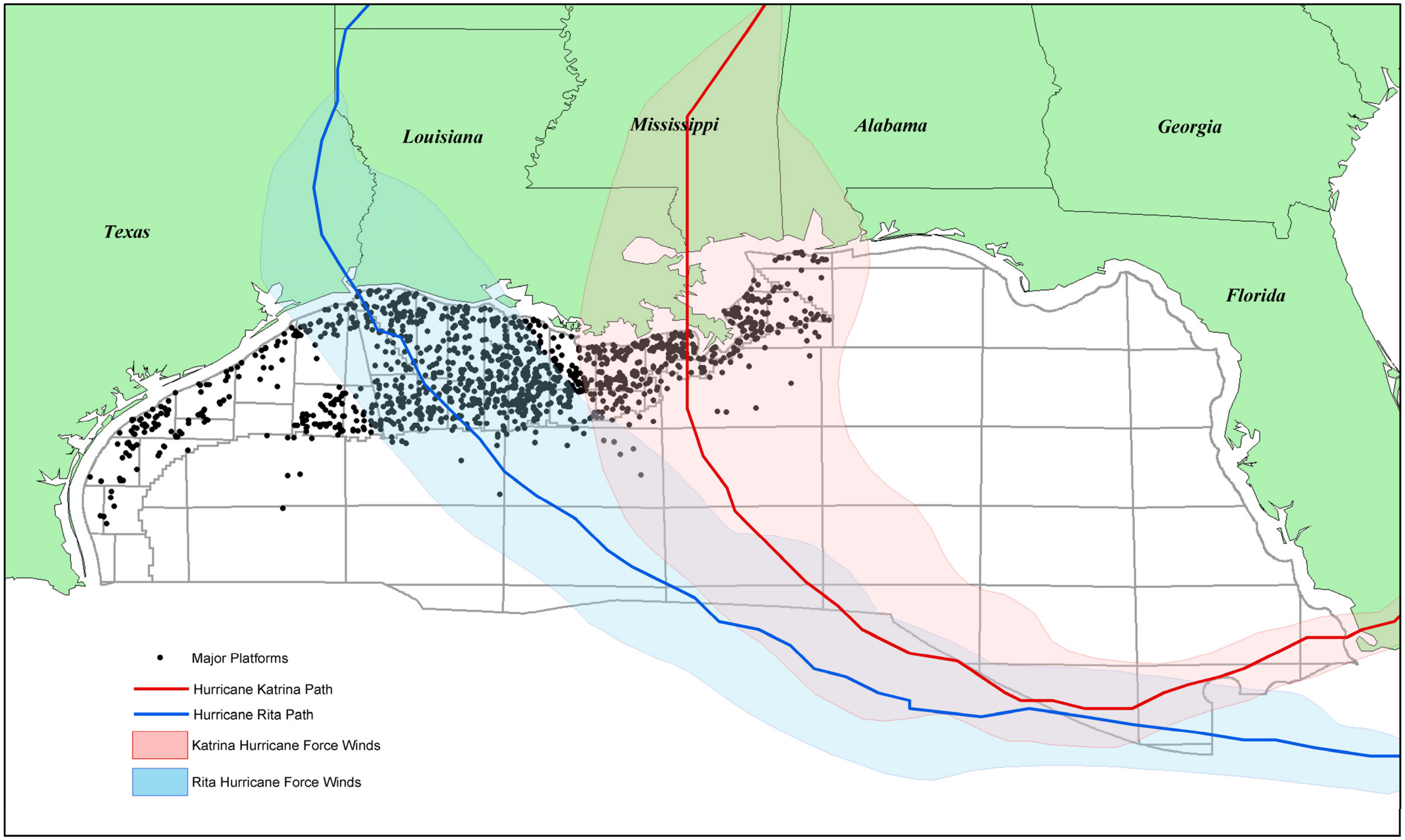

Figure 68. Platforms within the path of Hurricanes Katrina and Rita in the Gulf of Mexico.

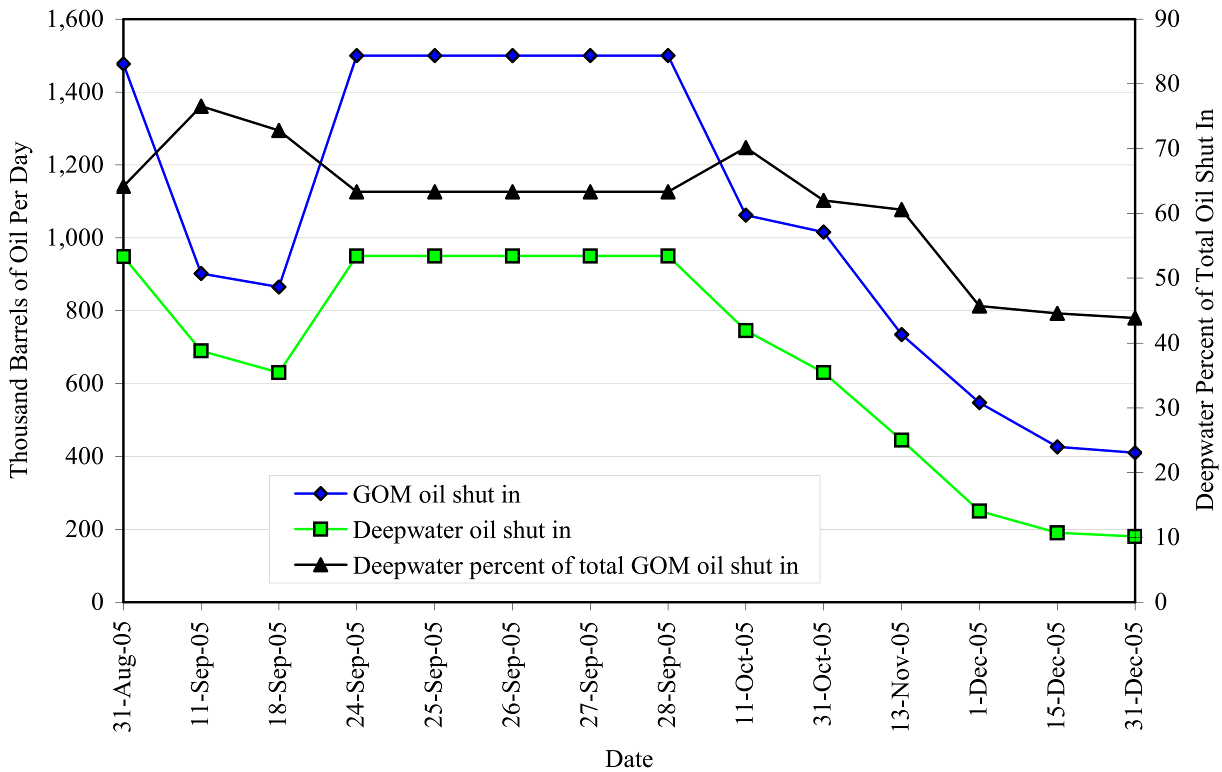

Figure 69a. Comparison of total GOM oil shut in and GOM deepwater oil shut in.

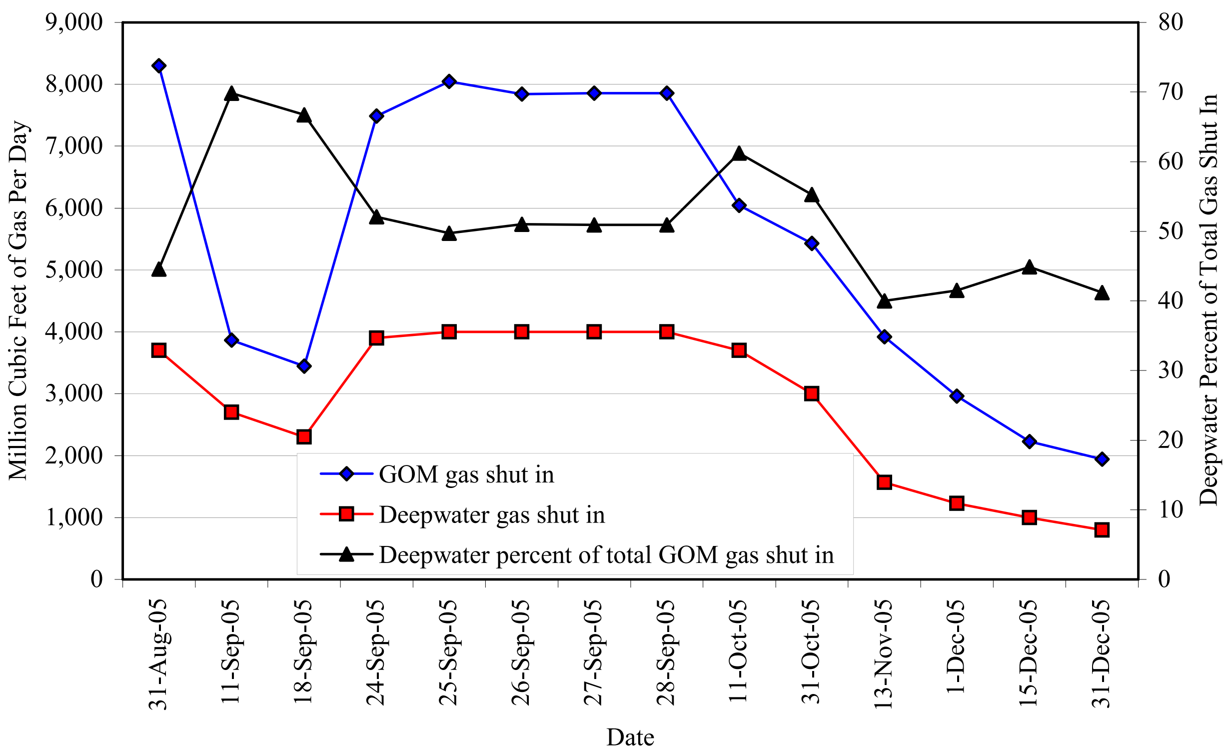

Figure 69b. Comparison of total GOM gas shut in and GOM deepwater gas shut in.

SUMMARY AND CONCLUSIONS

This report has discussed

- significant new discoveries that are expanding large new geologic plays;
- technological innovations and new concepts (e.g., hydrate potential, impact of loop currents, LNG terminals, and HIPPS) that may have significant effects on the energy outlook of the GOM;
- technological challenges such as the HPHT drilling environment;
- sustained deepwater leasing activity;
- deepwater leaseholdings of major oil and gas companies compared with nonmajor companies, showing the increased presence of nonmajor companies;
- future deepwater lease availability and anticipated lease expirations;
- declines in deepwater drilling;
- the progression of exploration activities, and the resulting discoveries, into the ultra-deep frontier;
- the extension of development activities and infrastructure, which include subsea wells, hubs, and pipelines reaching into ever deeper waters;
- the anticipated large deepwater reserve additions, especially when unproved reserves, known resources, and recent industry-announced discoveries are considered;
- the large increase in average deepwater field sizes when compared with same-year shallow-water discoveries; and
- production rates of deepwater wells exceeding those of shallow-water wells by 800 to 2,400 percent.

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

Figure 70 illustrates deepwater projects that began production in 2004 and 2005 and those expected to commence production in the next six years. Sixteen deepwater projects went online in 2004 and another six in 2005. As of March 2006, six additional projects began production, with another four projects expected to go online by yearend. In addition to the projects shown in figure 70, many more are likely to come online in the next few years but are not shown because operators have not yet announced their plans.

DEVELOPMENT CYCLE

There was considerable lease activity in the late 1980's (figure 71). (Note that historic deepwater leasing shows no clear relation to average oil or gas prices.) Acreage at Auger (Garden Banks Block 426) was acquired in 1985 as part of this early activity. The first Auger well was drilled soon after, in 1987. Even though Auger was leased and drilled early, first production did not begin until 1994, approximately 10 years after the initial lease acquisition. Acreage at Thunder Horse (Mississippi Canyon Block 778) was acquired in 1988; however, the discovery was not drilled until 1999, and production is not anticipated until later this year. This large gap highlights the considerable lag between leasing and first production. These lags are not unusual with complex deepwater developments. In contrast, other deepwater projects,

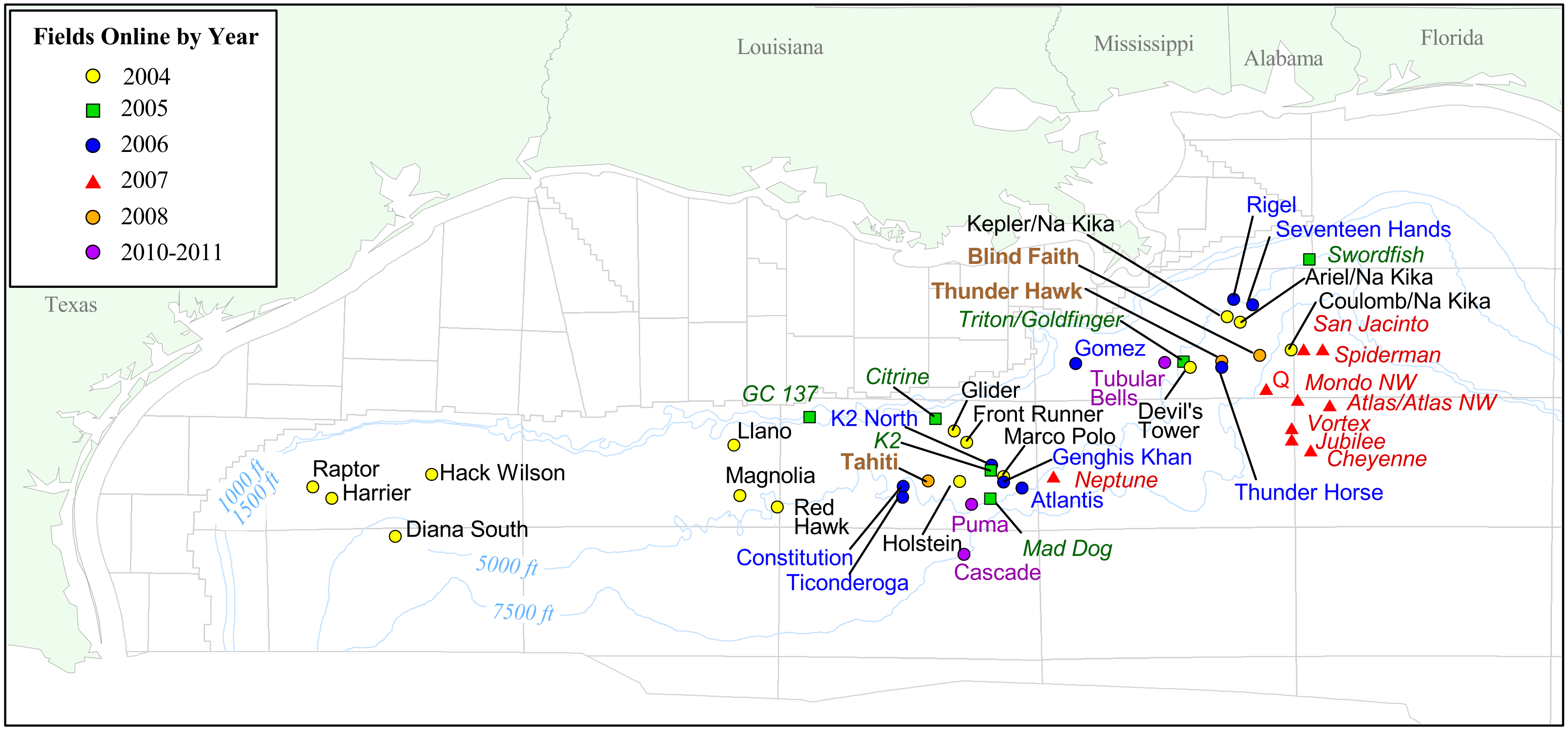

Figure 70. Deepwater projects that began production in 2004 and 2005 and those expected to begin production by yearend 2011.

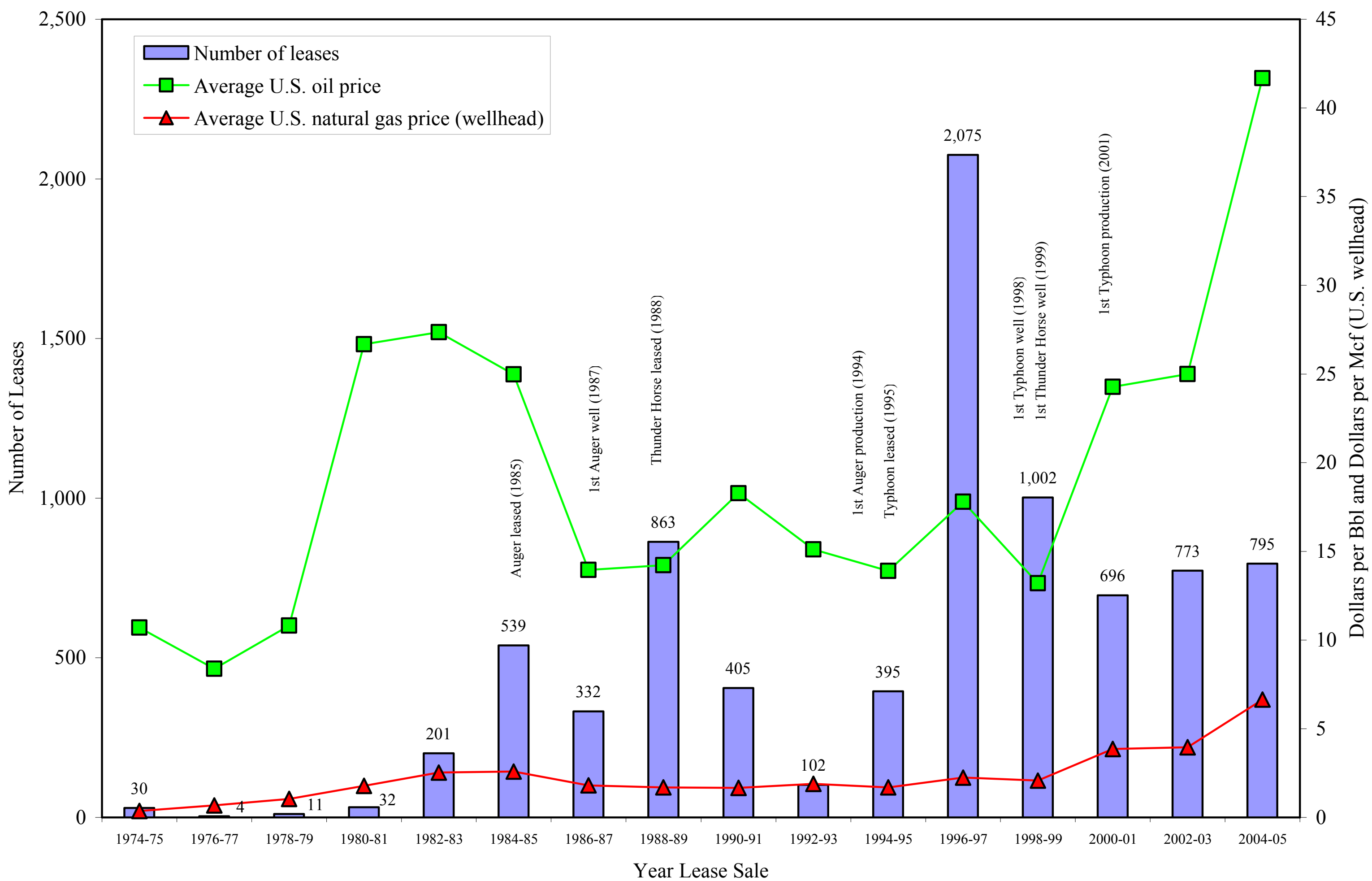

Figure 71. Deepwater lease activity and oil/natural gas prices (prices from U.S. Energy Information Administration: oil through December 2005 and natural gas through October 2005).

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

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

There is a significant interval from lease acquisition to first production; however, this interval has decreased from 10 to less than 7 years. Figure 72 demonstrates average lags associated with deepwater operations. The figure uses data from only productive deepwater leases and illustrates the lags between leasing and qualification and from qualification to first production. Operators sometimes announce discoveries to the public long before qualifying the lease as productive with MMS (and thereby granted field status). Note that, since deepwater leases are in effect for 8 or 10 years, the data are incomplete beyond 1995. The apparent decreasing lags for leases issued after 1995 are explained by the fact that the lease evaluation process has not yet been completed.

The data show an increase from 1976 to 1989 in the number of years before the first well is drilled. 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). During the 1980's there was a gradual increase in the lag between drilling 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 in the late 1980's. The most recent complete data (many leases issued after 1995 are still in their primary terms) indicate that, since 1989, the time from lease to first production has decreased from over 11 to less than 7 years.

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

Another interesting trend is shown in figure 73. For any given lease-sale year, 43 percent of tested leases were first drilled within three years of lease acquisition, and 23 percent were drilled in year eight or later. Eighteen percent of the hydrocarbon volumes were discovered during the first three years of their lease terms, but 47 percent of the hydrocarbon volumes were discovered in year eight or later. The data for this analysis include only deepwater leases acquired through 1995, since later leases are still within their primary terms.

As expected, the majority of wells are drilled in the first half of a lease's primary term. What is surprising is the amount of major discoveries found in the later years of some leases' terms — two-thirds of hydrocarbons discovered. For example, the discoveries of Thunder Horse, North Thunder Horse, Holstein, and Atlantis occurred late in their lease terms. This fact demonstrates the difficulty in recognizing, or perhaps drilling, the best prospects at the beginning of a lease's term.

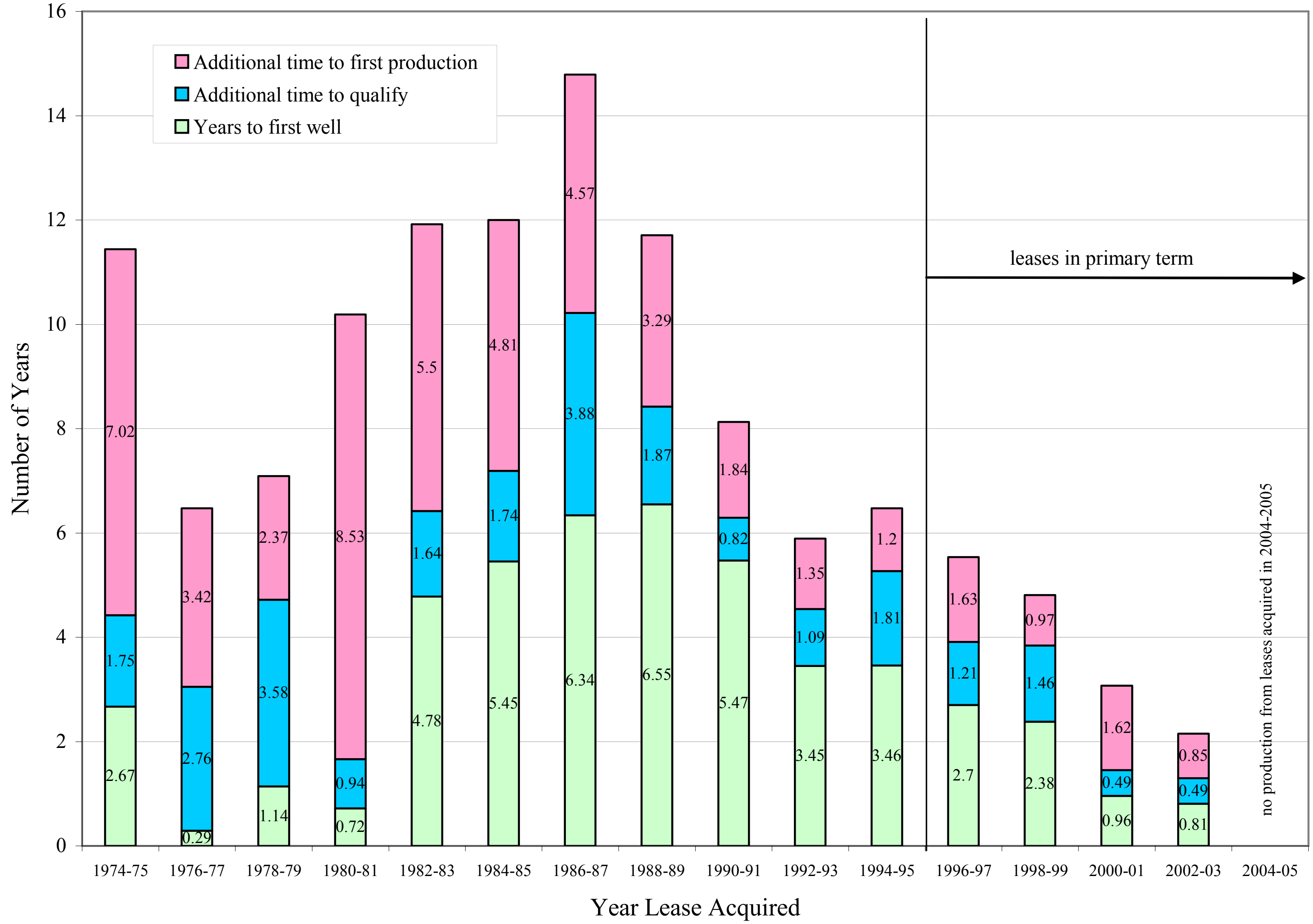

Figure 72. Lag from leasing to first production for producing deepwater fields.

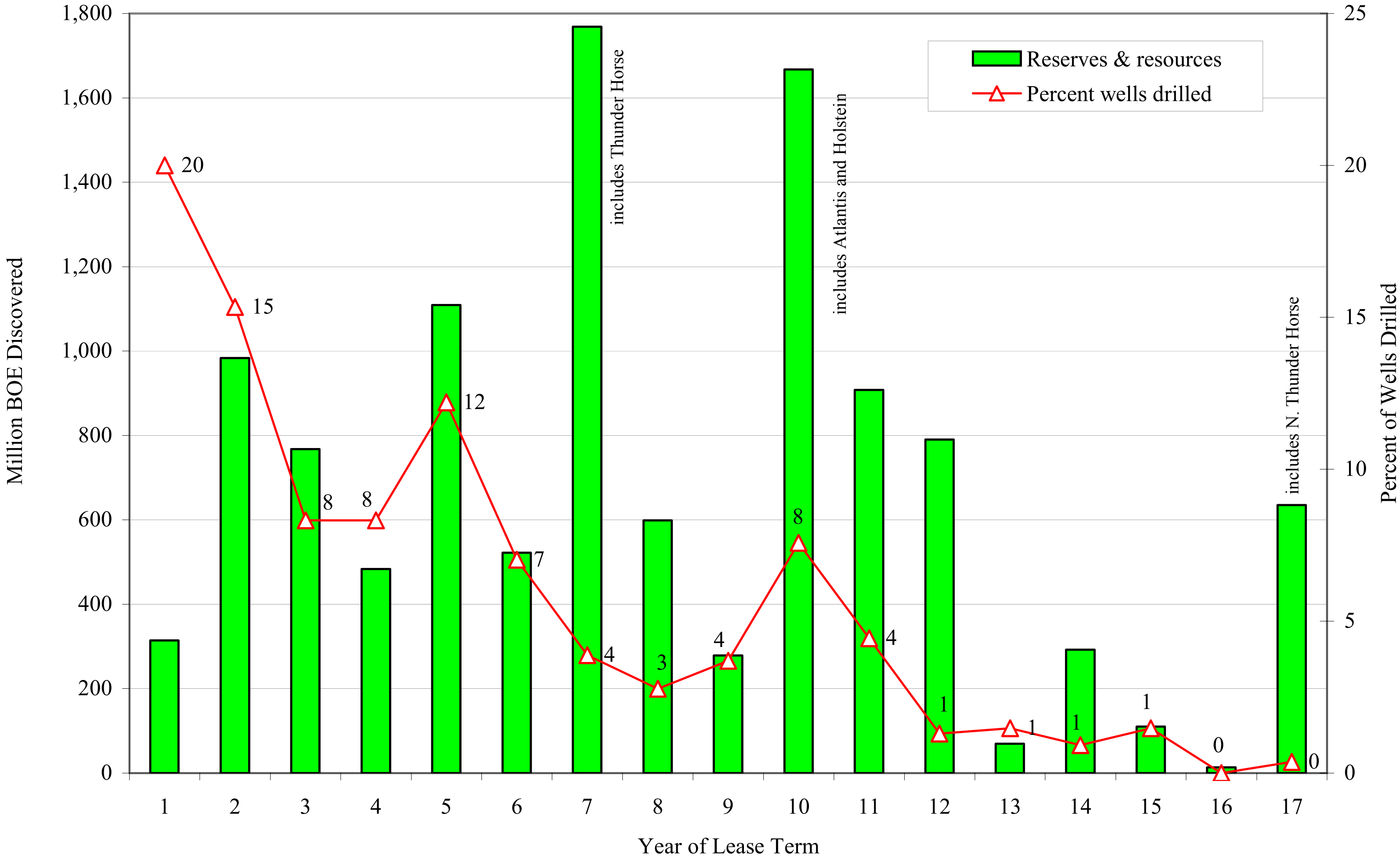

Figure 73. Year in the lease term in which BOE was discovered and percent of leases were tested, for deepwater leases, 1974-1995.

DRILLING THE LEASE INVENTORY

The combination of huge deepwater lease inventories and a limited rig fleet dedicated to the GOM means that the vast majority of today's leases may remain untested when their terms expire. Figure 74 shows historic lease activity trends. As mentioned previously, these data are complete only through 1995, since most deepwater leases beyond that time are still under their primary terms and still under evaluation. Similar to today's large lease inventory was the period 1988 to 1989, during which large numbers of new leases were acquired. The percentage of leases drilled decreased as lease inventory swelled because of a limited number of available rigs. During times of high lease inventory, fewer than 10 percent of deepwater leases were drilled and fewer than 5 percent were produced.

Exploratory drilling is arguably the most important indicator of exploration effort. Figure 75 uses the number of newly drilled leases as the measure of this effort. The general relationship between exploration effort and amount of hydrocarbons discovered is shown in figure 75. The amount discovered includes reserves, resources, and industry-announced discoveries (same data as figure 57). Notice that, in the last two years, there has been a decline in the number of new leases tested, but an increase in 2005 in barrels found. It is important to recognize that volumes discovered in 2004 and 2005 are significantly understated because of the 24-month delay in industry's release of proprietary drilling results.

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 76a-c. There is only a general correlation between the number of leases issued and those drilled and produced (figures 76a-b). In contrast, the number of deepwater leases drilled correlates strongly with the number of those leases that later produced (figure 76c).

Figure 77 illustrates the magnitude of the deepwater lease inventory and industry's ability to evaluate this large number of leases. The annual historic lease data from 1984 through 2005 are indicated by the solid colored lines and depict the number of primary term leases, number of leases tested, and the number of leases expiring untested. The large increase in lease inventory from 1996 through 2002 is very evident and propagates through to 2012. Future values for primary term leases, lease expirations, and leases drilled are in the dotted lines. These values assume that, after the year 2006, all leases will expire unless drilled and that 60 untested deepwater leases will be drilled each year.

A historic review of GOM exploration activity indicates that, on average, about 10 percent of the deepwater leases acquired in the large sales are drilled. Of the approximately 3,300 deepwater leases issued from 1996 through 2000, however, less than 8 percent have been drilled to date. There are over 2,000 leases from these sales still in their primary lease term, with more than 630 of these leases in water depths of greater than 7,000 ft (2,134 m). Only 39 wells have been drilled on the ultra-deepwater leases from these sales; 14 of these wells resulted in announced discoveries. Figure 77 projects a steep decline in active leases as the large number of leases acquired in 1996 through 1998 start to expire. Note that this graph does not include the hundreds of new leases that will be added to the inventory each year from upcoming lease sales. The available deepwater rig fleet will challenge industry's ability to evaluate their lease inventory, both current and future additions. Other factors play a significant role in the industry's ability to evaluate their GOM lease inventory, including alternative deepwater exploration and development targets throughout the world, capital limitations, and limited qualified personnel.

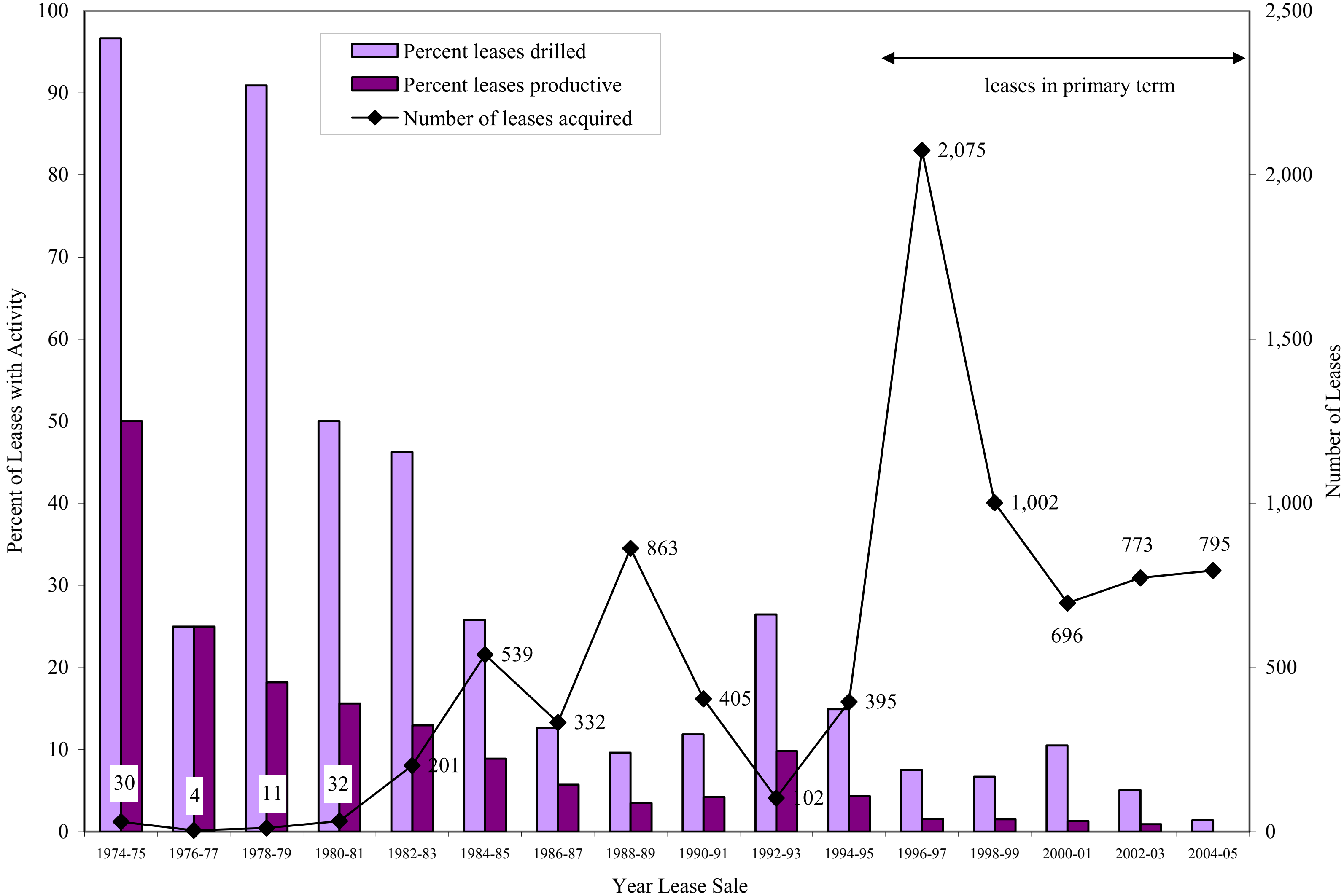

Figure 74. Activity on deepwater leases.

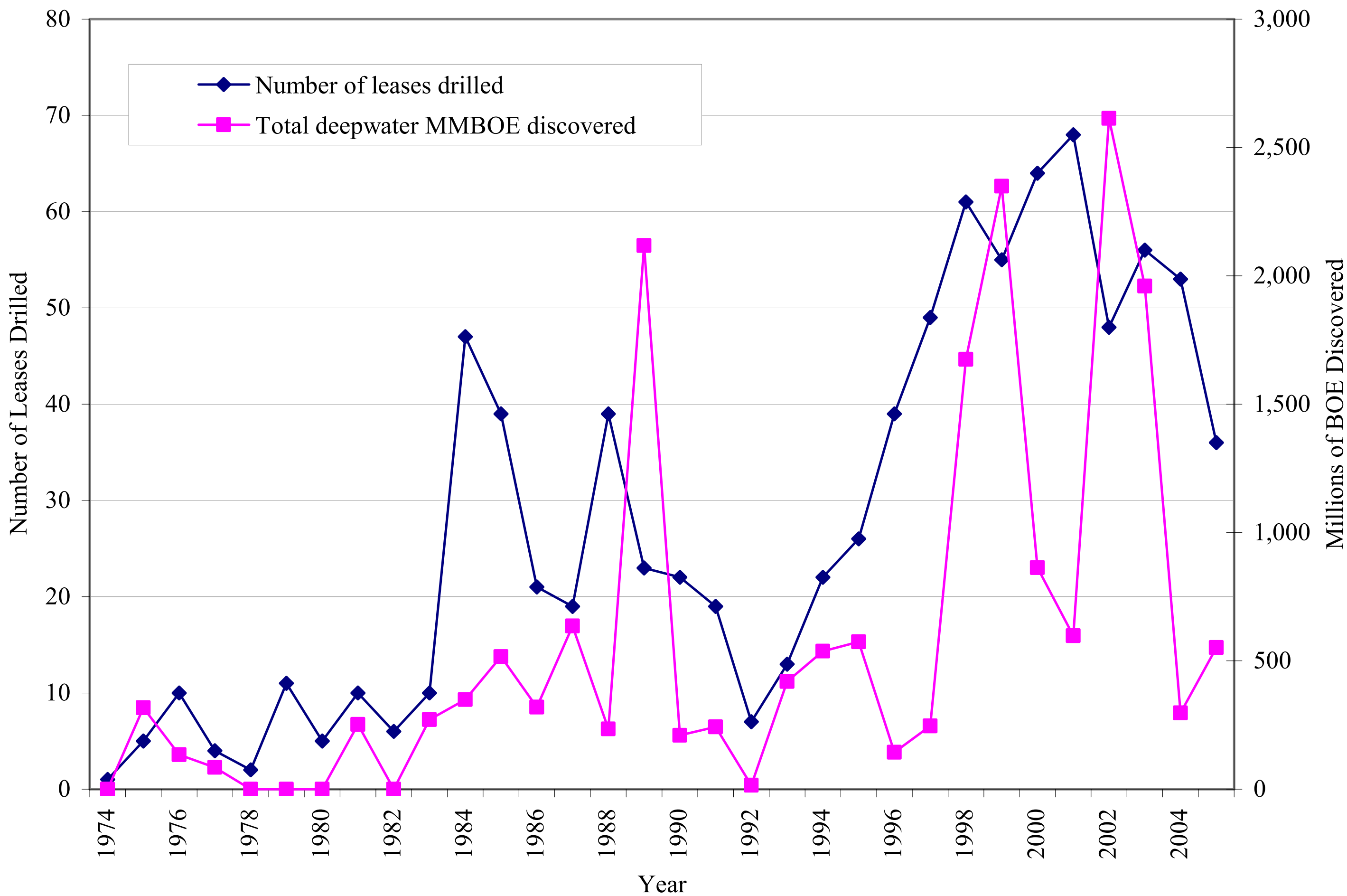

Figure 75. Leases drilled and barrels found.

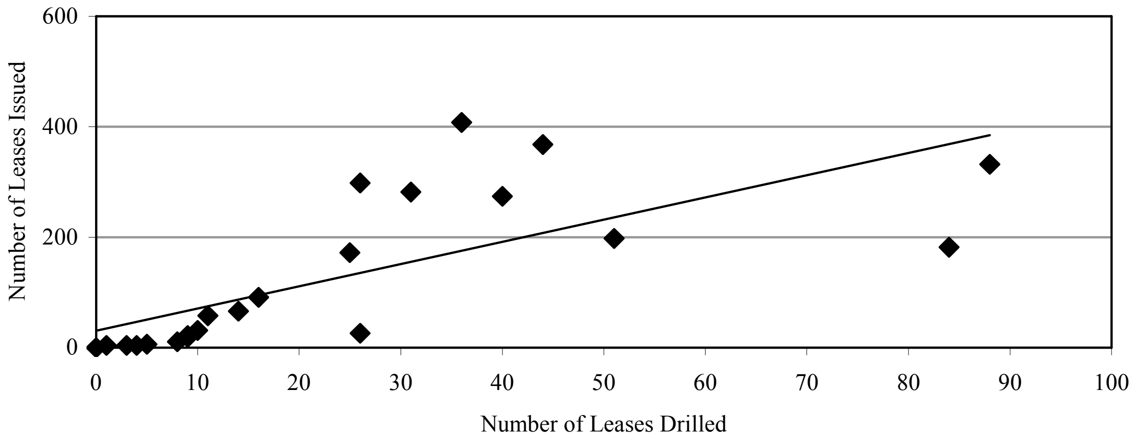

Figure 76a. Relationship between number of leases issued and number of leases drilled, 1974-1995.

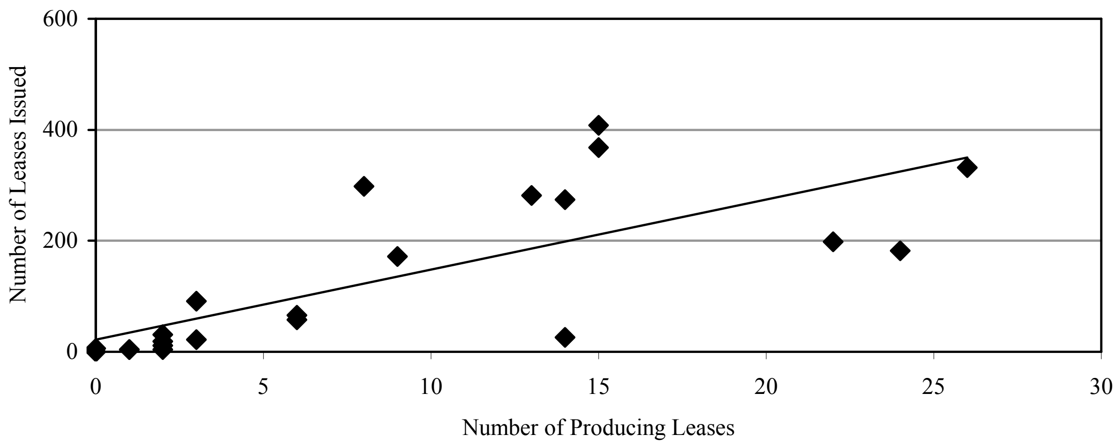

Figure 76b. Relationship between number of leases issued and number of resulting producing leases, 1974-1995.

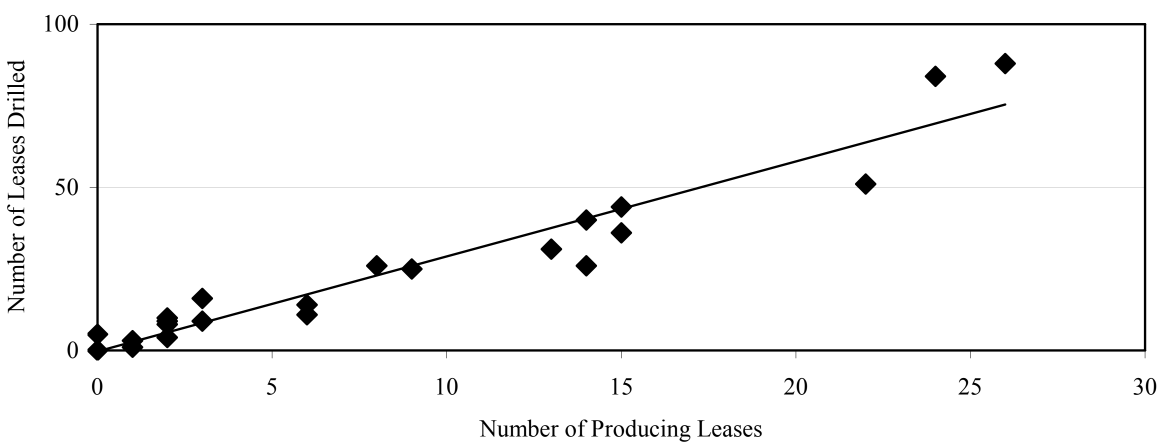

Figure 76c. Relationship between number of leases drilled and number of resulting producing leases, 1974-1995.

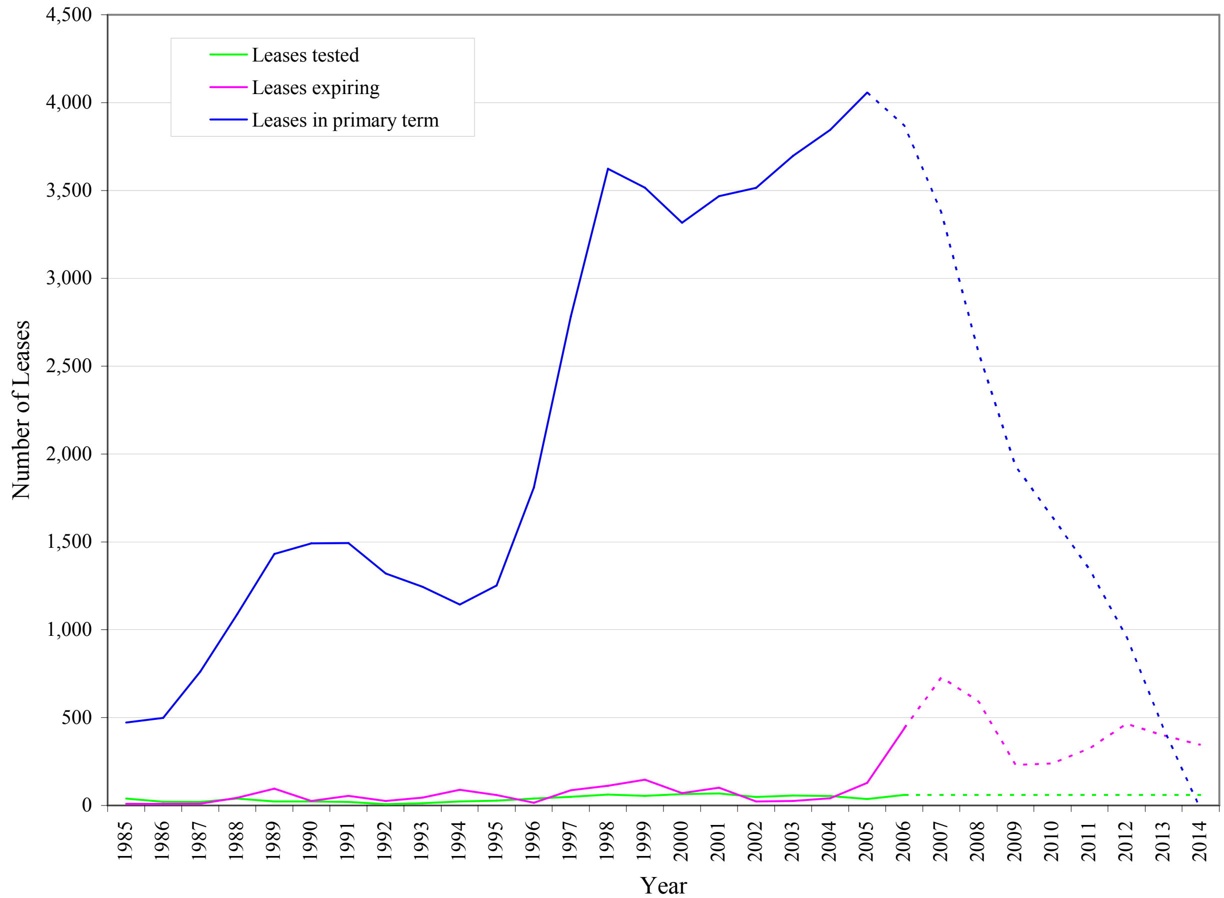

Figure 77. The challenge of deepwater lease evaluation.

EXPANDING FRONTIER

It is instructive to look back to the earlier deepwater reports (figure 78) and observe the dramatic increases in proved reserves and discovered volumes (which include proved and unproved reserves, resources, and industry-announced discoveries). Many of the discovered volumes in earlier reports have progressed to become proved reserves in subsequent reports. For example, in the 2002 report, Thunder Horse was in the discovered-volumes category, and in the 2004 report its volumes were classified as proved reserves. While proved reserves and discovered volumes have substantially increased from report to report, the most dramatic increases have occurred in the discovered volumes, suggesting a bright outlook for future deepwater production, as the less constrained resource and industry-announced volumes move into the reserve category and are produced.

The future of deepwater GOM exploration and production remains very promising. As shown in figure 77, industry is nearing the end of the primary lease term of the exceptional number of leases acquired in 1996 through 1998. Traditional deepwater minibasin plays are far from mature, as several recent discoveries attest, and new deepwater plays near and even beyond the Sigsbee Escarpment, beneath thick salt canopies, and in lightly explored Paleogene reservoirs show that the deepwater GOM is an expanding frontier. The 2000 Assessment indicated that more than 50 billion recoverable BOE remained to be discovered (Lore et al., 2001).

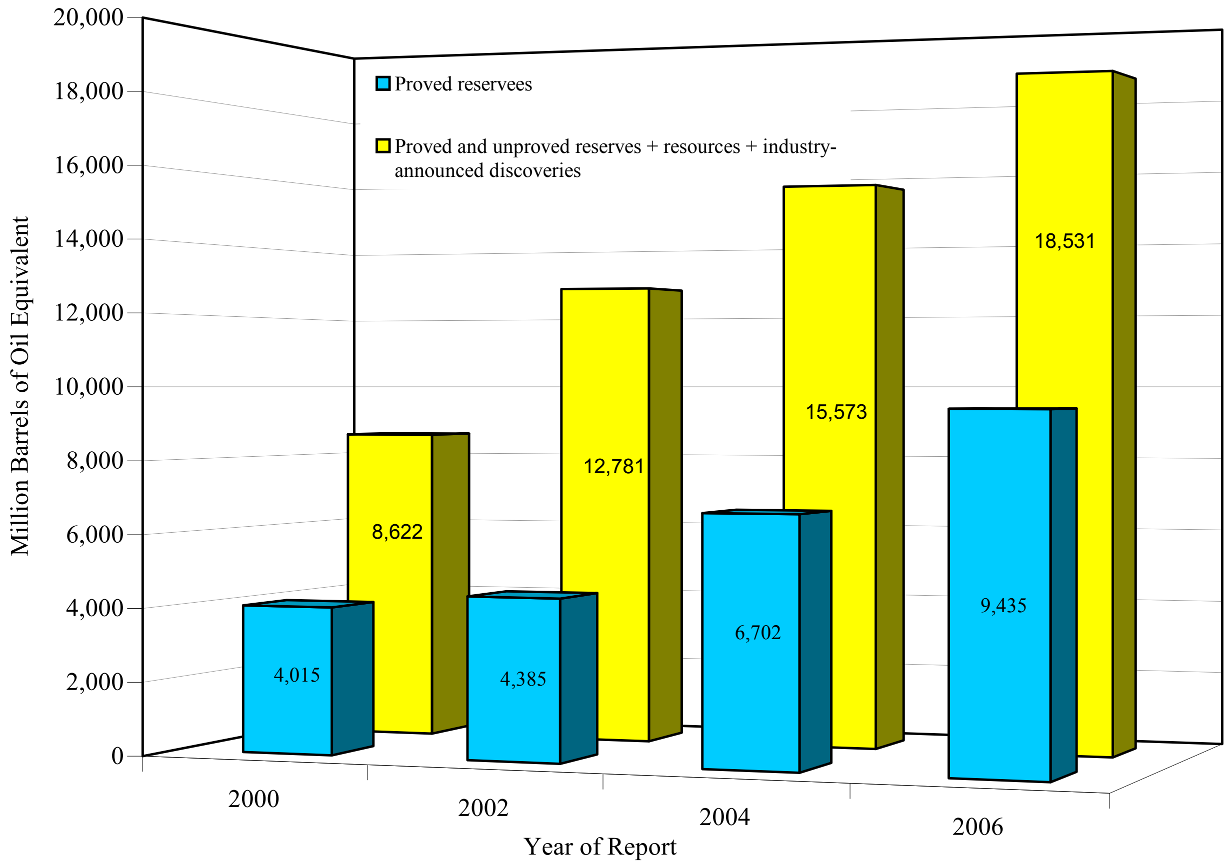

Figure 78. Comparison of 2000, 2002, 2004, and 2006 deepwater GOM reports: successive increases in deepwater BOE.

The deepwater arena has made great strides in the last few years, establishing itself as an expanding frontier. The previous edition of this report (Richardson et al., 2004) documented the advancements made in deepwater exploration and development since 1974. Several notable changes have occurred in the deepwater GOM since the 2004 report.

Highlights

- The deepwater frontier is expanding in water depths greater than 7,000 ft (2,134 m).
- The deepest well in the GOM was drilled by Chevron/Unocal at the Knotty Head discovery to a TVD of 34,157 ft (10,411 m) and in a water depth of 3,557 ft (1,084 m).
- Nine discoveries were found in over 7,000-ft (2,134-m) water depths.
- The first cell spar was installed at Red Hawk.
- Four discoveries were made in the Eastern GOM.
- Four discoveries were made in Paleogene reservoirs in Walker Ridge and Alaminos Canyon.
- Newly collected loop-current data will promote technological developments to ensure safe, reliable drilling and production.

- Wells are moving into more high-temperature, high-pressure (HPHT) environments.
- Technologies such as high integrity pressure protection systems (HIPPS) will enable development in deeper waters and harsher environments.
- The number of completed subsea wells is down 15 percent.
- There was nearly a 190-percent increase in the number of pipelines less than or equal to 12 inches approved for installation.
- There was a 38-percent increase in the number of producing deepwater projects.
- Nonmajor companies have made more deepwater discoveries and hold more deepwater acreage than the major companies.
- Subsea gas production increased more than 110 percent between December 2000 and May 2004.

Since the beginning of 2000, new deepwater drilling added over 6.2 billion BOE, a 50-percent increase over the total deepwater BOE discovered from 1974 to 1999.

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

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APPENDICES

APPENDIX A. ANNOUNCED DEEPWATER DISCOVERIES (SORTED BY PROJECT NAME[1]).

Project Name	Area/Block	Water Depth (ft)[2]	Field	Field Discovery Date[3]	Year of First Production	Year of Last Production
Aconcagua	MC 305	7,100	MC 305	2/21/1999	2002	
Alabaster	MC 485	1,438	MC 397	8/27/1982	1992	
Allegheny	GC 254	3,294	GC 254	1/01/1985	1999	
Amberjack	MC 109	1,100	MC 109	11/13/1983	1991	
Anduin	MC 755	2,904				
Angus	GC 112	2,045	GC 112	6/08/1997	1999	
Ariel/Na Kika	MC 429	6,240	MC 429	11/20/1995	2004	
Arnold	EW 963	1,800	EW 963	6/12/1996	1998	
Aspen	GC 243	3,065	GC 243	1/27/2001	2002	
Atlantis	GC 699	6,133		5/12/1998		
Atlas	LL 50	8,934				
Atlas NW	LL 5	8,810				
Auger	GB 426	2,860	GB 426	5/01/1987	1994	
Baha	AC 600	7,620	AC 600	5/23/1996		
Balboa	EB 597	3,352	EB 597	7/02/2001		
Baldpate	GB 260	1,648	GB 260	11/01/1991	1998	
Big Foot	WR 29	5,286				
Bison	GC 166	2,381	GC 166	3/01/1986		
Black Widow	EW 966	1,850	EW 921	5/01/1986	2000	
Blind Faith	MC 696	6,989				
Boomvang East	EB 668	3,650	EB 668	9/12/2003	2003	
Boomvang North	EB 643	3,650	EB 643	12/13/1997	2002	
Boomvang West	EB 643	3,650	EB 643	12/13/1997	2003	
Boris	GC 282	2,378	GC 282	9/29/2001	2003	
Brutus	GC 158	3,300	GC 158	3/01/1989	2001	
Bullwinkle	GC 65	1,353	GC 065	10/01/1983	1989	
Camden Hills	MC 348	7,216	MC 348	8/04/1999	2002	
Cascade	WR 206	8,143				
Champlain	AT 63	4,457	AT 063	2/11/2000		
Cheyenne	LL 399	8,987				
Chinook	WR 469	8,831				
Citrine	GC 157	2,614	GC 158	5/14/1998	2005	
Clipper	GC 299	3,452				

Project Name	Area/Block	Water Depth (ft)[2]	Field	Field Discovery Date[3]	Year of First Production	Year of Last Production
Cognac	MC 195	1,023	MC 194	7/01/1975	1979	
Conger	GB 215	1,500	GB 260	11/01/1991	2000	
Constitution	GC 680	5,071		10/31/2001	2006	
Cooper	GB 388	2,600	GB 388	3/16/1989	1995	1999
Coulomb/Na Kika	MC 657	7,591	MC 657	11/01/1987	2004	
Crested Butte	GC 242	2,846				
Crosby	MC 899	4,400	MC 899	1/04/1998	2001	
Cyclops	AT 8	3,135	AT 008	4/26/1997		
Dawson	GB 669	3,152	GB 668	5/22/2000	2003	
Dawson Deep	GB 625	2,900	GB 668	5/22/2000		
Devil's Tower	MC 773	5,610	MC 773	12/13/1999	2004	
Diamond	MC 445	2,095	MC 445	12/05/1992	1993	1999
Diana	EB 945	4,500	EB 945	8/01/1990	2000	
Diana South	AC 65	4,852	AC 065	3/24/1997	2004	
Dionysus	VK 864	1,508	VK 864	10/01/1981		
Dulcimer	GB 367	1,120	GB 367	2/09/1998	1999	
Durango	GB 667	3,105	GB 668	5/22/2000	2003	
East Anstey/ Na Kika	MC 607	6,590	MC 607	11/12/1997	2003	
EB 377	EB 377	2,450	EB 377	10/01/1985		
Einset	VK 872	3,500	VK 873	3/01/1988	2001	
El Toro	GC 69	1,465	GC 069	9/13/1984		
Entrada	GB 782	4,690				
Europa	MC 935	3,870	MC 935	4/22/1994	2000	
EW 1006	EW 1006	1,884	EW 1006	1/26/1988	1999	
EW 878	EW 878	1,585	EW 878	7/03/2000	2001	
Falcon	EB 579	3,638	EB 579	9/29/2002	2003	
Fourier/Na Kika	MC 522	6,950	MC 522	7/01/1989	2003	
Front Runner	GC 338	3,330	GC 339	6/08/2001	2004	
Fuji	GC 506	4,262	GC 506	1/30/1995		
GB 208	GB 208	1,275	GB 208	9/01/1991		
GB 244	GB 244	2,130	GB 244	8/15/2001		
GB 302	GB 302	2,411	GB 302	2/01/1991		
GB 379	GB 379	2,076	GB 379	7/01/1985		
GC 137	GC 137	1,168		2/16/2004	2005	
GC 147	GC 147	1,275	GC 147	5/01/1988		
GC 162	GC 162	2,616	GC 162	7/01/1989		

Project Name	Area/Block	Water Depth (ft)[2]	Field	Field Discovery Date[3]	Year of First Production	Year of Last Production
GC 21	GC 21	1,296	GC 021	10/01/1984		
GC 228	GC 228	1,950	GC 228	7/01/1985		
GC 27	GC 27	1,593	GC 027	7/01/1989		
GC 29	GC 29	1,554	GC 029	1/01/1984	1988	1990
GC 31	GC 31	2,243	GC 075	5/01/1985	1988	1989
GC 39	GC 39	2,068	GC 039	4/01/1984		
GC 463	GC 463	4,032	GC 463	12/01/1998		
GC 70	GC 70	1,618	GC 070	6/01/1984		
Gemini	MC 292	3,393	MC 292	9/07/1995	1999	
Genesis	GC 205	2,590	GC 205	9/01/1988	1999	
Genghis Khan	GC 652	4,300				
Glider	GC 248	3,440		12/19/1996	2004	
Goldfinger	MC 771	5,423			2005	
Gomez	MC 711	3,098	MC 755	3/19/1986	2006	
Goose	MC 751	1,624	MC 751	12/15/2002		
Grand Canyon	GC 141	1,720				
Great White	AC 857	8,717				
Gretchen	GC 114	2,685	GC 114	12/18/1999		
Gunnison	GB 668	3,100	GB 668	5/22/2000	2003	
Habanero	GB 341	2,015	GB 387	10/03/1994	2003	
Hack Wilson	EB 598	3,650	EB 643	12/13/1997	2004	
Harrier	EB 759	4,114	EB 759	1/28/2003		
Hawkes	MC 509	4,174	MC 509	11/20/2001		
Herschel/Na Kika	MC 520	6,739	MC 522	7/01/1989	2003	
Holstein	GC 645	4,344	GC 644	2/11/1999	2004	
Hoover	AC 25	4,825	AC 025	1/30/1997	2000	
Horn Mountain	MC 127	5,400	MC 084	1/01/1993	2002	
Hornet	GC 379	2,076	GC 379	12/14/2001		
Ida/Fastball	VK 1003	4,942				
Jack	WR 759	6,965				
Jolliet	GC 184	1,760	GC 184	7/01/1981	1989	
Jubilee	AT 349	8,825				
Jubilee Extension	LL 309	8,774				
K2	GC 562	4,006	GC 562	8/14/1999	2005	
K2 North	GC 518	4,049			2006	
Kepler/Na Kika	MC 383	5,759	MC 383	8/31/1997	2004	
King (MC-BP)	MC 84	5,000	MC 084	1/01/1993	2002	

Project Name	Area/Block	Water Depth (ft)[2]	Field	Field Discovery Date[3]	Year of First Production	Year of Last Production
King (MC-Shell)	MC 764	3,250	MC 807	4/01/1989	2000	
King Kong	GC 472	3,980	GC 472	2/01/1989	2002	
King's Peak	DC 133	6,845	DC 133	3/01/1993	2002	
Knotty Head	GC 512	3,557				
Ladybug	GB 409	1,355	GB 409	5/13/1997	2001	
La Femme	MC 427	5,800				
Lena	MC 280	1,000	MC 281	5/01/1976	1984	
Leo	MC 546	2,505	MC 546	2/01/1986		
Llano	GB 386	2,663	GB 387	10/03/1994	2004	
Lorien	GC 199	2,315				
Lost Ark	EB 421	2,960	EB 421	1/31/2001	2002	
Macaroni	GB 602	3,600	GB 602	1/21/1996	1999	
Mad Dog	GC 782	4,428	GC 826	11/24/1998	2005	
Madison	AC 24	4,856	AC 024	6/25/1998	2002	
Magnolia	GB 783	4,674	GB 783	5/03/1999	2004	
Manatee	GC 155	1,939	GC 110	8/07/1987	2002	
Marathon	GC 153	1,618	GC 153	4/01/1984		
Marco Polo	GC 608	4,320	GC 608	4/21/2000	2004	
Marlin	VK 915	3,236	VK 915	6/01/1993	2000	
Mars	MC 807	2,933	MC 807	4/01/1989	1996	
Marshall	EB 949	4,376	EB 949	7/30/1998	2001	
Matterhorn	MC 243	2,850	MC 243	9/01/1990	2003	
MC 113	MC 113	1,986	MC 113	1/01/1976		
MC 285	MC 285	3,161	MC 285	9/01/1987		
MC 455	MC 455	1,400	MC 455	2/01/1986		
MC 68	MC 68	1,360	MC 068	12/09/1975	2001	
MC 709	MC 709	2,599	MC 709	2/01/1987		
MC 837	MC 837	1,524	EW 878	7/03/2000		
MC 929	MC 929	2,250	MC 929	11/01/1987		
McKinley	GC 416	4,019	GC 416	7/14/1998		
Medusa	MC 582	2,223	MC 582	10/10/1998	2003	
Medusa North	MC 538	2,223	MC 582	10/10/1998	2003	
Mensa	MC 731	5,318	MC 731	12/01/1986	1997	
Merganser	AT 37	8,015	AT 037	11/28/2001		
Mica	MC 211	4,580	MC 211	5/01/1990	2001	
Mighty Joe Young	GC 737	4,415				
Mirage	MC 941	3,927	MC 899	1/04/1998		

Project Name	Area/Block	Water Depth (ft)[2]	Field	Field Discovery Date[3]	Year of First Production	Year of Last Production
Moccasin	GB 254	1,920	GB 254	7/23/1993		
Mondo Northwest	LL 2	8,340				
Mondo NW Ext.	LL 1	8,340				
Morgus	MC 942	3,960	MC 899	1/04/1998		
Morpeth	EW 921	1,696	EW 921	5/01/1986	1998	
Mosquito Hawk	GB 269	1,102	GB 269	3/06/1996		
Nansen	EB 602	3,675	EB 602	9/25/1999	2002	
Navajo	EB 690	4,210	EB 602	9/25/1999	2002	
Navarro	GC 37	2,019				
Neptune(AT-BHP)	AT 575	6,220	AT 575	9/26/1995		
Neptune (VK-Kerr-McGee)	VK 826	1,930	VK 825	11/01/1987	1997	
Ness	GC 507	3,947	GC 507	12/27/2001		
Nile	VK 914	3,535	VK 914	4/30/1997	2001	
Nirvana	MC 162	3,724	MC 162	11/30/1994		
Northwestern	GB 200	1,736	GB 200	5/14/1998	2000	
Oregano	GB 559	3,400	GB 559	3/27/1999	2001	
Oyster	EW 917	1,195	EW 873	12/01/1985	1998	
Pardner	MC 401	1,139	WD 152	10/01/1968[4]	2003	
Penn State	GB 216	1,450	GB 260	11/01/1991	1999	
Petronius	VK 786	1,753	VK 786	7/14/1995	2000	
PI 525	PI 525	3,430	PI 525	4/30/1996		
Pilsner	EB 205	1,108	EB 205	5/02/2001	2001	
Pluto	MC 674	2,828	MC 718	10/20/1995	1999	
Pompano	VK 990	1,290	VK 990	5/01/1981	1994	
Popeye	GC 116	2,000	GC 116	2/01/1985	1996	
Poseidon (GC)	GC 691	4,489	GC 691	2/27/1996		
Poseidon (MC)	MC 772	5,567	MC 728	6/30/2002	2005	
Prince	EW 1003	1,500	EW 958	7/20/1994	2001	
Princess	MC 765	3,600	MC 807	4/01/1989	2002	
Ptolemy	GB 412	1,322	GB 412	7/01/1984		
Puma	GC 823	4,129				
Q	MC 961	7,925				
Ram-Powell	VK 956	3,216	VK 956	5/01/1985	1997	
Raptor	EB 668	3,710	EB 668	9/13/2003	2004	
Red Hawk	GB 877	5,334	GB 877	10/18/2001	2004	
Rigel	MC 252	5,229	MC 252	11/29/1999	2006	

Project Name	Area/Block	Water Depth (ft)[2]	Field	Field Discovery Date[3]	Year of First Production	Year of Last Production
Rockefeller	EB 992	4,872	EB 992	11/28/1995		
Rocky	GC 110	1,785	GC 110	8/07/1987	1996	
San Jacinto	DC 618	7,850				
San Patricio	AT 153	4,785	AT 153	8/09/2001		
Sangria	GC 177	1,487	GC 177	8/22/1999	2002	
Serrano	GB 516	3,153	GB 516	7/23/1996	2001	
Seventeen Hands	MC 299	5,881	MC 299	5/04/2001	2006	
Shasta	GC 136	1,048	GC 136	7/01/1981	1995	
Shenzi	GC 653	4,238				
Silvertip	AC 815	9,226				
Spiderman	DC 621	8,087				
St. Malo	WR 678	7,036				
Stones	WR 508	9,556				
Sturgis	AT 183	3,710				
Supertramp	MC 26	1,272	MC 026	5/27/1994		
SW Horseshoe	EB 430	2,285	EB 430	5/03/2000		
Swordfish	VK 962	4,677	VK962	11/15/2001	2005	
Tahiti	GC 640	4,292				
Tahoe	VK 783	1,500	VK 783	12/01/1984	1994	
Thunder Hawk	MC 734	5,724				
Thunder Horse	MC 778	6,050	MC 778	4/01/1999		
Thunder Horse North	MC 776	5,660				
Ticonderoga	GC 768	5,272		10/03/2004	2006	
Tiger	AC 818	9,004				
Timber Wolf	MC 555	4,749	MC 555	10/30/2001		
Tobago	AC 859	9,627				
Tomahawk	EB 623	4,114	EB 579	1/28/2003	2003	
Trident	AC 903	9,743				
Triton	MC 728	5,373	MC 728	6/30/2002	2005	
Troika	GC 244	2,721	GC 244	5/30/1994	1997	
Tubular Bells	MC 725	4,334				
Tulane	GB 158	1,054	GB 200	5/14/1998	2002	
Typhoon	GC 237	2,679	GC 236	10/01/1984	2001	
Ursa	MC 809	3,800	MC 807	4/01/1989	1999	
Virgo	VK 823	1,130	VK 823	1/01/1993	1999	
VK 862	VK 862	1,043	VK 862	10/01/1976	1995	
VK 917	VK 917	4,370	VK 917	12/08/2001		

Project Name	Area/Block	Water Depth (ft)[2]	Field	Field Discovery Date[3]	Year of First Production	Year of Last Production
Vortex	AT 261	8,344				
Wrigley	MC 506	3,700				
Yosemite	GC 516	4,150	GC 472	2/01/1989	2002	
Zia	MC 496	1,804	MC 582	10/10/1998	2003	
Zinc	MC 354	1,478	MC 354	8/01/1977	1993	

[1] A block may be listed under more than one project name because of lease relinquishment, expiration, or termination and subsequent re-leasing. Some announced discoveries never reached the project stage and are listed under their prospect names.

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

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

[4] The deepwater portion of the Pardner project was discovered in 2002.

APPENDIX B. CHRONOLOGICAL LISTING OF GOM LEASE SALES BY SALE LOCATION AND SALE DATE.

Sale Number	Sale Location	Sale Date
1	LA[1]	10/13/1954
1S	LA	10/13/1954
2	TX	11/09/1954
3	TX, LA	7/12/1955
6	LA[2]	8/11/1959
7	TX, LA	2/24/1960
8	LA[3]	5/19/1960
9	LA	3/13/1962
10	TX, LA	3/16/1962
11	LA[2]	10/09/1962
12	LA[2]	4/28/1964
13	SUL-TX[4]	12/14/1965
14	LA[2]	3/29/1966
15	LA[2]	10/18/1966
16	LA	6/13/1967
17	SA-LA[5]	9/05/1967
18	TX	5/21/1968
19	LA[2]	11/19/1968
19A	LA[2]	1/14/1969
20	SUL-LA[6]	5/13/1969
19B	LA[2]	12/16/1969
21	LA[2]	7/21/1970
22	LA	12/15/1970
23	LA[2]	11/04/1971
24	LA	9/12/1972
25	LA	12/19/1972
26	TX, LA	6/19/1973
32	MAFLA[7]	12/20/1973
33	LA	3/28/1974
34	TX	5/29/1974
S1	TX, LA	7/30/1974
36	LA	10/16/1974
37	TX	2/04/1975
38	TX, LA	5/28/1975
38A	TX, LA	7/29/1975
41	GOM	2/18/1976
44	TX, LA	11/16/1976
47	GOM	6/23/1977
45	TX, LA	4/25/1978
65	GOM	10/31/1978
51	TX, LA	12/19/1978
58	GOM	7/31/1979
58A	GOM	11/27/1979

Sale Number	Sale Location	Sale Date
A62	GOM	9/30/1980
62	GOM	11/18/1980
A66	GOM	7/21/1981
66	GOM	10/20/1981
67	GOM	2/09/1982
69	GOM	11/17/1982
69A	GOM	3/08/1983
72	CGOM	5/25/1983
74	WGOM	8/24/1983
79	EGOM	1/05/1984
81	CGOM	4/24/1984
84	WGOM	7/18/1984
98	CGOM	5/22/1985
102	WGOM	8/14/1985
94	EGOM	12/18/1985
104	CGOM	4/30/1986
105	WGOM	8/27/1986
110	CGOM	4/22/1987
112	WGOM	8/12/1987
SS	CGOM	2/24/1988
113	CGOM	3/30/1988
115	WGOM	8/31/1988
116	EGOM	11/16/1988
118	CGOM	3/15/1989
122	WGOM	8/23/1989
123	CGOM	3/21/1990
125	WGOM	8/22/1990
131	CGOM	3/27/1991
135	WGOM	8/21/1991
139	CGOM	5/13/1992
141	WGOM	8/19/1992
142	CGOM	3/24/1993
143	WGOM	9/15/1993
147	CGOM	3/30/1994
150	WGOM	8/17/1994
152	CGOM	5/10/1995
155	WGOM	9/15/1995
157	CGOM	4/24/1996
161	WGOM	9/25/1996
166	CGOM	3/05/1997
168	WGOM	8/27/1997
169	CGOM	3/18/1998
171	WGOM	8/26/1998

Sale Number	Sale Location	Sale Date
172	CGOM	3/17/1999
174	WGOM	8/25/1999
175	CGOM	3/15/2000
177	WGOM	8/23/2000
178-1	CGOM	3/28/2001
178-2	CGOM	8/22/2001
180	WGOM	8/22/2001
181	EGOM	12/05/2001
182	CGOM	3/20/2002
184	WGOM	8/21/2002
185	CGOM	3/19/2003

Sale Number	Sale Location	Sale Date
187	WGOM	8/20/2003
189	EGOM	12/10/2003
190	CGOM	3/17/2004
192	WGOM	8/18/2004
194	CGOM	3/16/2005
196	WGOM	8/17/2005
197	EGOM	3/16/2005
198	CGOM	3/15/2006
200	WGOM	
201	CGOM	

[1] Sale 1 was an oil, gas, and sulfur lease sale offshore Louisiana.
[2] These were oil and gas drainage lease sales offshore Louisiana.
[3] Sale 8 was a salt lease sale offshore Louisiana.
[4] Sale 13 was a sulfur and salt lease sale offshore Texas.
[5] Sale 17 was a salt lease sale offshore Louisiana.
[6] Sale 20 was a sulfur and salt lease sale offshore Louisiana.
[7] Sale 32 was an oil and gas lease sale offshore Mississippi, Alabama, and Florida.
LA = oil and gas lease sale offshore Louisiana (unless otherwise footnoted)
TX = oil and gas lease sale offshore Texas
GOM = oil and gas lease sale in the Gulf of Mexico
CGOM = oil and gas lease sale in the Central Gulf of Mexico Planning Area
EGOM = oil and gas lease sale in the Eastern Gulf of Mexico Planning Area
WGOM = oil and gas lease sale in the Western Gulf of Mexico Planning Area

APPENDIX C. NTL NO. 2006-G02, SUSPENSION OF OPERATIONS BASED ON RIG DELAYS, LACK OF RIG AVAILABILITY AND PROCUREMENT OF LONG LEAD EQUIPMENT.

UNITED STATES DEPARTMENT OF THE INTERIOR MINERALS MANAGEMENT SERVICE
GULF OF MEXICO OCS REGION

NTL No. 2006-G02

Effective Date: February 10, 2006
Expiration Date: February 28, 2008

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES
IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO OCS REGION

Suspensions of Operations Based on Rig Delays, Lack of Rig Availability
and Procurement of Long Lead Equipment

This Notice to Lessees and Operators (NTL) is issued pursuant to 30 CFR 250.103 and 30 CFR 250.175(a) to provide guidance to our existing authority for approving requests for lease or unit Suspensions of Operations (SOO's) based on rig delays and to implement a temporary policy for granting SOO's based on a lack of rig availability and for unanticipated time frames needed to secure long lead equipment such as high pressure/temperature tubulars and wellheads.

In accordance with the Outer Continental Shelf (OCS) Lands Acts, regulations, and current policy, the Department expects lessees to explore and commence development within the primary term of any OCS lease. However, pursuant to 30 CFR 250.175(a), the Regional Supervisor may grant an SOO when necessary to allow you time to begin drilling or other operations when you are prevented by reasons beyond your control such as unexpected weather, unavoidable accidents, or drilling rig delays. In general, SOO's are short in duration.

Currently, pursuant to 30 CFR 250.175(a), an SOO may be granted to extend the term of a lease when a drilling rig was contracted and scheduled to begin leaseholding operations prior to the lease expiration but due to reasons beyond your control, the rig was delayed. When considering an SOO request based on a rig delay, it is expected that no other rig options are available; therefore, any delay in the rig release date should be short term. It is expected that you have an approved plan (e.g., EP, DPP, etc.) and an approved APD. Likewise, MMS may approve SOO's when you can demonstrate that long lead equipment was contracted and scheduled to arrive in time to commence a lease holding operation prior the lease expiration date but was delayed for reasons beyond your control. In addition, any SOO request must include:

(1) verification that a rig or a long lead equipment contract has been executed,

(2) the original date before lease expiration the rig or long lead equipment was expected to arrive on the lease,

(3) full details explaining the delay,

(4) the new anticipated date for the rig or long lead equipment to arrive on location, and

(5) the expected date operations will commence.

In addition to the delays as described above, an SOO request may be approved under a temporary policy established by this NTL when you can demonstrate to MMS's satisfaction that a timely search has resulted in a total lack of rigs capable of drilling prior to lease expiration. In such a case, an SOO will be considered to allow time for the first available rig to commence operations, provided a drilling contract has been executed prior to lease expiration. The SOO request must include:

(1) full details, with supporting documentation, demonstrating that a timely rig search was performed,

(2) verification that a rig contract has been executed prior to lease expiration, and

(3) the anticipated date for the rig to arrive on location and commence operations.

Likewise, under this temporary policy, MMS may approve SOO's when you can demonstrate that timely attempts to secure long lead equipment needed for the commencement of leaseholding operations prior to lease expiration were unsuccessful. MMS encourages you to contact our office upon learning that your "timely attempts" were not sufficient. In such cases, before an SOO can be granted, a contract must have been executed for the timely delivery of the long lead equipment and the request must include the expected delivery date and an explanation why such equipment will not be delivered prior to lease expiration. Late attempts to secure a drilling rig contract or long lead equipment will not be justification for an SOO approval.

In all cases, SOO requests must be received by the MMS prior to lease expiration. Late permit filings (e.g., EP, APD, etc.) will not be justification for an SOO approval.

If you have any questions, please contact Kevin J. Karl at (504)736-2632, kevin.karl@mms.gov; or Ronald Konecni at (504)736-2661, ronald.konecni@mms.gov.

Paperwork Reduction Act of 1995 Statement

The information collection referred to in this NTL is intended to provide clarification, description, or interpretation of requirements contained in 30 CFR 250.175, suspension of operations. The Office of Management and Budget (OMB) has approved the information collection requirements in these regulations under OMB Control Number 1010-0114. This NTL does not impose additional information collection requirements subject to the Paperwork Reduction Act of 1995.

Chris C. Oynes [Original Signed]

Regional Director

APPENDIX D. DEEPWATER STUDIES PROGRAM

All reports are available at our web sites—

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

http://www.mms.gov/tarprojectcategories/deepwate.htm

Active Studies (MMS Project Number/Study Number)

An Analysis of the Socioeconomic Effects of OCS-Activities on Ports and Surrounding Areas in the Gulf of Mexico [GM-92-42-56], [19957 G]

An Assessment of Magnetization Effects on Hydrogen Cracking for Thick Walled Pipelines [487]

Application of Dual Gradient Technology to Top Hole Drilling [541]

Assessing and Monitoring Industry Labor Needs [GM-98-06] [30898 G]

Benefits and Burdens of OCS Deepwater Activities on Selected Communities and Local Public Institutions [GM-98-10] [30899 G]

Characterization of Gulf of Mexico Deepwater Hard Bottom Communities with Emphasis on Lophelia Coral [GM-03-02] [72323]

Characterizing Natural Gas Hydrates in the Deepwater Gulf of Mexico [461]

Comparison of Remote Technologies to Better Assess the Location of Gas Hydrates [39076]

Cooperative Research on Sperm Whales and Their Response to Seismic Exploration in the Gulf of Mexico [GM-01-04C] [85186]

Damaged Polyester Rope--Large Scale Experiments JIP [416]

Deep-Sea Furrows [479]

Deep-Sea Furrows: Physical Characteristics, Mechanisms of Formation, and Associated Environmental Processes [73209]

Deepwater Current Measurements at 25EN; 90EW in Mexican Territory [85309]

Deepwater Currents at 92° W [GM-92-42-73] [16807 B]

Deepwater Riser VIV Project—CFD Simulation of Riser VIV [481]

Determination of Yellowfin Tuna Aggregation and Movement Patterns Near Gulf of Mexico Deepwater Petroleum Structures [USGS study for MMS]

Direct Observations of Ocean Currents over the Western Slope in the Gulf of Mexico [GM-03-01b] [32916]

Document and Characterize the Branching Deepwater Corals and Geology at Two Upper-Slope Sites in the Northeastern Gulf of Mexico [73719]

Drilling and Completion Gaps for High Temperature and High Pressure in Deep Water [519]

Effects of Oil and Gas Exploration and Development at Selected Continental Slope Sites in the Gulf of Mexico [GM-00-01] [31034 E]

Exploratory Study of Deepwater Currents in the Gulf of Mexico [GM-01-02] [31152 B]

Factors Affecting Petroleum Exploration and Development and Their Impacts on the Attractiveness and Prospectivity of the Gulf of Mexico Deepwater [39305]

Foraminiferal Communities of Bathyal and Abyssal Hydrocarbon Seeps, Northern Gulf of Mexico: A Taxonomic, Ecologic, and Geologic Study [GM-92-42-86]

Gulf of Mexico Deepwater Protected Species Studies: Sperm Whale Study [15958]

Hydrotest Alternative JIP—For Deepwater Gas Export Pipelines [525]

Interstitially Insulated Pipe [509]

Investigations of Chemosynthetic Communities on the Lower Continental Slope of the Gulf of Mexico (Chemo III) (NOPP) [39187]

Methodologies for Measuring and Monitoring Hydrogen for Safety in Advanced High Strength Linepipe Steel Applications [522]

New Touch-Down Zone Solutions for Steel Catenary Risers [494]

Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology [GM-99-02] [30991 C]

Numerical Modeling of Torpedo Anchors [557]

Observation of Deepwater Manifestation of Loop Current Rings [GM-92-42-72] [16805 B]

OTRC Cooperative Agreement [328]

Performance Data Base for Deepwater Production Platforms [560]

Polyester Rope Analysis Tool [369]

Potential Spatial and Temporal Vulnerability of Pelagic Fish Assemblages in the Gulf of Mexico to Surface Oil Spills Associated with Deepwater Petroleum Development [GM-92-42-61]

Probabilistic Reliability and Integrity Assessment of Large-Diameter Compliant Risers for Ultra-Deepwater Operations [497]

Regional Synthesis of the Sedimentary Thermal History and Hydrocarbon Maturation in the Deepwater Gulf of Mexico [432]

Repeatability and Effectiveness of Subsurface Controlled Safety Valves [403]

Riser VIV Workshop [521]

Risk Assessment for Submarine Slope Stability [491}

Risk Assessment of Surface vs. Subsurface BOP's on Mobile Offshore Drilling Units [540]

SCR Flex Joint Design and Performance JIP [530]

SCR Integrity Management [531]

Seafloor Interaction with Steel Catenary Risers [510]

Strain-Based Design of Pipelines [434]

Survey of Deepwater Currents in the Eastern Gulf of Mexico [GM-04-01] [34269]

Survey of Deepwater Currents in the Western Gulf of Mexico [GM-03-01] [71562]

Technology Assessment of Alternatives for Handling Associated Gas Produced from Deepwater Oil Developments in the GOM [443]

The Archaeological and Biological Analysis of World War II Shipwrecks in the Gulf of Mexico: A Pilot Study of the Artificial Reef Effect in Deepwater [GM-03-07] [73095]

Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico [GM-02-06]

Completed Reports

Analysis and Validation of a Mechanism that Generates Strong Mid-Depth Currents and a Deep Cyclone Gyre in the Gulf of Mexico [31027 B]. Report Number 2004-040, Strong Mid-Depth Currents and a Deep Cyclonic Gyre in the Gulf of Mexico

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

Assessment of New and/or Improved Repair Techniques for Ageing or Damaged Structures [502]

Assessment of Performance of Deepwater Floating Production Facilities [471]

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

Characterizing Polyester Rope Installation Damage [389]

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]. Report Number 2004-017, Cross-Shelf Exchange Processes and the Deepwater Circulation of the Gulf of Mexico: Dynamical Effects of Submarine Canyons and the Interactions of Loop Current Eddies with Topography, Final Report

Damage Tolerance of Synthetic-Fiber Mooring Ropes; Phase I: Small-Scale Experiments [407]

Deep Water Anchor Reliability [362]

Deepwater Field Measurements [417]

Deepwater GOM Pipeline Damage Characteristics and Repair Options [532]

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

Design of Cathodic Protection Systems for Deep Water Compliant Petroleum Production Risers [496]

Development of a Blowout Intervention Method and Dynamic Kill Simulated for Blowouts Occurring in Ultra-Deepwater [408]

Evaluation of Methods of Detecting and Monitoring of Corrosion Damage in Risers [433]

Evaluation of Secondary BOP Intervention Methods in Well Control [431]

Experimental Validation of Well Control Procedures in Deepwater [382]

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

Gulf of Mexico Marine Protected Species Workshop [30665-8]. Report Number 2001-039, Gulf of Mexico Marine Protected Species Workshop, June 1999

Joint Industry Project, Gulf of Mexico Comprehensive Synthetic Based Muds Monitoring Program [31069 E]. Gulf of Mexico Comprehensive Synthetic Based Muds Monitoring Program, Executive Summary, Gulf of Mexico Comprehensive Synthetic Based Muds Monitoring Program, Volumes I, II, and III: Appendices.

Labor Migration and the Deepwater Oil Industry [19958 G]. Report Number 2004-57, Deepwater Program: Labor Migration and the Deepwater Oil Industry

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

Long Term Integrity of Deep-Water Cement Systems [426]

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]. Report Number 2003-074, Modeling and Data Analyses of Circulation Processes in the Gulf of Mexico, Final Report

OCS-Related Infrastructure in the Gulf of Mexico [30955 G]. Report Number 2004-027, OCS-Related Infrastructure in the Gulf of Mexico Fact Book

Offshore Data Search and Synthesis on Highly Migratory Species in the GOM and the Effects of Large Fish Attracting Devices (FADs) [RD-0202]. MMS Report Number 2002-039 and USGS BSR 2002-0005, Potential for Gulf of Mexico Deepwater Petroleum Structures to Function as Fish Aggregating Devices (FADs)—Scientific Information Summary and Bibliography

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

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]. Report Number 2005-012, Potential Spatial and Temporal Vulnerability of Pelagic Fish Assemblages in the Gulf of Mexico to Surface Oil Spills Associated with Deepwater Petroleum Development

Project Offshore Deep Slopes (PODS)Phase II [472]

Project Offshore Deep Slopes (PODS): Seafloor Stability on the Continental Shelf/Slope [404]

Reliability Analysis of Deepwater Anchors [437]

Reliability of Pressure Signals In Offshore Pipelines Leak Detection [398]

Risk-Extend Comparative Risk Assessment (CRA) for a SPAR-Based FPSO [418]

ROV/AUV Capabilities [446]

Study of Subsurface, High-Speed Current Jets in the Deep Water Region of the Gulf of Mexico [31026 B]. Report Number 2004-022, Deepwater Program: Subsurface, High-Speed Current Jets in the Deepwater Region of the Gulf of Mexico

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

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]. Report Number 2004-047, Supply Network for Deepwater Oil and Gas Development in the Gulf of Mexico: An Empirical Analysis of Demand for Port Services

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

Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico [85080]. Report Number 2205-032, Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico, Synthesis Report

Workshop on Deepwater Environmental Studies Strategy: A Five Year Follow-up and Planning for the Future [85035]. Report Number 2003-030, Workshop on Deepwater Environmental Studies Strategy: A Five-Year Follow-Up and Planning for the Future

World Wide Assessment of Industry Leak Detection Capabilities for Single and Multiphase Pipelines [409]

Study in the Procurement Process

Synthetic-based Fluid Spill of Opportunity: Environmental Impact and Recovery

APPENDIX E. SUBSEA COMPLETIONS.

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
AC	24	608054000501	Exxon Mobil Corporation	2/03/2002	4,856
AC	65	608054000302	Exxon Mobil Corporation	12/31/2003	4,852
BA	A 17	427044034500	Spinnaker Exploration Company LLC	8/10/2003	140
DC	133	608234000200	ATP Oil & Gas Corporation	10/15/2001	6,376
EB	112	608044015700	Eni Petroleum Co Inc	5/01/1996	638
EB	117	608044016102	Apache Corporation	4/11/1996	570
EB	157	608044015200	Eni Petroleum Co Inc	5/23/1996	941
EB	161	608044022600	Union Oil Company of California	7/23/2001	1,107
EB	168	608044023000	Walter Oil & Gas Corporation	12/15/2001	500
EB	205	608044021800	Union Oil Company of California	6/01/2001	1,081
EB	421	608044020000	Noble Energy Inc	5/12/2002	2,740
EB	430	608044019202	Walter Oil & Gas Corporation	3/13/2005	2,285
EB	579	608044023500	Pioneer Natural Resources USA Inc	11/18/2002	3,453
EB	602	608044019001	Kerr-McGee Oil & Gas Corporation	7/15/2001	3,678
EB	602	608044022000	Kerr-McGee Oil & Gas Corporation	3/06/2002	3,678
EB	623	608044023400	Pioneer Natural Resources USA Inc	12/30/2002	3,412
EB	646	608044023200	Kerr-McGee Oil & Gas Corporation	8/06/2005	3,905
EB	668	608044024101	Pioneer Natural Resources USA Inc	5/26/2005	3,710
EB	688	608044022400	Kerr-McGee Oil & Gas Corporation	12/13/2001	3,795
EB	688	608044022101	Kerr-McGee Oil & Gas Corporation	1/10/2002	3,788
EB	690	608044022801	Kerr-McGee Oil & Gas Corporation	2/18/2002	4,202
EB	759	608044022301	Pioneer Natural Resources USA Inc	11/01/2004	4,114
EB	945	608044017700	Exxon Mobil Corporation	11/20/1999	4,638
EB	945	608044016200	Exxon Mobil Corporation	3/31/2002	4,628
EB	945	608044017804	Exxon Mobil Corporation	9/25/2003	4,639
EB	946	608044018100	Exxon Mobil Corporation	3/08/2000	4,651
EB	946	608044018000	Exxon Mobil Corporation	5/31/2000	4,657
EB	948	608044017601	Exxon Mobil Corporation	5/06/2001	4,376
EB	949	608044019301	Exxon Mobil Corporation	4/02/2001	4,376
EC	57	177034047100	Houston Exploration Company	12/09/1984	52
EC	335	177044030300	Pogo Producing Company	7/15/1976	272

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
EC	347	177044101300	Apache Corporation	1/3/2001	291
EC	374	177044101700	Energy Resource Technology Inc	7/17/2002	425
EC	378	608074015700	El Paso Production Company	1/27/1997	495
EI	106	177094121001	Devon Louisiana Corporation	2/21/2005	40
EI	294	177104126801	B T Operating Co	10/06/1991	214
EI	349	177104100500	NCX Company LLC	11/23/1990	337
EI	386	177104147500	Tarpon Offshore LP	2/24/2002	417
EI	390	177104149001	Walter Oil & Gas Corporation	2/11/2004	377
EI	395	177104157700	Walter Oil & Gas Corporation	3/03/2004	517
EW	868	608104011501	Walter Oil & Gas Corporation	10/17/2003	685
EW	871	608104011000	Walter Oil & Gas Corporation	11/13/2000	932
EW	871	608104011300	Walter Oil & Gas Corporation	4/13/2001	724
EW	878	608105009500	Walter Oil & Gas Corporation	7/26/2000	1,523
EW	878	608105009601	Walter Oil & Gas Corporation	9/25/2000	1,523
EW	913	608104011700	Walter Oil & Gas Corporation	10/13/2004	685
EW	917	608105006500	Marathon Oil Company	4/08/1998	1,195
EW	921	608105008104	Eni Petroleum Co Inc	8/16/2002	1,692
EW	921	608105007903	Eni Petroleum Co Inc	8/16/2002	1,696
EW	921	608105009801	Eni Petroleum Co Inc	1/25/2005	1,712
EW	963	608105006000	Marathon Oil Company	5/25/1998	1,740
EW	963	608105006800	Marathon Oil Company	6/29/1998	1,758
EW	965	608105008003	Eni Petroleum Co Inc	1/26/2002	1,694
EW	966	608104010001	Mariner Energy Inc	5/12/2000	1,853
EW	991	608104009300	Walter Oil & Gas Corporation	7/06/1996	765
EW	1006	608105004102	Walter Oil & Gas Corporation	3/01/2002	1,884
EW	1006	608104012100	Walter Oil & Gas Corporation	6/23/2003	1,851
EW	1006	608104012200	Walter Oil & Gas Corporation	8/27/2003	1,854
GA	A 192	427074010300	Walter Oil & Gas Corporation	5/22/2003	242
GB	108	608074020600	Kerr-McGee Oil & Gas Corporation	7/17/1999	619
GB	117	608074013500	Flextrend Development Company LLC	7/16/1996	922
GB	117	608074014901	Flextrend Development Company LLC	5/05/1997	924
GB	139	608074064501	W & T Offshore Inc	11/25/2002	550
GB	152	608074020800	Walter Oil & Gas Corporation	7/07/1999	619

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
GB	158	608074021702	Amerada Hess Corporation	1/28/2002	1,050
GB	161	608074015801	Newfield Exploration Company	9/20/1999	972
GB	161	608074017500	Newfield Exploration Company	11/17/1999	970
GB	179	608074063700	Walter Oil & Gas Corporation	10/12/1997	712
GB	184	608074065100	Kerr-McGee Oil & Gas Corporation	3/20/2003	698
GB	200	608074021100	Amerada Hess Corporation	11/29/2000	1,736
GB	201	608074023701	Amerada Hess Corporation	11/02/2002	1,736
GB	201	608074027002	Amerada Hess Corporation	9/05/2005	1,736
GB	205	608074024103	LLOG Exploration Offshore Inc	8/30/2002	1,330
GB	215	608074016001	Amerada Hess Corporation	12/15/2000	1,450
GB	215	608074020101	Amerada Hess Corporation	2/19/2001	1,457
GB	215	608074017202	Amerada Hess Corporation	12/30/2002	1,464
GB	216	608074081901	Amerada Hess Corporation	5/22/1999	1,456
GB	216	608074022600	Amerada Hess Corporation	6/20/2001	1,481
GB	224	608074061800	Kerr-McGee Oil & Gas Corporation	5/22/1991	742
GB	235	608074010600	W & T Offshore Inc	11/10/1994	785
GB	236	608074063300	Chevron USA Inc	9/08/1997	685
GB	341	608074025401	Shell Offshore Inc	6/14/2003	2,013
GB	341	608074019104	Shell Offshore Inc	7/30/2003	2,015
GB	409	608074016300	ATP Oil & Gas Corporation	5/12/2001	1,355
GB	409	608074063500	ATP Oil & Gas Corporation	5/16/2001	1,360
GB	472	608074020903	Shell Offshore Inc	10/21/2001	3,380
GB	472	608074024303	Shell Offshore Inc	4/24/2003	3,392
GB	516	608074022402	Shell Offshore Inc	11/21/2001	3,400
GB	559	608074019901	Shell Offshore Inc	8/03/2001	3,400
GB	559	608074022103	Shell Offshore Inc	9/02/2001	3,400
GB	559	608074023901	Shell Offshore Inc	3/18/2003	3,393
GB	602	608074019401	Shell Offshore Inc	8/16/1999	3,693
GB	602	608074014401	Shell Offshore Inc	12/28/1999	3,708
GB	602	608074019301	Shell Offshore Inc	2/27/2001	3,708
GB	667	608074065803	Kerr-McGee Oil & Gas Corporation	2/18/2004	3,105
GB	668	608074067500	Kerr-McGee Oil & Gas Corporation	1/03/2006	3,137
GC	20	608114021300	Shell Gulf of Mexico Inc	12/10/1999	880

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
GC	50	608114038500	LLOG Exploration Offshore Inc	5/05/2004	922
GC	50	608114043400	LLOG Exploration Offshore Inc	10/26/2005	690
GC	60	608114020101	Mobil Oil Exploration & Producing	6/22/1996	868
GC	110	608114020600	Shell Offshore Inc	1/23/1996	1,730
GC	112	608115024501	Shell Deepwater Development Inc	7/13/2000	1,968
GC	113	608115013100	Marubeni Oil & Gas (USA) Inc	7/17/1999	1,968
GC	113	608115012701	Marubeni Oil & Gas (USA) Inc	9/01/1999	2,045
GC	116	608115008600	Shell Offshore Inc	1/11/1996	2,046
GC	116	608115012200	Shell Offshore Inc	2/14/1998	2,046
GC	136	608114020000	Chevron USA Inc	11/21/1995	860
GC	136	608114029600	Chevron USA Inc	11/19/2002	990
GC	137	608114039202	LLOG Exploration Offshore Inc	3/31/2004	1,168
GC	155	608114031100	Shell Offshore Inc	6/23/2002	1,939
GC	157	608114037100	LLOG Exploration Offshore Inc	6/12/2002	1,890
GC	157	608114043801	LLOG Exploration Offshore Inc	11/11/2005	2,614
GC	200	608114021800	Shell Offshore Inc	11/10/1997	2,670
GC	200	608114021600	Shell Offshore Inc	12/07/1997	2,670
GC	200	608114020501	Shell Offshore Inc	6/29/1998	2,670
GC	200	608114021901	Shell Offshore Inc	2/27/1999	2,670
GC	200	608114028900	Shell Offshore Inc	1/25/2001	2,672
GC	237	608114024100	Chevron USA Inc	6/13/2001	2,025
GC	237	608114023101	Chevron USA Inc	7/09/2001	2,025
GC	237	608114024704	Chevron USA Inc	6/10/2003	1,982
GC	243	608114027606	Nexen Petroleum USA Inc	9/19/2002	3,065
GC	243	608114034000	Nexen Petroleum USA Inc	12/28/2002	3,048
GC	244	608114021701	Shell Offshore Inc	3/02/1998	2,670
GC	254	608115009001	Eni Petroleum Co Inc	8/16/2000	3234
GC	254	608115008001	Eni Petroleum Co Inc	11/04/2001	3226
GC	282	608114030804	BHP Billiton Petroleum (GOM) Inc	11/22/2002	2,386
GC	282	608114033701	BHP Billiton Petroleum (GOM) Inc	8/01/2003	2,370
GC	297	608115009400	Eni Petroleum Co Inc	9/11/2001	3,308
GC	473	608114027300	Eni Petroleum Co Inc	9/15/2001	3,840
GC	516	608114030101	Eni Petroleum Co Inc	10/02/2001	3,839

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
GC	768	608114041704	Kerr-McGee Oil & Gas Corporation	1/11/2006	5,272
GI	32	177174011700	BP America Production Company	3/09/1980	98
GI	101	177184010500	Walter Oil & Gas Corporation	9/29/2002	215
GI	109	177184009600	Walter Oil & Gas Corporation	10/16/2000	280
HI	A 308	427114085500	Tarpon Offshore LP	8/16/2004	212
HI	A 309	427114070100	SPN Resources LLC	1/24/1995	213
HI	A 316	427114084301	El Paso Production Oil & Gas Co	11/23/2002	217
HI	A 336	427114086100	Tarpon Offshore LP	12/31/2004	235
HI	A 343	427114082501	Tarpon Offshore LP	2/26/2005	257
HI	A 345	427114083000	Seneca Resources Corporation	7/26/2003	238
HI	A 355	427114084100	Newfield Exploration Company	12/15/2002	285
HI	A 378	427114075700	Kerr-McGee Oil & Gas Corporation	7/28/1996	360
HI	A 531	427094106900	Hunt Oil Company	8/25/1999	194
HI	A 531	427094109100	Hunt Oil Company	3/24/2001	194
HI	A 544	427094113200	Energy Resource Technology Inc	9/06/2003	234
HI	A 573	427094053700	Apache Corporation	9/17/1980	350
MC	28	608164018600	BP Exploration & Production Inc	4/21/1995	1,290
MC	28	608174051900	BP Exploration & Production Inc	6/30/1996	1,853
MC	28	608174051600	BP Exploration & Production Inc	8/16/1996	1,853
MC	28	608174052000	BP Exploration & Production Inc	4/24/1998	1,853
MC	28	608174051704	BP Exploration & Production Inc	6/26/2001	1,853
MC	66	608174100101	Mariner Energy Inc	9/03/2003	1,144
MC	68	608174088600	Walter Oil & Gas Corporation	6/03/2000	1,337
MC	72	608174051500	BP Exploration & Production Inc	4/27/1996	1,853
MC	72	608174051800	BP Exploration & Production Inc	2/14/1997	1,853
MC	84	608174096500	BP Exploration & Production Inc	2/05/2003	5,418
MC	85	608174090801	BP Exploration & Production Inc	5/13/2001	5,317
MC	85	608174090100	BP Exploration & Production Inc	6/15/2001	5,173
MC	161	608174106702	Walter Oil & Gas Corporation	8/23/2005	2,924
MC	167	608174088800	Exxon Mobil Corporation	10/28/2000	4,350
MC	211	608174088900	Exxon Mobil Corporation	11/22/2000	4,317
MC	211	608174099200	Exxon Mobil Corporation	8/28/2002	4,318
MC	217	608174091001	ATP Oil & Gas Corporation	8/22/2001	6,420

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
MC	217	608174090900	ATP Oil & Gas Corporation	1/07/2002	6,390
MC	278	608174091502	Walter Oil & Gas Corporation	5/21/2001	560
MC	292	608174050900	Chevron USA Inc	5/25/1999	3,405
MC	292	608174083201	Chevron USA Inc	8/25/1999	3,393
MC	292	608174083301	Chevron USA Inc	9/24/1999	3,393
MC	299	608174091202	Dominion Exploration & Production Co	5/13/2005	5,881
MC	305	608174091700	Total E&P USA Inc	5/01/2002	7,096
MC	305	608174083400	Total E&P USA Inc	7/12/2002	7,073
MC	305	608174098201	Total E&P USA Inc	8/15/2002	7,067
MC	305	608174087501	Total E&P USA Inc	9/11/2002	7,001
MC	321	608174089100	Walter Oil & Gas Corporation	9/15/2000	567
MC	322	608174093800	Walter Oil & Gas Corporation	7/08/2001	680
MC	348	608174084801	Marathon Oil Company	2/15/2002	7,209
MC	348	608174086801	Marathon Oil Company	5/31/2002	7,202
MC	354	608174044700	Exxon Mobil Corporation	7/05/1993	1,460
MC	355	608174044900	Exxon Mobil Corporation	5/29/1993	1,460
MC	355	608174044800	Exxon Mobil Corporation	9/11/1993	1,458
MC	355	608174084301	Exxon Mobil Corporation	7/02/1999	1,458
MC	357	608174053801	Newfield Exploration Company	2/25/1998	445
MC	383	608174094601	BP Exploration & Production Inc	8/11/2002	5,735
MC	383	608174094702	BP Exploration & Production Inc	8/26/2002	5,739
MC	400	608174096101	Apache Corporation	6/13/2005	1,139
MC	429	608174051300	BP Exploration & Production Inc	10/23/2002	6,240
MC	429	608174095402	BP Exploration & Production Inc	2/02/2003	6,101
MC	429	608174084404	BP Exploration & Production Inc	2/19/2003	6,134
MC	441	608174038400	Newfield Exploration Gulf Coast Inc	11/20/1992	1,531
MC	441	608174040100	Newfield Exploration Gulf Coast Inc	12/27/1992	1,531
MC	441	608174040002	Newfield Exploration Gulf Coast Inc	1/26/1993	1,531
MC	441	608174037601	Newfield Exploration Gulf Coast Inc	4/17/1993	1,438
MC	441	608174041500	Newfield Exploration Gulf Coast Inc	7/03/1993	1,438
MC	485	608174041600	Newfield Exploration Gulf Coast Inc	5/24/1993	1,438
MC	520	608174054601	BP Exploration & Production Inc	7/01/2002	6,738
MC	522	608174096900	BP Exploration & Production Inc	11/26/2002	6,932

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
MC	522	608174097000	BP Exploration & Production Inc	12/16/2002	6,934
MC	522	608174085802	BP Exploration & Production Inc	12/31/2002	6,940
MC	538	608174101301	Murphy Exploration & Production Co	2/16/2005	1,849
MC	608	608174098400	BP Exploration & Production Inc	7/22/2002	6,623
MC	661	608174083900	Pogo Producing Company	11/13/2001	854
MC	674	608174054404	Mariner Energy Inc	12/29/1999	2,710
MC	674	608174105502	Mariner Energy Inc	3/22/2005	2,799
MC	686	608174054100	Shell Offshore Inc	7/12/1997	5,292
MC	686	608174099600	Shell Offshore Inc	3/12/2003	5,318
MC	687	608174054000	Shell Offshore Inc	11/20/1998	5,292
MC	705	608174086001	Pogo Producing Company	12/24/2001	854
MC	730	608174054200	Shell Offshore Inc	11/04/1997	5,295
MC	755	608174057300	Anadarko E&P Company LP	12/11/2005	2,975
MC	763	608174047700	Shell Offshore Inc	8/08/1997	2,945
MC	764	608174058701	BP Exploration & Production Inc	4/06/2000	3,283
MC	765	608174100501	Shell Offshore Inc	7/18/2003	3,642
MC	765	608174098802	Shell Offshore Inc	12/29/2003	3,642
MC	766	608174096302	Shell Offshore Inc	9/11/2003	3,637
MC	771	608174102404	Dominion Exploration & Production Co	1/20/2005	5,413
MC	772	608174099100	Dominion Exploration & Production Co	3/16/2005	5,380
MC	806	608174049501	Shell Offshore Inc	1/03/2005	2,945
MC	807	608174038800	Shell Offshore Inc	3/25/1996	2,956
MC	822	608174038800	BP Exploration & Production Inc	11/10/2004	6,034
MC	837	608174092401	Walter Oil & Gas Corporation	6/22/2001	1,524
MC	899	608174058002	Shell Offshore Inc	7/24/2001	4,393
MC	899	608174091600	Shell Offshore Inc	8/13/2001	4,393
MC	899	608174087807	Shell Offshore Inc	10/31/2001	4,389
MC	934	608174083501	Shell Offshore Inc	11/13/1999	3,875
MC	934	608174083601	Shell Offshore Inc	3/10/2000	3,875
MC	934	608174083700	Shell Offshore Inc	9/01/2001	3,875
MI	685	427034054400	EOG Resources Inc	7/07/2004	90
MP	149	177254058901	Walter Oil & Gas Corporation	9/06/1994	220
MP	150	177254069600	Walter Oil & Gas Corporation	12/3/2000	245

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
MP	260	177244081400	Devon SFS Operating Inc	4/26/1999	315
MP	263	177244089600	Magnum Hunter Production Inc	3/31/2003	280
MP	280	177244091200	Dominion Exploration & Production Co	2/09/2005	307
MP	286	177244090400	Walter Oil & Gas Corporation	11/17/2003	292
MU	806	427024024500	Apache Corporation	11/30/1995	164
PN	996	427134009900	F-W Oil Exploration LLC	11/14/2003	159
PN	A 9	427134050200	Newfield Exploration Company	11/05/2003	201
SM	195	177084093200	Tarpon Offshore LP	2/25/2005	300
SP	32	177212050500	Devon Louisiana Corporation	6/12/2002	115
SS	321	177124057000	ATP Oil & Gas Corporation	5/29/1997	323
ST	177	177154007800	Chevron USA Inc	11/06/1976	144
ST	231	177164019900	W & T Offshore Inc	6/25/1998	238
ST	239	177164031300	Walter Oil & Gas Corporation	9/25/2003	162
ST	248	177164029700	PRS Offshore LP	6/04/2002	178
ST	260	177164029501	ConocoPhillips Company	2/17/2004	288
VK	738	608164036601	Newfield Exploration Company	9/24/2000	809
VK	783	608164013401	Shell Offshore Inc	4/08/1991	1,494
VK	783	608164021701	Shell Offshore Inc	7/18/1996	1,142
VK	783	608164022301	Shell Offshore Inc	12/20/1996	1,450
VK	783	608164022400	Shell Offshore Inc	12/20/1996	1,451
VK	783	608164022501	Shell Offshore Inc	1/22/1997	1,451
VK	784	608164023200	Shell Offshore Inc	6/30/1996	1,750
VK	825	608164033201	Kerr-McGee Oil & Gas Corporation	10/16/1998	1,722
VK	825	608164034400	Kerr-McGee Oil & Gas Corporation	8/29/1999	1,711
VK	862	608164021600	Walter Oil & Gas Corporation	11/15/1995	1,067
VK	869	608164042300	Kerr-McGee Oil & Gas Corporation	1/01/2004	2,033
VK	869	608164043000	Kerr-McGee Oil & Gas Corporation	12/29/2004	2,050
VK	873	608164033601	Shell Offshore Inc	12/29/2001	3,463
VK	914	608164028403	BP Exploration & Production Inc	3/15/2001	3,535
VK	915	608164038300	BP Exploration & Production Inc	5/18/2001	3,460
VK	915	608164040200	BP Exploration & Production Inc	4/17/2002	3,460
VK	917	608164040000	Noble Energy Inc	10/21/2004	4,370
VK	944	608164040602	Walter Oil & Gas Corporation	5/02/2002	730

Area	Block	API Number	Operator	Completion Date	Water Depth (ft)
VK	961	608164043100	Noble Energy Inc	8/24/2004	4,677
VK	962	608164039901	Noble Energy Inc	8/24/2004	4,677
VK	986	608164022800	Walter Oil & Gas Corporation	12/23/1995	893
VK	986	608164040800	Walter Oil & Gas Corporation	5/26/2002	895
VR	51	177054118800	Bois D'Arc Offshore Ltd	5/31/2004	17
VR	116	177054107201	W & T Offshore Inc	4/19/1998	55
VR	272	177054034600	LLOG Exploration Offshore Inc	7/19/2004	175
VR	332	177064091100	Noble Energy Inc	10/19/2002	223
WC	22	177004118800	Newfield Exploration Company	3/22/2004	28
WC	625	177024132702	LLOG Exploration Offshore Inc	10/29/2004	338
WC	635	177024127500	ATP Oil & Gas Corporation	1/08/2001	360
WC	638	177024116900	Newfield Exploration Company	11/06/1998	373
WD	45	177190038402	Nexen Petroleum USA Inc	12/08/1981	50
WD	106	177194070300	Walter Oil & Gas Corporation	6/14/2001	254
WD	107	177194058000	Walter Oil & Gas Corporation	1/02/1996	250
WD	107	177194056400	Walter Oil & Gas Corporation	1/02/1996	222
WD	112	177204014901	Tarpon Offshore LP	1/12/2005	277

Appendix F. Annual GOM Oil and Gas Production.

Year	Shallow-water Oil (MMB)	Deepwater Oil (MMB)	Total GOM Oil (MMB)	Shallow-water Gas (BCF)	Deepwater Gas (BCF)	Total GOM Gas (BCF)
1947	0	0	0	0	0	0
1948	0	0	0	0	0	0
1949	0	0	0	0	0	0
1950	0	0	0	0	0	0
1951	0	0	0	2	0	2
1952	1	0	1	19	0	19
1953	1	0	1	25	0	25
1954	2	0	2	60	0	60
1955	4	0	4	87	0	87
1956	7	0	7	91	0	91
1957	12	0	12	93	0	93
1958	20	0	20	144	0	144
1959	30	0	30	224	0	224
1960	41	0	41	281	0	281
1961	56	0	56	335	0	335
1962	77	0	77	451	0	451
1963	96	0	96	561	0	561
1964	111	0	111	645	0	645
1965	136	0	136	743	0	743
1966	175	0	175	992	0	992
1967	210	0	210	1,285	0	1,285
1968	254	0	254	1,600	0	1,600
1969	292	0	292	1,950	0	1,950
1970	329	0	329	2,402	0	2,402
1971	376	0	376	2,729	0	2,729
1972	373	0	373	3,004	0	3,004
1973	366	0	366	3,312	0	3,312
1974	338	0	338	3,418	0	3,418
1975	310	0	310	3,427	0	3,427
1976	301	0	301	3,556	0	3,556
1977	284	0	284	3,767	0	3,767
1978	276	0	276	4,244	0	4,244
1979	263	1	263	4,668	0	4,669
1980	260	5	265	4,762	4	4,766
1981	260	4	263	4,886	3	4,889
1982	273	13	286	4,651	16	4,666
1983	294	26	321	4,034	41	4,076

Year	Shallow-water Oil (MMB)	Deepwater Oil (MMB)	Total GOM Oil (MMB)	Shallow-water Gas (BCF)	Deepwater Gas (BCF)	Total GOM Gas (BCF)
1984	330	25	355	4,527	39	4,566
1985	330	21	351	4,047	34	4,081
1986	337	19	356	4,028	37	4,065
1987	311	17	328	4,501	44	4,545
1988	289	13	302	4,554	38	4,592
1989	271	10	281	4,618	32	4,650
1990	263	12	275	4,886	31	4,917
1991	272	23	295	4,648	58	4,707
1992	268	37	305	4,569	87	4,656
1993	272	37	309	4,556	120	4,675
1994	273	42	315	4,685	159	4,845
1995	290	55	345	4,614	181	4,795
1996	297	72	369	4,816	278	5,094
1997	303	108	412	4,776	382	5,158
1998	285	159	444	4,488	560	5,049
1999	270	225	495	4,217	846	5,062
2000	252	271	523	3,967	999	4,966
2001	243	315	558	3,882	1,177	5,060
2002	219	348	567	3,239	1,284	4,523
2003	211	350	561	3,005	1,425	4,430
2004	187	348	535	2,606	1,396	4,002

Appendix G. GOM Platforms Destroyed by Hurricanes (2004-2005)

Platforms Destroyed by Ivan (September 2004)

Area/Block	Number of platforms	Facility	Water Depth (ft)
MC 20	1	A	479
MP 98	1	A	79
MP 293	2	"SONAT", A	232, 247
MP 305	1	C	244
MP 306	1	E	255
VK 294	1	A	119

Platforms Destroyed by Katrina (August 2005)

Area/Block	Number of platforms	Facility	Water Depth (ft)
GI 32	1	J	106
GI 40	2	B, F	83, 86
GI 41	1	A	91
GI 47	1	C	88
GI 48	1	D	86
MP 138	1	A	158
MP 270	1	A	205
MP 298	1	B-Valve	222
MP 306	1	D	255
MP 312	1	JA	248
PL 20	1	39	30
SP 62	2	A, B	340, 322
ST 21	10	75, 71, 67, 1, 22, 27, 66, 25, E, 31	47, 48, 46, 37, 36, 40, 45, 40, 40, 36
ST 135	1	M	116
ST 151	3	O, I, G	137, 128, 137
ST 161	2	B, A	120, 117
ST 176	1	A	140
WD 69	2	C, K	121, 134
WD 70	1	H	141
WD 94	1	G	153
WD 103	2	B, A	228, 223
WD 104	1	C	228
WD 117	5	D, E, C, QRT, F	195, 208, 214, 214, 200
WD 133	1	B	285
WD 137	1	A	310
WD 95	1	#5 Well	150

Platforms Destroyed by Rita (September 2005)

Area/Block	Number of platforms	Facility	Water Depth (ft)
EC 71	1	B	53
EC 151	1	C	80
EC 160	2	C, A-AUX	84, 85
EC 161	1	A	85
EC 195	1	A	103
EC 222	2	D, A-PROD	123, 110
EC 254	1	B	164
EC 272	2	A-AUX1, A	182, 182
EC 286	1	B	186
EC 322	1	A	230
EI 276	2	D, B-PROD	176, 172
EI 294	1	A	204
EI 313	2	B, C	240, 230
EI 314	2	F, J	230, 230
EI 330	1	S	254
EI 333	1	A	231
EI 338	1	A	253
GC 237	1 (final loc. EI270)	A-Typhoon TLP	2107
HI A467	1	D	187
SM 11	3	K, B, J	68, 68, 68
SM 49	1	B	98
SM 66	2	A, E	128, 134
SM 76	1	B	140
SM 90	1	A	163
SM 108	1	D	183
SM 128	1	A-PRD	228
SS 69	1	16	28
SS 169	1	A	54
SS 177	1	C	92
SS 181	1	K	67
SS 193	1	B	86
SS 218	1	D	112
SS 219	1	C	113
SS 253	1	A-AUX	165
SS 269	1	A	170
ST 51	1	CH	62
ST 146	1	A	170
ST 161	1	D	120
VR 131	2	5, CF	56, 57
VR 201	1	A	83
VR 217	1	A	121
VR 245	2	B, C-DRILL	126, 131
VR 255	2	B, A	152, 158
VR 273	1	A	185
VR 340	1	JA	227
WC 45	1	5	28
WC 56	1	CAIS #15	34
WC 110	4	3, 9, 10, 1	40, 41, 40, 40
WC 172	1	E	47
WC 176	1	2	49
WC 229	1	A	65
WC 313	1	1	49

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.

MMS Securing Ocean Energy & Economic Value for America