Biological Services Program

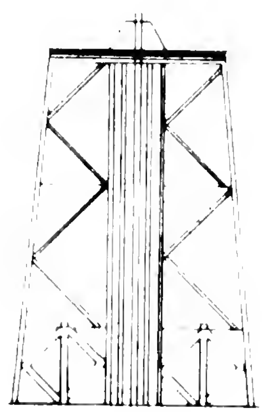
FWS/OBS 77/16.3
March 1978

Environmental Planning for Offshore Oil and Gas

Volume V

Regional Status Reports

Part 3: Gulf Coast



Fish and Wildlife Service

U.S. Department of the Interior

The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems. The mission of the program is as follows:

- To strengthen the Fish and Wildlife Service in its role as a primary source of information on national fish and wildlife resources, particularly in respect to environmental impact assessment.

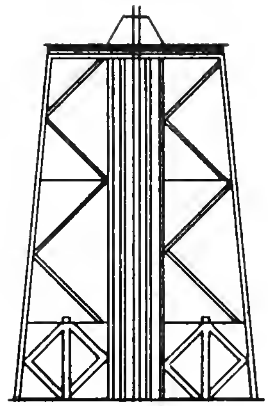
- To gather, analyze, and present information that will aid decisionmakers in the identification and resolution of problems associated with major changes in land and water use.

- To provide better ecological information and evaluation for Department of the Interior development programs, such as those relating to energy development.

Information developed by the Biological Services Program is intended for use in the planning and decisionmaking process to prevent or minimize the impact of development on fish and wildlife. Research activities and technical assistance services are based on an analysis of the issues, a determination of the decisionmakers involved and their information needs, and an evaluation of the state of the art to identify information gaps and to determine priorities. This is a strategy that will ensure that the products produced and disseminated are timely and useful.

Projects have been initiated in the following areas: coal extraction and conversion; power plants; geothermal, mineral and oil shale development; water resource analysis, including stream alterations and western water allocation; coastal ecosystems and Outer Continental Shelf development; and systems inventory, including National Wetland Inventory, habitat classification and analysis, and information transfer.

The Biological Services Program consists of the Office of Biological Services in Washington, D.C., which is responsible for overall planning and management; National Teams, which provide the Program's central scientific and technical expertise and arrange for contracting biological services studies with states, universities, consulting firms, and others; Regional staff, who provide a link to problems at the operating level; and staff at certain Fish and Wildlife Service research facilities, who conduct inhouse research studies.



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Environmental Planning for Offshore Oil and Gas

Volume V: Regional Status Reports

Part 3: Gulf Coast Region

by

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ENVIRONMENTAL PLANNING FOR OFFSHORE OIL AND GAS

FOREWORD

This report is one in a series prepared by The Conservation Foundation for the Office of Biological Services of the U.S. Fish and Wildlife Service (Contract 14-16-0008-962). The series conveys technical information and develops an impact assessment system relating to the recovery of oil and gas resources beyond the three-mile territorial limit of the Outer Continental Shelf (OCS). The series is designed to aid Fish and Wildlife Service personnel in the conduct of environmental reviews and decisions concerning OCS oil and gas development. In addition, the reports are intended to be as helpful as possible to the public, the oil and gas industry, and to all government agencies involved with resource management and environmental protection.

Oil and gas have been recovered for several decades from the Outer Continental Shelf of Texas, Louisiana and California. In the future, the Department of the Interior plans to lease more tracts, not only off these coasts, but also off the frontier regions of the North, Mid- and South Atlantic, eastern Gulf of Mexico, Pacific Northwest and Alaska. Within the set of constraints imposed by the international petroleum market (including supply, demand and price), critical decisions are made jointly by industry and government on whether it is advisable or not to move ahead with leasing and development of each of the offshore frontier areas. Once the decision to develop a field is made, many other decisions are necessary, such as where to locate offshore platforms, where to locate the onshore support areas, and how to transport hydrocarbons to market.

Existing facilities and the size of the resource will dictate which facilities will be needed, what the siting requirements will be, and where facilities will be sited. If the potential for marketable resources is moderate, offshore activities may be staged from areas already having harbor facilities and support industries; therefore, they may have little impact on the coast adjacent to a frontier area. An understanding of these options from industry's perspective will enable Fish and Wildlife Service personnel to anticipate development activities in various OCS areas and to communicate successfully with industry to assure that fish and wildlife resources will be protected.

The major purpose of this report is to describe the technological characteristics and planning strategy of oil and gas development on the Outer Continental Shelf, and to assess the effects of OCS oil and gas operations on living resources and their habitats. This approach should help bridge the gap between a simple reactive mode and effective advanced planning--planning that will result in a better understanding of the wide range of OCS activities that directly and indirectly generate impacts on the environment, and the countermeasures necessary to protect and enhance living resources.

Development of offshore oil and gas resources is a complex industrial process that requires extensive advance planning and coordination of all phases from exploration to processing and shipment. Each of hundreds of system components linking development and production activities has the potential for adverse environmental effects on coastal water resources. Among the advance judgements that OCS planning requires are the probable environmental impacts of various courses of action.

The relevant review functions that the Fish and Wildlife Service is concerned with are: (1) planning for baseline studies and the leasing of oil and gas tracts offshore and (2) reviewing of permit applications and evaluation of environmental impact statements (EIS) that relate to facility development, whether offshore (OCS), near shore (within territorial limits), or onshore (above the mean high tidemark). Because the Service is involved with such a broad array of activities, there is a great deal of private and public interest in its review functions. Therefore, it is most valuable in advance to have some of the principles, criteria and standards that provide the basis for review and decisionmaking. The public, the offshore petroleum industry, and the appropriate Federal, state, and local government agencies are thus able to help solve problems associated with protection of public fish and wildlife resources. With advanced standards, all interests should be able to gauge the environmental impacts of each OCS activity.

A number of working assumptions were used to guide various aspects of the analysis and the preparation of the report series. The assumptions relating to supply, recovery, and impacts of offshore oil and gas were:

1. The Federal Government's initiative in accelerated leasing of OCS tracts will continue, though the pace may change.

2. OCS oil and gas extractions will continue under private enterprise with Federal support and with Federal regulation.

3. No major technological breakthroughs will occur in the near future which could be expected to significantly change the environmental impact potential of OCS development.

4. In established onshore refinery and transportation areas, the significant impacts on fish and wildlife and their habitats will come from the release of hydrocarbons during tanker transfers.

5. A significant potential for both direct and indirect impacts of OCS development on fish and wildlife in frontier areas is expected from site alterations resulting from development of onshore facilities.

6. The potential for onshore impacts on fish and wildlife generally will increase, at least initially, somewhat in proportion to the level of onshore OCS development activity.

The assumptions related to assessment of impacts were:

1. There is sufficient knowledge of the effects of OCS development activities to anticipate direct and indirect impacts on fish and wildlife from known oil and gas recovery systems.

2. This knowledge can be used to formulate advance criteria for conservation of fish and wildlife in relation to specific OCS development activities.

3. Criteria for the protection of environments affected by OCS-related facilities may be broadly applied to equivalent non-OCS-related facilities in the coastal zone.

The products of this project--reported in the series Environmental Planning for Offshore Oil and Gas--consist of five technical report volumes. The five volumes of the technical report series are briefly described below:

Volume I Reviews the status of oil and gas resources of the Outer Continental Shelf and programs for their development; describes the recovery process step-by-step in relation to existing environmental regulations and conservation requirements; and provides a detailed analysis for each of fifteen OCS activity and facility development projects ranging from exploration to petroleum processing.

Volume II	Discusses growth of coastal communities and effects on living resources induced by OCS and related onshore oil and gas development; reports methods for forecasting characteristics of community development; describes employment characteristics for specific activities and onshore facilities; and reviews environmental impacts of probable types of development.
Volume III	Describes the potential effects of OCS development on living resources and habitats; presents an integrated system for assessment of a broad range of impacts related to location, design, construction, and operation of OCS-related facilities; provides a comprehensive review of sources of ecological disturbance for OCS related primary and secondary development.
Volume IV	Analyzes the regulatory framework related to OCS impacts; enumerates the various laws governing development offshore; and describes the regulatory framework controlling inshore and onshore buildup in support of OCS development.
Volume V	In five parts, reports current and anticipated OCS development in each of five coastal regions of the United States: New England; Mid and South Atlantic: Gulf Coast; California; and Alaska, Washington and Oregon.

John Clark was The Conservation Foundation's project director for the OCS project. He was assisted by Dr. Jeffrey Zinn, Charles Terrell and John Banta. We are grateful to the U.S. Fish and Wildlife Service for its financial support, guidance and assistance in every stage of the project.

William K. Reilly
President
The Conservation Foundation

PREFACE

This report is one of five regional reviews, the fifth volume in a series of background reports on the impacts of Outer Continental Shelf (OCS) oil and gas recovery sponsored by the U.S. Fish and Wildlife Service, Office of Biological Services, and prepared by The Conservation Foundation (under Contract 14-16-0008-962). The five reviews are: New England, Mid and South Atlantic, Gulf Coast, California,and Alaska, Washington and Oregon. Other volumes in the series and the overall purposes of the OCS project are described in the Foreword.

The regional reports focus on past and potential impacts on living resources and on their habitats in each region. They also highlight prominent coastal resource-related issues associated with proposed OCS lease sales.

The regional reports present brief overviews of the status of offshore oil and gas activities and impacts for the selected regions. They are meant to inform U.S. Fish and Wildlife Service employees and other interested persons outside the subject region who wish to be generally knowledgeable about the status of OCS around the country and both past and anticipated effects on living resources of the region.

The reports were prepared by analysts who are recognized for their expertise in OCS impacts or coastal zone management. The contents and organization of the reports are as consistent as possible given regional differences in subject matter and differences in the authors' approaches. Each study has five sections:

1. The initial section of each regional report is a discussion of <u>past and present OCS production</u>. This provides a historical perspective that establishes a setting for the remaining sections. Statistics on lease sales, production and reserves are important topics in this section.

2. The second section describes <u>OCS development and future potential</u>, including industry activities, the present leasing schedule and anticipated future projects. This section varies depending upon the amount of anticipatory investigation completed by public agencies and industry.

3. The third section discusses the <u>effects on living resources</u> of activities that accompany OCS petroleum development. A majority of these concerns occur near shore or onshore, where resource values and high impact potential are concentrated. The relative importance of particular habitats

and living resources vary by region. For example, shellfish may be of paramount concern in one region, birds in a second region, and coastal marshes and wetlands in a third region.

4. The fourth section concerns socio economic impacts. These issues are generally treated in less detail, because living resources is the primary subject of the project and the socio economic impact information is only to provide a working background. Since socio economic impacts have been the subject of many other studies, and interest in most areas has centered on socio economic rather than living resource impacts, there is extensive information elsewhere on this subject. Two major topic areas are included in each report: effects of anticipated development and regional interest in OCS.

5. The fifth section is regional information analysis. Publications of regional import are annotated. Each study lists about a dozen publications which contain the best regional research into OCS and related issues.

Each regional report is meant to provide a compilation of information available for the region through midyear 1976.

TABLE OF CONTENTS

TABLE OF CONTENTS, Continued

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES, Continued

ACKNOWLEDGMENTS

We are very appreciative to a number of people who assisted with these reports. We would particularly like to thank the following for their help and guidance: Dr. Howard Tait and Larry Shanks of the National Coastal Ecosystems Team, Office of Biological Services, U.S. Fish and Wildlife Service, provided guidance and review. Reviewers who commented on draft products include: Dr. Bill Van Horn of the Bureau of Land Management; Mr. Bud Damaburgher of the U.S. Geological Survey and Mr. Al Powers. U.S. Department of the Interior, OCS Coordinator.

Additional assistance was provided by U.S. Fish and Wildlife personnel familiar with the area covered by this report: James Barkuloo (Panama City); Lee Barclay (Galveston) and James Johnston, National Coastal Ecosystems Team.

Dr. J. Clarence Davies, Executive Vice President, the Conservation Foundation, provided institutional review and editorial guidance. Portions of the draft reports were reviewed by staff members Raymond Tretheway and Claudia Wilson.

CHAPTER 1

PAST AND PRESENT OCS PRODUCTION

1.1 -- FIELDS AND YIELDS

The first offshore oil well in the Gulf of Mexico was completed in 1947 in the Ship Shoal area off the coast of Terrebonne Parish, Louisiana (Louisiana Department of Conservation, 1952: 1,3). Information on the present number of producing oil and gas reservoirs and wells on the Gulf of Mexico OCS, by state, and by offshore area, along with the Maximum Efficient Rates (MER)[1] for reservoirs and the Maximum Production Rates (MPR)[2] for wells as of January 16, 1976, appears in Table 1.1. The Louisiana OCS has 3,020 wells tapping its 1,612 oil reservoirs and 1,773 gas wells tapping 1,167 gas reservoirs for a maximum production rate of 953,406 barrels of oil and 8,989,449 thousand cubic feet (MCF) of gas per day. The Texas OCS has a maximum production rate of 1,330 barrels of oil and 314,559 thousand cubic feet of gas per day from its nine oil wells (7 reservoirs) and 71 gas wells (32 reservoirs) (U.S. Department of Interior, 1976a).

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[1]MER is the highest daily rate of production that can be sustained by a reservoir without jeopardizing the maximum practicable ultimate recovery from that reservoir (Melancon, 1977).

[2]MPR is the maximum daily rate for completed wells in a reservoir. The rate is determined by the USGS through quarterly tests of oil wells and semi-annual tests of gas wells. The total MPR's of the wells within a reservoir may not exceed the MER of that reservoir (Melancon, 1977).

Table 1.1. Approved Maximum Efficient Rates for Reservoirs and Maximum Production Rates for Well Completions, January 16, 1976 (Total Well Completions Oil-BBls/Day and Gas-MCF/Day) (Source: U.S. Department of Interior, 1976a)

ADJACENT STATE	OIL RESERVOIRS	OIL MER	OIL WELLS	OIL MPR	GAS RESERVOIRS	GAS MER	GAS WELLS	GAS MPR
Louisiana	1,612	1,299,810	3,020	953,406	1,167	11,744,878	1,773	8,989,499
Texas	7	2,230	9	1,330	32	410,696	71	314,559
Total OCS	1,619	1,302,040	3,029	954,736	1,199	12,155,574	1,844	9,304,058
OFFSHORE AREAS								
Louisiana								
West Cameron	7	2,095	9	1,723	193	1,555,500	287	1,271,736
East Cameron	32	27,190	64	16,605	126	1,653,695	194	1,216,920
Vermilion	63	44,980	85	32,926	160	1,510,851	241	1,198,641
South Marsh	65	31,781	88	22,916	100	861,460	113	606,680
Eugene Isld.	286	283,909	437	177,307	156	2,647,467	309	2,115,869
Ship Shoal	246	164,939	434	118,916	167	1,697,460	253	1,142,470
South Pelto	21	12,585	26	7,161	2	12,000	2	4,480
Bay Marchand	61	80,473	172	75,486	1	2,006	1	2,006
So. Timbalier	120	65,309	207	49,949	60	412,530	83	354,973
Grand Isle	162	151,744	358	113,206	71	374,483	99	293,026
West Delta	226	204,128	472	157,352	64	506,606	85	393,870
South Pass	156	123,298	310	83,491	21	84,770	32	71,858
Main Pass	167	107,379	358	96,368	46	426,050	74	316,970

Table 1.1 Continued

ADJACENT STATE	OIL RESERVOIRS	OIL MER	OIL WELLS	OIL MPR	GAS RESERVOIRS	GAS MER	GAS WELLS	GAS MPR
Texas								
Brazos	0	0	0	0	8	50,900	16	97,670
Galveston	5	1,605	7	1,040	7	103,000	29	82,419
High Island	2	625	2	290	17	256,796	26	134,470
TOTAL OCS	1,619	1,302,040	3,029	954,736	1,199	12,155,574	1,844	9,304,958

OCS activity in federal areas of jurisdiction, including tracts and acres offered and leased, bonus dollars paid, tracts and platforms currently active, and number of fields was summarized (Table 1.2). Louisiana's OCS has been the most significant, while the Mississippi-Alabama-Florida (MAFLA) area has been the least significant, with no fields discovered there thus far (Table 1.2).

Louisiana's significance is better illustrated in Table 1.3, which shows the relative importance of production on the Gulf of Mexico OCS compared to total U.S. OCS production and to total offshore and onshore production in the U.S. Louisiana has accounted for 99.5 percent of the oil, and 95.6 percent of the gas produced on the Gulf OCS since 1953 (Table 1.3). Of the total U.S. OCS production since 1953, the Gulf of Mexico has produced 96.4 percent of the oil and 97 percent of the gas. Of the total U.S. oil and gas production for the years 1953 through 1975, the Gulf OCS has produced 5.70 percent of the oil and 7.57 percent of the gas.

The total production of oil and gas from the Gulf of Mexico OCS is tabulated by year and by state (Table 1.4). Also included in Table 1.4 is the OCS production of sulfur. and salt (which began in 1960 off the coast of Louisiana). Thus far, none of these minerals has been produced offshore from Mississippi, Alabama, or Florida. (There were, however, oil and gas leases sold in 1959 for the Florida Gulf OCS and in 1973 and 1976 for Mississippi, Alabama and Florida, but no production has resulted from these leases up to 1977.)

Table 1.2. Gulf of Mexico
OCS Oil and Gas,
Federal Waters Summary
1947-1976 (Source: Offshore, June 20, 1976)

	Originally				
	Tracts offered	Acres offered	Tracts leased	Acres leased	Bonus dollars paid
Texas	1,145	8,710,156	672	3,172,455	4,075,858,139
Louisiana	3,701	15,318,541	1,968	8,356,003	9,393,001,831
Miss.-Ala. & Fla.	287	1,619,844	114	640,917	1,496,817,103
Total	5,133	25,648,541	2,754	12,169,375	14,965,677,073

	Presently					
	Tracts active	Acres presently in force	Bonus dollars presently in force	Total platforms installed	Platforms still active	Fields discovered
Texas	392	2,108,160	3,589,963,970	29	26	32
Louisiana	1,221	5,332,344	8,272,849,929	835	681	255
Miss.-Ala. & Fla.	73	404,757	1,437,170,090	2	2	—
Total	1,686	7,845,261	13,300,092,989	866	709	287

Table 1.3. Gulf OCS Production as % of All U.S. OCS Production and as % of Total U.S. Production for Years 1953-1975[1] (Source: U.S. Department of Interior, 1976b)

	% Gulf OCS		% U.S. OCS		% Total Production	
	oil	gas	oil	gas	oil	gas
Louisiana	99.5	95.6	95.9	95.3	5.67	7.24
Texas	.5	4.4	.5	4.4	.03	.33
Gulf	100.0	100.0	96.4	99.7	5.70	7.57

[1]This table includes only production from federal areas of jurisdiction.

Table 1.4. Total Mineral Production on Gulf of Mexico OCS

(Source: U.S. Department of Interior, 1976b)

	OIL						
	LOUISIANA			TEXAS			
Year	Barrels (M)[1]	State (%)	Federal (%)	Barrels	State (%)	Federal (%)	Total
Pre-1954	54,803	98	2	-	-	-	54,803
1954	15,926	79	21	10	100	-	15,936
1955	25,731	74	26	156	99	1	25,887
1956	40,906	73	27	140	90	10	41,046
1957	52,835	70	30	256	98	2	53,091
1958	57,381	57	43	470	100	-	57,851
1959	72,793	51	49	499	100	-	73,292
1960	88,122	44	56	567	100	-	88,689
1961	103,197	38	62	292	100	-	103,489
1962	126,801	29	71	803	100	-	127,604
1963	149,087	20	70	669	92	8	149,756
1964	173,709	29	71	578	99	1	174,287
1965	199,293	27	73	557	99	1	199,850
1966	243,080	23	77	1,246	29	71	244,326
1967	284,033	23	77	3,400	16	84	287,433
1968	329,922	20	80	3,400	9	91	333,322
1969	365,691	18	82	3,109	11	89	368,800

Table 1.4. Continued.

OIL

	LOUISIANA			TEXAS			
Year	Barrels (M)	State (%)	Federal (%)	Barrels	State (%)	Federal (%)	Total
1970	398,378	16	84	3,046	26	74	401,424
1971	444,363	13	87	2,885	42	58	447,248
1972	452,584	14	86	3,035	43	57	455,619
1973	429,465	13	87	2,285	29	71	431,750
1974	389,260	12	88	1,869	26	74	391,545
1975	353,570	11	89	2,136	37	63	355,396
TOTAL	4,850,930	22	78	31,408	37	63	4,882,338

GAS

	LOUISIANA			TEXAS			
Year	MMCF[2]	State (%)	Federal (%)	MMCF	State (%)	Federal (%)	Total
Pre-1954	91,675	78	22	-	-	-	91,675
1954	81,325	31	69	3,440	100	-	84,765
1955	121,279	33	67	6,880	100	-	128,159
1956	136,527	39	61	6,880	100	-	143,407
1957	160,472	49	51	13,765	100	-	174,237

Table 1.4. Continued.

GAS

	LOUISIANA			TEXAS			
Year	MMCF	State (%)	Federal (%)	MMCF	State (%)	Federal (%)	Total
1958	233,967	45	55	24,080	100	-	258,047
1959	329,280	37	63	24,080	100	-	353,360
1960	408,388	33	67	30,960	100	-	439,348
1961	458,481	31	69	13,760	100	-	472,241
1962	588,361	23	77	41,280	100	-	629,641
1963	706,545	20	80	30,960	100	-	737,505
1964	783,474	21	79	30,960	100	-	814,834
1965	871,124	26	74	27,520	100	-	898,644
1966	1,265,899	24	76	59,259	29	71	1,325,158
1967	1,655,223	34	66	127,473	22	78	1,782,696
1968	2,057,291	31	69	154,631	29	71	2,211,922
1969	2,478,745	26	74	240,212	47	53	2,718,957
1970	2,800,104	19	81	264,420	50	50	3,064,524
1971	3,219,300	18	82	387,245	67	33	3,606,445
1972	3,480,831	17	83	156,772	6	94	3,637,603
1973	3,614,892	15	85	250,338	41	59	3,865,230
1974	3,871,964	14	86	254,338	37	63	4,126,302
1975	3,821,746	13	87	332,862	63	37	4,154,608
TOTAL	33,236,793	22	78	2,482,115	51	49	35,718,908

Table 1.4. Continued.

SULFUR AND SALT[3]

Year	Sulfur (tons)	Salt (tons)
1960	98,025	59,794
1961	401,521	528,581
1962	285,975	176,924
1963	552,573	262,951
1964	634,875	212,978
1965	1,090,950	290,804
1966	1,400,848	297,475
1967	1,409,276	274,422
1968	1,553,621	540,651
1969	1,232,939	343,060
1970	1,099,584	269,691
1971	1,178,400	370,406
1972	1,176,833	358,782
1973	1,235,358	381,247
1974	1,303,750	346,411
1975	1,248,134	151,032
TOTAL	15,902,662	4,865,209

[1] In Thousands of Barrels (M).

[2] In Millions of Cubic Feet (MMCF).

[3] All sulfur and salt production has been offshore Louisiana in the federal area of jurisdiction.

Federal areas of OCS jurisdiction in the Gulf have become increasingly important in recent years. Louisiana's area of jurisdiction produced 97 percent of the oil and 31 percent of the gas in 1954 but its share declined to 11 percent and 13 percent respectively, in 1975. The State of Texas has fared somewhat better in this regard since its area of jurisdiction extends 3 leagues (approximately 10 miles) from its shore instead of 3 miles like Louisiana's. The Texas area of jurisdiction produced approximately 98 percent of the oil and 100 percent of the gas in the years 1954 through 1965, then dropped significantly. While varying since 1965, its 1975 share was 37 percent of the oil and 63 percent of the gas production in the Gulf of Mexico.

Oil production in the Gulf peaked in 1972, and sulfur and salt production peaked in 1968 as indicated in Table 1.4. Total production of these minerals has declined since their peaks. Although natural gas production peaked in Louisiana in 1974, it has continued to rise overall due to the production in offshore Texas, which has risen each year since 1972. Also, the variation of sulfur production since its peak production year may reflect the current worldwide oversupply of sulfur rather than a depletion of reserves.

A total of 173 active and mobile rigs operated in the Gulf of Mexico in 1976 (Table 1.5). Louisiana has the bulk of these rigs and the Eugene Island area is the most active with 14 fixed and 5 mobile rigs. The High Island area has the most activity in the Texas OCS areas with 4 fixed and 11 mobile rigs.

Table 1.5 Active Platform Rigs, Gulf of Mexico 1976, By Area and Number (Source: Offshore, January 1976b: 119-122; April 1976)

AREA	FIXED RIGS[1]	MOBILE RIGS[2]
LOUISIANA		
Bay Marchand	2	0
Bayou Boeuf	1	0
Chandeleur Sound	0	1
East Cameron	7	3
Eugene Island	14	5
Grand Isle	5	1
Main Pass	7	2
Mobile South #2	0	4
St. Mary Parish	1	0
Ship Shoal	6	3
South Marsh Island	6	4
South Pass	5	5
South Pelto	1	0
South Timbalier	3	5
Vermilion	5	7
West Cameron	4	8
West Delta	10	1
Other	4	8
TOTAL LOUISIANA	81	57
TEXAS		
Brazos	0	1
Galveston	0	4
High Island	4	11
Matagorda Island	0	2
Mustang Island	0	5
Other	3	4
TOTAL TEXAS	7	27
TOTAL GULF OF MEXICO	89	84

[1]For January 1976.
[2]For April 1976.

1.2 -- OCS EXPLORATION AND PRODUCTION METHODOLOGY

Exploration

The exploration segment of the oil and gas industry can be identified as three distinct phases:

Regional surveys to identify promising geological formations;
Detailed surveys upon which to base the evaluation of specific tracts; and
Exploratory drilling to determine whether oil or gas are actually present (Kash et al., 1973: 26).

Phase 1 is generally passive in nature and includes: looking for natural oil seeps, observing local variations in the earth's gravity, and various methods of detecting changes in the earth's magnetic field, all of which may indicate the presence of oil. Salt domes, a prime location for oil deposits along the Gulf Coast, are located primarily by detecting variations of gravity readings (Kash et al., 1973: 27).

Phase 2 involves a more detailed analysis of specific tracts of land, primarily by two techniques: seismic or geophysical surveying, and direct hydrocarbon detection. Basically, seismic detection, as shown in Figure 1.1, involves the transmission of pulses[4]

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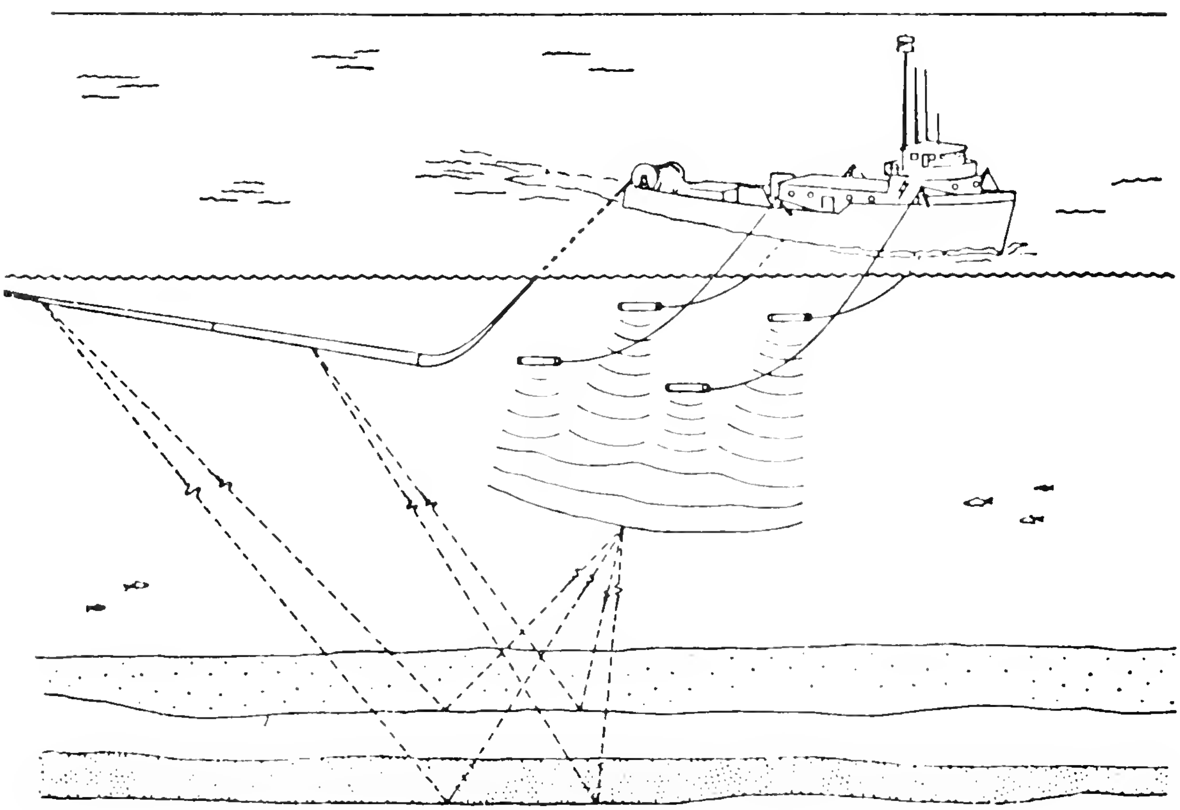
[3]Adapted from Mumphrey et al., 1976: 57-94.

[4]Until a few years ago, dynamite or some other explosive was used as the source of energy for the pulses. However, since the explosives caused ecological damage and killed marine life, other energy sources have been developed. Currently, almost all seismic work is done with these new energy sources of which there are two principal types. The first type detonates propane and oxygen inside a rubber sleeve, which transmits wave energy directly to the water. The second type is a high-powered ocillator whose frequency changes continuously over a period of a few seconds. Neither of these new energy sources appears to have any significantly adverse environmental effects (Kash et al., 1973: 30).

Figure 1.1 Seismic surveying in open water areas (Source: Offshore Technology Conference 1969, preprints. SPE/AIME owns copyright).



to the ocean floor which are recorded on a seismograph as they bounce back to the surface. The time it takes (intervals) for the waves to go down and return reveals whether the formation is hard or soft and the actual depth of the formation (Shell, 1975: 8). Seismic surveys are extremely useful in locating geologic structures that could "trap" oil and gas to form a commercial deposit. Direct hydrocarbon detection is the latest technological advance in the effort to locate more oil and gas reserves (Offshore, January 1976a: 100). It consists of a series of new and different techniques which measure physicochemical phenomena (generation of an electric current) in rocks associated with the presence of underground pooled hydrocarbons (Pirson, 1973: 63-66). Recent gains in successfully pinpointing probable deposits have been rewarding.

Phase 3 is centered around the drilling of exploratory wells by one of the four basic types of mobile platforms: drill ships, jack-ups, semi-submersibles, or drilling barges.[5] Each type is designated for and limited by the depth of the water in which it will be operating and the average adverse weather conditions that can be expected to be encountered (Council on Environmental Quality, 1974-III: A-3).

Drilling

There are five basic types of drilling platforms found on the Gulf of Mexico Outer Continental Shelf; drilling barges,

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[5]A more detailed description of each type will be given in the upcoming analysis of drilling platforms.

semi-submersibles, drill-ships, jack-ups, and fixed platforms. Four of these types -- barges, semi-submersibles, drill-ships, and jack-ups -- are primarily used in the exploration facet of the oil industry, but may also be used, after oil or gas discovery, for drilling development wells.

Barges can be used to drill in water depths up to 600 ft. This depth limitation is primarily imposed by the anchor and chain systems used for maintaining position. Other disadvantages are that they are easily affected by adverse weather conditions and lack a self-propulsion system (Kash et al., 1973: 37). While barges were used extensively in the early years of OCS operations in the Gulf of Mexico, they are not normally used there now.

Semi-submersibles are self-contained and supported by either lower displacement type hulls or by large caissons (Figure 1.2). After towing to the drilling site, the caissons are flooded, causing a portion of the rig to be below the sea level. This procedure causes the rig to be virtually unaffected by wave action and generally more stable than a drill ship. Another advantage is that they act as fixed platforms when drilling in shallow water (Jenner et al., 1973: 127).

Jack-ups are platforms with legs that can be extended or retracted, depending upon the depth of water at which the drilling will take place (Figure 1.3). With the legs retracted, it becomes a floating platform, thus allowing it to be moved. It can be used either for exploratory drilling when only one well is desired or for multiwell production platform drilling. Its advantages are

Figure 1.2 Semi-submersible drilling platform used in OCS areas (Source: Council on Environmental Quality, 1974-I).

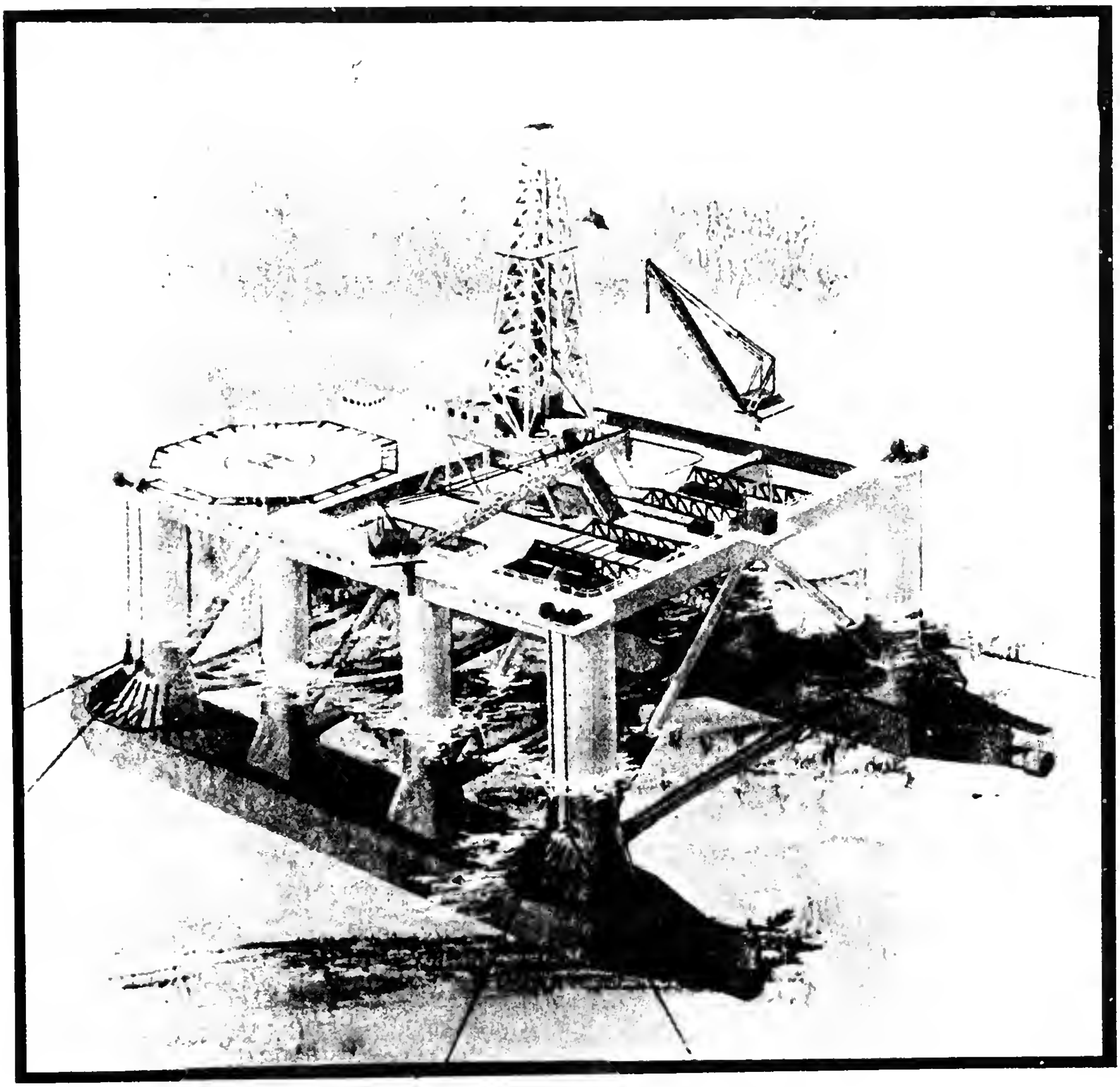
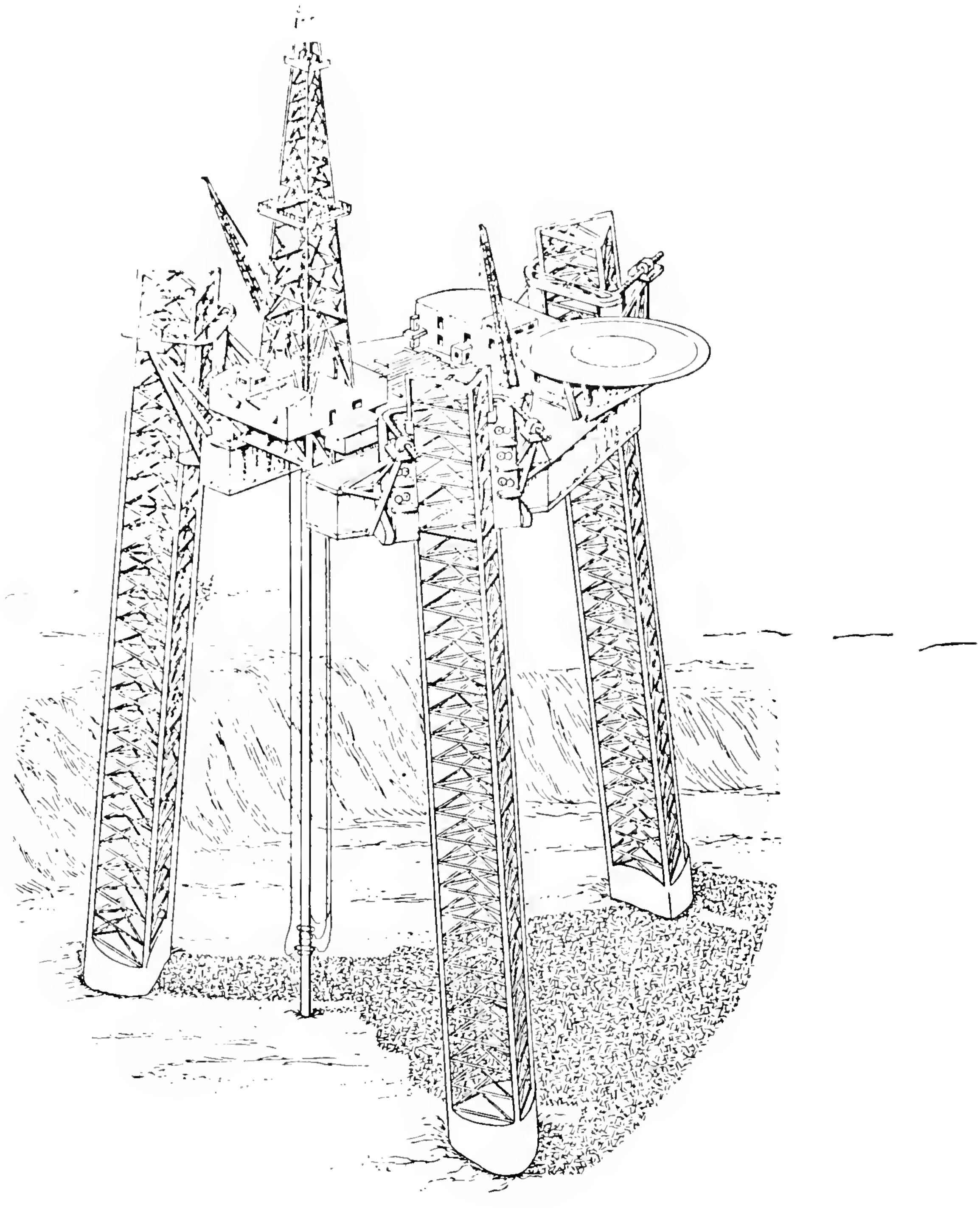


Figure 1.3 A jack-up drilling platform (Source: Fortune, February 1965).



its economy of operation, stability, and the speed with which it can begin operation after arrival at the drilling site (Jenner et al., 1973: 121-125).

Drill ships (Figure 1.4) are self-propelled and therefore capable of moving from one drilling location to another without the assistance of ocean tugs or other propulsion units. Two methods, a mooring system with anchors and chains or a dynamic positioning system which uses propellers or thrusters coupled to sensors to detect and compensate for movement, are used to keep the vessel stable during drilling operations (Kash et al., 1973: 39).

Drill ships are usually replaced by fixed platforms (Figure 1.5) following the initial discovery; normally by one of the other four types of rigs. However, they may be used in the developmental stage of a field when it becomes necessary to drill (from 10 to 40 individual) wells directionally for production (Jenner et al., 1973: 121).

Production

Once exploratory drilling has located sufficient quantities of oil or natural gas, production and development efforts begin. Due to the complexity of the entire operation, many exploration and field development activities may overlap. Figure 1.6 gives a general breakdown of the overlapping which can occur, beginning before the lease sale and extending through the installation of permanent production facilities (Kash et al., 1973: 49-50).

Figure 1.4 An illustration of a drillship used in OCS activities Source: Fortune, February 1965).

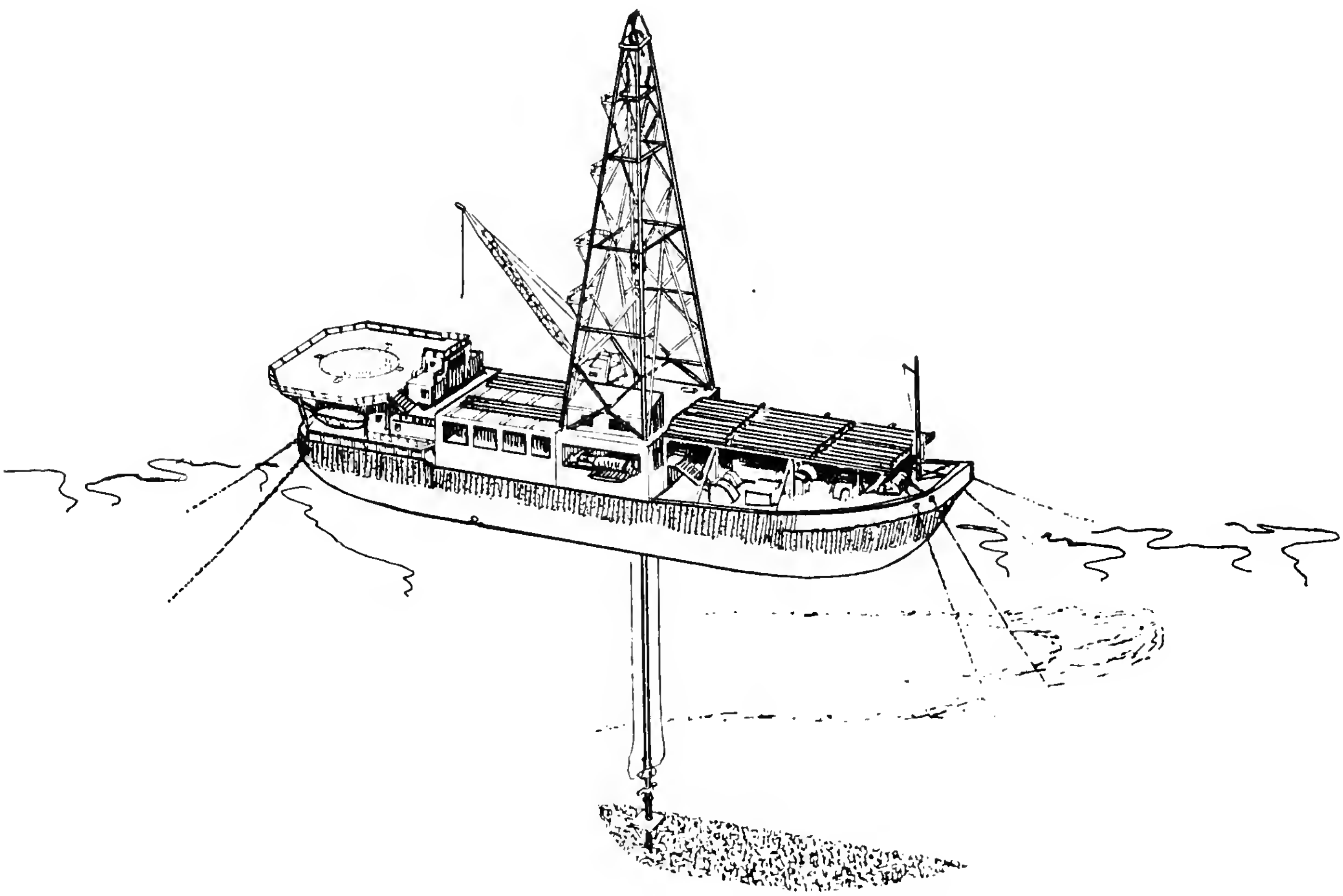


Figure 1.5 Fixed drilling platform for OCS areas (Source: _Fortune_, February 1965).

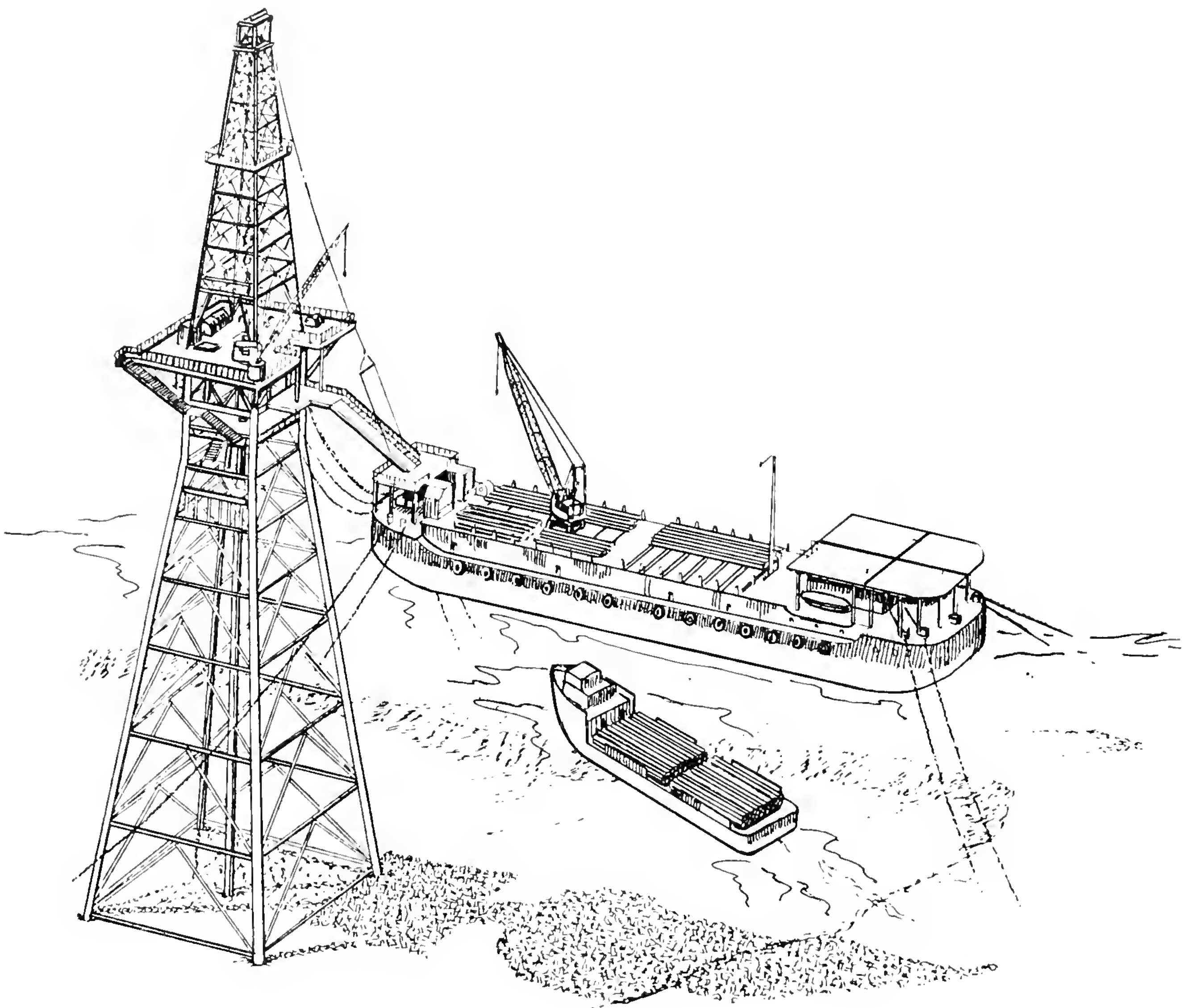
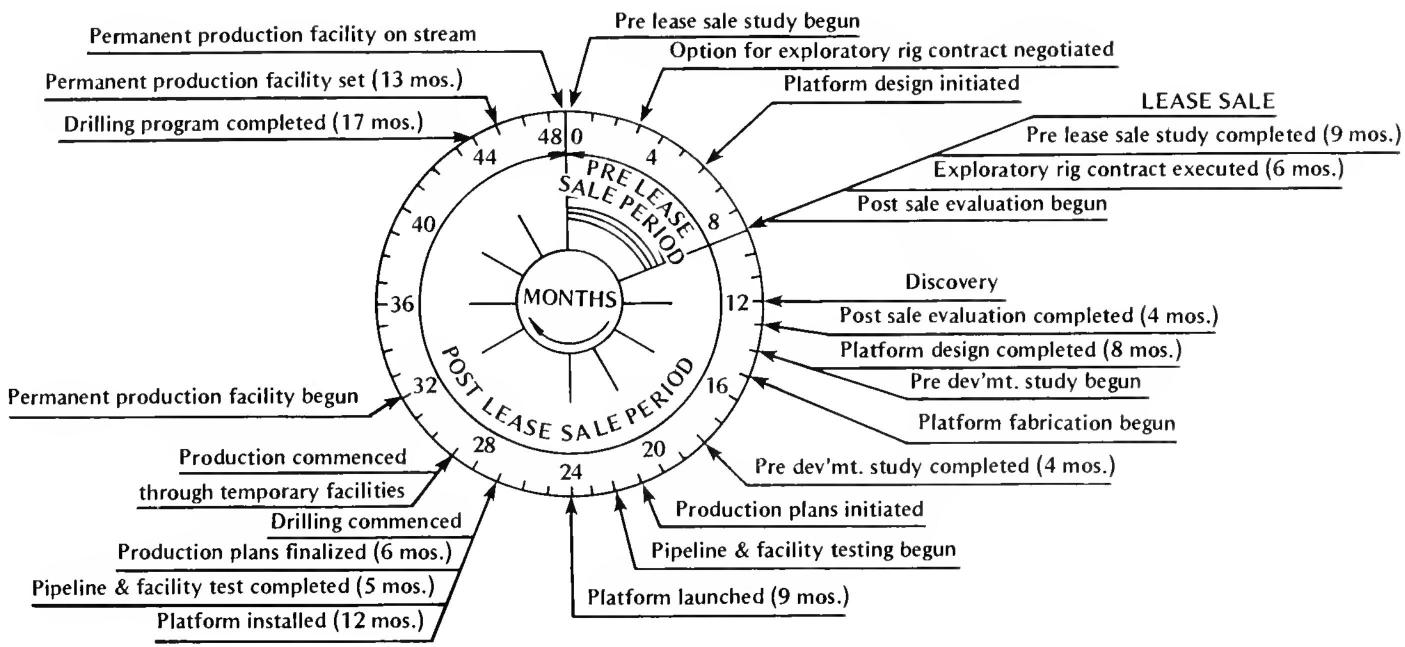


Figure 1.6 A hypothetical 4-year offshore planning and field development program (Source: Kash, et al., 1973).



Once the field is considered ready for development, a fixed platform is installed from which as many as 20 to 30 wells may be drilled. When the drilling phase has ceased, the drilling equipment is disassembled and production equipment is installed on the platform (Council on Environmental Quality, 1974-I: 60). Directional drilling is a drilling procedure used by many companies to reach remote areas of a reservoir from a single fixed platform (Figure 1.7).

If the quantity of oil found in a reservoir is considered sufficient for commercial development, production results only after completion of the well:

> Completion can include setting and cementing casing, perforating (cutting holes in the casing which will permit oil or gas to flow from the formation into the well hole), fracturing (applying pressure or using explosives to increase permeability), acidizing (using acid to enlarge openings in the rock formation), consolidating sand (to keep sand from entering the well bore), setting tubing (conduit for routing the oil or gas to the surface), and installing downhole safety devices (valves installed to prevent blowouts during production). Several of these completion activities are aimed at increasing production rate. If performed after initial completion, they are considered servicing or workover operations (Kash et al., 1973: 59-60).

Equipment on production platforms is used in a variety of ways to alter the crude oil and make it ready for shipment to onshore facilities for refining. The equipment used to separate the crude into oil, gas, water, and solid impurities on a typical production platform is illustrated in Figure 1.8.

Figure 1.7 Typical directionally drilled wells (Source: Council on Environmental Quality, 1974-I).

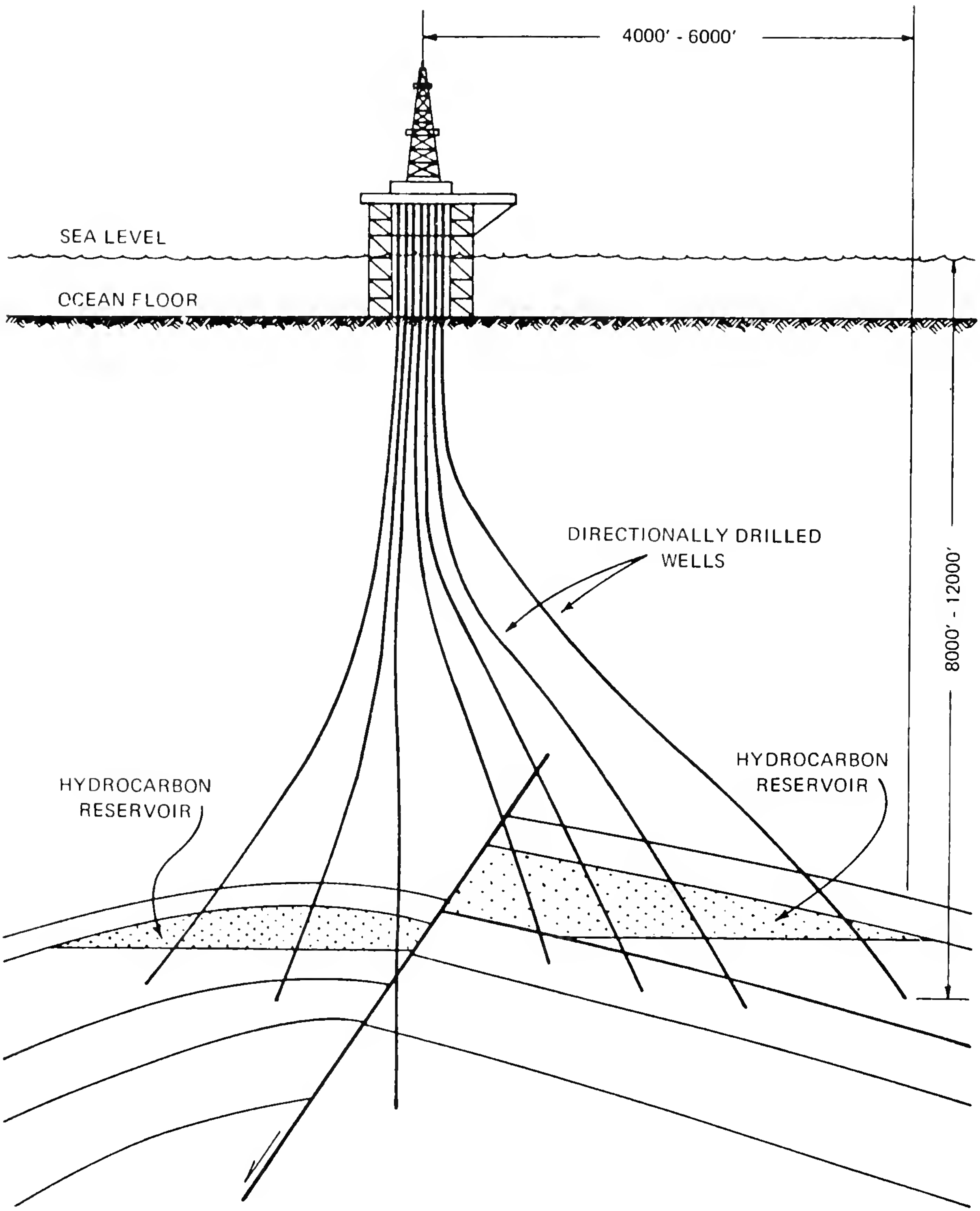
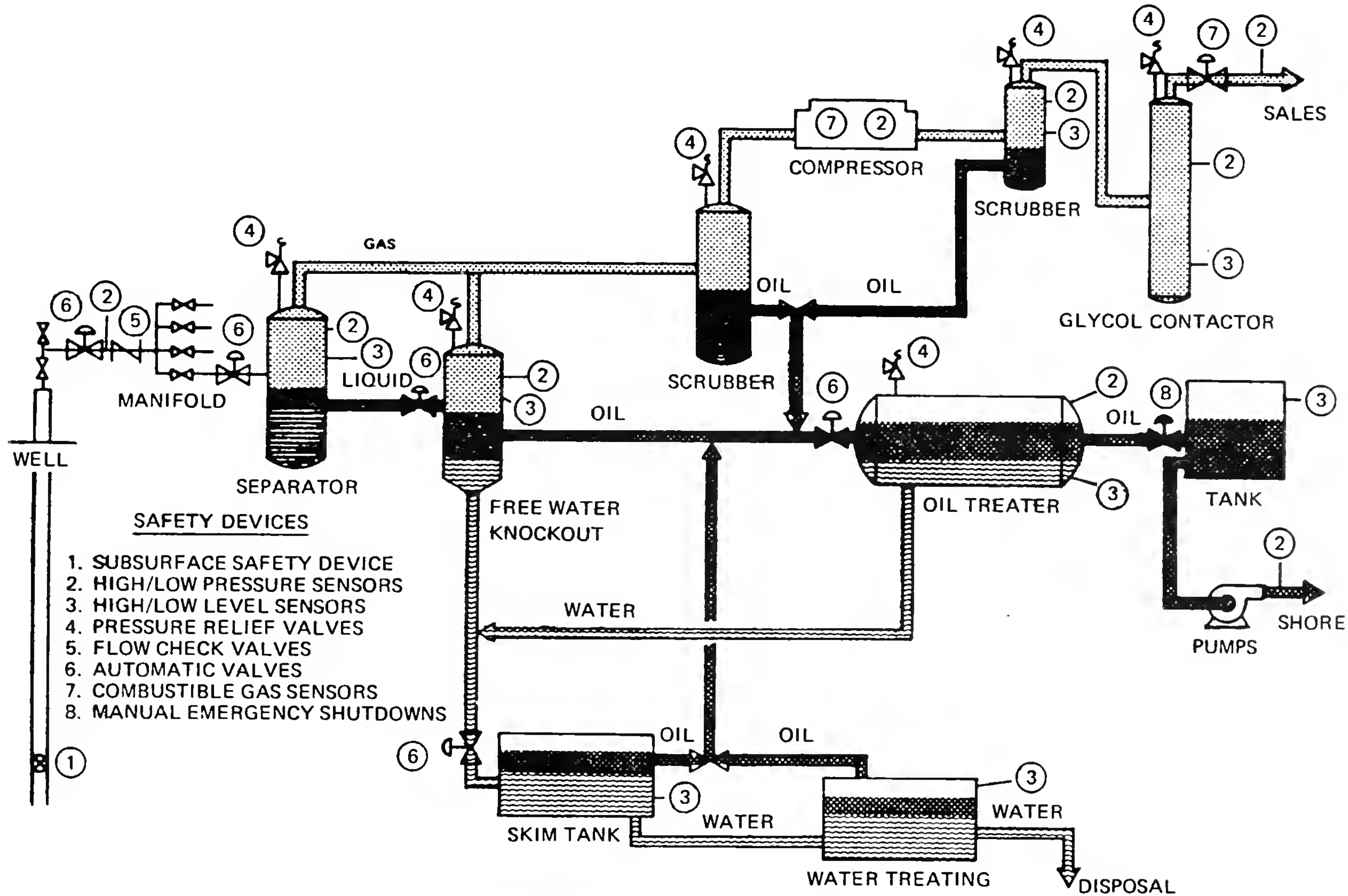


Figure 1.8 A typical production facility with safety equipment (Source: Council on Environmental Quality, 1974-I).



1.3 -- ONSHORE SUPPORT FACILITIES

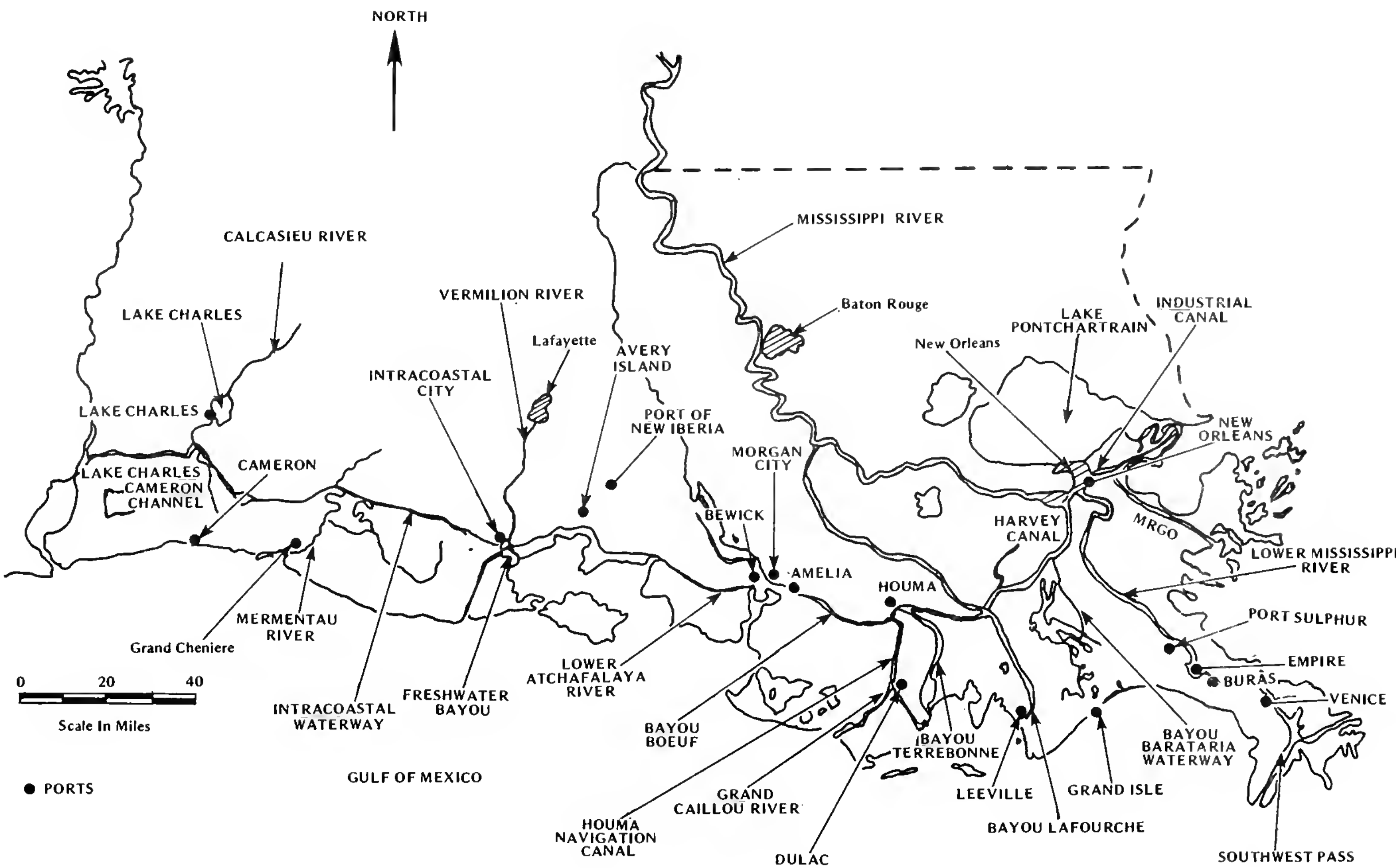
Since the inception of offshore drilling on the Gulf Coast in 1947, Louisiana and Texas have developed an extensive infrastructure of support facilities. The activities offshore have generated a need for platform fabrication yards, ports and waterways, supply and service industries, onshore storage facilities, highways, airports and heliports, vocational schools, pipelines, and electrical power.

Of a total of four large platform fabrication yards in the USA, three are on the Gulf Coast. One of these, owned by Brown and Root is located near Houston, Texas while the other two, owned by J. Ray McDermott and Avondale Ship Yards, are located near Morgan City, Louisiana. In addition to supplying the Gulf Coast, these yards have built platforms for Nigeria, the North Sea, and the Persian Gulf (Conservation Foundation, 1976: 2.1-3).

Other major onshore facilities required to support off-shore operations are ports and waterways. These are important to provide water transportation access to the offshore rigs for personnel and supplies. Major service industries will usually be associated with the ports to provide the needs generated by OCS development. For example, terminal and storage facilities are needed to serve as collecting points for oil brought to shore by pipeline or barge. Also, oil field supply companies need storage and warehouse facilities. Cement, mud, and chemical firms require equipment and supplies staging areas. Rental tool and well servicing companies need office space and small storage areas. Yards are needed to store pipe and steel to be used offshore. The producing companies require a dockside location as a production force headquarters consisting of accountants, engineers, radio dispatchers, and other operators who control the movement of men and supplies to and from work areas. The headquarters also requires crew boat docking facilities and heliports (U.S. Department of the Interior, 1973; U.S.D.I., 1976c). The ports and waterways used by offshore operators in Louisiana are shown in Figure 1.9. In addition, another port, Port Fourchon, is being developed at the mouth of Bayou Lafourche (south of Leeville), and at least some of the aforementioned service facilities are expected to develop around it (Mumphrey et al., 1976: 258-262).

Airports and heliports constitute another major type of onshore support facility, the more significant of which are heliports. Because of the intensity of OCS activity in the Gulf of Mexico, Louisiana is the site of the most extensive helicopter operations in the world. Their main functions include (1) transporting oil rig crews to and from the drilling platforms and associated facilities of offshore fields; (2) transporting emergency parts and service personnel; and (3) performing pipeline patrol and oil spill control tasks. The three largest operators, Petroleum Helicopters, Inc., Air Logistics, and Air Marine, operate a total of over 200 helicopters in Louisiana (Airways Engineering Corporation,

Figure 1.9 Louisiana ports and waterways used by offshore operations (Source: Gulf South Research Institute, no date).



1976: IV-26). The major airports and heliports used by offshore operators are shown in Figure 1.10. While the facilities at Dulac, Grand Isle, and Leeville are strictly heliports, some of the other airports, such as Houma-Terrebonne and New Orleans Lakefront, also contain heliport facilities. Seaplane bases, which are used primarily for onshore oil and gas operations in the wetlands are not included. (Airways Engineering Corporation, 1976: IV-26).

Many Louisiana highways are used by offshore operators (Figure 1.11). While most of these highways are not used exclusively, nor even primarily, by the offshore oil and gas industry, they do function as part of industry's transportation network. This can result in increased maintenance work and traffic control, or, in some cases, may necessitate widening of a roadway or even construction of a new roadway. For example, in Lafourche Parish, Louisiana, where the oil industry has had a substantial impact, a new road, Louisiana 3090, was needed to provide land access to Port Fourchon, and Louisiana 1, a two-lane highway, is being relocated as a four-lane facility for at least part of its length (Larose-Golden Meadow section) (Mumphrey et al., 1976: 313, 316).

The need for vocational school programs concerning oil and gas production, and offshore service industries such as water transportation and ship and boat building and repair represents another type of support facility. The vocational schools, of course, do not exclusively serve the OCS-related industries, but there is a need for vocational schools

Figure 1.10 Louisiana airports and heliports used by offshore operations (Source:- Gulf South Research Institute, undated).

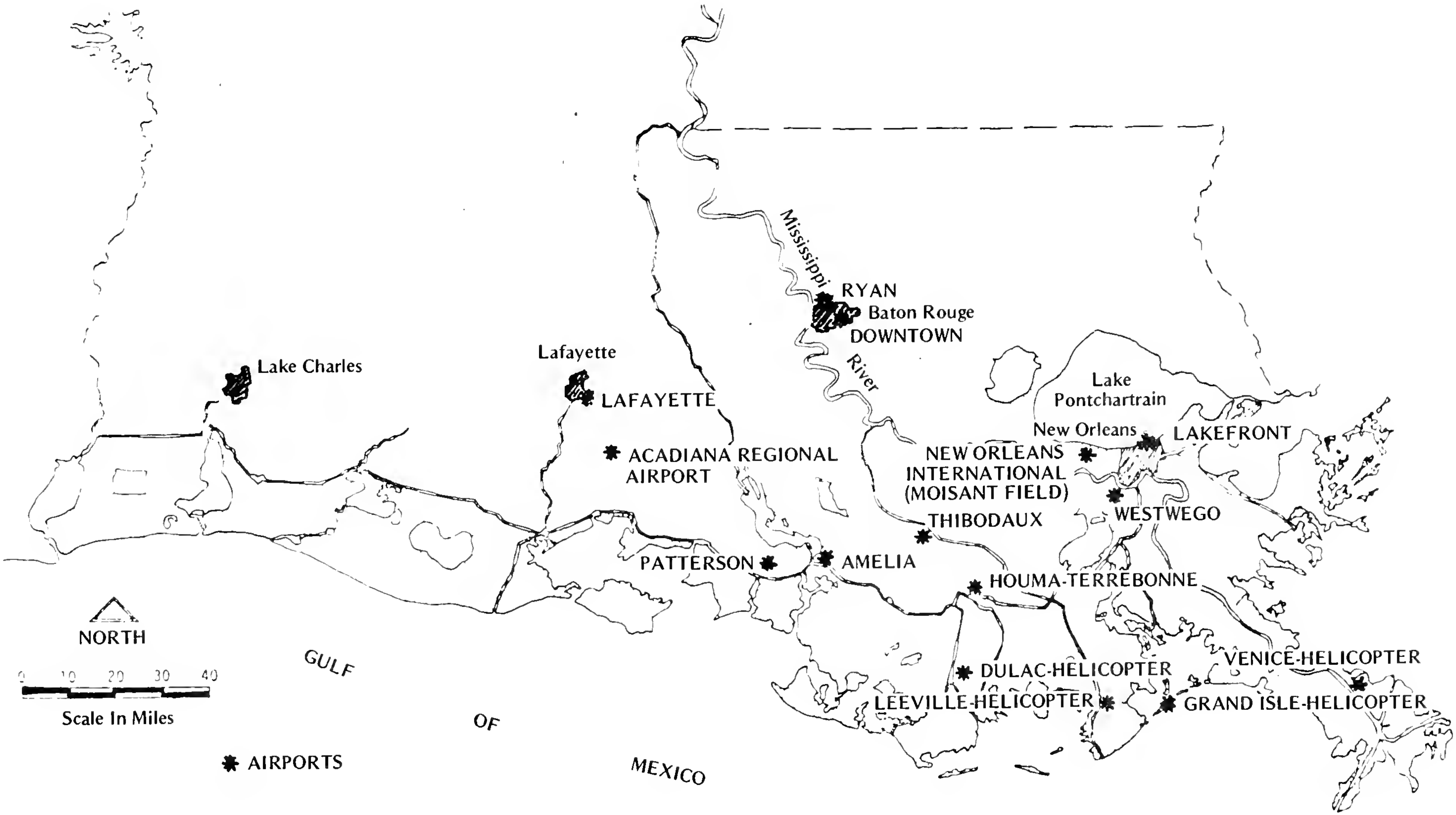
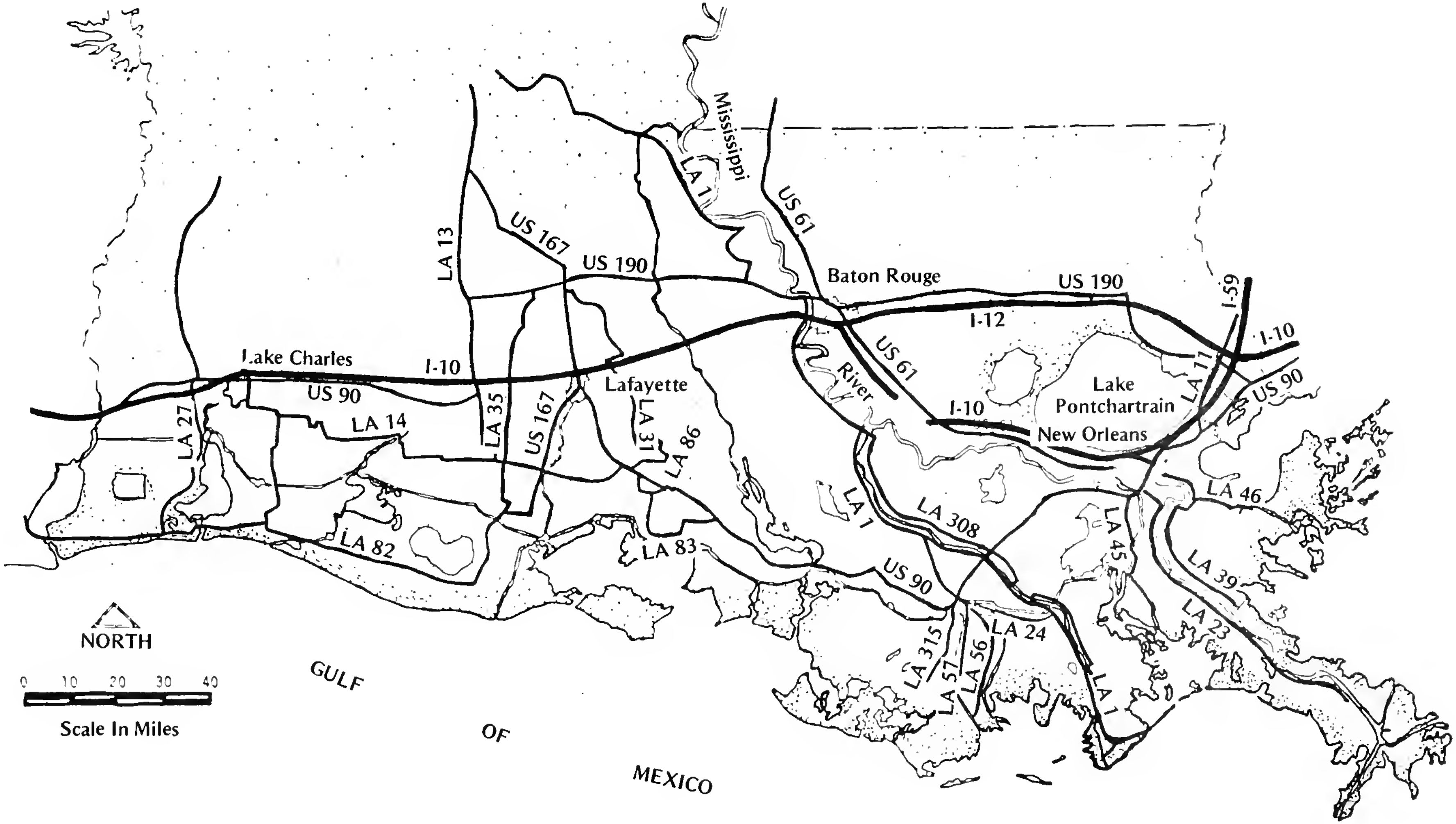


Figure 1.11 Louisiana highways used by offshore operations (Source: Gulf South Research Institute, undated).

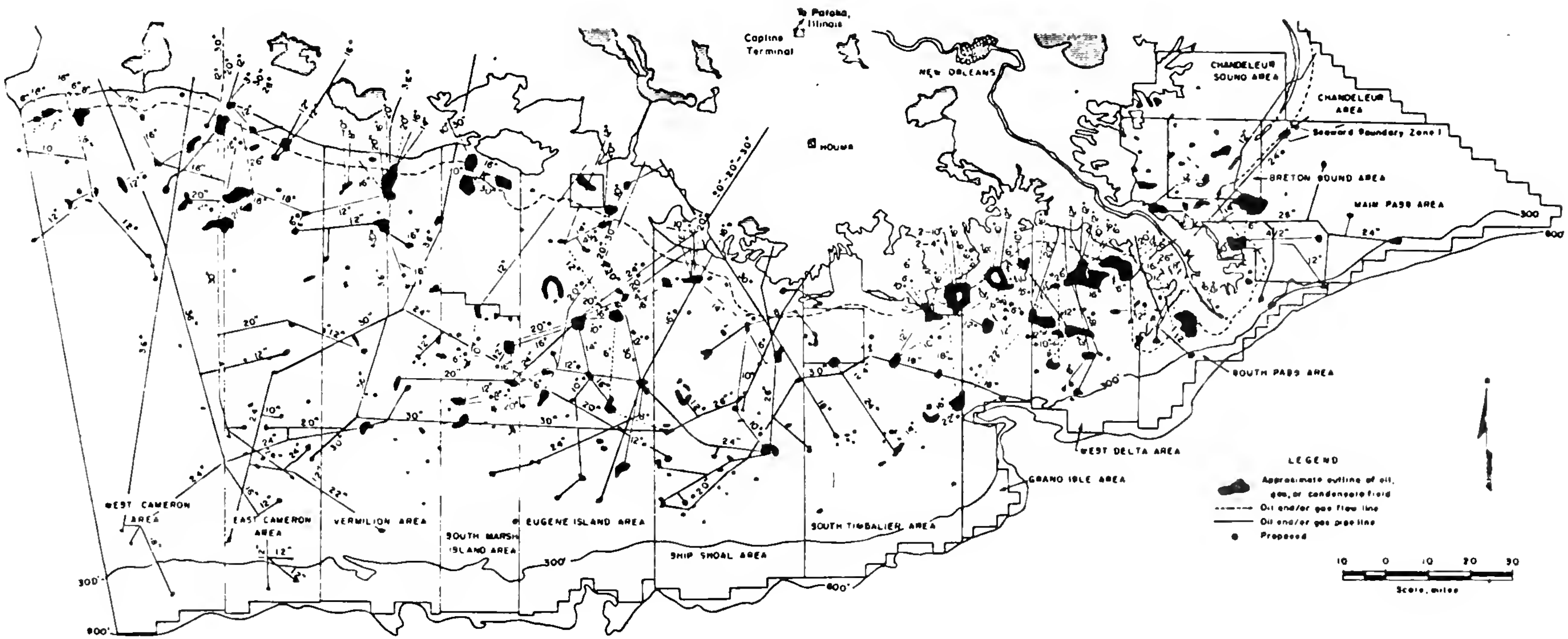


on the Gulf Coast to offer OCS-related programs that are not needed in other areas. For example, a survey by employers in Lafourche Parish revealed an acute shortage of skilled workers in occupations affected by OCS development, particularly in the categories of "captains, mates, pilots, etc.," and "metal fabrication, fitters, etc." These categories represent the water transportation and boat building industries, both important to OCS development (Mumphrey et al., 1976: 320). A good illustration of a response to this need is the nautical science program at the Terrebonne Vocational Technical High School in Houma (similar programs exist in Lafourche and Jefferson Parishes). When the first class graduated in 1974, the 27 graduates had a total of 206 job offers (LSU, 1976).

Pipelines are the major means of transporting OCS production to shore. All natural gas production and nearly all crude oil production[6] is transported to shore by pipeline: crude oil either to a refinery or storage tank and natural gas to a gas-processing plant. The Gulf Coast has developed such an extensive pipeline system (see Figure 1.12) that it is expected that very few, if any, new transmission lines will be needed to accommodate new field development. This is a result of current excess capacity and declining production of existing fields (Mumphrey et al., 1976). However, a major

[6]Barges and tankers are sometimes used as a temporary means of transportation during field development or to transport oil from fields with low production rates. Nearly all current plans for developing petroleum resources within 200 miles of the coast include pipelines as the means of transporting the oil to shore (Mumphrey et al., 1976: 357).

Figure 1.12 Approximate location of the proposed and existing pipeline-flowline system, offshore Louisiana, March 1974 (Source: U.S. Department of Interior, 1976b:8).



pipeline system, associated with the Louisiana Offshore Oil Port (Superport), will be required if the Superport is built as proposed (the Superport and more of its impacts are discussed in Chapter 2).

Electrical power needs are increased by development of OCS resources with much of the need required by onshore support facilities and induced growth of industry (especially petrochemical complexes), population, and commercial activities. For example, the area with the greatest impact from offshore development, the St. Mary-Lafourche-Terrebonne Parishes area and the New Orleans-Baton Rouge corridor, has experienced and is experiencing tremendous growth in demand for electricity. While the 1975 electrical generating capacity for this area was 10,200 million kilowatt-hours (KWH), the demand for 1990 is expected to be 56,460 million KWH, a 450% increase. Present generating plant construction plans will meet this need for 1990, but further capacity will be needed beyond that year (Mumphrey et al., 1976: 355-356).

1.4 -- PROCESSING/DISTRIBUTION NETWORK

Crude Oil

In 1954, when offshore production began to reach significant proportions, there were 57 refineries in Texas, with a total operating capacity of 2,273,000 barrels per day. Almost 90% of this capacity was along the Gulf Coast area, centering around the Corpus Christi, Houston, Baytown, Texas City, Beaumont and Port Arthur areas. These locations offered cheap water transportation to East Coast markets by ocean tankers, and to Midwest markets by barge via the Intracoastal Canal and Mississippi River, and by pipeline (U.S. Department of the Interior, 1957).

In Louisiana during the same year, there were 16 refineries with a total daily operating capacity of 643,500 barrels. Eleven of these refineries (with a capacity of 574,175 barrels) were in the Gulf Coast area (2 were in Lake Charles, the rest were in the New Orleans-Baton Rouge corridor), because of the transportation advantages (U.S. Department of the Interior, 1957).

Increasing reserves, both onshore and offshore, encouraged continued expansion of refining capacity so that by 1976 the capacity of Texas refineries has grown to 3,966,330 barrels per day (although the number of plants has decreased to 46), and Louisiana's refining capacity has grown to 1,753,095 barrels per day at 19 plants (Oil and Gas Journal, March 29, 1976).

While OCS production of crude oil has represented a significant proportion of total production in Louisiana (almost 52% in 1973), it has accounted for less than 1% of Texas production (Table 1.6). Therefore, it can be concluded that OCS production has been an important factor in stimulating expansion of Louisiana refinery capacity, but that the Texas expansion has been largely a result of onshore production.

The intrastate and interstate refinery receipts for Texas and Louisiana by Petroleum Administration for Defense (PAD) districts are shown in Table 1.7 and Figure 1.13.

Table 1.6 Percent of Total State Oil and Gas Production Produced on the OCS for the Years 1954-1973 (Source: Computed from figures in Department of Interior, various years, and USDI 1976b)

	Louisiana		Texas	
Year	Oil	Gas	Oil	Gas
1954	6.4	5.8	a	a
1955	9.5	7.2	a	a
1956	13.7	7.2	a	a
1957	16.3	8.3	a	a
1958	18.4	9.5	a	a
1959	20.1	12.3	a	a
1960	22.0	13.7	a	a
1961	24.3	14.0	a	a
1962	26.6	16.7	a	a
1963	28.5	18.0	a	a
1964	31.6	18.9	a	a
1965	33.5	19.5	a	a
1966	36.1	24.9	a	a
1967	36.7	28.9	a	1.8
1968	40.4	32.1	a	2.1
1969	43.3	34.3	a	3.1
1970	44.0	36.0	a	3.1
1971	47.5	39.0	a	4.5
1972	50.1	43.7	a	1.8
1973	51.7	43.9	a	3.9

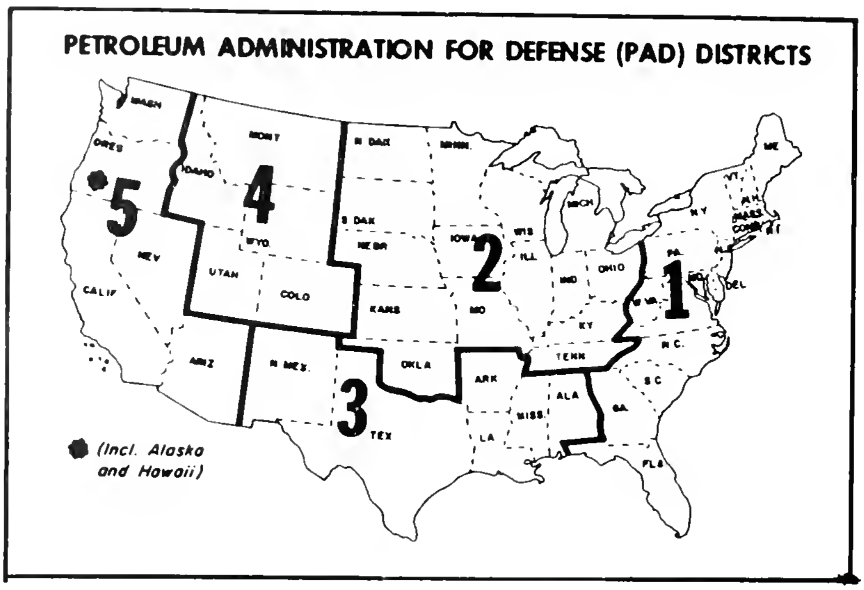
a -- less than 1%

Table 1.7 Refinery Receipts of Domestic Crude Oil by PAD District of Origin[1] 1973 (Source: U.S. Department of the Interior, 1975)

	Intrastate Receipts	Interstate Receipts PAD I	PAD II	PAD III	PAD IV	PAD V	Total
Louisiana	404,747	6,448	2,412	97,926	--	--	516,533
Texas	863,495	12,240	4,672	160,940	4,091	--	1,045,438
TOTAL	1,273,342	18,688	7,084	258,866	4,091	--	1,561,971

[1]Figure 1.13 presents a map of PAD Districts.

Figure 1.13 Petroleum Administration for Defense (PAD) Districts (Source: U.S. Department of the Interior, 1975).



As expected, most of the crude refined in Louisiana and Texas is produced within those states. However, since the total crude oil (including OCS) produced in Louisiana and Texas for 1973 was 831,524 and 1,294,671 thousand barrels respectively (U.S. Department of Interior, 1975), the state oil refined per state oil produced ratios for the states were 0.49 for Louisiana and 0.66 for Texas. This indicates a substantial difference between the states in terms of the economic impact of oil production. Since Louisiana transports a larger percentage of its production to be refined elsewhere, it reaps a smaller proportion of the total potential economic benefits of its oil production. The ratio's for total oil refined per state oil produced are 0.62 and 0.81 for Louisiana and Texas. Thus Louisiana gets some of the benefits of other states' oil production but again not as much as Texas.

The pipeline distribution of refinery products from PAD district III (of which Louisiana and Texas are a part) to each of the other PAD districts is summarized by product for the year 1973 (Table 1.8). PAD I is the most important recipient of PAD III products, accounting for 74.5% of the refinery products of PAD III shipped by pipeline.

The importance of PAD I as a recipient of PAD III petroleum products is further illustrated by Table 1.9, which shows the shipments of products by tanker and barge from the Gulf Coast to the East Coast, PAD District II, and the West Coast. Again, the East Coast accounts for 84.7% of the Gulf Coast products shipped by tanker and barge.

Table 1.8 Transportation of Petroleum Products By Pipeline from PAD District III to Other PAD Districts I, II, IV, and V, By Product, for 1973 (Source: U.S. Department of Interior, 1975)

Petroleum Product	From District III to District I	From District III to District II	From District III to District IV	From District III to District V
Gasoline				
Motor	329,616*	63,660	4,499	11,873
Aviation	219	1,197	260	--
Total Gasoline	329,835	64,857	4,759	11,873
Jet Fuel:				
Naphtha type	747	3	--	652
Kerosene type	54,757	4,611	4,175	1,056
Total jet fuel	55,504	4,614	4,175	1,708
Kerosene	11,134	2,505	4	--
Distillate fuel oil	180,331	30,938	688	4,532
Natural gas liquids	18,112	71,698	1,259	--
TOTAL	594,916	174,612	10,885	18,113
PERCENT OF TOTAL	74.5	21.8	1.4	2.3

*All quantities stated in thousands of barrels.

Table 1.9 Interdistrict Movements by Tanker and Barge of Crude Oil and Petroleum Products in 1973, by Month (Source: U.S. Department of Interior, 1975)

Item	Quantity 1000s of Barrels	Percent of Total
Gulf Coast to East Coast:		
Crude oil	56,614	
Unfinished oils	14,797	
Gasoline:		
Motor	204,258	
Aviation	3,216	
Total Gasoline	207,474	
Special naphthas	7,192	
Kerosene	15,078	
Distillate fuel oil	97,292	
Residual fuel oil	15,951	
Jet Fuel:		
Naphtha type	9,480	
Kerosene type	31,554	
Total Jet Fuel	41,034	
Lubricating oil	12,342	
Wax	573	
Asphalt and road oil	5,869	
Liquefied gases	1,304	
Petrochemical feedstocks	3,226	
Other products	1,654	
Total	480,220	84.7%
Gulf Coast to PAD District II		
Crude oil	10,250	
Unfinished oils	120	
Gasoline:		
Motor	31,998	
Aviation	732	
Total Gasoline	32,730	
Special naphthas	3,187	
Kerosene	956	
Distillate fuel oil	11,095	
Residual fuel oil	8,652	
Jet fuel:		
Naphtha type	14	
Kerosene type	2,612	
Total Jet Fuel	2,626	
Lubricating oil	3,692	
Asphalt and road oil	3,523	
Liquefied gases	654	
Petrochemical feedstocks	1,872	
Other products	993	
Total	80,350	14.2%

Table 1.9 Continued

Item	Quantity 1000s of Barrels	Percent of Total
Gulf Coast to West Coast		
Crude oil	--	
Unfinished oils	372	
Motor gasoline	675	
Kerosene	36	
Distillate fuel oil	687	
Residual fuel oil	1,898	
Jet fuel:		
Naphtha type	110	
Kerosene type	691	
Total Jet Fuel	801	
Lubricating oil	1,491	
Petrochemical feedstocks	4	
Other products	105	
Total	6,069	1.1%
GRAND TOTAL	566,639	100.0%

This relationship between the Gulf Coast and East Coast is significant in that it illustrates the economic dependence of the regions on each other -- the East Coast dependent on the Gulf Coast as a source of petroleum products and the Gulf Coast on the East Coast as a market for its products.

The prospects for future expansion of refinery capacity is largely dependent on the development of deep-draft offshore oil ports such as LOOP in Louisiana and Seadock in Texas. The potential for expansion of refinery capacity as well as other potential effects of LOOP and Seadock are discussed in Chapter 2.

Natural Gas

The impact of OCS natural gas production on gas processing facilities in Texas has been minimal due to the very small percentage of total gas production from the OCS (see Table 1.6). In 1975, there were a total of 358 gas processing plants in Texas with a capacity of 29,452 million cubic feet/day (Oil and Gas Journal, July 14, 1975). However, over 95% of the gas processed was produced onshore. In addition, it should be noted that some of the OCS gas produced in Texas is processed in Louisiana. That is, pipelines from two gas fields in the Texas High Island area come onshore in Louisiana (Oil and Gas Journal, August 19, 1974).

The situation in Louisiana is different (Table 1.6). While Louisiana had 122 plants with a total capacity of 23,112.2 MMCF/D (Oil and Gas Journal, July 14, 1975), nearly 50% of natural gas production is from offshore sources. As of 1971, six of these gas-processing units were large main-line plants that processed principally offshore gas and they processed about 85% of the offshore gas produced (American Petroleum Institute, 1973). In addition, one of these plants has been expanded and two new ones built in 1972-1973 so most of the offshore gas is processed at eight plants located at Calumet, Yscloskey, North Terrebonne, Grand Chenier, Lirette, Toca, Henry, and Pecan Island.

Distribution of the gas flow from the Gulf Coast both onshore and offshore is estimated for the year 1970 (Table 1.10). It can be seen that the bulk of Gulf Coast needs is supplied from onshore production while most of the offshore production is transmitted elsewhere. The Appalachian region is the recipient of most of the exported offshore gas (receiving most of the exported onshore gas as well), getting 1,292 billion cubic feet (BCF) in 1970.

1.5 -- ENVIRONMENTAL PROBLEMS

The major environmental impacts of OCS development have been in the form of oil spills, dredging and channelization of the wetlands, and onshore development. The specific effects of these actions are discussed in Chapter 3, but this section provides an outline of the major types of oil and condensate spills that have occurred, as well as a discussion of the other types of environmental problems.

Table 1.10 Natural Gas Flow Estimates from Gulf of Mexico Offshore and West Gulf Basin Onshore Production Areas, 1970 (in billions of cubic feet) (Source: Federal Power Commission, 1973)

	West Gulf Basin[1]	Offshore	Total
New England	140	103	243
Appalachian	1,981	1,292	3,273
Southeast	1,083	516	1,599
Great Lakes	1,059	624	1,683
Northern Plains	6	2	8
Mid-Continent	190	31	221
Gulf Coast	4,396	328	4,724
Rocky Mountain	0	0	0
Pacific Southwest	0	0	0
Pacific Northwest	0	0	0
Alaska	0	0	0
Exports	9	1	10
Subtotal	8,864	2,896	11,760
Field Use	802	169	971
TOTAL	9,665	3,065	12,730

[1] Includes onshore Louisiana, Mississippi, Alabama, South Arkansas, and Southeast Texas.

Since 1971, there have been no blowouts spilling more than 200 barrels of oil (USDI, 1976d: III-6). Twenty-one blowouts have occurred since 1953 (Table 1.11). The two worst blowouts occurred in 1970 when Shell and Chevron production accidents spilled a total of 83,500 to 160,500 barrels of oil. Another significant event took place during Hurricane Hilda in 1964, which caused at least 11 blowouts (although the volume of oil spilled is not known).

Other sources of oil pollution resulting from OCS operations include pipeline leaks and ruptures, waste water disposal, and platform explosions and fires.[7] The two major causes of pipeline accidents are through anchor dragging and internal corrosion (USDI, 1976d: III-6). In 1967, a pipeline was ruptured by an anchor and spilled about 161,000 barrels of oil (Kash et al., 1973: 287). Since 1967, there have been 26 reported pipeline breaks in the Gulf of Mexico of greater than 50 barrels each (spills of 50 barrels or less are not required to be reported) spilling a total of approximately 202,588 barrels (USDI, 1976d: III-6). The percentage of total oil spilled by offshore facilities accounted for by pipeline leaks and ruptures can be significant. While pipelines are considerably safer than barges as a means of transporting offshore oil to shore (virtually all offshore oil is transported by pipeline), in 1971, pipeline leaks and ruptures accounted for

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[7] Gulf of Mexico OCS oil operations have accounted for 96.4% of total U.S. OCS oil operations. (See Table 1.3.)

Table 1.11 Major Blowouts Spilling Oil/Condensate on the Gulf of Mexico OCS, in Order of Severity, 1953-1972 (Source: Kash, *et al.*, 1973)

Year	Cause/ Type	Company	Volume of Oil Spilled (barrels) OR Duration of Spill[2]
1970	Production	Shell	53,000 - 130,000
1970	Production	Chevron	30,500
1969	Storm	Mobil	2,500 - 3,000
1971	Production	Amoco	400 - 500
1964	Production	Gulf	500
1958	Production	CAGC[1]	1 month, 6 days
1961	Production	Exxon	6 months
1960	Production	Union Producing	4 months
1966	Drilling	Texaco	2 days
1966	Production	Union Oil	15 minutes
1964	Hurricane	CAGC[1] - 1 blowout Gulf - 2 blowouts Shell - 1 blowout Sinclair - 4 blowouts Tenneco - 3 blowouts	unspecified # of days

[1]Continental

[2]Data presented as available in source.

1,643 spills of 13,309 barrels of oil, or 61% of the total number of spills and 85% of the total volume of oil spilled from offshore facilities in that year (Kash et al., 1973: 291).

Waste water disposal is another source of oil pollution in the Gulf of Mexico. Waste water is the water from the oil reservoir which is produced with the oil. It is separated from the oil, treated again to remove entrained oil and then deposited into the Gulf. The treatment facilities, however, are not 100% efficient. Government regulations permit a maximum of only 50 parts per million of oil in water before disposal but the waste water still accounted for 3,600 barrels of oil introduced into the Gulf of Mexico in 1971. This is a rate of 9 barrels spilled from waste water sources per million barrels of oil/condensate produced (Kash et al., 1973: 291-292).

Most platform fires are believed to be caused by combustible hydrocarbon vapors or liquids making contact with arcing electrical or overhead mechanical devices, however, some fires are caused by accidental ignition of fuel, solvent, or heat exchanger fluids and by lightning or static electricity. From 1956 to 1976, there were 180 recorded platform explosions or fires. However, only 9 of these resulted in spills amounting to a total of 87,112 barrels (USDI, 1976d; III-8).

It should be noted that a survey following the 1970 Chevron oil spill did not establish detrimental environmental effects, nor have other accidents resulted in clear documentation of substantial impact. Short-term effects of oil spills include mortality and tissue damage to fishes and invertebrates, but experience has shown that a year after the spills there is recovery of the biological resources. However, it was found that mangrove communities in Panama have not recovered following a spill there, which indicates that among Gulf habitats the mangrove communities and coral associations in Florida could be particularly sensitive (Kash et al., 1973: 331).

Probably the most significant environmental impact of OCS operations has been the effect on the wetlands. First, there has been considerable dredging and channelization of wetlands in order to bury and maintain pipelines, and to provide water transportation access to the offshore facilities from points inland. The effects of dredging and channelization are discussed in Chapter 3. The second significant effect on the wetlands is the urbanization that has resulted from the economic expansion stimulated by offshore operations. In addition to the onshore support facilities that directly support the offshore operations, secondary development has created a need for more residential, commercial, transportation, and educational facilities, and some of this growth has been at the expense of the wetlands. The socioeconomic impacts responsible for this growth are discussed in Chapter 4.

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CHAPTER 2

OCS DEVELOPMENT IN THE GULF OF MEXICO

2.1 -- POTENTIAL

A major indication of the potential of an area as an oil and/or gas producing region is the amount of proven reserves[1] the region holds. The amount of proven reserves on December 31 of the years 1947 through 1975 for oil and 1966 through 1975 for natural gas is tabulated for the Gulf (Table 2.1). The amount of oil reserves increased steadily until it reached a peak of 2,924,095 thousand barrels in 1970 and has decreased steadily since that time. Natural gas reached its peak of 38,785,667 million cubic feet in 1972, then declined in 1973 and 1974, but rose again in 1975 to 37,332,642 MMCF.

In addition to reserves, the major themes affecting the future of offshore activity in the Gulf of Mexico include the following: disenchantment with the Mississippi-Alabama-Florida (MAFLA) and South Texas areas of the Gulf, renewed interest and activity into the central Gulf area (off Louisiana and the upper Texas coasts), a move into the potentially lucrative deep-water areas, and the emergence of developmental activity in existing fields as more significant than exploratory activity in previously unexplored areas.

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[1]The estimated quantities of all fluids statistically defined as crude oil or natural gas, which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions (American Gas Association et al., 1976: 14).

Table 2.1 Estimates of Proved Reserves of Crude Oil and Natural Gas[1] at Year-End in the Gulf of Mexico, 1947-1975 (Source: American Gas Association *et al*. 1976)

Year	Crude Oil (1000s of Barrels)	Natural Gas (MMCF)
1947	3,247	
1948	6,938	
1949	26,890	
1950	80,624	
1951	79,585	
1952	78,475	
1953	112,032	
1954	199,316	
1955	429,165	
1956	718,698	
1957	878,551	
1958	1,027,102	
1959	1,492,441	
1960	1,619,228	
1961	1,759,091	
1962	1,786,736	
1963	1,804,644	
1964	1,961,575	
1965	2,001,189	
1966	2,282,618	30,340,112
1967	2,379,436	34,182,893
1968	2,536,471	35,851,529
1969	2,768,557	35,306,705
1970	2,924,095	37,781,044
1971	2,748,310	38,397,675
1972	2,565,862	38,785,667
1973	2,347,525	36,785,308
1974	2,212,008	35,347,841
1975	2,099,786	37,332,642

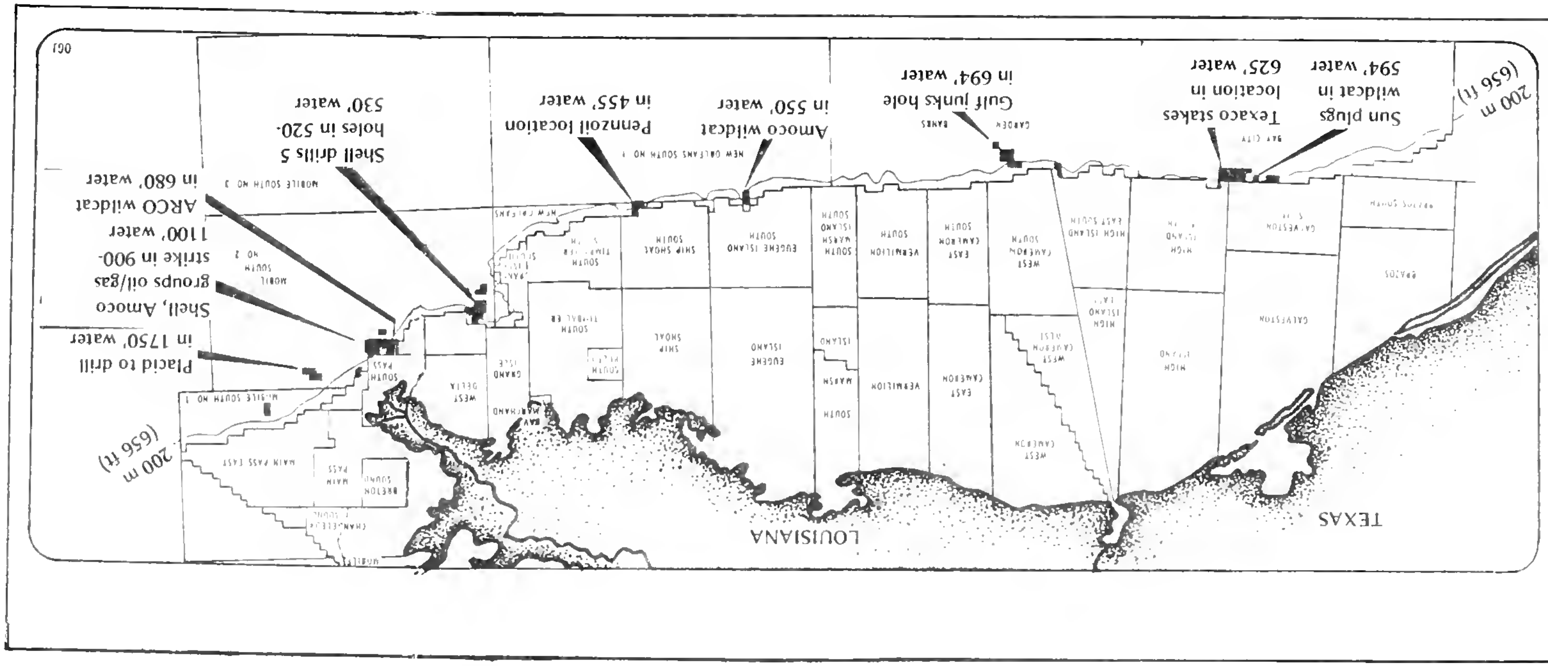
[1]Data unavailable prior to 1966.

The MAFLA area of the Gulf had interested oil prospectors since the late 1960's with the Destin Dome area (about 50 miles southwest of Panama City, Florida) being the focus of attention. In August, 1970, an onshore discovery, the Jay Field in the Florida panhandle, gave further impetus to offshore exploration and the first lease sale in the area was held in December of 1973. The sale was dominated by the Destin Dome area. Approximately 42% of the winning bid values were for six tracts of the dome, including the two highest bids ever made at an offshore lease sale anywhere in the world (Offshore, 1975: 47-48). However, after drilling seven dry holes in 1974 and 1975, Exxon and its partners, Mobil and Champlin (the holders of the lease) stopped drilling and the potential of the Eastern Gulf was reduced to practically zero (Leblanc, 1976: 89). In fact, out of 60 MAFLA tracts offered in the 1976 lease sale, bids were received on only four. The four tracts were subsequently leased at an average price of only $175.00 per acre compared to an average of $3,075 per acre on tracts leased in the 1973 sale (Offshore, 1976).

The South Texas area had also presented some hope to oilmen, but seismographic tests dimmed hopes by the end of 1974. The February, 1975 lease sale for offshore Texas drew only a few bids and most of those were for the High Island South area (off the upper Texas coast) (Figure 2.1). Subsequent sales in May and July drew even fewer and lower bids. The bulk of the activity along the Texas coast took place in the upper Texas coast High Island and Brazos areas (Leblanc, 1976: 83).

Due to the failure of the MAFLA and South Texas areas to materialize as prime production areas, there has been renewed interest in the central Gulf area, mostly for development of

Figure 2.1 Leasing areas in the central Gulf of Mexico (Source: McNabb, 1975).



tracts leased earlier, but for added exploration as well. There was a flurry of gas wells brought to production in late 1974 and 1975 on the outer reaches of High Island South and High Island East-South which increased interest in the upper Texas coast. By early 1976, 8 platforms had been set in these areas and 12 more were on the way. In the Louisiana areas there were also some significant findings, particularly in the deep-water areas (discussed below), but also in the shallower areas. There were new discoveries and extensions of previously existing fields in the Eugene Island, Vermilion, West Cameron, and South Marsh Island areas in 1975 (Figure 2.1). The gas finds in High Island South and High Island East-South and oil discoveries, such as those found in Eugene Island, lead operators to believe that there are still pools of commercial size on the far reaches of the continental shelf. This belief is indicated by the fact that the majority of rigs being ordered along the Gulf Coast are jack-ups designed for waters of approximately 300 ft -- the depths of the far reaches of the OCS (Leblanc, 1976: 84-90).

The other major potential for future production in the Gulf of Mexico lies in the deep-water areas of the continental slope and the ocean floor. Explorationists feel that the undiscovered oil and gas fields remaining on the Continental Shelf are few and commercially small but that larger finds, especially oil, are under the continental slope and out under the ultra-deep waters of the central Gulf. In fact, some geologists predict that the largest reserves yet to be found in the Gulf are in these ultra-deep waters.

While there has been increasing interest in the Bay City and Garden Banks deepwater areas, the major activity is currently occurring in the Mobile South 1 and 2 areas on the slope (see Figure 2.1). What is considered the most significant of the 1975 Louisiana offshore discoveries was Shell's Prospect Cognac in the Mobile South 2 area. In addition to confirming a find on their own tract, a directional well drilled by Shell discovered oil and gas in an adjoining block owned by Amoco. In addition to these dsicoveries, Atlantic-Richfield discovered oil and gas about 6 miles west of Shell's Prospect Cognac, Gulf Oil Company has had strikes to the south and east of Prospect Cognac, and more recently (1976), Placid had a strike 17 miles south of the Shell find. The Placid oil strike is in 1,796 feet of water, a record for the Gulf of Mexico (Leblanc, 1976: 81-90). Of course, production in these deepwater areas will require new technology and this is discussed later in this chapter.

The final major theme involving the potential of the Gulf as a petroleum-producing region is the emergence in 1975 of developmental activity in existing fields as the major activity of the oil companies. During exploratory and developmental operations, a total of 907 OCS wells were drilled offshore of Louisiana and Texas in 1975 (Table 2.2). The number of developmental wells drilled in Louisiana (629) far exeeded the number of exploratory wells -- wells in previously unexplored areas -- (131). In Texas, which has not been developed as extensively as Louisiana, exploratory drilling

Table 2.2 Drilling Results Offshore Louisiana and Texas, 1975
(Source: Leblanc, 1976)

DRILLING RESULTS -- LOUISIANA 1975		DRILLING RESULTS -- TEXAS 1975	
Phase	Wells	Phase	Wells
Exploratory	131	Exploratory	138
Oil Discoveries	5	Oil Discoveries	0
Gas Discoveries	16	Gas Discoveries	11
Dry	110	Dry	127
(Success percentage--16.0)		(Success percentage--8.0)	
Developmental	629	Developmental	9
Oil Discoveries	184	Oil Discoveries	0
Gas Discoveries	273	Gas Discoveries	4
Dry	164	Dry	5
(Success percentage--73.0)		(Success percentage--44.0)	
Total	760	Total	147
(Success percentage--55.0)		(Success percentage--10.0)	

continued to account for most of the wells drilled. However, the forecast for 1976 predicted a 100% increase in total wells drilled offshore of Texas represented by a surge in developmental drilling and only a slight increase in the number of exploratory (wildcat) wells. The expectation for the future is that exploration will drop considerably in 1977 and 1978, but that development will continue at a high pace at least until 1985. If the predictions about large reserves in the ultra-deep water are correct, then development activity will probably continue through the turn of the century after these areas have been explored (Leblanc, 1976: 89-90).

2.2 -- LEASING

Historical information is presented for the lease sale areas in the Gulf of Mexico (Figure 2.2). Summarized data include the number of tracts, acres, and number leased; the bonus paid; average price per acre; and number of bids received for each sale. The present status of the leased acreage is discussed including the number of tracts and acres still in force, platforms installed, platforms presently active, and number of fields discovered on the leased acreage. Maps illustrate the status of areas by tract of the OCS off Louisiana, Texas, and the MAFLA area.

Analysis of the data (Figure 2.2) indicates continuous leasing and development activity for the Gulf OCS. This demonstrates a commitment to full development of the Gulf Outer Continental Shelf. In fact, the

Figure 2.2 Gulf of Mexico, map of Federal waters (Source: Offshore, June 20, 1976).

TEXAS LEASE SALES

What's been bought at the sales

Date	Tracts offered	Acres offered	Tracts leased	Acres leased	Bonus paid	Av. price per ac.	Bids received	OCS-G numbers
*	93	125,090	93	125,090	—	—	—	091
Nov. 9, 1954	38	111,788	19	67,149	$ 23,357,029	$ 348	90	0500-0518
July 12, 1955	39	216,000	27	149,760	8,437,462	56	33	0614-0640
Feb. 26, 1960	97	437,760	48	240,480	35,732,031	149	105	0702-0749
March 16, 1962	30	90,720	10	28,800	557,720	19	10	1109-1118
May 21, 1968	169	728,551	110	541,304	593,899,046	1,097	556	1711-1851
June 19, 1973	124	672,643	96	527,173	1,537,495,671	2,321	539	2336-2434
May 29, 1974	245	1,355,678	102	565,112	1,471,851,831	2,605	352	2644-2766
July 30, 1974	143	787,821	10	53,253	22,264,900	418	35	2767-2794
Feb. 4, 1975	515	2,870,344	113	626,587	274,690,955	378	281	2976-3118
May 28, 1975	36	192,660	9	51,840	25,337,000	489	31	3210-3220
July 29, 1975	176	963,832	23	132,480	44,852,318	339	49	3222-3250
Feb. 18, 1976	30	157,269	12	63,427	37,382,176	589	22	3304-3316
Total	1,145	8,710,156	672	3,172,455	4,075,858,139	—	—	—

What's been found on the leased acreage

Date	No. of tracts	Acres presently in force (%)	Bonus presently in force (%)	Platforms installed	Platforms active	Fields discovered
*	1	4,320 (03)	—	1	1	1
Nov. 9, 1954	6	11,700 (17)	$ 12,408,764 (53)	3	3	1
July 12, 1955	—	—	—	—	—	—
Feb. 26, 1960	9	29,340 (12)	18,728,539 (52)	5	2	2
March 16, 1962	—	—	—	—	—	—
May 21, 1968	13	54,450 (10)	156,316,816 (26)	8	8	10
June 19, 1973	95	521,413 (99)	1,531,380,671 (99)	11	11	13
May 1974	101	559,352 (99)	1,466,601,831 (99)	1	1	5
July 1974	10	53,253 (100)	22,264,900 (100)	—	—	—
Feb. 1975	113	626,585 (100)	274,690,955 (100)	—	—	—
May 28, 1975	9	51,840 (100)	25,337,000 (100)	—	—	—
July 29, 1975	23	132,480 (100)	44,852,318 (100)	—	—	—
Feb. 18, 1976	12	63,427 (100)	37,382,176 (100)	—	—	—
Total	392	2,108,160 (66)	3,589,963,970 (88)	29	26	32

*Leases awarded by state prior to federal jurisdiction
List includes all federal offerings since 1947.

MISSISSIPPI-ALABAMA-FLORIDA LEASE SALES

What's been bought at the sales

Date	No. Tracts offered	Acres offered	No. Tracts leased	Acres leased	Bonus paid	Av. price per ac.	Bids received	OCS numbers
May 26, 1959	80	458,000	23	132,480	$ 1,711,872	$ 13	23	0655-0677
Dec. 20, 1973	147	817,297	87	485,397	1,491,065,231	3,072	373	2440-2528
Feb. 18, 1976	60	344,547	4	23,040	4,040,000	175	4	3341-3344
Total	287	1,619,844	114	640,917	$1,496,817,103	—	—	—

What's been found on the leased acreage

Date	No. of tracts	Acres presently in force (%)	Bonus presently in force (%)	Platforms installed	Fields discovered
May 26, 1959	—	—	—	—	—
Dec. 20, 1973	69	381,717	$1,433,130,090	2*	—
Feb. 18, 1976	4	23,040	4,040,000	—	—
Total	73	404,757	$1,437,170,090	2	—

*Installed on deep water Louisiana acreage purchased at the MAFLA sale.

Figure 2.2 Continued.

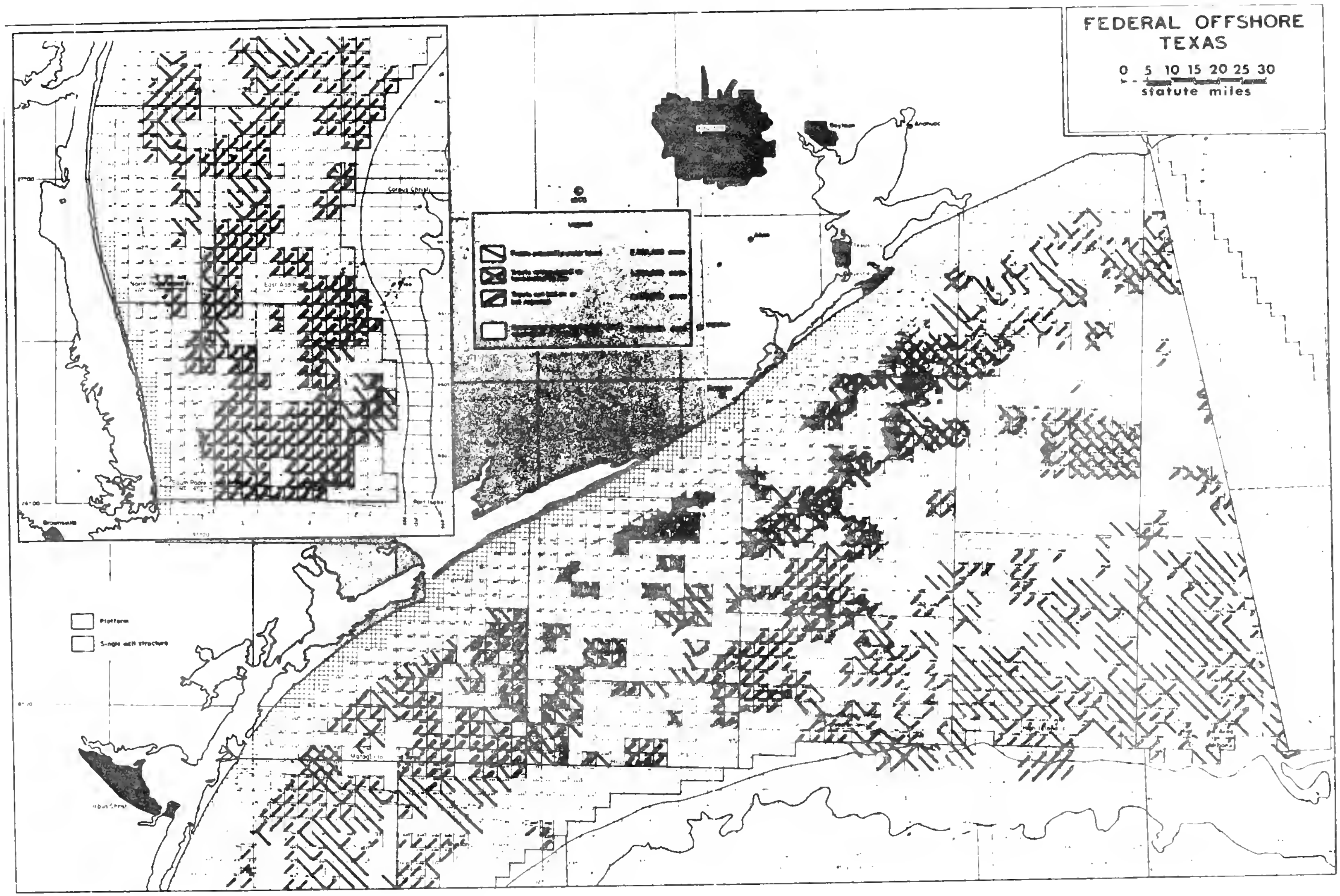


Figure 2.2 Continued.

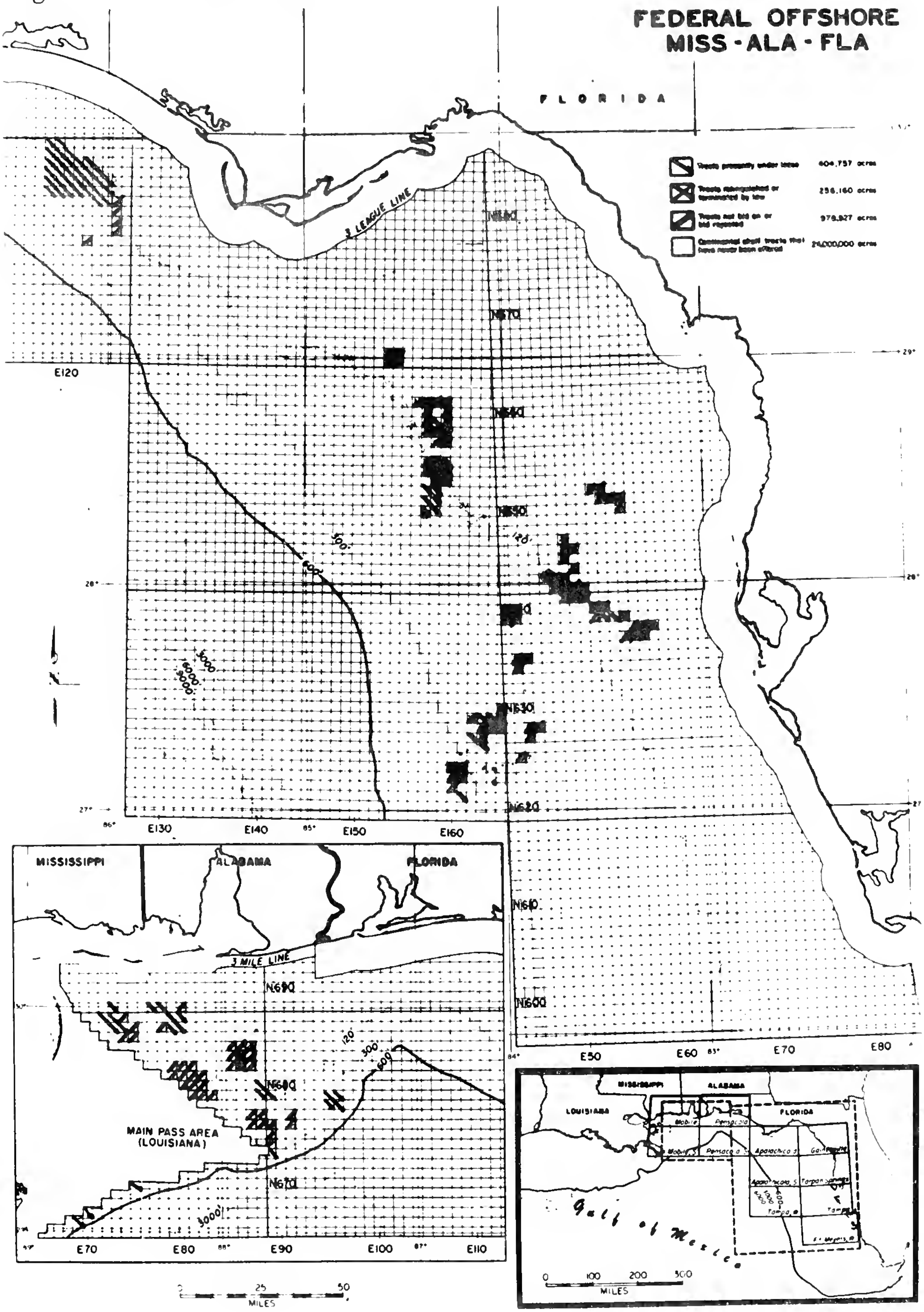


Figure 2.2 Continued.

LOUISIANA LEASE SALES

What's been bought at the sales

Date	Tracts offered	Acres offered	Tracts leased	Acres leased	Bonus paid	Av. price per ac.	Bids received	OCS-G numbers
*	270	997,674	270	997,674	—	—	—	008-0391
Oct. 13, 1954	199	748,000	90	394,721	$ 116,378,476	$ 294	327	0405-0498
July 12, 1955	171	458,095	94	252,806	100,091,264	396	351	0520-0611
Feb. 24, 1960	288	1,173,223	99	464,046	246,909,784	532	339	0750-0874
March 1962	781	3,588,541	401	1,879,527	445,035,982	237	1,194	0897-1318
June 13, 1967	206	971,489	158	744,456	510,079,178	685	742	1507-1678
Dec. 15, 1970	127	593,485	118	551,398	845,877,860	1,548	1,043	1993-2119
Sept. 12, 1972	78	366,682	62	290,320	585,827,925	2,018	324	2140-2213
Dec. 19, 1972	132	604,029	116	535,874	1,665,519,631	3,108	690	2217-2335
March 29, 1974	206	930,918	91	421,218	2,092,510,854	4,967	402	2530-2643
July 30, 1974	115	510,918	9	46,988	7,971,900	170	22	2797-2812
Oct. 16, 1974	297	1,421,546	144	675,587	1,427,242,455	2,248	387	2818-2974
May 28, 1975	247	1,153,772	77	355,102	207,579,050	585	160	3119-3208
July 29, 1975	169	809,126	43	203,821	118,361,688	581	130	3251-3301
Feb. 18, 1976	42	186,247	18	74,819	134,554,317	1,798	55	3317-3344
Total	3,398	14,513,745	1,790	7,888,357	8,503,938,264	—	—	—
			Drainage sales					
Aug. 11, 1959	38	81,813	19	38,820	$ 88,035,121	$2,268	56	0680-0698
Oct. 9, 1962	38	33,855	9	16,178	43,887,358	2,713	26	1324-1337
April 28, 1964	28	34,028	23	32,674	60,340,626	1,847	69	1351-1373
Mar. 29, 1966	18	35,993	17	35,056	88,845,963	2,534	64	1435-1452
Oct. 18, 1966	52	227,898	24	104,717	99,164,930	947	79	1469-1500
Nov. 19, 1968	26	46,824	16	29,679	147,868,789	5,050	38	1858-1878
Jan. 14, 1969	38	96,389	20	48,504	44,087,339	908	40	1879-1904
Dec. 16, 1969	27	93,764	16	60,153	66,908,196	1,112	38	1953-1968
July 21, 1970	34	73,360	19	44,642	97,769,013	2,190	39	1970-1990
Nov. 4, 1971	18	55,872	11	37,222	96,304,523	2,587	33	2125-2137
June 19, 1973	5	25,000	4	20,000	53,901,709	2,695	12	2435-2439
Total	303	804,796	178	467,646	$ 889,063,567	—	—	—
Grand Total	3,701	15,318,541	1,968	8,356,003	$9,393,001,831	—	—	—

What was found on the leased acreage

Date	No. of tracts	Acres presently in force (%)	Bonus presently in force (%)	Platforms installed	Platforms active	Fields discovered
*	151	627,412 (64)	—	278	200	45
Oct. 13, 1954	36	148,722 (38)	$ 51,974,874 (45)	76	47	11
July 12, 1955	26	70,699 (28)	48,214,843 (48)	32	23	9
Feb. 24, 1960	63	294,739 (64)	165,524,650 (67)	87	79	17
March 1962	154	737,270 (39)	236,478,649 (53)	158	138	71
June 13, 1967	66	313,882 (42)	346,709,668 (68)	40	38	21
Dec. 15, 1970	75	349,958 (63)	665,416,583 (79)	62	60	28
Sept. 12, 1972	45	215,730 (74)	479,568,307 (82)	4	4	4
Dec. 19, 1972	113	516,313 (96)	1,613,489,631 (97)	20	20	18
March 29, 1974	89	410,458 (97)	2,013,326,254 (96)	11	11	13
July 30, 1974	9	46,988 (100)	7,971,900 (100)	—	—	—
Oct. 16, 1974	141	660,587 (98)	1,424,803,455 (99)	3	3	10
May 28, 1975	77	355,102 (100)	207,579,050 (100)	—	—	—
July 29, 1975	43	203,821 (100)	118,361,688 (100)	—	—	—
Feb. 18 1976	18	74,819 (100)	134,554,317 (100)	—	—	—
Total	1,108	5,026,500 (64)	7,513,973,869 (88)	771	623	247
			Drainage sales			
Aug. 11, 1959	6	11,363 (29)	$ 67,989,617 (77)	5	4	1
Oct. 9, 1962	5	8,393 (52)	34,947,550 (79)	5	4	—
April 29, 1964	15	21,532 (66)	55,485,335 (92)	9	8	—
March 29, 1966	11	25,540 (73)	75,805,274 (85)	6	6	1
Oct. 18, 1966	14	60,830 (58)	68,283,665 (69)	10	10	1
Nov. 19, 1968	8	14,520 (49)	127,793,134 (85)	8	7	—
Jan. 14, 1969	12	29,994 (62)	18,747,437 (43)	4	2	—
Dec. 16, 1969	13	45,598 (76)	66,843,778 (99)	3	3	1
July 21, 1970	14	30,892 (69)	92,874,038 (95)	8	8	1
Nov. 4, 1971	11	37,222 (100)	96,304,523 (100)	2	2	1
June 19, 1973	4	20,000 (100)	53,901,709 (100)	4	4	2
Total	113	305,844 (65)	758,876,060 (85)	64	58	8
Grand Total	1,221	5,332,344 (64)	$8,272,849,929 (88)	835	681	255

*Leases awarded by state prior to federal jurisdiction

Listing includes all federal offerings since 1947.

Figure 2.2 Continued.

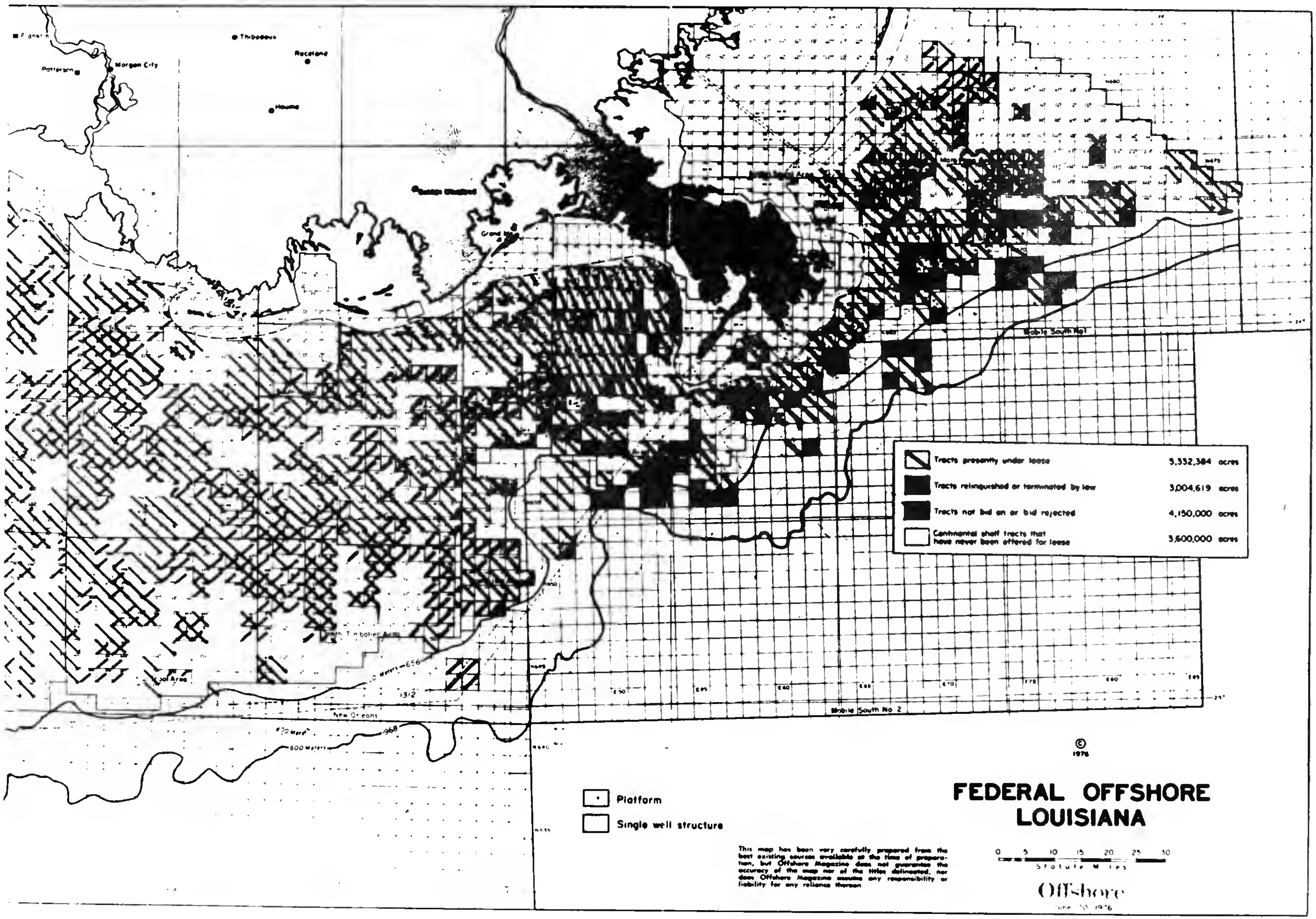
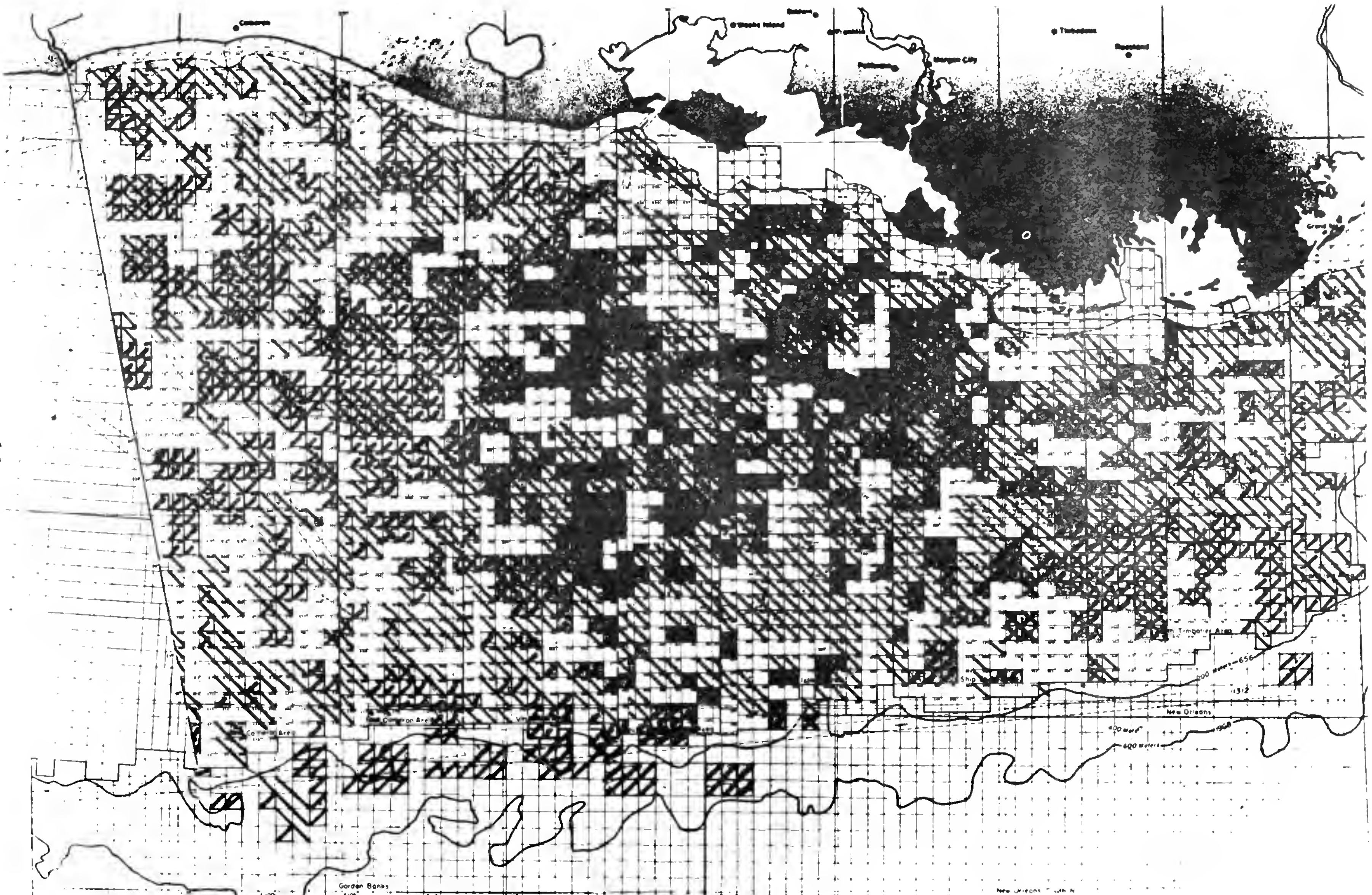


Figure 2.2 Continued.



FEDERAL OFFSHORE LOUISIANA

Gulf of Mexico is the only offshore area in the U.S. where the effort to increase leases of offshore oil and gas reserves is on schedule (Hanna, 1976).

The reduced chances of significant finds in OCS leases is reflected in the average price per acre which has declined substantially since the highs it reached in 1974. The March 29, 1974 sale in Louisiana brought a record high bid of $4,967 per acre while subsequent sales brought average bids of $170, $2,248, $585, $581, and $1,793. In Texas, the highest average bid per acre was $2,605 in the May 29, 1974 sale while average bids since then have not exceeded $600.

The January, 1977 proposed OCS Planning Schedule appears in Table 2.3. As can be seen, the most recent lease sale in the Gulf of Mexico was a drainage sale[2] held in November, 1976. The schedule also indicates that 5 move lease sales are scheduled for the Gulf of Mexico through 1980, including 2 in 1977 and 1 each in 1978, 1979, and 1980. This schedule represents a revision of the 1975 schedule, that had become off-target, except for those portions pertaining to the Gulf of Mexico which have remained on schedule.

The planning schedule (Table 2.3) indicates the process undertaken by the Bureau of Land Management prior to each

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[2]A drainage sale is one in which the offered tracts are being drained of their oil and gas reserves by producing adjacent tracts.

Table 2.3 Proposed OCS Planning Schedule (Source: U.S. Department of the Interior, 1977)

August 1977

SALE AREA	1977 A	S	O	N	D	1978 J	F	M	A	M	J	J	A	S	O	N	D
CI Cook Inlet		N	S														
42 N Atlantic	F		P		N	S											
43 South Atlantic Georgia Embayment			F		P		N	S									
45 Gulf of Mexico				F		P		N	S								
65 Eastern Gulf of Mexico						E		H			F	P		N	S		
51 Gulf of Mexico							E		H			F		P		N	S
49 Mid-Atlantic		T						E		H			F			P	
48 Southern California													E		H		
58 Gulf of Mexico			C		D		T							E		H	
54 South Atlantic Blake Plateau		C				D			T								
Federal/State Beaufort (near shore)			C		D				T								
55 Gulf of Alaska										C		D			T		
62 Gulf of Mexico														C		D	
46 Kodiak																	
52 North Atlantic																C	
53 Central and Northern California				C							D			T			
60 Cook Inlet																	C
56 South Atlantic Georgia Embayment																	
59 Mid-Atlantic																	
66 Gulf of Mexico																	
57 Bering Norton																	

SALE AREA	1979 J	F	M	A	M	J	J	A	S	O	N	D
CI Cook Inlet												
42 N Atlantic												
43 South Atlantic Georgia Embayment												
45 Gulf of Mexico												
65 Eastern Gulf of Mexico												
51 Gulf of Mexico												
49 Mid-Atlantic	N	S										
48 Southern California	F		P		N	S						
58 Gulf of Mexico		F		P		N	S					
54 South Atlantic Blake Plateau	E		H			F		P		N	S	
Federal/State Beaufort (near shore)			E		H			F			N	S
55 Gulf of Alaska								E		H		
62 Gulf of Mexico		T								E		H
46 Kodiak												E
52 North Atlantic	D			T								E
53 Central and Northern California												
60 Cook Inlet		D			T							
56 South Atlantic Georgia Embayment			C		D			T				
59 Mid-Atlantic									C		D	
66 Gulf of Mexico											C	
57 Bering Norton				C							D	

SALE AREA	1980 J	F	M	A	M	J	J	A	S	O	N	D
CI Cook Inlet												
42 N Atlantic												
43 South Atlantic Georgia Embayment												
45 Gulf of Mexico												
65 Eastern Gulf of Mexico												
51 Gulf of Mexico												
49 Mid-Atlantic												
48 Southern California												
58 Gulf of Mexico												
54 South Atlantic Blake Plateau												
Federal/State Beaufort (near shore)												
55 Gulf of Alaska	F		P		N	S						
62 Gulf of Mexico			F		P		N	S				
46 Kodiak		H			F		P		N	S		
52 North Atlantic		H				F		P		N	S	
53 Central and Northern California				E		H			F		P	
60 Cook Inlet		E				H				F		P
56 South Atlantic Georgia Embayment						E		H			F	
59 Mid-Atlantic		T								E		H
66 Gulf of Mexico	D			T							E	
57 Bering Norton		T										E

SALE AREA	1981 J	F	M	A	M	J	J	A	S	O	N	D
CI Cook Inlet												
42 N Atlantic												
43 South Atlantic Georgia Embayment												
45 Gulf of Mexico												
65 Eastern Gulf of Mexico												
51 Gulf of Mexico												
49 Mid-Atlantic												
48 Southern California												
58 Gulf of Mexico												
54 South Atlantic Blake Plateau												
Federal/State Beaufort (near shore)												
55 Gulf of Alaska												
62 Gulf of Mexico												
46 Kodiak												
52 North Atlantic												
53 Central and Northern California	N	S										
60 Cook Inlet		N	S									
56 South Atlantic Georgia Embayment	P		N	S								
59 Mid-Atlantic			F		P		N	S				
66 Gulf of Mexico	H			F		P		N	S			
57 Bering Norton		H					F		P		N	S

C - Call for Nominations
D Nominations Due
T - Announcement of Tracts
E - Draft Environmental Statement
H - Public Hearing
F - Final Environmental Statement
P - Proposed Notice of Sale
N Notice of Sale
S Sale

THE DEPARTMENT OF THE INTERIOR

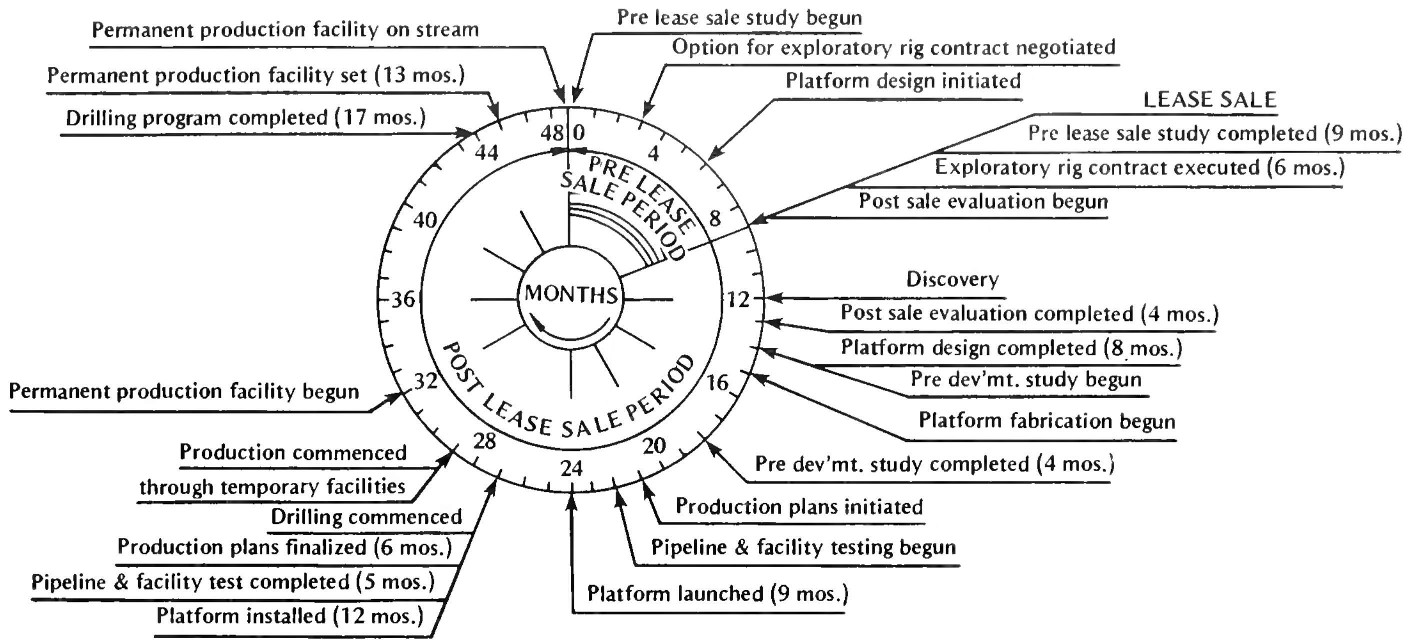
lease sale. That is, the first step is generally a call for nominations. Next, baseline environmental studies are initiated in frontier areas such as MAFLA, tracts are announced, draft environmental statements are made, public hearings held, final environmental statements made, and the sale held. The time involved can range from 15 to 40 months, averaging 19 months with some overlapping steps. The entire production process from pre-lease studies through production is presented in Figure 2.3.

2.3 -- NEW ONSHORE FACILITIES--OFFSHORE OIL PORTS

The central Gulf Coast, particularly Louisiana, has an extensive infrastructure of onshore support facilities. Since production has already peaked, it is expected that any new finds will serve to maintain existing levels of production rather than to increase production. It is expected that the existing onshore support facilities along the Louisiana and Texas coastal areas will be utilized for OCS activity resulting from future lease sales (USDI, 1976a: III-65; USDI, 1976b: 60). New facilities would have been necessary in the MAFLA and South Texas areas if significant finds had been discovered there. However, since no significant finds have been found in these areas and most exploration and development activity is again concentrated in the central Gulf, no major new onshore support facilities are anticipated.

However, onshore facilities are expected to be built to accommodate LOOP and Seadock, the proposed supertanker terminals off the coast of Louisiana and Texas for imported crude oil. As can be seen in Figure 2.4, LOOP will be located 19 miles

Figure 2.3 A hypothetical 4-year industry-oriented offshore planning and field development program (Source: Kash, et al., 1973).



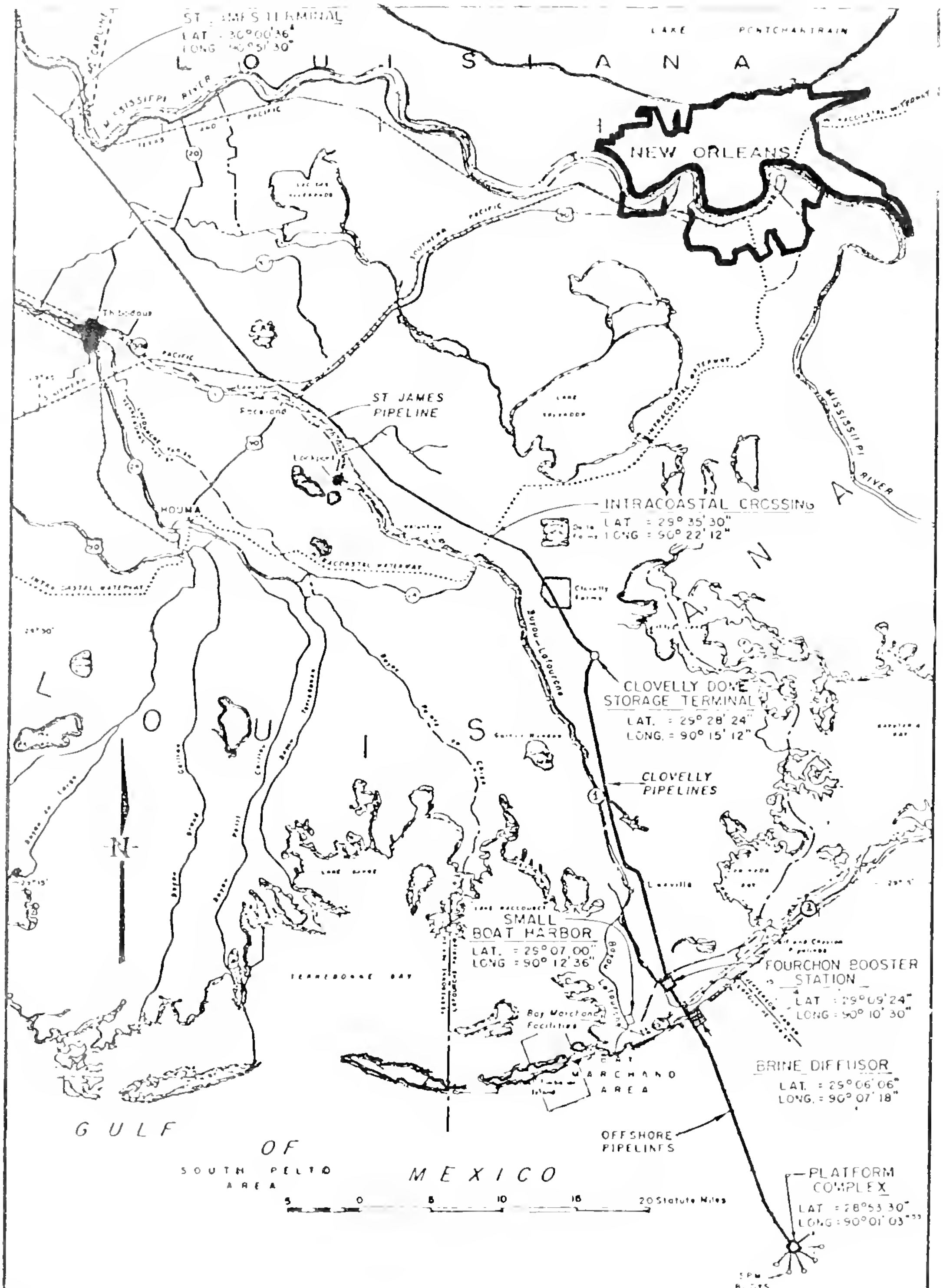


Figure 2.4 Tentative plans for Louisiana Offshore Oil Port (LOOP) (Source: Offshore Terminal Authority, 1976).

south of Grand Isle, Louisiana. As proposed, it will have an initial crude oil throughput capacity of 1.4 million barrels per day (1.4 MMBD) with two additional construction phases increasing the capacity to 3.4 MMBD. Its final phase form would consist of six single point mooring (SPM) buoy systems arrayed around two fixed platforms in water depths of 105 to 115 ft. Each SPM buoy will be connected to pumps on one of the platforms by 56 inch outside diameter (O.D.) pipelines. Oil will then be pumped to shore through up to three 48-inch O.D. pipelines through the Fourchon booster station to the Clovelly Dome storage facility. The Clovelly Dome facility will consist of 14 individual storage cavities leached out of a salt dome with a total capacity of 56 million barrels. Two 43-inch (O.D.) pipelines will connect the salt dome facility to the St. James terminal (St. James Parish) of CAPLINE (a pipeline to Midwest refineries). In addition, there will be a pipeline from the Clovelly Dome storage terminal to a point two miles into the Gulf to dispose of brine resulting from leaching the salt dome (U.S. Department of Transportation, 1976: 2).

The major environmental impacts of the LOOP project are as follows (U.S. Department of Transportation, 1976: 3):

> The disruptive effects of extensive pipeline construction through approximately 100 miles of marine, marsh, swamp , and dry land environments in three separate construction phases carried out over 14 years. (See Chapter 3.)

The use of approximately 3500 acres of marsh, swamp, and dry land for construction and operation of pipelines and onshore facilities (eliminating or displacing indigenous biota). (See Chapter 3.)

The risk of oil spills at the port or along the pipeline or at the storage facility. (See Chapters 1 and 3.)

The discharge of very large quantities of brine and other substances into Louisiana coastal waters.

Freshwater drawdown in the Barataria Bay area over a long period of time in order to leach storage cavities from the Clovelly Salt Dome.

Preemption of the offshore areas from other uses in the deepwater port safety zone and fairway.

The impacts associated with secondary development in the refinery and petrochemical industry (these impacts are discussed further below and in Chapter 4).

LOOP is also expected to have an impact on the development of Port Fourchon in Lafourche Parish. That is, the Superport will enhance the chances of the port becoming a major service base for offshore operations (Mumphrey, et al., 1976).

The Seadock proposal is somewhat different from LOOP. It will be located 28 miles offshore of Freeport, Texas. Its onshore facilities consist of a large tank farm where the pipeline comes onshore. The oil will then be pumped from the tank farm into pipelines to refineries (Perrin, 1976). The environmental effects of Seadock are similar to those of LOOP except for the differences resulting from the difference in storage facilities. That is, there will be no discharge of brine or freshwater drawdown from leaching activities but there will be an additional negative aesthetic impact from the large tank farm that will be constructed.

2.4 PROCESSING

As in the case of onshore support facilities, oil and gas extraction activities are not expected to have a major impact on processing, but a major impact will result from the LOOP and Seadock superport projects. The existing refineries likely to be affected by the two projects are shown in Figure 2.5.

The existing and projected refining capacity of plants in south Louisiana will change if the two superports are constructed (Table 2.4). Analysis of the projections indicates that LOOP will affect

Figure 2.5 Refineries likely to be affected by superport development (Source: H. J. Kaiser Company, 1976).

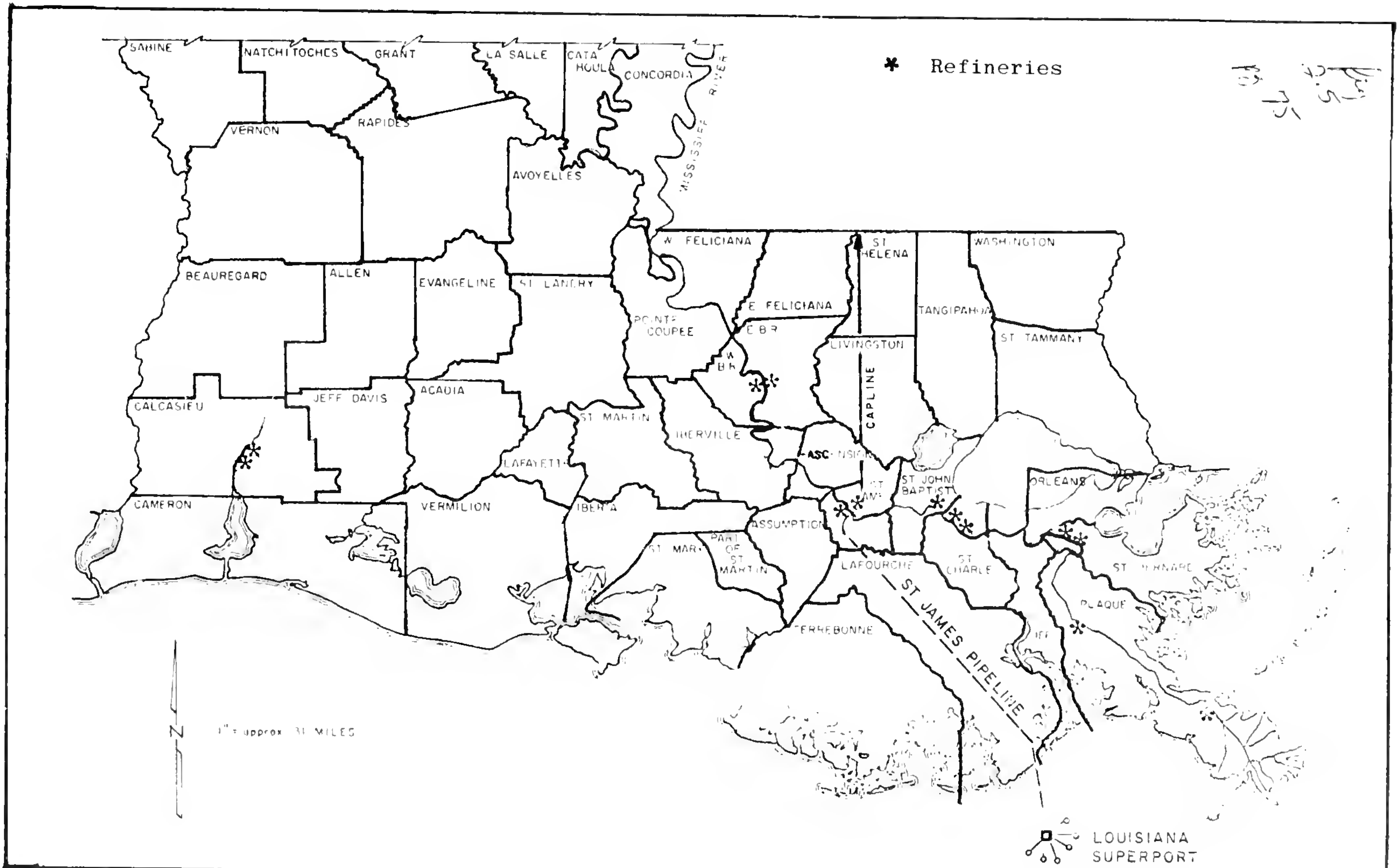


Table 2.4 Existing and Projected Refining Capacity in Southeast and Southwest Louisiana (Source: H. J. Kaiser Company, 1976)

AREA	TOTAL CAPACITY 1975	1980	1990	2010
Louisiana Superport				
Baton Rouge Area Refining (MB/D)	481.0	496.0	571.0	846.0
River Parish Area Refining (MB/D)	420.5	837.5	1,326.5	1,451.5
New Orleans Area Refining (MB/D)	404.5	499.5	574.5	674.5
Subtotal, Louisiana Superport Refining (MB/D)	1,306.0	1,833.0	2,472.0	2,972.0
Texas Superport				
Calcasieu Area	351.0	878.5	455.5	532.5
TOTAL Refining (MB/D)	1,657.0	2,211.5	2,927.5	3,504.5

Note: This table does not include refining and petrochemical capacity growth not directly related to Superport development.

the nine existing refineries (and possible future refineries) in southeast Louisiana while Seadock will affect the two refineries in the Calcasieu area of southwest Louisiana. As can be seen in the table, refinery capacity in southeast Louisiana is projected to increase to 1,833 million barrels daily (MB/D) by 1980 (the expected first year of Superport operation), to 2,472 MB/D by 1990, and to 2,972 MB/D by 2010, more than doubling the 1975 capacity. This is based on the estimate that about 40% of the crude oil imported through LOOP will be refined in Louisiana and the remaining 60% will be sent elsewhere via pipeline (H.J. Kaiser Company, 1976: 6). Without a superport, refining capacity in southeast Louisiana is projected to decrease to 1,200 MB/D by 1985 and remain at that level through 2010 (H.J. Kaiser Company, 1976: 9).

Since the two refineries in the Calcasieu area are owned by members of Seadock, they are expected to be affected by that project (H.J. Kaiser Company, 1976: 3-4). The capacity of these two refineries (no new refineries are expected in southwest Louisiana) is projected to more than double by 1980 to 878.5 MB/D from the 1975 level of 351 MB/D (Table 2.4). It is then projected to decline to 455.5 MB/D by 1990, then rise again to 532.5 MB/D by 2010.

The Seadock project is not expected to result in an expansion of refinery capacity in Texas. Since Texas already has a large refinery capacity and production of crude oil in the state is declining, the major purpose of Seadock is to sustain existing refineries at their present levels (Perrin, 1976).

2.5 -- TECHNOLOGY ADVANCEMENT NEEDS AND POTENTIALS

The technological advancement needs of offshore development consist basically of two types: (a) improvement of existing technology in order to increase efficiency, prevent spills and accidents, and minimize environmental impacts of present operations on the continental shelf; and (b) modification of existing technology and development of new technology in order to exploit the potential resources lying in the deeper waters beyond the continental shelf.

Relative to the improvement of existing technology, Kash, et al., (1973) have identified the technological needs in several categories of OCS operations. These categories include: drilling, production, transportation, and accident response.

Successful drilling involves a delicate balance between the weight of the drilling mud and upward pressure exerted by the oil and/or gas reservoir (downhole pressure). Any sudden loss of mud, increase in downhole pressure, or sudden change in drilling rate is an indication of danger. The operation is particularly vulnerable when the drill string is moved into or out of the well bore. While human error due to inexperience, poor training, or inadequate procedures are the major problems, technological advances to alleviate the situation include improved monitoring of mud weight and downhole pressure, longer-lasting bits to reduce the number of times the drill string must be removed from the bore, separation of wellheads (on multiwell platforms), and fail-safe designs of multiwell platforms to reduce the chances of multiple blowouts and fires resulting from a single failure. Also, development of more automatic drilling equipment and improved training could reduce human error (Kash et al., 1973: 114-118).

Producing wells account for far fewer accidents than drilling operations. The major area of concern is the trend to multiwell platforms. In addition to separating wellheads as already mentioned, there is a need for methods to identify which wells are on fire in the event of an accident. Further development of equipment such as gas and flame detectors, fire control equipment, and personnel escape systems is also necessary. Also, due to possible human error, there needs to be increased emphasis on automatic and fail-safe features of equipment. Finally, the development of automated subsea production systems would reduce the threat of storm damage, avoid conflict with surface uses such as shipping and fishing, reduce aesthetic objections, and reduce the likelihood of human error (Kash et al., 1973: 118-123).

Transportation of OCS production consists almost entirely of pipelines. While pipeline transportation is relatively safe, pipelines are subject to corrosion which leads to leaks, and the dredging and channelization of wetlands in order to lay pipelines has severe environmental impacts. Therefore, the major technological needs involving pipelines include methods for detecting weak points and flaws to prevent leaks, wider use of mass flow monitoring systems to alert an operator when a major break does occur, and a more environmentally acceptable method of laying pipelines in the wetlands. Other needs include methods of laying and maintaining pipelines in deeper waters and the development of multi-phase pumping (simultaneously moving oil and gas in the same line). Multi-phase pumping could reduce use of separate gas and oil lines (diminishing the number of pipelines and their environmental effects) as well as eliminate the need for separation and treatment facilities in subsea production platforms (Kash et al, 1973: 124-125).

Technologies involving accident response are concerned with four main problems: reestablishing control over wells that have blown out, containing and cleaning up oil on water, salvaging marine life and birds, and cleaning up beaches. Kash et al. (1973) emphasize that the best way to deal with these situations is to improve drilling and production equipment and operating techniques in order to minimize spills and accidents. However, recommendations by Kash et al. for better response when spills and accidents do occur include installation of emergency sub-mudline shut-off systems which are not likely to be affected by surface damage, development of fast-response emergency equipment to support well control efforts, development and stockpiling of effective and rapidly deployable containment equipment, research into the behavior of oil in water to enhance spill containment, and continued development of containment and clean-up devices for moderately rough waters (Kash et al., 1973: 126-130).

The second type of technology advancement needed concerns operations in the deeper waters beyond the Continental Shelf, that is, in water depths over 600 ft. (Offshore, 1975: 46) Drillships already have the capability to drill in depths of 4000 to 6000 ft. of water (Carmichael, 1975: 52), and, in fact, the Seagap Group (consisting of Getty Oil, Hispanoil, Phillips, and AGIP) is planning a well in 4,500 ft. of water off the west coast of Africa (Leblanc, 1976: 58). However, there are several new developments which are coming into use that are necessary in the exploration phase of deepwater operations before these wells are able to be completed and brought to production. These include dynamic positioning of drillships (no anchors), sonar wellhole re-entry (without guidelines) of drill string, electric blowout preventor (BOP) valves for fast response, and marine riser systems capable of supporting the weight of the greater lengths of the drill string, mud, etc. (Carmichael, 1975: 52).

Of course, dynamic positioning is needed to keep the drillship from drifting while drilling, but it is also needed to be used in conjunction with the sonar reentry system to reenter the wellhole. The dynamic positioning system must bring the drilling equipment to within 2 ft. of the wellhole centerline. From that point, the sonar reentry system will further align it to within eight inches of center, which is within the capability of the connector at the wellhole to adjust and make final connection with the well (Robertson, 1976: 63).

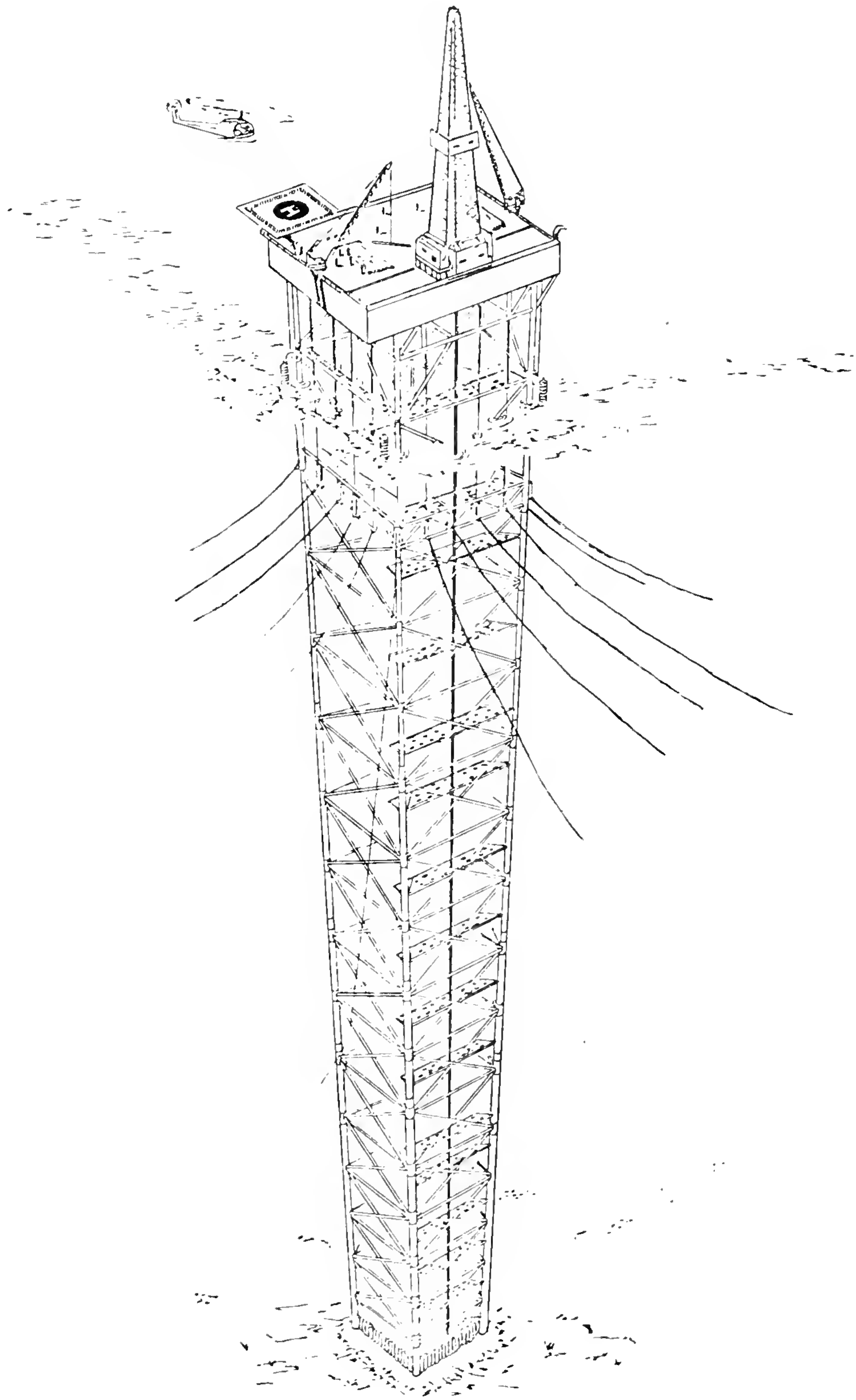
Since conventional riser systems are not able to support the added weight of the drill string, mud, etc., new systems are being developed that use bouyant riser joints to reduce the above water pull required to support the riser system.

It is believed that equipment now available can provide bouyancy capable of supporting risers to a water depth of 6,000 ft. (Carmichael, 1975: 53).

Conventional hydraulic controls for BOP valves cannot be used in water deeper than 2,000 ft. because it takes too long to respond to a problem and close the valves. A new electro-hydraulic BOP control system has been developed which speeds both response and function control. Its reliability and response time is believed to be adequate in water depths beyond 6,000 ft. (Carmichael, 1975: 53).

The production phase of deepwater operations also requires some major advancements in technology. Conventional platforms have a practical depth limit of about 1,200 ft. (Langley, 1975: 41). Currently, efforts are underway to develop a "guyed tower" platform for use in water depths of 600 to 2,000 ft., and subsea production systems for use in water depths of 3,000 ft. or more. The guyed tower platform (see Figure 2.6) is currently being tested by Exxon with a 370-ft. model installed in 300 ft. of water off the coast of Louisiana. It represents a one-fifth scale model of a platform designed for 1,500 ft. of water. The platform sits on a base that is held in place by bridge cables attached to anchors surrounding the structure. The structure is compliant, that is, it moves with the waves 1 to 2 degrees in any direction. The model was installed in 1975 and has been through one winter. Most data was acquired during the 1975 and 1976 winter months (and

Figure 2.6 Guyed tower platform (Source: Exxon, no date, a).



the results have been encouraging) but the structure will remain in place for 4 to 5 years to test its durability (Burwell, 1976).

Currently, two basic types of subsea production systems are being developed. Lockheed is developing a "dry" system consisting of a wellhead cellar (into which production from the well enters the system), a manifold center (which gathers, measures, and controls production (States-Item, September 2, 1976: 2), and a service capsule (a manned atmospheric habitat operating from a support boat for installation and periodic maintenance) (Carmichael, 1975: 53). This system is currently being tested by Shell in the Gulf of Mexico in 240 ft. of water. It is designed for use in up to 3,000 ft. of water, but Shell's project manager says it will take at least 5 years before it can be applied in deep water (States-Item, September 2, 1976: 1).

The other system is Exxon's SPS, a "wet" system. This system uses clustered wells located on a bottom founded template containing preinstalled production manifolds and oil-gas separation equipment. It is installed from the surface and maintained remotely using a maintenance manipulator. It is believed that subsea production systems could be ready for widespread use by the end of 1976 or first part of 1977 (Exxon, no date, b).

Another major technological advance necessary for deep-water development is pipeline laying in deep waters. Currently, laying pipelines in water greater than 400 to 500 ft. is limited to pipes of 12 in. diameter or less. Also, repair of pipelines and other aspects of OCS activity that require diving present a problem. The deepest actual working dives so far have been in approximately 650 ft. of water although this is being extended and divers are receiving a large number of requests from oil companies to develop a capacity for work in 2,000 and 3,000 ft. of water (Feder, 1975: 57). The sub-contractors and service companies must also improve their technology. These companies must play an increasing role in designing, fabricating, and testing highly reliable components in order to extend their life and reduce their maintenance. This is essential for deepwater and subsea operations (Langley, 1975: 42).

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CHAPTER 3

THE IMPACT OF OCS DEVELOPMENT ON LIVING RESOURCES IN THE GULF COAST AREA[1]

3.1 -- INTRODUCTION

This chapter presents a discussion of OCS-related impacts on the shrimp, oyster, menhaden, fur, and sport fishing industries in Louisiana. Also included is a list of public interest groups and agencies concerned with environmental management. While the discussion of ecological effects applies to the entire Gulf Coast area, the specific examples cite only Louisiana because nearly all Gulf OCS development has occurred offshore of Louisiana and has affected the entire coastal zone of the state. By comparison, OCS development in Texas has been minor and has had an impact on only a portion of its coastal zone. There have thus far been only exploration activities offshore of Mississippi-Alabama-Florida; no production has yet occurred in that area.

Wetlands serve as a nursery, habitat, and source of nutrients for many aquatic and fur animals. Destruction of wetlands leads to diminished production from these organisms. Natural and man-made phenomena cause stresses and destruction of the wetland environment. Natural stresses result from wave erosion, hurricanes, natural sedimentation from rivers and streams, natural pollution (such as oil seeps and natural

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[1]Adapted from Mumphrey _et al_., 1976a.

phosphorus), certain marine organisms, geologic subsidence and other factors. Man-made changes in the wetlands which have caused environmental stress include pollution from urban runoff, industry, and pesticides; and channelization, drainage, and filling of wetlands for urbanization, agriculture and mining. All of these cause loss of habitat and productive capabilities. Channeling and dredging in the marsh and estuary areas are necessary for access to offshore and onshore oil facilities, laying pipelines, and constructing oil wells. As a consequence, various ecological changes occur along with oil industry development (Mumphrey et al., 1975: 41-95).

Mumphrey et al. (1975: 86) list the following ecological changes in coastal zones caused by channelization and dredging by the petroleum industry:

> Interfering with sheet water flow through the marsh;
> Allowing rapid salinity changes with the resultant death of vegetation and erosion of the marsh;
> Allowing destruction of marsh by wave action;
> Decreasing productivity by the presence of straight vs. sinuous channels that accelerate removal of freshwater and also confine water movement;
> Destruction of barrier islands with resultant increased destruction of marsh.

The flushing rate (movement of fresh water from wetlands into bayous and to the Gulf) increases when north-south bayous are straightened and deepened. This results because the water does not have time to unload sediment and nutrients in the wetland area. The faster movement of water in the bayous and canals also causes erosion along the unstable banks of the streams. Other channels that are dug east-west across the marsh create spoil banks that interrupt the normal north-south sheet-like flow of water. This flow of water is important because it disperses nutrients and detritus over the wetlands. Additionally, man-made channels disrupt nursery areas of many commercially important marine animals (e.g., shrimp and menhaden). Dredging and channeling for the building of oil wells and pipelines can often destroy vegetation and habitats of marsh animals. (See Mumphrey et al. (1975: 86-89) for a more complete discussion.) Burying pipelines and the revegetation of their paths through the marshes mitigates but does not eliminate the effects of the associated channels (Willingham et al., 1974). Also, creative dispersal of spoil banks can mitigate some of the effects of channelization.

Where deep, straight canals are cut, salt wedges can result and extend far inland, causing the death of vegetation which results in the loss of nutrients, habitat, and erosion in the wetlands. These large, straight canals carry high velocity seawater (waves) during hurricanes and destroy vegetation. After a hurricane, the spoil banks tend to trap the saline seawater in the wetlands and prohibit it from draining. The result is the destruction of more vegetation and erosion. Also, the dredging of canals near barrier islands helps speed their destruction. Normally, these islands protect the plant and animal life of the wetlands from destruction by storm-generated tidal surges and diminish wetland erosion (Mumphrey et al., 1975: 89-93).

The seafood and fur industries in Louisiana are rather large. Therefore, preservation of wetlands productivity is important to the state's economy. In 1974, 1,228,906,000 pounds of seafood with a value of $86,694,000 were landed in Louisiana. For the same year there were 9,500 full-time and 4,050 part-time commercial fishermen in Louisiana Louisiana's seafood catch is about one-quarter of the nation's total catch (U.S. Department of Commerce, 1975: 18 and 76).

3.2 -- EFFECTS OF OIL INDUSTRY ON LIVING RESOURCES

Most of the commercial fishes important to Louisiana industry rely on estuaries for food or live part of their lives in the estuaries. Table 3.1 shows the migratory behavior of selected coastal organisms. Fish are subjected to two stresses from the oil industry: pollution from oil spills and destruction of estuary nursery and feeding grounds. Channeling and dredging have increased salinity in most of the estuary and marsh areas of Louisiana. Changes in salinity cause changes in flora, plankton, and overall habitat. Levee building for drainage and flood protection decreases the amount of freshwater runoff from land. This, in turn, leads to a depletion in nutrients necessary for plankton life (fish food). Straightening channels and bayous increases the flushing rate and turbidity of the stream or stops sheetwater flow, resulting in diminished wetland nutrients. Increased turbidity affects ability of many plankton species to float (Patrick, 1967).

Fish populations can be damaged in five major ways by oil spills:

Coating and exposure to hydrocarbon concentrations in excess of 0.1 ppm cause eggs and larvae to die;

Adult fish, especially anadromous fish, die or fail to reach spawning grounds if a spill occurs in a critical, narrow, or shallow waterway;

Contaminated spawning of nursery grounds causes loss of a local breeding population;

Table 3.1 Migratory Behavior of Coastal Fishes and Crustaceans (Source: Dames and Moore, 1975)

Month	Movement into Estuaries (or nearshore zone)	Movement from Estuaries
Jan.	Southern hake, red drum (peak)	Gulf menhaden, spadefish
Feb.	Stingray, brown shrimp post-larvae, Gulf menhaden, spade-fish	
Mar.	Gulf killifish, spot, cutlass-fish, hogchoker, butterfish, rough silverside, flounder, tonguefish	Blue catfish, sheepshead minnow, long-nose killifish
Apr.	Gafftopsail catfish, sea catfish, bluefish, bumper, sand seatrout, southern king-fish, shipjack herring (in and out same month), adult Atlantic croaker, black drum (peak), pinfish, Atlantic threadfin, toadfish, midshipman	Bighead searobin
May	Striped anchovy, lizardfish, sardine, Spanish mackerel, white shrimp postlarvae	Gulf menhaden, southern hake, brown shrimp juveniles
June	Needlefish, pompano, crevalle jack, leatherjacket, Atlantic moonfish	Butterfish
July	Ladyfish, lookdown	
Aug.		Ladyfish, Atlantic threadfin
Sept.		Adult Atlantic croaker, rough silverside

Table 3.1 Continued.

Month	Movement into Estuaries (or nearshore zone)	Movement from Estuaries
Oct.	Gulf menhaden, sheepshead minnow, bighead searobin	Sardine, bluefish, leatherjacket, Atlantic moonfish, sand seatrout, cutlassfish, Spanish mackerel
Nov.	Blue catfish, juvenile Atlantic croaker	Striped anchovy, gafftopsail, sea catfish, needlefish, pompano, crevalle jack, bumper, lookdown, pinfish, tonguefish, toadfish, midshipman, white shrimp juveniles
Dec.	Longnose killifish	Stingray, lizardfish, Gulf killifish, spot, southern kingfish, flounder, hogchoker

Productivity and spawning patterns are changed;

Local food species of adults, juveniles, fry, or larvae are affected (Council on Environmental Quality, 1974: 107, 109).

Moore and Dwyer (1974: 819-827) describe five ways individual organisms including birds respond to the effects of oil pollution. The first is direct lethal toxicity, resulting in death. Cellular and sub-cellular processes, especially membrane activity, are interfered with by the hydrocarbons released by crude oil. The most toxic of the hydrocarbons (the chemical components of petroleum) are the lower boiling point aromatics. These stay in the environment the longest. The larva and juvenile species are more sensitive to toxic matter than the adults. Adult marine organisms respond to lethal toxic levels from concentrations of soluble hydrocarbons in the 1 to 100 parts per million (ppm) range. Larval stages may be affected by levels as low as 0.1 ppm.

The second response is sub-lethal disruption of physiological or behavioral activities. Disruption of cellular and physiological processes does not include immediate death, though it may occur in the long-run. Feeding and reproduction of species are possibly affected.

Direct coating of oil is the third response. This can cause smothering of the species and/or interference with feeding and movement. Oil can also destroy the waterproofing and insulating properties of animals with feathers and fur.

Oil can be ingested as animals try to clean themselves. Bird mortality, as a result of direct oil coating, has been well-documented along the California coast.

The fourth response is the incorporation of hydrocarbons in food chains. This includes tainting of edible organisms,such as oysters and clams. Accumulation and concentration of polycyclic aromatic hydrocarbons are major concerns especially since this includes carcinogens.

The final response listed is changes in biological habitats, especially alteration of substrate characteristics. The substrate is the ocean floor material that supports plant or animal life. Species living passively on the substrate (not depending heavily on the substrate for support) may have little or no interference with their habitat. Flora and fauna living in the substrate or actively dependent on it may experience adverse effects (Council on Environmental Quality, 1974: 106). Although the quantity and types of oil that may prevent a species from utilizing a substrate are unknown, analysis of data indicates concentrations of 10 to 100 parts per billion (ppb) of low to medium boiling point aromatic hydrocarbons may interfere with the species' relationship to the substrate. Chemical sensing and communications upon which anadromous fishes depend will be interfered with by the presence of aromatic hydrocarbon derivatives in such concentrations (Council on Environmental Quality, 1974: 106-107).

3.3 -- THE SHRIMP INDUSTRY

Louisiana's most important fishery in dollar terms is shrimp. The catch for the years 1940 to 1974 ranged from 31 to 103 million lbs. (Table 3.2). Since trawling is performed over extensive acres of water, oil platforms do not affect the size of the shrimp catch. Of the several species caught in state waters, brown shrimp (*Penaeus aztecus*) and white shrimp (*Penaeus setiferus*) are the most important. During the 1958 to 1971 seasons, brown shrimp totaled 41% of the total Louisiana shrimp production. White shrimp, at one time, contributed 95% of the total offshore Louisiana catch. However, because of increased amounts of fresh water into estuary nursery grounds, where shrimp spend considerable time, there has been a decline in the catch since 1952 (Barrett and Gillespie, 1973). White shrimp spawn in the open Gulf during May through July (Figure 3.1). After that, the larvae return to bays and estuaries and mature to adults in the safety of nursery grounds. The adults then return to the Gulf in the early spring and live in waters less than 100 ft. deep (Viosca, 1957: 8-9).

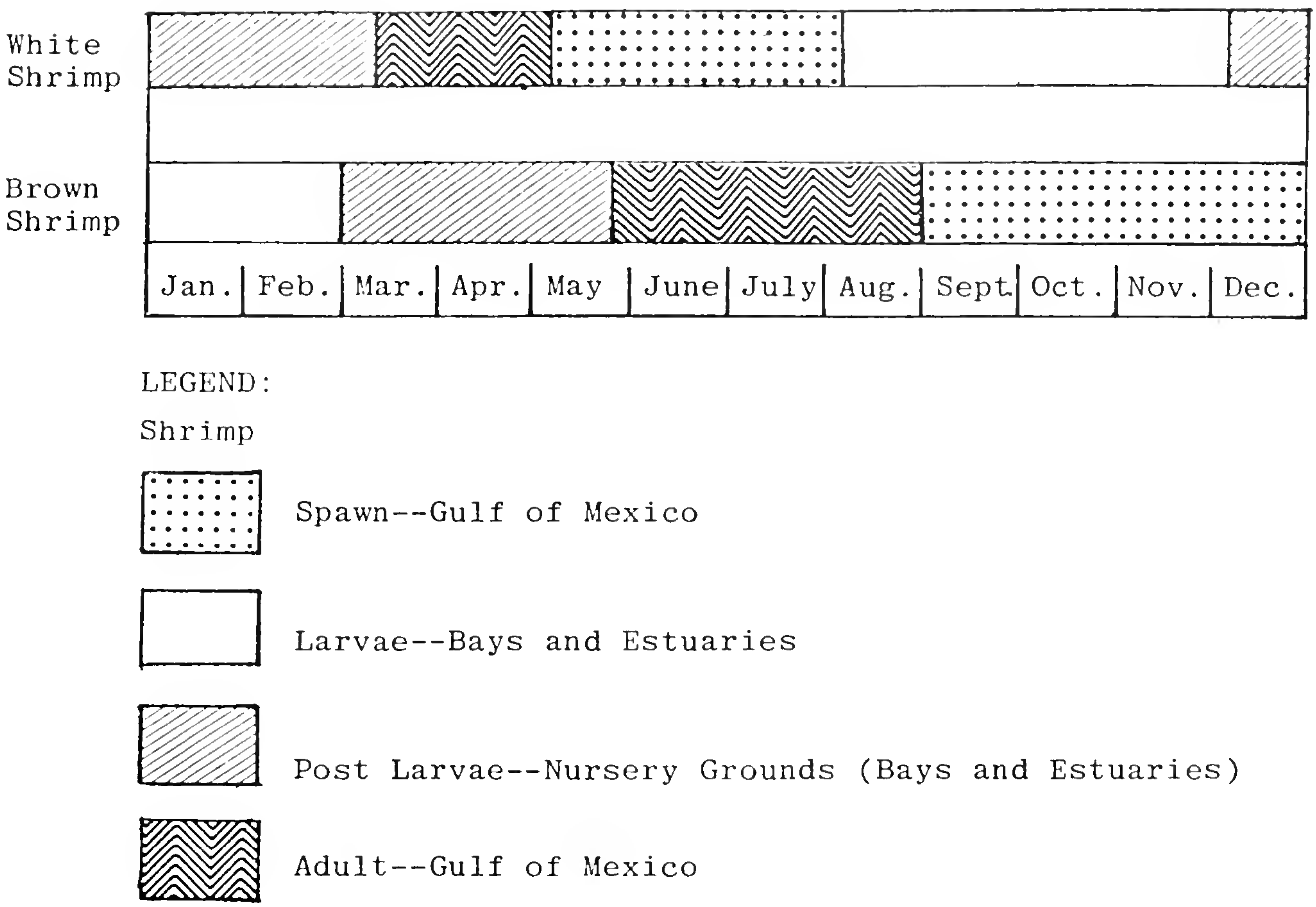
Table 3.2 Louisiana Shrimp Catch, 1940-1974 (Source: U.S. Department of the Interior, 1955-1969 and U.S. Department of Commerce, 1970-1974, 1975)

Year	Quantity (1000 lbs.)	Value Before processing (1000 $)
1940	90,820	3,645
1941*		
1942*		
1943*		
1944*		
1945	103,352	12,402
1946*		
1947*		
1948	79,966	16,827
1949	77,046	17,662
1950	70,630	14,696
1951	78,164	17,587
1952	75,854	15,722
1953	81,589	16,427
1954	77,709	15,451
1955	68,986	13,745
1956	56,886	15,316
1957	31,917	9,660
1958	39,760	13,080
1959	57,036	12,803
1960	61,758	15,881
1961	31,027	8,913
1962	43,585	14,985
1963	80,809	19,789
1964	59,382	18,794
1965	62,593	19,584
1966	62,276	24,390
1967	75,325	24,575
1968	67,768	25,623
1969	82,888	33,358
1970	90,948	34,614
1971	92,481	43,285
1972	83,035	47,066
1973	58,653	44,513
1974	59,591	32,206**

*Data not available for these years

**As it appears in source.

Figure 3.1 Seasonal movement of shrimp (Source: Dames and Moore, 1975).



Since fishermen have extended their trawling grounds into deeper Gulf waters, the brown shrimp has become more important than the white. Brown shrimp are associated with muddy substrates of peat and sandy mud. They bury themselves during the day and at night they feed in the Gulf's surface waters. Trawlers bring in their greatest catches during summer nights. Brown shrimp spawn in the open Gulf waters during fall and early winter. Larvae reaching the estuary nursery grounds remain until maturity when adults return to the open water in June (Figure 3.1). Brown shrimp are more tolerant of high salinities than white, 19 ppt (parts per thousand) being an optimum salinity (Barrett and Gillespie, 1973). Growth of the brown shrimp is dependent on moderate temperatures, 20 C or greater, and salinity near 19 ppt (White, 1975).

Estuarine nursery grounds provide shrimp with safety until they reach maturity. Plants, animals, and inorganic and organic detritus in the nurseries provide food for the shrimp. The estuarine nursery grounds are affected in two major ways by man's activities. First, changes in salinity and chemical composition of water are the results of channeling. Secondly, loss of vegetated marsh areas by channeling and dredging reduces the shrimp supporting capacity of the estuaries (McGinnis et al., 1972: 3-24).

Another problem which may affect the shrimp catch is the laying of pipelines. Pipelines laid in bays and offshore waters are either buried in the seabed or are eventually covered by the substrate (ocean floor material that supports plant or animal life). Occasionally, before pipelines are covered, or when they become uncovered by water current action, trawlers face navigational hazards. Nets could become caught and snagged on exposed lines. For the same navigational reasons, trawling is not performed near oil platforms. However, many people believe the pipelines do not interfere with overall yields. Willingham et al. (1974: 135) concluded "offshore pipelines...didn't appear to diminish yields of aquatic organisms." Many shrimpers say the best trawling areas are along underwater pipelines. Shrimp and other smaller fishes hide from predators and feed in the abundant growths of seaweed found on both sides of a pipeline (LaPlace, 1976).

The largest shrimp production areas are in Terrebonne and Lafourche Parishes with Barataria and Caminada Bays being the traditional center of brown shrimp production in Louisiana (Dames and Moore, 1975; White, 1975). Only slightly less important are Timbalier and Terrebonne Bays. These are areas with much OCS activity.

While shrimp catches are important, processing is a necessity to distribute the various shrimp products. Shrimp producers sell shrimp in several forms including fresh headless, fresh peeled, fresh heads-on, frozen peeled, frozen heads-on, frozen heads-off, canned and dried. The Louisiana Advisory Commission (1973: 187-188) recommends that the dockside value of commercial catches be multiplied by a factor of between 2.5 and 3.5 to obtain the total worth of production after value added in processing. Using a factor of 3, a catch of 59.5 million pounds in 1974 (Table 3.2) is valued at $32.2 million before processing and $96.6 million after processing.

3.4 -- THE OYSTER INDUSTRY

The Eastern oyster, <u>Crassostrea virginica Gmelin</u>, is the only commercially valuable oyster taken in Louisiana waters (Pollard, 1973). Although <u>Crassostrea virginica</u> may live in a salinity range of 10 to 30 ppt, it is usually found in salinities of 10 to 15 ppt. Large populations of the Eastern oyster inhabit lower salinities compared to many less tolerant oyster predators, such as the fungus <u>Dermocystidium marinum</u> and the conch (commonly called oyster drill) <u>Thais haemastoma</u>. These two predators cannot survive in a low salinity environment.

Dermocystidium marinum infects oysters usually during high temperature periods and in salinities above 10 ppt. Infection is usually lethal to the host oyster, but also may cause loss of weight, castration, and failure to grow normally. A change to a lower salinity achieved by fresh-water flushing of the estuary is believed to be the best way to rid the oyster bed of the fungus (Mackin, 1962).

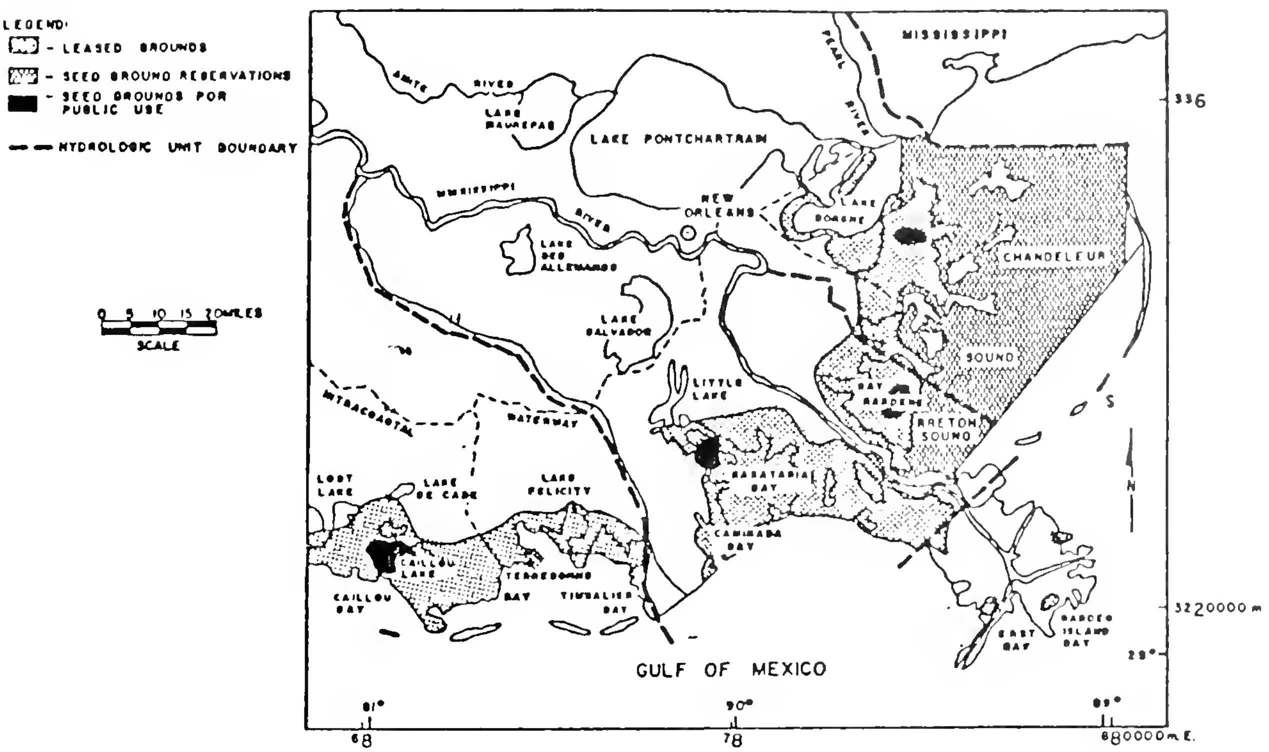
The conch *Thais haemastoma hayse* is common in the northern Gulf waters. *T. haemastoma* feeds on oysters and other mollusks by drilling holes in the shell or penetrating the shell from the edge by secreting enzymes that soften the mollusks' shell. The conch has a high reproductive rate and the larvae have a high survival rate. A salinity of 10 ppt or lower will prevent the conch from entering waters and exposure to a salinity of 7 ppt or lower for 1 or 2 weeks is known to kill it. *T. haemastoma* breeds in Louisiana during a period beginning no later than the end of March and ending in July. The conch's tendency to climb on rocks or structures above ground to attach its eggcases has led many oyster growers to erect stakes in the oyster grounds to trap the animal (Galtsoff, 1964: 433).

The majority of Louisiana's oyster production depends on "seed" oysters taken from state-managed seed grounds east of the Mississippi River and transported to private grounds for cultivation. Cultivating oysters has become more important in Louisiana with the depletion of natural oyster reefs. Some believe that the decline in productivity in the natural oyster reefs is due to overfishing more than the effects of salinity changes. Mackin and Hopkins (1962) define an oyster reef as "an area of not less than 500 square yards of the bottom of any body of water upon which oysters are found or have been found within a term of five years...in quantitites which would warrant taking them for profit by means of tongs." The largest natural oyster reef in Louisiana is the Point au Fer reef in the Atchafalaya Bay (Mackin and Hopkins, 1962).

The first seed plantings were tried in 1886 near the end of the Mississippi River delta with the Garden Island Bay oyster culture. Plantings were later begun below Quarantine Bay in an area known as the "Salt Works" (Mackin and Hopkins, 1962). Natural reefs were used to provide seed oysters. Oysters are dredged from the seed areas and transported to public and private leases for cultivation. Figure 3.2 shows the principal lease and seed grounds in southeast Louisiana.

Louisiana oysters tend to grow faster, spawn more abundantly, and have a larger population in salinities up to 30 ppt. The abundance of natural predators in higher salinities forces the oyster to keep to lower salinity waters. Mackin and Hopkins (1962) believe the best oyster producing areas are high salinity waters where freshets

Figure 3.2 Principal oyster producing areas in southeast Louisiana (Source: Dames and Moore, 1975).



(freshwater intrusions) drive out or kill predators. Oysters can withstand freshets by shutting their shells for long periods.

The oil industry has had two main effects on the oyster populations of Louisiana, one direct and another indirect. Oil pollution directly affects the commercial value of the oyster. Oysters are sessile (attached to the substrate) filter feeders. While feeding, they can ingest crude oil and concentrate it in their systems. The ingestion of oil does not affect their feeding process; however, an oily taste is imparted, making them.undesirable in markets. Over time, if the oil is dispersed, the oysters will eventually lose the oily taste. In a study done on the effects of an oil spill from a Mecom Oil Company well, Mackin and Sparks (1962) found that after 2 months, the oily taste had "probably disappeared" from a great number of the population in the most contaminated area (located in Grand Isle Block, Freeport Sulphur vicinity), because of the breakdown of the oil.

Salinity changes have been caused indirectly by the oil industry through channeling and dredging for access to offshore oil facilities. The increases in salt water allow the oyster predators to enter oyster grounds and often cause serious damage. Also, dredging that covers oyster beds or dislocates oysters from the substrate can cause destruction of the oyster reef.

The catch and value of oysters in Louisiana was tabulated for the years 1940 through 1974 (Table 3.3). In 1940, 12,412.1 thousand pounds of oysters were taken at a value of $694,875. In 1963, 11,463.2 thousand pounds of oysters were valued at $3,720,113 and in 1974, 9,971 thousand pounds were valued at $6,347,912. The 1968 catch was the largest catch at 13,122 thousand pounds and was valued at $5,305,000. The 1974 catch, after processing would be valued at over $19 million.

3.5 -- THE MENHADEN INDUSTRY

Since its beginning in Louisiana in 1948, the menhaden fishery has been an important commercial fishery in the state and recently is second only to shrimp. The dominant species caught is the Gulf menhaden (Brevoortia patronus). Industries use menhaden oil for manufacturing margarine and in a wide variety of industrial products and processes. Menhaden fish meal and solubles are used for agricultural purposes. Louisiana's menhaden catch has greatly increased since 1948, based on the market for the fish and unrelated to the oil industry (Table 3.4). The processed value would be over $118.5 million. The size of the menhaden purse-seine catch apparently is not affected by the presence of oil and gas platforms. Inshore, the degradation and loss of menhaden estuarine nursery areas are related to man's activities, such as dredge and fill and channelization.

Table 3.3 Louisiana Oyster Catch, 1940-1974 (Source: USDI, 1955 to 1969 and USDC, 1970 to 1974; 1975)

Year	Pounds (in thousands)	Unprocessed Value
1940	12,412.2	$ 694,875
1941*		
1942*		
1943*		
1944*		
1945	9,884.1	2,829,007
1946*		
1947*		
1948	9,016.3	3,157,393
1949	9,687.5	3,459,341
1950	8,715.4	2,842,603
1951	8,163.7	1,902,647
1952	11,401.6	3,075,141
1953	9,435.3	2,672,664
1954	8,361.1	2,350,270
1955	9,394.9	2,753,177
1956	10,056.1	2,238,034
1957	10,489.3	2,756,098
1958	8,264.8	2,425,917
1959	9,667.5	2,645,124
1960	8,310.8	2,303,997
1961	10,139.2	2,849,090
1962	10,160.3	3,316,554
1963	11,563.2	3,720,113
1964	11,401.1	2,976,152
1965	8,342.7	2,401,607
1966	4,764.0	2,156,000
1967	7,743.0	3,414,000
1968	13,122.0	5,305,000
1969	9,178.0	3,969,000
1970	8,639.0	3,631,000
1971	10,528.0	4,638,000
1972	8,805.0	4,457,000
1973	8,953.8	5,545,022
1974	9,971.2	6,347,912

*NOTE: Data not available for these years.

Table 3.4 Menhaden Catch for Louisiana (Source: USDI, 1955 to 1969 and USDC, 1970 to 1974, 1975)

Year	Catch (1000 pounds)	Unprocessed Value (in thousands $)
1948	88,110	*
1949	165,914	*
1950	207,755	*
1951	209,574	*
1952	283,373	2,765
1953	307,492	3,690
1954	270,094	3,727
1955	298,309	4,594
1956	320,521	4,840
1957	162,817	2,459
1958	241,813	3,627
1959	442,740	*
1960	470,108	*
1961	581,682	6,748
1962	689,157	7,994
1963	633,484	7,862
1964	599,538	9,046
1965	682,435	11,790
1966	555,852	9,558
1967	510,414	6,134
1968	622,291	7,740
1969	856,251	12,764
1970	959,810	18,931
1971	1,237,093	20,015
1972	928,252	15,279
1973	894,931	37,221
1974	1,079,304	39,539

*NOTE: Data not available for these years.

3.6 -- THE FUR INDUSTRY

O'Neil and Linscombe (no date) studied the fur industry of Louisiana and found that the state leads the United States in fur production, amounting to 40 to 65 percent of the nation's annual total harvest. Fur trapping began in Louisiana in the 18th century with the founding of New Orleans. Furs were transported to the city and shipped to all parts of the world. Mink, raccoon, otter and alligator were hunted in Louisiana coastal marshes during the 1800's. Burning of the marsh to make alligator habitats more accessible to hunters, and other factors such as salinity changes, caused alterations of the marsh vegetation. These man-induced changes to the marsh produced a favorable environment for the muskrat. During the early 1900's efforts were begun to trap muskrat in large numbers.

Nutria were first brought to Avery Island, Louisiana, in 1938 from Argentina by Mr. E. A. McIlhenny. During captivity, some nutria escaped and others were intentionally released. This resulted in the establishment of a sizeable population in south Louisiana by 1943. The presence of nutria has offset changes in marsh vegetation and has consequently caused the muskrat population to decline (O'Neil and Linscombe, no date : 23). The nutria is now Louisiana's most valuable fur animal. The Louisiana fur catch was tabulated for the 1974-1975 season (Table 3.5). After processing, its value was greater than $30 million (Louisiana Wildlife and Fisheries Commission, no date).

Table 3.5 Louisiana Fur Catch, 1974-1975 Season (Source: Louisiana Wildlife and Fisheries Commission, no date)

Category	Number of Pelts	Approximate Price to Trapper	Unprocessed Value
Muskrat (Eastern)	240,214	$ 3.25	$ 780,695.50
Muskrat (Western	60,000	4.50	270,000.00
Mink	32,319	4.50	145,435.50
Nutria (Eastern)	1,000,000	4.50	4,500,000.00
Nutria (Western)	502,617	5.50	2,764,393.50
Raccoon (Coastal)	70,000	4.00	280,000.00
Raccoon (Upland)	90,863	7.00	636,041.00
Opossum	30,447	1.50	45,670.50
Otter	6,118	25.00	152,950.00
Skunk	298	1.00	298.00
Fox	3,471	16.00	55,536.00
Bobcat	775	25.00	19,375.00
Beaver	276	5.00	1,380.00
Coyote	342	10.00	3,420.00
TOTAL PELTS	2,038,379		$9,655,195.00
Nutria Meat	9,000,000 lbs.	.09	$ 810,000.00
Muskrat Meat	250,000 lbs.	.09	22,500.00
Raccoon Meat	930,000 lbs.	.30	279,000.00
Opossum Meat	250,000 lbs.	.25	62,500.00
TOTAL MEAT	10,430,000 lbs.		$1,174,000.00
TOTAL PELTS AND MEAT			$10,829,195.00

Muskrat and nutria live in coastal marsh areas and have a diet consisting of three-cornered grass, salt meadow cord-grass, cattail bullwhip, alligator weed and other grasses. (Muskrat may also eat small amounts of fish, mussels, insects, and snails). Three-cornered grass (Scirpus oeneyi) is found in brackish marshes in dense, uniform stands often covering large areas. Marshes of three-cornered grass produce more than 80 percent of the muskrat catch and many of the nutria (McGinnis et al., 1972: 2.20).

Fur-bearing animals are affected in several ways by man's activities in the coastal zone. Habitat loss for fur animals consists of land disturbed by dredging and channeling operations and the resulting spoil banks. An indirect effect on habitat is the increased salinity in the marsh resulting from channeling. Salinity changes affect vegetation important to the animals, such as three-cornered grass (McGinnis, et al., 1972: 3.17-3.18). Channeling may also create migrational and home range barriers for animals. Crossing spoil banks will subject many animals to increased predatory vulnerability (McGinnis, et al., 1972: 3.18).

3.7 -- ENDANGERED SPECIES AND PROTECTED HABITATS

Several endangered species inhabit the Gulf Coast area and are susceptible to impacts from OCS development. These species include the brown pelican, red wolf, alligator, sea turtles, southern bald eagle, Mississippi sandhill crane, and whooping crane (USDI, 1976B: III-38 and Visual No. 4).

A small breeding colony of brown pelicans has been established on Queen Bess Island of the Grand Terre Islands (east of Grand Isle) and appear to be making a comeback. There are also two nesting rookeries along the Texas coast. The possible impacts of OCS activity on the brown pelican include the possibility of their feathers becoming contaminated with oil or their ingesting oil-contaminated food (USDI, 1976b: III-38).

The alligator inhabits the entire coastal area of the central Gulf. They are dependent on a well-established marsh habitat for their food supply and for nesting. An acute oil spill or pipeline break resulting in devegetation of a marsh may adversely affect alligators. The loss of alligator habitat is directly related to the time required for reestablishment of marsh vegetation (USDI, 1976b: III-38). In three Louisiana parishes (Calcasieu, Vermilion, and Cameron) the status of the alligator has been reduced from "endangered" to "threatened" Each year short hunting seasons are allowed in those parishes. In other parishes, they remain on the endangered list (Louisiana Wildlife and Fisheries Commission, 1977).

Sea turtles in the Gulf include the Atlantic ridley, hawksbill, and leatherback (USDI, 1976b: III-38). The turtles are susceptible to oil coating during a spill since they surface at 1 to 3 minute intervals while actively swimming and at least every 30 to 40 minutes when resting. (See Chapter 3 for the effects of oil spills on marine organisms.) Also, some mortality could result if spills reach nesting beaches. Nesting season lasts from late spring through summer and eggs or hatchlings, as well as adults, could be oiled during this period. Death of eggs could also occur through asphyxiation of embryos if the sand in which they are buried is covered with oil. Also, hatchlings are disoriented by lights. Therefore, young turtles attracted to lighted off-shore structures would be vulnerable to attack by predatory fishes known to concentrate around offshore platforms (Ogren 1977).

The red wolf inhabited the Coastal Prairie in southeast Texas and southwest Louisiana. This species may be extinct due to breeding with local canines. There have been no studies done concerning ingestion of crude oil by wolves or consumption of oil coated birds and fish. However, no direct impacts to the wolf from offshore leasing are anticipated (USDI, 1976b: III-38).

The southern bald eagle also maintains a fragile nesting population in some areas of Terrebonne and Jefferson Parishes in Louisiana,and in Brazoria, Galveston, Refugio, and Calhoun counties in Texas (USDI, 1976b: Visual No. 4). These are not expected to be impacted by future lease sales (USDI, 1976b: III-38).

The Mississippi sandhill crane has a small population on the coast of Jackson County, Mississippi (USDI, 1976b: Visual No. 4), but since there is no OCS activity in that vicinity (and none is expected in the near future) they are not threatened by oil spills from OCS development.

Whooping cranes exist in Aransas and Calhoun counties in an area designated as "critical" to their survival by the U.S. Fish and Wildlife Service (USDI, 1976b: Visual No. 4). However, potential OCS impacts on this are are unknown.

A number of protected habitats may be affected by OCS activity (Table 3.6). However, no impacts on these areas are expected other than as discussed in this chapter.

3.8 -- ROLE OF OIL RIGS IN SPORT FISHING

Deep-sea sport fishing in Louisiana increased dramatically with the advent of the offshore oil industry. As a result of man's search for oil, numerous platforms were established throughout the Gulf (Chapter 1). These platforms act as artificial reefs, providing protection, food sources, spawning sites, and spatial orientation markers for fishes (USDI, 1976a). Almost immediately after being placed in the water, the legs and templates of the platforms become covered with algae, which can thrive on steel or rubber in water near the surface, forming artificial reefs. Attached algae grow readily on the platform structures in the upper layers of deep Gulf waters; in shallow water, strong currents hinder the establishment of algae.

Growth of algae is followed by occurrences of organisms that attach themselves to the platform structure. Barnacles, bryozoa, coral, tunicates, hydrozoans, mollusks and worms are found growing on the platform frame. Many of these

Table 3.6 Protected Habitats on National Wildlife Refuges (U.S. Department of the Interior, 1976b)

NAME OF AREA	COUNTY LOCATION	HECTARES
Louisiana		
Delta-Breton	Plaquemines-Offshore	21,573
Lacassine	Cameron	12,856
Sabine	Cameron	57,809
Shell Keys	Offshore	20
Texas		
Anahuac	Chambers	4,023
Brazoria	Brazoria	3,857
San Bernard	Brazoria	6,038
Aransas	Aransas	22,190
Laguna Atacosa	Cameron	18,272
Mississippi		
None		
Alabama		
None		
State Wildlife Management Areas and Preserves		
Louisiana		
Pearl River	St. Tammany	10,812
St. Tammany	St. Tammany	526
Biloxi	St. Bernard	16,019
Bohemia	Plaquemines	6,475
Pass-A-Loutre	Plaquemines	26,710
Wisner	Lafourche	8,750
Salvador	St. Charles	11,129

Table 3.6 Continued.

NAME OF AREA	COUNTY LOCATION	HECTARES
Louisiana Cont'd		
Pointe au Chien	Lafourche	11,430
Rockefeller	Cameron	33,185
Louisiana State	Vermilion	6,070
Marsh Island	Iberia	31,971
Manchac	St. John the Baptist	2,129
Texas		
J. D. Murphee	Jefferson	3,401
Sheldon	Harris	1,013
Las Palomas		283
Longoria Unit	Cameron	
Voshell Unit	Cameron	
Fredricks Unit	Willace	
Alabama		
Rob Boykin	Mobile	9,600
Mississippi		
Red Creek	Harrison, Jackson, Stone and George	N/A
Wolf River	Pearl River	N/A

types of animals not only need shallow, warm and sunlighted waters, but require waters of salinities less than 36.0 ppt (oceanic). The surface waters of the Gulf are less saline than the deeper waters.

Small fishes are attracted to the platforms for two important reasons: to initially feed on the sea life attached and to hide from larger prey. Larger fishes follow the smaller individuals in search of food and therefore tend to concentrate around the platforms.

The large concentrations of fishes that gather at the "artificial reef" sites also include many species that were unknown in Gulf waters before the platforms were built. This is not to say these species were not there before, only that the presence of "artificial reefs" concentrates the fishes that were before scattered over a larger area. Many of these fishes are sport fish, including resident fishes (living year-round in the vicinity of platforms) and seasonal migrants (coming in with warmer weather). Resident fishes include the following: groupers, red snapper, trigger fish, Atlantic spadefish, sea basses and pompanos. Seasonal migrants include Spanish and king mackerel, tarpon, ladyfish and several species of jack, bluefish and cobia. Marlin, sailfish, wahoo, tunas, sharks, skates and rays are also found (U.S. Department of the Interior, 1972).

Conflicts arise between commercial and sport fishermen and many commercial fishermen feel that sport fishermen are taking a large portion of the potential catch in such species as bass and flounder from the commercial fishermen (McHugh, 1967). A 1970 estimate of 60.4 million lbs. for the sport catch in Louisiana is 6 percent of the commercial fish catch of the same period. However, this proportion is comparatively small. In Massachusetts, it has been estimated that the sport catch is 14 percent of the commercial catch (Mumphrey, et al., 1975: 108). Many researchers fear that the taking of fishes concentrated around platforms will deplete fish stocks in the Gulf (St. Amant, 1972). St. Amant, however, (Treadway, 1976) has said that there is no evidence showing that fish stocks in the Gulf are in danger or that the fish population is being depleted by either commercial or sports fishermen. Sport fishes are affected by the oil industry in the same way as commercial fishes. See earlier section of this chapter. Many sport and game fishes gather around offshore platforms for feeding and protection. Their mobility allows them to escape the effects of oil spills by moving into deeper water; however, those fishes whose nursery grounds are in contaminated estuaries face greater problems.

The habitats of birds and onshore animals are affected by the oil industry as discussed earlier in this chapter. The natural areas of the wetlands are sometimes spoiled by the oil industry for the enjoyment of people in their outdoor activities. Therefore, the oil industry may impact hunting, fishing, camping, water sports, etc. both through pollution (oil spills) and disruption of the natural setting.

3.9 -- SUMMARY

The major environmental stresses resulting from OCS development include the following:

> The impacts of channelization and urbanization on the wetlands.
>
> The threat of pollution from oil spills.
>
> The aesthetic and obstructive effects of the placement of platforms and pipelines throughout the Gulf of Mexico.

Since the Louisiana coastal zone consists largely of wetlands, channelization and dredging are often necessary to provide access to offshore rigs and to construct pipelines. Such action results in interfering with sheet water flow, changing salinities, and increasing erosion. The urbanization induced by OCS development results in loss of wetlands valuable to the ecosystem through draining and filling them for urban uses; and pollution from urban runoff, industry, and pesticides.

The second major impact is the threat of oil spills. Oil may be spilled as a result of well blowouts, pipeline leaks, barge or tanker accidents, and the discharge by ships of wastewater containing oil into the Gulf.

The numerous platforms and pipelines throughout the Gulf also have an impact. While the platforms have a positive impact on sports fishing, they have a negative aesthetic impact. In addition, pipelines, when they are not buried (or when they are buried but subsequently uncovered by water current action), and platforms interfere with the operations of commercial fishermen.

3.10 -- CONCLUDING OBSERVATION

Concerning the implications of this discussion on the as yet undeveloped OCS areas such as offshore Mississippi-Alabama-Florida, it should be noted that subsequent to an announcement of future leasing, an environmental evaluation program must be initiated by the Bureau of Land Management. The first phase of the evaluation program consists of gathering baseline data before any development activity. After the lease sale, and concurrent wiht development activities, a program of environmental monitoring is developed. However, these programs concern only the federal OCS areas (offshore). Only limited study has been done concerning the impacts of offshore oil and gas production on nearshore waters and onshore wetlands, but it is this region where the greatest potential for environmental damage exists. It is within these nonfederal areas that maximum natural productivity exists, and where the ecosystem is considerably more vulnerable and fragile than the federal areas further offshore. Since the source of potential damage to these areas is due to development activities on Federal lands and the revenues derived from such activity accrues solely to the Federal government, a good case can be made for at least a moral obligation on the part of the Federal government to evaluate and monitor the environmental condition of these areas (Jones, no date: 2-4). A 1976 amendment to the Coastal Zone Management Act -- Section 308 entitled "Coastal Energy Impact Program" -- provides Federal funds to states for preventing, mitigating, or rectifying the adverse environmental or recreational impacts of coastal energy activities on the states' coastal zones.

The groups and organizations concerned with or having an interest in the environmental effects of offshore oil and gas development (direct and induced effects) are the following (Mumphrey, et al., 1976b):

Federal Agencies

U.S Army Corps of Engineers
New Orleans District Office
Colonel Early J. Rush III
Robert Buisson, Environmental Section
Charles Decker, Permitting Section
P.O. Box 60267
New Orleans, Louisiana 70160 504-865-1121

U.S. Coast Guard
Captain of the Port, Marine Environmental Protection Department
Lieutenant H.N. Young
Paul Dicharry, Environmental Impact
4640 Urquhart Street
New Orleans, Louisiana 70117 504-527-7171

U.S. Department of Commerce
National Marine Fisheries Service (NMFS)
Environmental Assessment Division
Galveston, Texas

Southeast Regional Office:
William H. Stevenson
Duval Building
9450 Gandry Boulevard N.
St Petersburg, Florida 33702 813-826-3141

New Orleans Office:
Edward J. Barry, Marketing News Reporter
Orville M. Allen, Fisheries Statistics
546 Carondelet Street
New Orleans, Louisiana 70130 504-589-6151

Panama City Laboratory 904-234-6541
P.O. Box 4218
Panama City, Florida 32401

U.S. Department of the Interior
Bureau of Land Management
New Orleans Outer Continental Shelf Office
John Rankin
Hale Boggs Federal Building
500 Camp Street - Suite 841
New Orleans, Louisiana 70130 504-589-6541

U.S. Geological Survey
Gulf of Mexico-OCS Operations
3301 N. Causeway Blvd. - Suite 336
Metairie, Louisiana 70004 504-837-4720

Bureau of Outdoor Recreation
John Crutcher, Director
Washington, D.C. 20240 202-343-5741

Fish and Wildlife Service (FWS)
Division of Law Enforcement
546 Carondelet Street, Room 100
New Orleans, Louisiana 70130 504-589-2334/504-589-2692

Regional Director, (FWS) 404-881-4671
Atlanta, Georgia

Ecological Services 904-769-5430
P.O. Box 4646
Panama City, Florida 32401

Ecological Services (FWS) 318-234-4833
Lafayette, Louisiana

U.S. Environmental Protection Agency
Lower Mississippi River Facility
NASA/NSTL Station, Mississippi 39529
Thomas F. Beckers
P.O. Drawer N
Slidell, Louisiana 70458 504-688-2265
New Orleans, Louisiana 504-822-4190 x2265

U.S. Environmental Protection Agency
Environmental Monitoring Support Laboratory
Las Vegas Land and Water Quality Field Investigation
James Butch, Director
6130 Renoir Drive
Baton Rouge, Louisiana 70815 504-924-1381

State Agencies

Louisiana Conservation Department (Oil and Gas Only)
Benjamin F. Walsh, Manager
William Clark, District Engineer
325 Loyola Avenue
New Orleans, Louisiana 70112 504-527-8404

Louisiana Department of Community Development
Donna Irvin
300 Louisiana Avenue
Baton Rouge, Louisiana 70815 504-389-5664

Louisiana State Attorney General
Environmental Protection Unit
Richard Troy
234 Loyola Avenue, Seventh Floor
New Orleans, Louisiana 70112 504-527-8375

Louisiana Department of Parks, Culture and Tourism
Sandra Thompson, Secretary
P.O. Drawer 1111
Baton Rouge, Louisiana 70821 504-389-5761

Bureau of Outdoor Recreation
Gilbert C. Lagasse, Liaison Officer
W. Edwin Martin, Executive Assistant
625 North Fourth Street
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Louisiana Stream Control Commission
Robert A. Lafluer
P.O. Drawer FC
Baton Rouge, Louisiana 70803 504-389-5300

Louisiana Wildlife and Fisheries Commission
J. Burton Angelle, Director and Secretary
Lyle St. Amant, Assistant Director
400 Royal Street
New Orleans, Louisiana 70130 504-527-5126

Offshore Terminal Authority (Superport)
Shepard A. Perrin
International Trade Mart
New Orleans, Louisiana 70130 504-527-5126

Citizen Interest Groups

Audubon Society, Orleans Chapter
Frank P. Fischer, President
2720 Octavia Street
New Orleans, Louisiana 70115 504-482-9701

Barry Kohler, Conservation Chairman
346 Audubon
New Orleans, Louisiana 70118 504-861-8465

Cliff Danby
4843 Gabriel Drive
New Orleans, Louisiana 70127 504-242-4695

Ecology Center of Louisiana, Inc.
Ross Vincent, President
John Hammond, Vice-President
111 South Hennessey Street
New Orleans, Louisiana 70119 504-581-2287
Mailing Address: P.O. Box 19344
New Orleans, Louisiana 70179

Fund for Animals
Sydney Rosenthal
4141 Veterans Memorial Boulevard
Metairie, Louisiana 70002 504-887-9222

Louisiana Chapter, American Institute of Planners
Anthony J. Mumphrey, Jr., President
Urban Studies Institute
University of New Orleans
New Orleans, Louisiana 70122 504-288-3161 x277

Louisiana Nature Center, Incorporated (educational)
Gary Schadle, President
One Shell Square, Suite 4100
New Orleans, Louisiana 70139 504-581-7017

Louisiana Wildlife Federation
Executive Director
P.O. Box 16089
Louisiana State University
Baton Rouge, Louisiana 70803 504-355-1871

Save Our Wetlands, Inc.
Luke Fontana
4821 Prytania Street
New Orleans, Louisiana 70115 504-897-0772

Sierra Club of New Orleans
Mrs. Joan Phillips, President
922 Octavia Street
New Orleans, Louisiana 70115 504-482-9701

Commercial Fishing/Trapping

American Shrimp Canners Association
Anthony Cuccia, President
Cutcher Canning Company, Inc.
128 Sala Avenue
Westwego, Louisiana 70094 504-341-3439

Louisiana Oyster Dealers and Growers Association
Peter G. Vujnovich
2105 Decatur Street
New Orleans, Louisiana 70112 504-949-5443

Louisiana Shrimp Association
1405 Jefferson Highway
Jefferson Parish, Louisiana 70123 504-834-2687

Sport Fishing, Hunting, and Outdoor Recreation

Ducks Unlimited, New Orleans Area
Ed Gueydon, President
Suite 1313
Pere Marquette Building
New Orleans, Louisiana 70122 504-581-2355

New Orleans Sportsmen's League (Orleans Parish)
Captain Lloyd A. Moreau, President
5420 Chamberlain Drive
New Orleans, Louisiana 70122 504-282-7187
Permanent Address of Club:
P.O. Box 30245
New Orleans, Louisiana 70190

Oil and Gas Producers

American Petroleum Institute
2101 L Street, N.W.
Washington, D.C. 20037 202-457-7000

Louisiana Association of Independent Producers and Royalty Owners
Gilbert J. Sevier
Pere Marquette Building
New Orleans, Louisiana 70112 504-523-5764

Mid-Continent Oil and Gas
111 Thompson Building
Tulsa, Oklahoma 74103 918-582-5166
Vernon Dowdy, Louisiana Representative
Fidelity Bank Building, Suite 519
Baton Rouge, Louisiana 70801 504-387-3205

Petroleum Club of New Orleans
925 Common Street
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Clarence W. Coffey, Sr., President
Chevron Oil
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New Orleans, Louisiana 70112 504-521-6311

Offshore Operations Committee
P.O. Box 50751
New Orleans, Louisiana 70150
C.E. Galay
1111 Tulane Avenue
New Orleans, Louisiana 70112 504-521-6584

Commercial and Industrial Interests

Chamber of Commerce of Greater New Orleans
William G. McCullum, Chairman
Christopher Laborde, West Bank
Elias McColloster, Environmental Issues (x245)
301 Camp Street
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Economic Development Council of the New Orleans Area
Tom Purdy, Director
Clement A. Cole, Manager, Industrial Development Department
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301 Camp Street
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CHAPTER 4

SOCIO ECONOMIC IMPACTS

4.1 -- OCS DEVELOPMENT EFFECTS

Past and Present

The offshore oil and gas industry has had a substantial impact on the economy of the coastal areas of Louisiana and Texas. It has also had considerable impact on the financial condition of the state and local governments. Factors concerning the impact of the offshore industry on the economy of Louisiana are outlined in Table 4.1. A breakdown of the types of direct employment associated with the offshore industry and the number of individuals in each category appear in Table 4.2 Total direct employment (38,000) in OCS oil and gas industry was about 5 percent of the 1971 total employment in Louisiana (800,000). Total direct employment and indirect employment (other industry supporting the direct employment) was almost 15 percent of the total employment in 1971.

The population growth of several communities in the Louisiana coastal zone that have been affected by OCS development has increased substantially (Table 4.3). This additional population requires government expenditures for services such as airports, roads, schools, police protection, medical facilities, recreational facilities, utilities, etc. It has been estimated that, for the year 1972, the total number of employees (direct and indirect) associated with OCS development and their

Table 4.1 Impact of the Offshore Oil and Gas Industry on the State of Louisiana, 1948-1971 (Source: American Petroleum Institute, 1973)

1. People directly and indirectly employed as a result of the existence of the offshore oil industry in 1971

Direct	
Number	38,000
Annual Income	$381,000,000
Indirect	
Number	76,000
Annual Income	$418,000,000
Total	
Number	114,000
Annual Income	$799,000,000

2. Capital expended to find, develop, produce, transport and process offshore oil and gas

Period 1948-1971	$9,390,000,000
1971	807,000,000
1971 - Daily Rate	2,200,000

3. Capital expended which stayed within the State of Louisiana to find, develop, produce, transport, and process offshore oil and gas

Period 1948-1971	$5,500,000,000
1971	482,000,000
1971 - Daily Rate	1,300,000

4. Operating and maintenance expenses for producing, transporting, and processing offshore oil and gas

Period 1948-1971	$2,600,000,000
1971	376,000,000
1971 - Daily Rate	1,000,000

5. Operating and maintenance expenses which stayed within the State of Louisiana for producing, transporting, and processing offshore oil and gas

Period 1948-1971	$2,080,000,000
1971	301,000,000
1971 - Daily Rate	800,000

Table 4.1 Continued.

6.	Cumulative Industry Impact on the Economy of Louisiana (3 + 5)	
	Period 1948-1971	$7,580,000,000
	1971	783,000,000
	1971 - Daily Rate	2,100,000
7.	Louisiana payroll from indirect employment as a result of offshore oil industry (See 1 above)	
	Period 1948-1971	$4,020,000,000
	1971	418,000,000
	1971 - Daily Rate	1,200,000
8.	Total direct and indirect impact of offshore oil industry on State of Louisiana (6 + 7)	
	Period 1948-1971	$11,600,000,000
	1971	1,201,000,000
	1971 - Daily Rate	3,300,000

Table 4.2 Service Company Personnel Employed in Offshore Oil and Gas Industry in Louisiana, 1971 (Source: American Petroleum Institute, 1973)

Production	8000
Fabrication Yards for Offshore Platforms	6000
Derrick Barge	1400
Deep Sea Divers	500
Boat Transportation	2800
Helicopter and Float Planes	950
Oil Barges	170
Drilling Rigs	4000
Workover Rigs	1320
Production Equipment Fabricators	2000
Caterers	1500
Drilling Mud	870
Directional	120
Seismic	600
Contract Maintenance	1000
Government Employees	350
Pipeline Companies	300
Pipeline Contractors	300
Supply Company	450
Wellhead Suppliers	400
Tool Companies	900
Service Companies	1000
Miscellaneous	3070
TOTAL	38000

Table 4.3 Population in OCS-Impacted Louisiana Communities, Various Years (Source: U.S. Department of Commerce, Bureau of the Census, 1967, 1972)

CITY	PARISH	1950	1960	1970
Larose	Lafourche	1,286	2,796	4,267
Thibodaux	Lafourche	7,730	13,403	15,028
Houma	Terrebonne	11,505	22,561	30,922
Morgan City	St. Mary	9,759	13,540	16,586
Berwick	St. Mary	2,619	3,880	4,168
Patterson	St. Mary	1,938	2,923	4,409
Franklin	St. Mary	6,144	8,673	9,325
Jeannerette	Iberia	4,692	5,568	6,322
New Iberia	Iberia	16,647	29,062	30,147
Lafayette	Lafayette	33,541	40,400	68,908
Rayne	Acadia	6,485	8,634	9,510
Crowley	Acadia	12,784	15,617	16,104
Lake Charles	Calcasieu	41,272	63,392	77,998
Sulphur	Calcasieu	5,996	11,429	14,959

dependents was 390,990. The cost of governmental services for this number of people was estimated to be $265 million. Approximately 40% of this amount is borne by individual taxpayers and 60% by corporations (Gulf South Research Institute (GSRI), no date: 46). OCS operations beyond the 3-mile limit are outside the state's jurisdiction so no tax revenues are available from these activities to Louisiana. However, the state and local governments must still provide onshore services to the OCS corporations, employees, and employees' dependents. Since the tax revenue to support these services is not available, the costs must be borne by others.[1] Therefore, most of the funds to support the $265 million in government services came from sources not directly related to OCS activity.

The taxes collected from the offshore industry (operations within the 3-mile area of state jurisdiction) and the taxes foregone (operations beyond the 3-mile limit) for the years 1965-1972 are described in Table 4.4. In 1972, at least $144.4 million in taxes was foregone. The Louisiana Department of Revenue estimates $183.5 million foregone when they include income, corporate franchise, sales and use, and occupational license taxes foregone in addition to the severance, ad valorem, and miscellaneous taxes included in the table (GSRI, no date: 42-43). Had this amount been available and added to the approximately $33 million collected (totaling $216 million), the $265 million

---

[1]By comparison, Texas' seaward jurisdiction extends 10.5 nautical miles providing more potential taxes.

Table 4.4 Selected Taxes Collection from Offshore and Foregone from Outer Continental Shelf (1965-1972) (Source: Gulf South Research Institute, no date)

Year	Severance Taxes		Ad Valorem Taxes		Miscellaneous Taxes	
	Collected	Foregone	Collected	Foregone	Collected	Foregone
1965	$ 13,489,160	$ 50,157,750	$ 1,131,875	$ 3,332,561	NA*	$ 4,840,000
1966	15,758,691	63,103,993	1,267,709	3,849,400	NA	5,252,000
1967	18,458,854	74,343,831	1,386,771	4,163,106	NA	5,960,000
1968	21,798,110	90,350,636	1,397,230	4,497,553	NA	6,256,000
1969	23,039,837	105,102,868	1,515,070	5,396,734	NA	6,600,000
1970	25,617,228	123,515,864	1,834,345	8,286,711	NA	6,944,000
1971	25,679,138	131,728,474	1,811,754	9,513,196	NA	7,100,000
1972	30,963,365	127,209,836	1,841,572	9,811,094	NA	7,340,000

*NA = Not Available. Most taxpayers do not separate inland and offshore sources of tax in their reports.

in governmental services would have been just about funded directly through OCS activity.[2] Taxes could have then been reduced or this amount could have been available to provide more services.

The situation in Texas is similar, but not as severe due to the relatively lower level of OCS operations in that state. In 1974, an attempt was made by the State of Texas to estimate the future impact of OCS production resulting from Federal lease sales made and scheduled through 1975. The estimated annual impact of OCS production in the Federal area of jurisdiction on employment and government revenues was tabulated (Table 4.5).

The 1970 Census of Population indicates that in 1970 there were 2.58 people for every person employed in Texas. Therefore, the total population associated with the 69,034 employees related to offshore production was estimated to be 177,961. In fiscal year 1971-72, the cost of providing state and local government services in Texas was $622 per capita. Thus, the total expenditures by state and local governments to provide necessary services to 177,961 people is approximately $111 million per year. Since the annual revenues of state and location governments is expected to be only $48.9 million, offshore production in the Federal areas of jurisdiction is projected to result in a net cost to state and local governments of $62 million per year (Grubb and McCray, 1974: 7-8).

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[2]This does not include personal income taxes generated by OCS employment.

Table 4.5 Estimated Annual Impact on Employment and Government Revenues in Texas Resulting from the Estimated Annual Production from the Current and Proposed Federal Leases Offshore Texas, through 1975, 1970 Constant Dollars (Source: Grubb and McCray, 1974)

FACTOR	DIRECT	INDIRECT	TOTAL
Employment (number)	10,093	58,941	69,034
Government Revenues (mil. dol.)			
Federal	305.3	138.5	443.8
Taxes	99.5	138.5	238.0
Royalties	205.8	0	205.8
State and Local	0	48.9	48.9

Future

OCS development has had a significant impact on the economy of the Gulf Coast area (particularly Louisiana) since the first offshore well was completed in 1947. However, the states collect no direct revenue from activity in the Federal areas of jurisdiction, as previously discussed. In light of this fact, the general attitude of public officials in Louisiana is that they will welcome future OCS activity because the economy is dependent on it and there is nothing to replace it. However, since the Federal government derives all the tax revenues from OCS activity (beyond the state area of jurisdiction), the state and local governments must provide many of the services required by the OCS industry and its workers. Government officials would like Federal assistance (in the form of cash grants, not loans) in providing services to deal with OCS impacts (past and present, as well as future.)

This attitude is expressed in comments of state officials about the proposed regulations for financial assistance to coastal states of the national Coastal Energy Impact Program (U.S. Department of Commerce, 1976: 46724-46740). As they are presently written, the proposed regulations would force Louisiana and some other states to apply for Federal loans (to be repaid with interest) instead of receiving outright cash grants for the onshore effects of OCS drilling. Cash grants would be available to newcomer states with OCS activity and for the impact on coastal recreational areas affected by stepped up drilling. Louisiana Governor Edwin Edwards commented that "several provisions of the regulations are not in accord with Congressional intent" to reimburse the coastal areas for OCS development. He went on to say, "the proposed regulations are too biased toward frontier areas, with little consideration for states with long histories of OCS activity". Louisiana Attorney General William J. Guste, Jr., speaking as a representative of the National Association of Attorneys General (chairman of its offshore development committee) also urged that the funding mechanism of the proposed regulations be changed, allowing all coastal states easier access to direct federal grants. U. S. Representative David Treen (R-La.) also believes that the regulations are "not in accord with the intent of Congress" and he intends to introduce an amendment to the present Coastal Zone Management Act that would make it easier for Louisiana to obtain cash grants, instead of federal loans, to pay for roads, schools, and other facilities needed to service the firms and individuals that work on the OCS (Anderson, 1976).

Since OCS production in the Gulf of Mexico has passed its peak, the major development effects in the future will come as a result of the construction of the LOOP and Seadock superport projects. As pointed out earlier (Chapter 2), Seadock will have little effect on refining and petrochemicals in Texas because of projected excess capacity in these industries (Perrin, 1976). Existing refining and petrochemical capacity in Southeast and Southwest Louisiana and projected capacity through 2010 due to the Louisiana and Texas superports are analyzed in Table 4.6. Refining and petrochemical capacity is expected to increase significantly to more than double its present capacity. Employment is expected to grow as a result of the operation and construction of the Louisiana Superport facilities and the refineries and petrochemical plants affected by both the Louisiana and Texas Superports (Table 4.7). As can be seen, the most significant impact is expected to occur in the River Parish area (including St. James, St. John, St. Charles, Assumption, and Tangipahoa parishes). One reason for the considerable impact here is that 3 of the 4 new refineries projected to result from superport construction are expected to locate here (H.J. Kaiser Company, 1976: 93). It should also be noted that although there are no refineries or petrochemical plants in the Lafourche area and none are expected to be built there. The onshore facilities of the Louisiana

Table 4.6 Existing and Projected Refining and Petrochemical Capacity in Southeast and Southwest Louisiana (Source: H.J. Kaiser Company, 1976)

AREA	TOTAL CAPACITY 1975[1]	1980	1990	2010
Louisiana Superport				
Baton Rouge Area				
Refining (MB/D)	481.0	496.0	571.0	846.0
Petrochemical (BP/Y)[2]	30.3	30.7	35.2	58.9
River Parish Area				
Refining (MB/D)	420.5	837.5	1,326.5	1,451.5
Petrochemical (BP/Y)	8.6	14.8	32.7	38.6
New Orleans Area				
Refining (MB/D)	404.5	499.5	574.5	674.5
Petrochemical (BP/Y)	4.2	5.0	6.8	9.6
Subtotal, Louisiana Superport				
Refining (MB/D)	1,306.0	1,833.0	2,472.0	2,972.0
Petrochemical (BP/Y)	43.1	50.5	74.7	107.0
Texas Superport				
Calcasieu Area				
Refining (MB/D)	351.0	878.5	455.5	532.5
Petrochemical (BP/Y)	11.2	11.6	14.0	18.2
TOTAL				
Refining (MB/D)	1,657.0	2,211.5	2,927.5	3,504.5
Petrochemical (BP/Y)	54.3	62.1	88.7	125.2

[1] Based on a survey of existing plants.

[2] BP/Y = billion pounds per year.

Note: This table does not include refining and petrochemical capacity growth not directly related to Superport development.

Table 4.7 Projected Total Employment Growth in Southeast and Southwest Louisiana Attributable to Superport Projects (Source: H. J. Kaiser Company, 1976)

AREA	TOTAL EMPLOYMENT GROWTH 1980	1990	2010
Louisiana Superport			
Baton Rouge Area			
Direct Employment Gain*	314	1,715	7,920
Total Employment Gain	604	3,435	16,570
River Parish Area			
Direct Employment Gain*	6,519	11,151	11,897
Total Employment Gain	12,609	22,311	24,887
New Orleans Area			
Direct Employment Gain*	1,253	1,599	2,257
Total Employment Gain	2,423	3,199	4,717
Lafourche Area			
Direct Employment Gain**	315	815	315
Total Employment Gain	615	1,635	665
Subtotal, Louisiana Superport			
Direct Employment Gain	8,401	15,280	22,389
Total Employment Gain	16,251	30,580	46,839
Texas Superport			
Calcasieu Area			
Direct Employment Gain*	423	1,339	2,406
Total Employment Gain	788	2,574	4,838
TOTAL			
Direct Employment Gain	8,824	16,619	24,795
Total Employment Gain	17,039	33,154	51,677

* Employment in operation and construction of refineries and petrochemical plants.

** Employment in operation and construction of Louisiana Superport facilities.

Superport will be located in Lafourche, so employment will increase there as a result of the construction and operation of these facilities, peaking in 1990.

4.2 -- PUBLIC INTEREST AND ATTITUDE

Of course, the area of greatest OCS development impact on the Gulf Coast is the coastal zone of Louisiana. Surveys have shown that people generally are aware that the coastal zone is important to Louisiana. As might be expected, awareness of environmental problems increases with higher levels of education and income, and among those living in urban areas (Patterson and Pinhey, 1976). A recent survey by Lindsey et al. 1976) shows that well over half of Louisiana residents (58.6%) feel that Louisiana benefits more from its coastal zone than other states benefit from their coastal areas. In addition, 83 percent feel that swamps and marshland have value for various reasons (Table 4.8). As shown in the table, ecological productivity is the most often cited reason with fishing and oil and gas activities second and third, respectively. When asked about the most important economic activity in the coastal zone, both present and future, Louisianians felt that mineral extraction and commercial fishing were identified as first and second in importance with water transportation a distant third. It is interesting to note that among residents of the coastal zone, a greater percentage perceive that mineral extraction will be the most important economic activity in the future than believe that it is the most important activity now, and that

Table 4.8 Interviewees' Opinions Regarding the Value of Marshland and Swamps, by Residence (Source: Lindsey et al., 1976)

Opinion As to Value Of Swamps & Marshland (1st Response)	Residents of Coastal Zone (N=662)	Residents Outside of Coastal Zone (N=264)	Total State Sample (N=926)
	(%)	(%)	(%)
Yes, because of oil and gas	17.5	15.7	17.0
Yes, because of ecological productivity	24.4	32.8	26.8
Yes, because of fishing	18.5	23.0	19.8
Yes, because of recreation	4.6	7.2	5.4
Yes, because of residential use	4.0	1.3	3.2
Yes, because of agriculture	4.3	2.4	3.8
Yes, because of other reasons	8.0	4.6	7.0
Have no value	9.5	4.9	8.2
No opinion	9.2	8.2	8.9

fewer believe that fishing will be the most important in the future than believe that it is the most important now. Among residents outside the coastal zone, these perceptions are reversed. (Lindsey et al., 1976.)

While Louisiana residents seem to understand the importance of the coastal zone and the types of activities that occur there, Lindsey et al. (1976) found that over 60 percent had no knowledge of what is meant by "Coastal Zone Management." In addition, 82.8 percent have no knowledge of specific development projects in the coastal zone. Oil industry development was the development project most people knew about and only 5.9 percent identified it. (Lindsey et al., 1976.)

Concerning the future of the coastal zone, Louisiana residents were asked their preferences for development of marshes and coastal water by Lindsey et al. (1976). Nearly half the respondents felt that marshes and waters should be left in their natural condition or restricted to recreational use such as sport fishing and hunting. Significantly, over 15 percent felt that marshes and waters should be drained for farming and residential use. When questioned about responsibility for decisions about the coastal zone, Louisianians indicate a strong preference for state, local, or individual control instead of federal control. Almost 50 percent of the residents' feel that the coastal zone will improve or not change in the future. Although more people in the coastal zone (34.8%) feel that it will decline than those outside of the coastal zone (22.9%).

This may be accounted for by the fact that residents of the coastal zone have had closer contact with deterioration of the marshes and other areas in the past and they expect these trends to continue.

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CHAPTER 5

REGIONAL INFORMATION AND ANALYSIS

5.1 -- DESCRIPTION OF CURRENT OCS STUDIES[1]

Alabama

In Alabama, the major area of potential impact from OCS development is Mobile Bay and its tributary rivers. In 1976, the U.S. Army Corps of Engineers published the Environmental Assessment of Mobile Bay and Adjacent Offshore Waters.

Information concerning existing land use and economic, social, public service, and fiscal/institutional conditions of Alabama's three coastal counties is available from the South Alabama Regional Planning Commission. Also, the commission is currently (1977) conducting a HUD-funded study of the potential impact of the proposed Ameriport (offshore superport). The study involves reviewing the counties' capabilities and facilities, developing alternative plans, and preparing a development plan, with a program for public investments. Much of this information will be applicable to the potential OCS development.

In addition, in 1975 the Geological Survey of Alabama published a document entitled A Bibliography of Coastal Alabama with Selected Annotations. The bibliography contains

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[1] Unless otherwise noted, the information in this section was received from the U.S. Fish and Wildlife Service, 1977.

over 900 references. A second bibliography, concerning the economic value of coastal marshes is in the final stages of preparation.

Florida

Florida's Department of Natural Resources has been awarded funds by the National Oceanic and Atmospheric Administration (NOAA) for multi-year study of coastal zone planning and onshore impacts of OCS development (U.S. Department of Commerce, 1975c). These funds are being administered by the Department's Bureau of Coastal Zone Planning, which is currently (1977) preparing: a) an inventory and analysis of OCS information relevant to Florida, b) mapping of biological elements of sites likely to be OCS onshore sites, c) socio economic analysis of selected areas, and d) inventory and analysis of laws applicable to controlling OCS development. Under contract from the State, regional planning councils are preparing all or most of the environment quality analysis, identification of areas of particular concern, and inventory of local and regional ordinances and regulations affecting the coastal zone.

With information gathered by the Bureau of Coastal Zone Planning, the Department of Natural Resources has prepared a "Coastal Zone Atlas of Florida;" the Division of State Planning has compiled a "Soil Atlas;" and the Department of Transportation has prepared a "Wetlands Survey."

In addition, the State University System of Florida Institute of Oceanography has been involved in a multi-year program concerning a baseline environmental survey in the federal areas of jurisdiction of the MAFLA lease tracts (Defenbaugh, 1976). Also, the University of South Florida and Florida State University jointly prepared a report for the State Energy Office (published in December 1975) entitled, Florida Coastal Policy Study: The Impact of Offshore Oil Development.

Louisiana

Louisiana State University has been granted funds over several years by NOAA to examine the ecology of the state's coastal marshes and conduct other marine research, education and advisory programs. These programs include studying the stresses placed on the wetlands by urban development, petroleum operations, and recreational activities and are ongoing in 1977 (U.S. Department of Commerce, 1975a).

The Louisiana State Planning Office has been awarded NOAA funds to study the onshore impacts of offshore oil and gas production and to develop a state coastal zone management (CZM) program including local CZM plans. These studies are continuing (1977) over several years. (U.S. Department of Commerce, 1976b and Hanna, 1976.)

Included in these studies, is a case study of OCS impacted Morgan City being conducted by the University of

Southwestern Louisiana. The study will include:

> A brief chronology of historic development of Morgan City prior to the onset of OCS activity in 1947.
>
> Physical, social, cultural, economic, and public service needs and changes since 1947.
>
> Analysis of economic, social, and geographic factors in Morgan City's development.
>
> Potential future impacts.

The Urban Studies Institute at the University of New Orleans is under contract to the State Planning Office for a study integrating planning for OCS impacts with coastal zone management. This study will include the economic and population impact of OCS development, analysis of governmental services and facilities required by OCS development, guidelines for impact mitigation, and coordination of assessment and planning with local governments.

Mississippi

Mississippi has studied and continues (1977) to study its legal authorities to regulate OCS pipelines and onshore facilities. A major survey of federal laws and laws and regulations of other states currently in force is entitled Pipeline Utility Corridor Standards, Volume II - Legislation Governing Pipeline Standards, 1974.

Information on the potential impacts of OCS facilities is contained in a study by James R. Williamson and F. John Wade for the Mississippi Research and Development Center entitled, *The Economic Impact on Mississippi of Production on the Outer Continental Shelf and of a Proposed Terminal for Supertankers*. The study was published in June, 1976.

Mississippi is also undertaking other OCS impact studies broadly covering current conditions, OCS activities, generalized site analysis, evaluation of OCS impacts, and formulation of state strategy. Also, land use and socio economic studies of coastal counties are currently underway by the respective regional planning districts.

Texas

The Texas General Land Office has been awarded grants over several years from NOAA to study the onshore impacts of offshore oil and gas production and to aid the state in developing a coastal zone management program which is now (1977) under accomplishment (U.S. Department of Commerce, 1975b).

The Texas Coastal Management Program has been a primary source of information for the Texas OCS planning program. Extensive inventories have been made of coastal resources and environmental conditions. The economic and fiscal impacts of offshore development have been addressed by three recent studies concerning economic impact on the state, fiscal impact on the state, and economic impact on the Lower Rio Grande economy.

The consulting firm which runs the Coastal Management Program is currently developing a methodology to assess onshore and nearshore impacts of OCS oil and gas development and using that methodology to calculate such impact on Texas' nearshore and onshore areas under three OCS development scenarios. The progress reports under that study to date include: "Natural Resource, Socio-economic, and Demographic Inventory of the Texas Coastal Area" (May, 1976), "An Impact Bibliography" (May, 1976), "An Inventory of Existing OCS Related Oil and Gas Facilities" (May, 1976), "A Survey of Selected Modeling Techniques" (May, 1976), "An Impact Methodology" (June, 1976).

The following annotated list references some of the output of these studies.

ANNOTATED LIST OF MAJOR STUDIES AVAILABLE

Angelovic, J.W. et al. (1976). Environmental Studies, South Texas Outer Continental Shelf, 1975: Plankton and Fisheries Investigation. National Marine Fisheries Service. U.S. Government Printing Office, Washington, D.C.

Discusses existing habitat of plankton and fisheries on outer continental shelf from the Rio Grande to Matagorda Bay.

Berryhill, H. et al. (1976). Environmental Studies, South Texas Outer Continental Shelf 1975: Geology. U.S. Geological Survey, Corpus Christi, Texas.

Discusses geological features of the outer continental shelf from the Rio Grande to Matagorda Bay.

Burk and Associates, Inc. (1975). Resource Inventory of Coastal Louisiana. Burk and Associates, Inc., New Orleans, Louisiana.

Volume III presents a master inventory of all proposed, under construction and completed Corps of Engineers projects. The inventory also includes a listing of projects being undertaken by the Department of Highways, Soil Conservation Service, and public and quasi-public Sources.

Conner, W.H. et al. (1976). Oil and Gas Use Characterization, Impacts, Guidelines, A Report to the Louisiana Office of State Planning. Center for Wetlands Resources, Louisiana State University, Baton Rouge, Louisiana.

Presents a nontechnical survey of the phases of operation of the mineral extraction industry from exploration to abandonment, particularly as it affects the Barataria Basin of Louisiana.

Happ, Georgeann et al. (1976). Impacts of Outer Continental Shelf Activities: Lafourche Parish, Louisiana, A Report to the Louisiana Office of State Planning. Center for Wetlands Resources, Louisiana State University, Baton Rouge, Louisiana.

Discusses the environmental impacts of mineral extraction, navigation, and transportation, as they relate to outer continental shelf development, on Lafourche Parish.

H.J. Kaiser Company. (1976). The Effect of Superport Development on Louisiana. Prepared for State of Louisiana Offshore Terminal Authority. H.J. Kaiser Company, New Orleans, Louisiana.

Discusses the projected impact of the proposed Louisiana and Texas Superports on the refining and petrochemical industries of Louisiana.

Mumphrey, A.J. et al. (1976). The Impacts of Outer Continental Shelf Development on Lafourche Parish. A Report to the Louisiana Office of State Planning. Urban Studies Institute, University of New Orleans, New Orleans, Louisiana.

Discusses environmental and socioeconomic impacts on Lafourche Parish, including data on job types (and their educational and vocational requirements), the fishing and fur industries, and the infrastructure of Lafourche Parish as they relate to outer continental shelf mineral extraction.

Parker, P. et al. (1976). Environmental Studies, South Texas Outer Continental Shelf 1975: Biology and Chemistry. Marine Science Institute, University of Texas, Port Aransas, Texas.

Discusses the biological and chemical aspects of the outer continental shelf from the Rio Grande to Matagorda Bay.

Pequegnat, W.E. (1976). Ecological Aspects of the Upper Continental Slope of the Gulf of Mexico. Tereco Corporation, College Station, Texas.

As the title makes clear, this study discusses ecological aspects of the upper continental slope in the Gulf of Mexico.

State University System of Florida Institute of Oceanography. (1976). Baseline Environmental Survey of MAFLA Lease Area, Contract Year 1974, Final Report. State University System of Florida Institute of Oceanography, St. Petersburg, Florida.

Discusses the existing environmental aspects in the federal area of jurisdiction of the MAFLA oil and gas lease tracts.

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Presents an overview of current and proposed levee systems, describing location, costs and purposes.

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