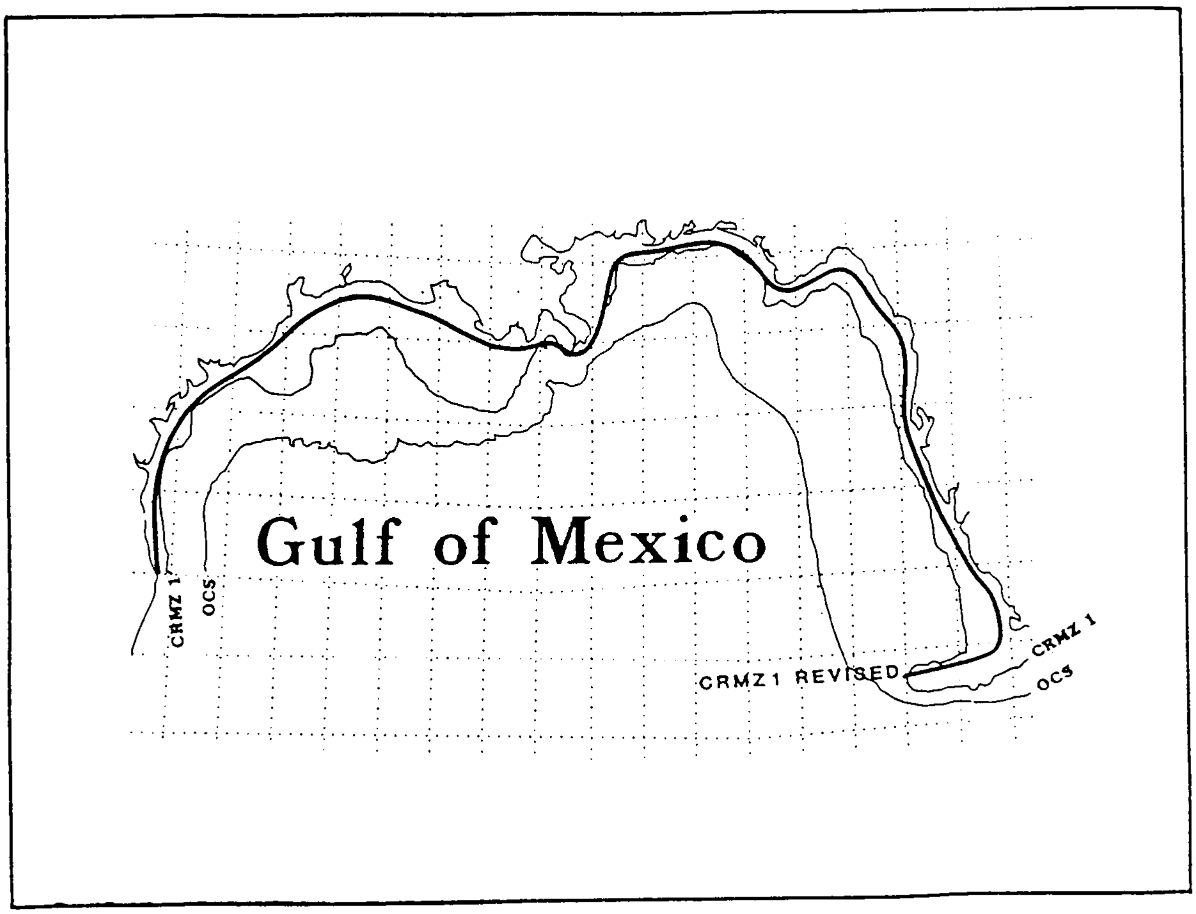
OCS Study
MMS 89-0062

Proceedings: Spring Ternary Gulf of Mexico Studies Meeting

March 1989



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

OCS Study
MMS 89-0062

Proceedings: Spring Ternary Gulf of Mexico Studies Meeting

March 1989

Minerals Management Service
New Orleans, Louisiana
March 21, 1989

Compiler

Geo-Marine, Inc.

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ABOUT THE COVER

Cover artwork is taken from the abstract of a paper given by Dr. Charles P. Giammona of Texas A&M University. The paper was presented at the Spring Ternary Studies Meeting held on March 21, 1989, at the MMS Gulf of Mexico OCS Regional Office, New Orleans, Louisiana. The figure is presented in its entirety on page 40 of this report.

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MEETING SUMMARY

Introduction

The Minerals Management Service (MMS), Gulf of Mexico OCS Regional Office, convened the Spring Ternary Meeting of 1989 on March 21st at the Region's Main Conference Room, 1201 Elmwood Park Boulevard, New Orleans, Louisiana. These public meetings are held as a forum for information exchange between interested and involved parties. This generally includes MMS personnel, representatives of various MMS-funded programs, state representatives, public interest groups, other Federal agencies, and invited investigators working on problems similar to or supportive of those of the MMS.

The meeting is a compilation of presentations given by several speakers. The speakers include both representatives of various MMS-funded studies, as well as invited guests. The purpose of each presentation is to provide information that defines each study's goals, schedule, methodology, present status, and any important or relevant insights recently developed. The meeting is planned so that ample opportunity for an exchange of information between speakers and audience is provided. In addition, a sufficient amount of unallocated time for discussion is also made available.

Meeting Agenda and Abstracts

The meeting's agenda is reproduced on page 3. Prior to the scheduled presentations, each speaker provides an abstract for distribution so that others have an opportunity to become familiar with the material to be presented. This procedure provides the audience an opportunity to formulate questions before each presentation is given and to attend each presentation with less distraction. These abstracts form the basis for this Meeting Summary Report.

Abstracts included in this volume are copies of those provided by each speaker. No adjustments have been made to the form and substance of these submissions.

Any questions regarding the presented material should be directed to the appropriate speaker. General questions regarding the Ternary Meeting or the Gulf of Mexico Environmental Studies Program should be directed to the Environmental Studies Section of the MMS Gulf of Mexico OCS Regional Office (504-736-2897).

MMS

GULF OF MEXICO OCS REGION

Environmental Studies Information

U.S. DEPARTMENT OF THE INTERIOR / MINERALS MANAGEMENT SERVICE

ENVIRONMENTAL STUDIES PROGRAM FOR THE GULF OF MEXICO

SPRING TERNARY STUDIES MEETING

March 21, 1989

The Minerals Management Service (MMS), Gulf of Mexico OCS Region will hold a Ternary Studies Meeting (TSM) on March 21, 1989. The meeting will take place in the Region's Main Conference Rooms 111/115, 1201 Elmwood Park Boulevard, Jefferson*, Louisiana. The meeting will present progress reports by various participating contractors on their individual study efforts. You are cordially invited to attend this informal meeting, or any of the individual presentations listed below. Please contact the Chief, Environmental Studies Section for further information (address below).

Also, the Gulf of Mexico Regional Technical Working Group, an advisory body serving the MMS, will hold a business meeting at the same location on March 22-23. Please contact Ms. Eileen Angelico (address below; mail stop ORD-5; (504)-736-2959) for further information.

Time	Speaker	Topic
9:30 a.m.	Mr. J. Rogers Pearcy Regional Director, MMS Mr. Ruben Garza Geo-Marine, Inc.	Welcome, Announcements, and Introductions
9:40 a.m.	Mr. Lawrence McKenzie Ms. Pam Xander Applied Technology Research Coporation	Socioeconomic Impacts of Declining OCS Oil and Gas Activities in the Gulf of Mexico
10:30 a.m.	Dr. Karen Wicker Coastal Environments, Inc.	Study of Impacts of OCS Activities on Barrier Beaches and Wetlands
11:00 a.m.	Dr. Don Cahoon Louisiana Geological Survey	A Study of Wetlands Mitigation: Marsh Management
11:30 a.m.	Adjourn for lunch	
1:30 p.m.	Dr. Ren Lohoefener National Marine Fisheries Service	Petroleum Structures and the Distribution of Sea Turtles
2:00 p.m.	Dr. Charles Giammona Texas A&M University	Re-Evaluation of Cultural Resource Management - Zone 1
2:30 p.m.	Dr. Richard Rezak Dr. Steve Gittings Texas A&M University	Mississippi-Alabama Shelf Marine Ecosystems Study
3:00 p.m.	Dr. Van Waddell Science Applications International Corporation	Physical Oceanography Field Measurements Program
3:30 p.m.	Adjourn	

*Please note that our proper mailing address is for New Orleans, but that we are physically located in Jefferson, LA. This distinction is very important for anyone traveling to our office from the airport by taxi. Our mailing address is:

Minerals Management Service
Gulf of Mexico OCS Region
Environmental Studies Section (LE-4)
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394
Phone: (504)-736-2897; FTS 680-9897

Our office is located at the north end of the Elmwood Shopping Center, which is near the Huey P. Long Bridge, on Clearview Parkway. We are in the south twin tower office building. Please call if you need directions or information on area accommodations.

*Presented by Dr. Charles Giammona
**Unable to attend; paper included in Proceedings

ABSTRACT

SOCIOECONOMIC IMPACTS OF DECLINING OUTER CONTINENTAL SHELF (OCS) OIL AND GAS ACTIVITIES IN THE GULF OF MEXICO (GOM)

Prepared for presentation at the:

Spring 1989 Ternary Studies Meeting

Sponsored by the:

Minerals Management Service
Gulf of Mexico OCS Regional Office
1201 Elmwood Park Boulevard
New Orleans, Louisiana

Prepared by:

Applied Technology Research Corporation
727 Spain Street
Baton Rouge, LA 70802

21 March 1989

ABSTRACT

SOCIOECONOMIC IMPACTS OF DECLINING
OUTER CONTINENTAL SHELF (OCS) OIL AND
GAS ACTIVITIES IN THE GULF OF MEXICO (GOM)

The recent price-related decline in oil and gas activity has impacted communities which were dependent on the oil and gas industry for their employment base and economic viability. The conditions resulting from the recent decline provide a case study scenario upon which future socioeconomic impacts resulting from a resource decline can be formulated. Analyses of recent socioeconomic impacts within a 49 county and parish study area contiguous with the Central and Western GOM Coastal Analysis Areas are expected to provide the basis for the development of conceptual models reflective of impacts likely to occur in conjunction with long-range, oil and gas resource depletion declines.

Task 1.b. An Analysis of the Recent Price-Related Decline.

The objective for Task 1 is to analyze the socioeconomic impacts of recent price-related declines in outer continental shelf oil and gas activities. The analysis involves the compilation and comparison of select social and economic parameters and oil and gas activity indicators.

Significant changes in population, net migration and employment patterns are noted within the study area during the recent price-related period. The rate of population growth (percent annual change) in the study area has changed considerably over the past several years. Between 1981 and 1982 the population in the study area increased by 4.01%. By 1984, the annual percent of population change had dropped to 0.48%.

The recent influx of people into the study area also reversed. Between 1985 and 1986, 35 of the 49 counties and parishes in the study area experienced a negative net migration compared to only 5 in the 1980 to 1981 period. Net migration which reached a high of 208,324 in 1982, dropped to a low of -60,976 in 1984.

Changes in the number of jobs in the study area indicate that industry sectors respond in differential measure to oil and gas activities. From 1982 to 1986, the number of jobs in the study area decreased by 4.62% for a decrease of 164,972 jobs. During that same period, the availability of mining jobs decreased by 28.63%. The percent annual change in jobs in the retail sector is indicative of the "lag" effect in certain industries. Although the price of oil started to drop in 1982, the percent annual change in the number of jobs in the retail sector did not reach a negative value until 1986. The annual percent change in the number of jobs in the state and local government sector increased each year from 1982 to 1986

Task 3. Coastal Resource Development Opportunities.

The goal of Task 3 was to evaluate other economic opportunities that are available in the coastal areas of the Gulf of Mexico and that can be developed to substitute for oil and gas activities as a source of employment and income. Work performed under this task includes:

- •the documentation of OCS-related oil and gas infrastructure and environmental modifications and of the existing oil and gas work force

- •the identification of economic development initiatives which have evolved during the recent price-related decline period.

- •the documentation of infrastructure, environmental modifications, and the existing work force which was obtained from reports prepared during the "boom" period.

Economic Development Initiatives:

A thorough review of economic development agencies throughout the study area was made. From the public and private sectors to academia, the Gulf Coast has been inundated by a myriad of developers, all claiming to have the necessary techniques needed to:

- •diversify industry,
- •expand existing industry, and
- •attract new industry from out of state as well as from international markets.

Each development initiative was examined for relevancy to the study and overall program methodology. A directory of economic development agencies was compiled and specific agencies and their programs which most closely relate to the productivity of OCS onshore facilities were evaluated. The team also investigated alternative opportunities, including, but not limited to:

- •other mineral resources development,
- •secondary and tertiary petrochemical opportunities,
- •commercial fisheries,
- •aquaculture,
- •tourism and recreation,
- •ports,
- •transportation, and
- •manufacturing.

OCS Infrastructure, Facilities, and Environmental Enhancements:

Practical concepts applied to long-term solutions for using the available OCS-related infrastructure and taking advantage of OCS-related environmental enhancements or modifications were explored. A composite drawing of activities within a typical OCS facility was used as a model to base alternatives on (Figure 1). The facilities and infrastructure have several common characteristics: cleared land, all-weather surfaces, access to a navigable waterway, highways, perhaps air service, buildings, engines on boats, rigs, barges, and other miscellaneous heavy equipment, trained and skilled personnel. Various environmental modifications are shown using the base. An example of one of many suggestions is seen in Figure 2. Figure 2 illustrates

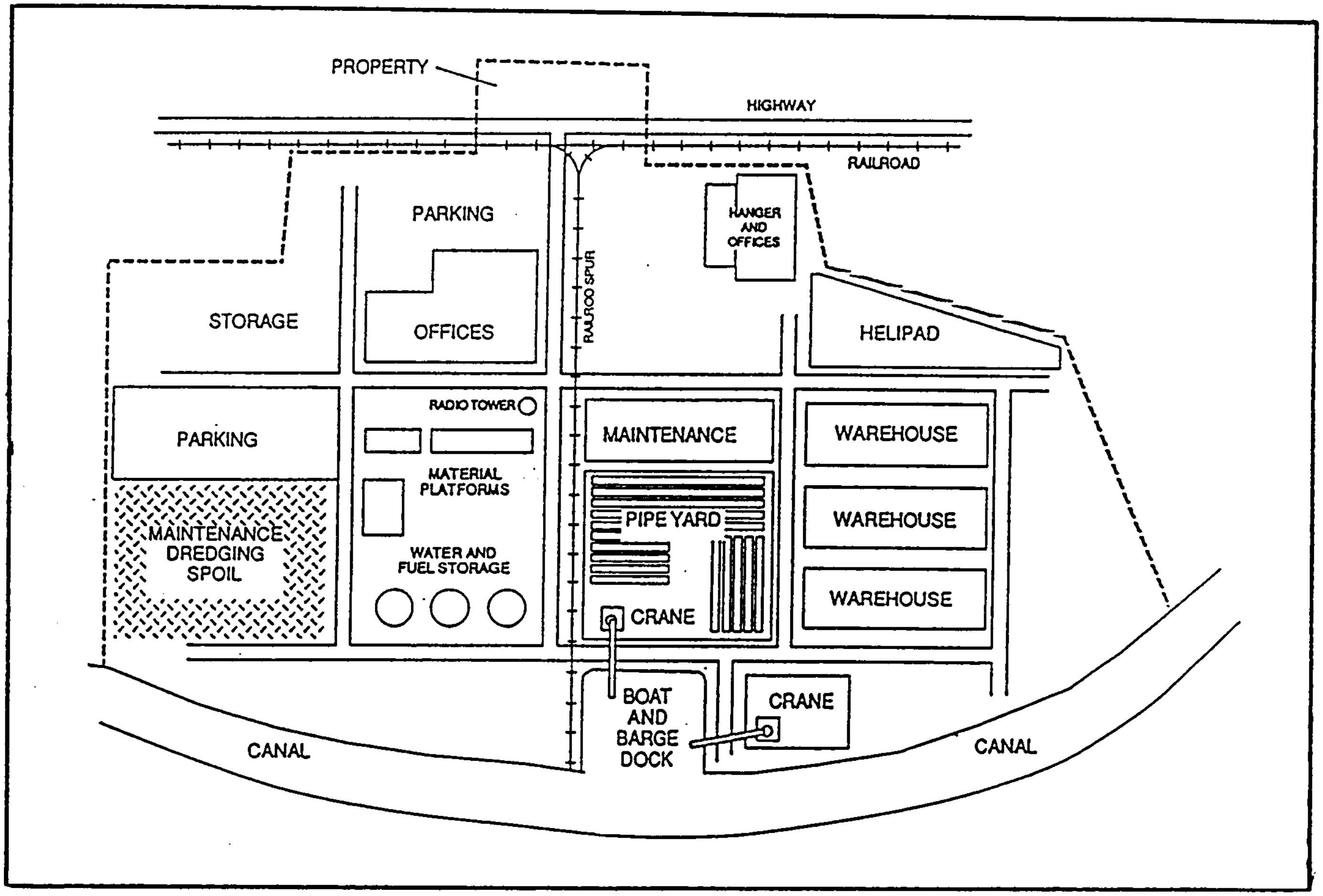

Figure 1. A composite of activities within an OCS facility (Sources: Wales et al. 1976; Clark and Terrell 1978).

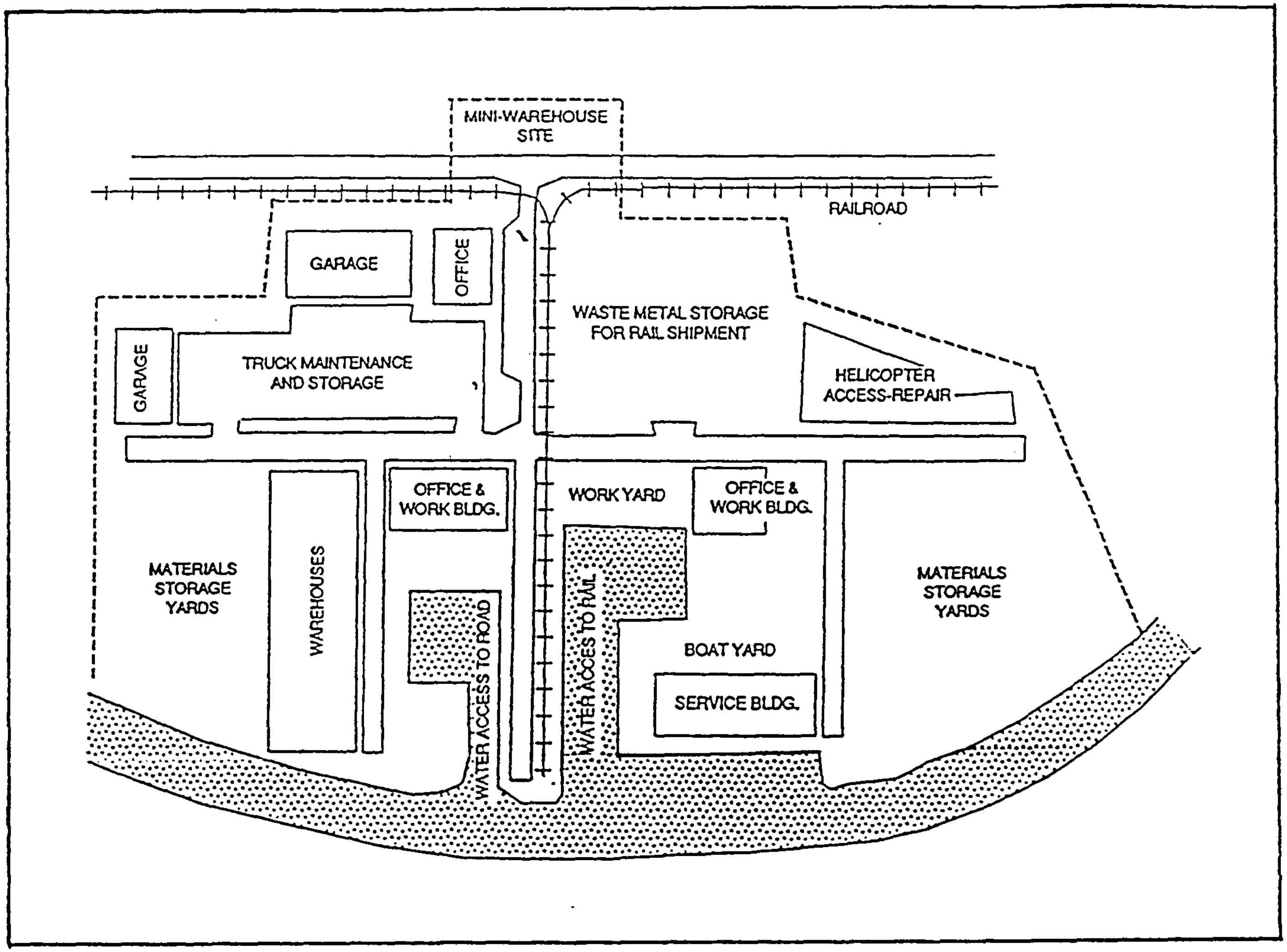

Figure 2. Public works maintenance and storage area.

the OCS facility converted into a Public Works maintenance and storage area. Other suggestions take into consideration the restoration and enhancement of coastal wetlands, more intensive management of coastal resources and other miscellaneous activities. Some examples of these include a water-oriented camper park, a multi-use park, a wetland nursery, piers for recreational fishing and crabbing, and a pond for recreation and migratory waterfowl and others.

The onshore infrastructure and an available and intelligent work force offers a tremendous opportunity for the Gulf coast states to diversify their economies to become less dependent on the oil and gas industry. The public and private sectors can initiate various programs and projects that will benefit the economy of the state and region in the long term and place people back to work in the short term.

ABSTRACT

IMPACTS OF OUTER CONTINENTAL SHELF (OCS) RELATED ACTIVITIES ON SENSITIVE COASTAL HABITATS

Prepared for presentation at the:

Spring 1989 Ternary Studies Meeting

Sponsored by the:

Minerals Management Service
Gulf of Mexico OCS Regional Office
1201 Elmwood Park Boulevard
New Orleans, Louisiana

Prepared by:

Coastal Environments, Inc.
1260 Main Street
Baton Rouge, LA 70802

21 March 1989

ABSTRACT

Impacts of Outer Continental Shelf (OCS) Related Activities on Sensitive Coastal Habitats. MMS Contract No. 14-12-0001-30325. Karen M. Wicker.* Coastal Environments, Inc. 1260 Main Street, Baton Rouge, LA 70802

The primary objective of this study was to document the impacts of Outer Continental Shelf (OCS) related activities on sensitive coastal habitats along the Gulf of Mexico in order to assess the significance and extent of these impacts (Figure 1). OCS-related activities included pipelines originating from Federal OCS waters, navigation channels constructed for use by OCS traffic and selected onshore OCS-related facilities. Onshore facilities included: oil storage tanks; gas processing and treating plants; oil refineries; compressor, pumping, metering stations; terminals; shipyards; pipe coating and/or storage yards; platform fabrication sites; service and supply bases/dock facilities; and helicopter services.

Sensitive coastal habitats are defined as barrier islands and barrier beaches, emergent wetlands, such as fresh-to-saline marshes, and submerged aquatic grassbeds. The purpose of establishing a correlation among the OCS activities (especially type and construction techniques utilized); physical, biological, and cultural forms and processes active at the site of the activity; and the amount of observable, quantifiable impacts was to formulate predictions regarding impacts of future OCS activities along the coast of the Northern Gulf of Mexico.

As documented by a literature review, there are many divergent and often negative perceptions regarding the magnitude and extent of impact of OCS activities on sensitive habitats (Table 1). By establishing correlations based on emplacement techniques and the environmental setting, it is possible to predict the impact of future OCS activities prior to construction and work within the environmental constraints to minimize or alleviate negative impacts.

The research effort was divided into four tasks: 1) literature research, personal consultation, and synthesis of data; 2) map and air photo analysis for gulf coast overview and site specific description and quantification of impacts (as evidenced by rate of shore change, canal width change and habitat change); 3) field investigations (ie, geologic, hydrologic and vegetative differences in pipeline right of way [ROW] and control sites), analyses and summation of results; and 4) summation of relationships between activities and environment and prediction of future impacts. This latter task also documents existing state and federal regulations influencing facility placement.

In order to maximize the comprehensiveness of this study in terms of activities reviewed and environments present along the Gulf Coast, the decision was made to evaluate, at the descriptive level, all pipelines, navigation channels and selected facilities associated with OCS activities that could be located on 7.5 minute U.S. Geological Survey (USGS) topographic maps and aerial photographs.

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* Information presented in this abstract was obtained from studies conducted by the author and other researchers: R. E. Emmer, K. Neese, S. Pierce, D. Roberts, R. Sauvage, and J. van Beek.

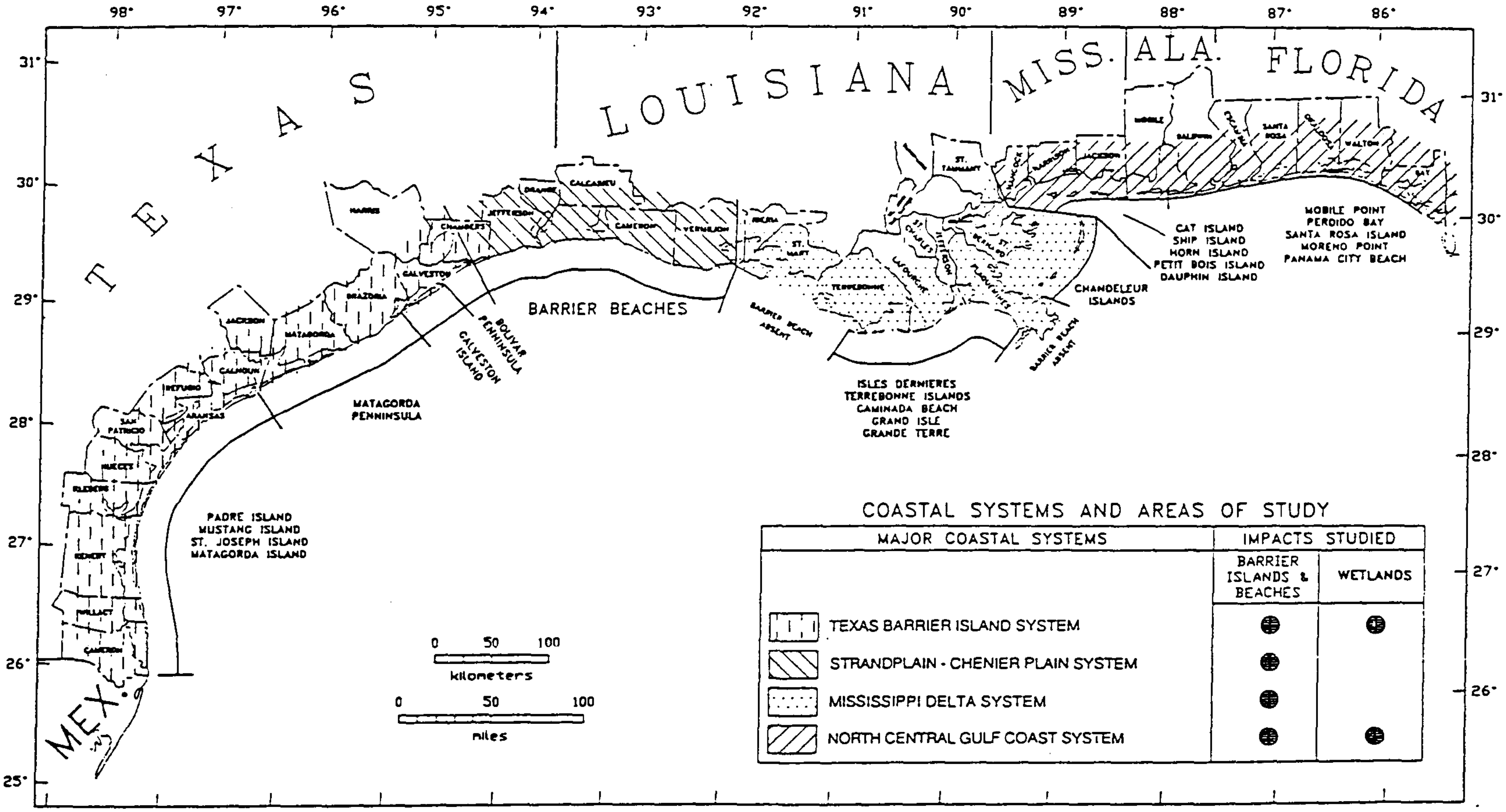

Figure 1. Location of study area and types of sensitive habitats studied by coastal system.

Table 1. Types of Impacts Associated with Open, Non-Backfilled Rig Cuts and Pipeline Canals and Navigation Channels.

Direct Impacts

1. Removal of aquatic and wetland habitat (flora) and non-mobile fauna through dredging and spoil deposition (variable)
2. Imposition of uniformly deep, straight drainage channel within wetland formerly having only overland flow and/or sinuous channels decreasing in depth toward headland
3. Loss or reduction in habitat quality and value
4. Segmentation of natural physiographic units or forms
5. Destruction of historic and archaeological sites
6. Release of large amounts of nutrients from the interstital water of the dredged sediment (temporary)
7. Oxidation of sulfides to sulfuric acid (temporary)
8. Increase in turbidity and oxygen demand (temporary)
9. Breaching of fordunes leaving them bare, unstable and susceptible to erosion (when backfilled but unvegetated)
10. Creation of sediment sinks for washovers
11. Creation of weak spot in island

Indirect Impacts

1. Floral and faunal changes due to saltwater intrusion (such as destruction of freshwater marshes, productive oyster grounds and muskrat habitat and waterfowl feeding and wintering areas)
2. Land loss
3. Increased storm-generated surge
4. Accelerated erosion due to increased length of land-water interface exposed to waves from wind and boat-generated waves
5. Increased freshwater runoff and loss of freshwater storage in some areas
6. Increased saltwater flooding of former freshwater areas
7. Impoundment and flooding in some areas
8. Accelerated erosion due to increase in tidal prism volume
9. Alteration in circulation patterns in bays and sounds
10. Alteration and/or disruption of longshore drift of sand
11. Introduction of agricultural, urban, and industrial pollutants
12. Changes in water cycling rates and volumes
13. Silting considerable distances from site of activity resulting from change in direction and velocity of currents
14. Increase the likelihood of island/beach breaching

Of the 164 Federal OCS pipelines constructed between 1950 and 1986, 71% cross barrier beaches or island complexes and 29% make landfall on marsh shorelines. The majority (57%) of the pipelines land in the Mississippi Delta System, 34% land in the Strandplain-Chenier Plain System and 6% cross the Texas Barrier Island System (Figure 2). Of the six pipelines studied in the North Central Gulf System, only four are OCS-related. The majority (65%) of the OCS lines carry gas, while 29% carry oil. Seventy seven percent of the pipelines are 20 in or less in diameter while 23% vary from 22 in to 42 in (1 line).

Navigation channels were considered to be OCS-related if there was documentation that they supported or were intended to support OCS activities or if OCS needs were used to justify their cost for construction. OCS navigation channels which were within this scope of study include: Matagorda Ship Channel, Texas; Mermentau River to Gulf of Mexico Channel and Belle Pass, Louisiana, and Gulfport Harbor in Mississippi. Freshwater Bayou, Houma Navigation Canal, Grand Pass (south of Venice), the Lower Atchafalaya River and Bayous Boeuf, Black and Chene in Louisiana are also OCS-related but were outside this scope of study in terms of habitat impacted.

OCS-related facilities were identified primarily from the literature and impacts for selected facilities were discussed in qualitative terms only.

In addition to researching and mapping at a scale of 1:250,000 physical, cultural and biological parameters of the study area, the physical parameters characterizing the major pipeline emplacement techniques were also summarized (Table 2). Furthermore, the guidelines for construction of pipelines by state within the study area were tabulated (Table 3), and examples of areas to be avoided, according to state guidelines, were documented with maps or references for Texas, Mississippi, Alabama, and Florida.

The extent of impact varied for the 11 pipelines studied in detail. In the Texas Barrier Island System, the 30- and 36-in pipelines installed across Matagorda Peninsula in 1971 and 1985, respectively, were constructed largely by the push-pull ditch technique and the ROW was recontoured to pre-site condition for all except the intertidal marsh portion of the 30-in line. By 1987, the 30-in line ROW was revegetated but the 36-in line ROW remained largely unvegetated. However, island crossings showed no sign of breaching or accelerated erosion and the mainland wetland crossing, north of the Gulf Intracoastal Waterway, appeared almost completely vegetated in both ROW.

Three pipelines with different emplacement techniques were studied in the Strandplain-Chenier Plain System: 1) a 26-in line installed in a flotation canal in 1958 with regularly spaced bulkheads, 2) a 26-in line placed in a push-pull ditch in 1968 with a bulkhead at the juncture of the push-pull ditch and the push-point flotation canal, and 3) a 4-in line in a push-pull ditch that was recontoured with an elevated cattle walkway levee in 1970. By 1987, all three pipeline crossing remained closed at the shore. Furthermore, the formerly open canals on the two 26-in lines had been filled in the vicinity of the high sea rim marsh near the Gulf and one canal was partially vegetated by smooth cordgrass (Spartina alterniflora). A beach consisting of sand and shell was migrating inland over the three infilled canals.

Within the Mississippi Delta System, three pipelines were studied: 1) a 16-in line placed in a flotation canal in 1961, 2) a 6-in line which appeared to have been placed in a push-pull ditch and backfilled shortly before 1973, and 3) a 24-in line placed in a flotation canal with regularly placed dams in 1956 and located parallel to the backside of Grand Terre Island.

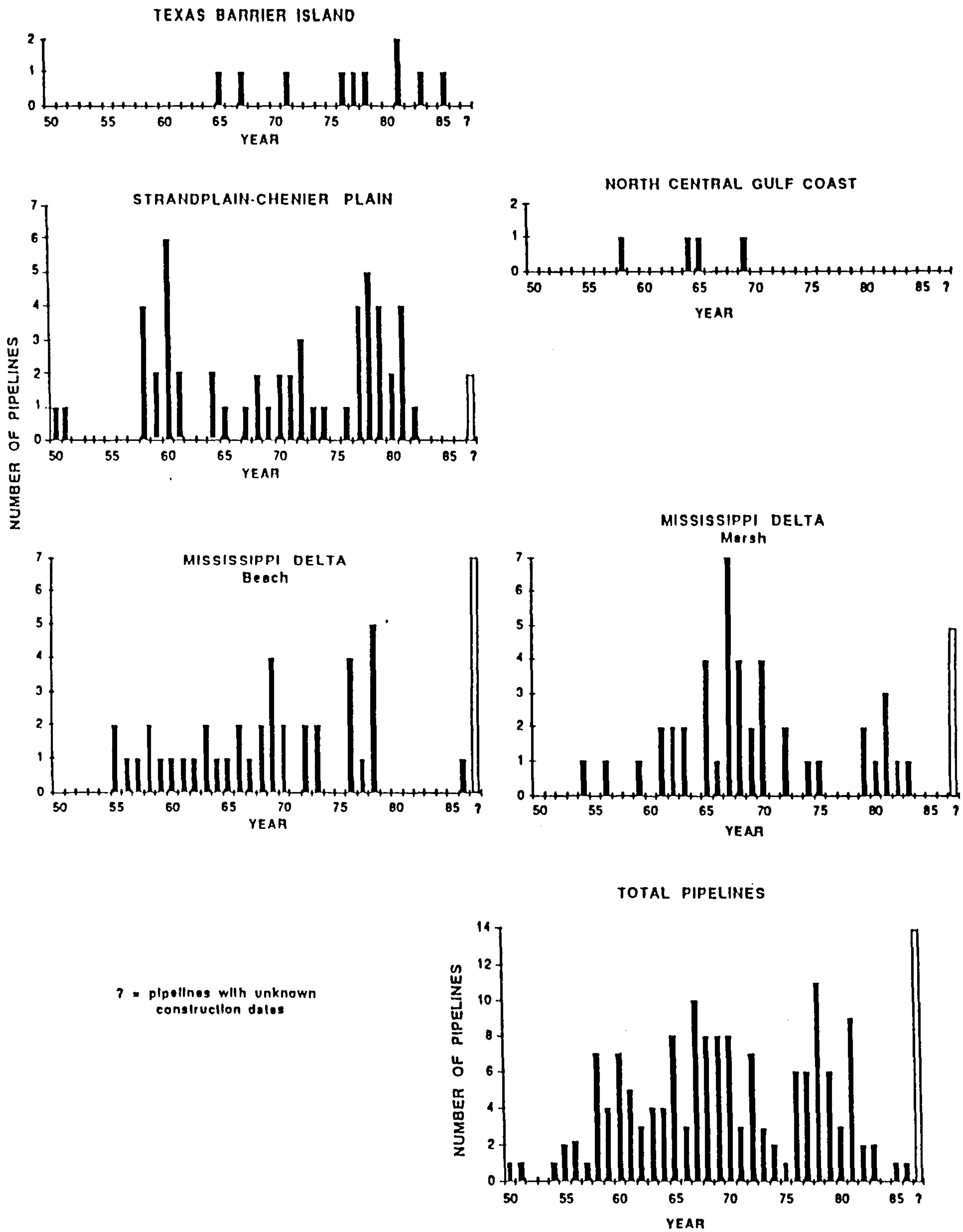

Figure 2. Depiction of OCS pipelines by coastal system and date of construction.

Table 2. Physical Parameters Characterizing the Four Major Pipeline Emplacement Techniques.

	VARIATION IN EMPLACEMENT CHARACTERISTICS BY EMPLACEMENT TECHNIQUES			
EMPLACEMENT FEATURE	Upland Trenching	Flotation Canal	Push-Pull Ditch	Directional Drilling
Associated Environment	Stable, well-drained soils.	Unstable soils, shallow water bodies.	Moderately firm but wet soils.	Barrier islands and beaches; development.
Construction ROW	30.5 to 38.1 m	45.7 to 91.4 m	30.5 to 61.0 m	
Maintenance ROW	9.1 to 30.5 m	30.5 to 61.0 m	15.2 to 30.5 m	15.2 to 30.5 m
Canal Depth (base)	0.9 to 2.4 m	12.2 to 15.2 m	2.4 to 3.0 m	N.A.
Canal Width (base)**	0.9 to 2.4 m	12.2 to 15.2 m	2.4 to 3.0 m	N.A.
Lay Barge Size: (onshore to 3.7 m) 30.5 x 9.1 x 2.0 m; 41.4 x 10.9 x 2.4 m; 48.8 x 12.2 x 1.7 m	N.A.	lays pipe in canal	pushes pipe along canal from push-point	N.A.
Lay Barge Size: (offshore -5.5 m out): 43.0 x 12.2 x 2.6 m; 76.2 x 15.2 x 3.5 m; 106.6 x 18.2 x 7.0 m	N.A.	N.A.	N.A.	Connects with drill pipe feeds pipe ashore.
Pipe Barge Size: 30.5 x 9.1 x 1.8 m; 41.4 x 10.9 x 2.4 m	N.A.	Brings pipe along canal to lay barge	Delivers pipe to push point	N.A.
Installation Segment Length	Indefinite	Indefinite	Approx. 24 km/ 76.2 cm line	Approx. 914.4 m
Construction Spoil Condition	One side of trench 0.9 to 1.5 m high; 3.0 to 6.1 m base.	One or both sides of trench; continuous or broken; 0.9 to 1.5 m high; 15.2 to 25.9 m base.	One or both sides of trench; continuous or broken; 0.3 to 0.9 m high; 6.1 to 15.2 m base.	N.A.
Post Construction Condition	Backfill	Leave in place or backfill	Leave in place or backfill	N.A.
Post Construction ROW	Cleared of tall vegetation.	Deep open water; or shallow open water.	Shallow open water; or marsh vegetation.	Cleared of tall vegetation.
Equipment utilized on pipeline	Cars/trucks; backhoe or ditcher; bulldozer.	Marsh buggies, small boats; tug boats, helicopters, barge-mounted dredge; lay barges; crew/supply boats; jet barge; pipe barge.	Marsh buggies, marsh buggy or track-mounted draglines with timber mats; lay barge; small boats; crew/supply boats.	Marsh buggies; cars/trucks; bulldozer; small boats.
Mitigation	Reestablish pre-construction contours; place top soil on top; plant/seed; implement erosion control measures for topsoil.	Isolate canal hydrologically from tidal flow; backfill canal to create shallow water, and aquatic beds; deposit spoil so as not to interfere with natural drainage; incorporate canal into wetland management plan.	Double ditch spoil and place top soil on top when back-filling; replant/reseed if necessary; bulkhead filled canal at waterway intersections.	Restore drilling site to preconstruction condition; reseed/plant, implement erosion control measures for topsoil.

* Flotation canal has pipe ditch, 0.9 to 1.5 m wide and 0.9 to 1.8 m deep in bottom to receive pipe from lay barge.

** Canal slope is dredged at 1:2 or 1:3 thereby giving a canal surface width larger than bottom width. Slumping of sides in unstable soils can further enlarge surface canal width during and post construction.

Table 3. Guidelines for Construction of Pipelines in Gulf Coast States.

	GUIDELINES	TEXAS (1)	LOUISIANA (2)	MISSISSIPPI (3)	ALABAMA (4)	FLORIDA (5)
1	Bury Pipeline Below Gulf Inlet, River or Stream Crossing at Least to Federal Standards (-121.9 cm in soil and -61.0 cm in consolidated rock under rivers, streams, and harbors; -91.4 cm in soil and - 45.7 cm in consolidated rock in offshore locations less than 3.6 m deep)	• (-61.0 cm)	• (-121.9 cm) (-91.4 cm)	•	• (-61.0 cm)	•
2	Evenly Backfill Trenches to Reasonably Conform to Surrounding Area's Bottom Profile	•	•	•	•	--
3	Take Erosion Prevention Measures at Shoreline	•	+	+	•	•
4	Double Ditching Will be Encouraged	--	--	•	--	--
5	Use "Push Ditch" Method and Backfill or Method that does not Degrade Wetlands	--	•	•	•	•
6	Revegetate Disturbed Wetlands	--	+	•	•	•
7	Plug and Maintain Plug at all Waterway Crossings Where Non-Navigation Canals, Channels, Ditches Connect More Saline Areas with Fresher Areas	--	•	+	--	--
8	Select ROW to Avoid Shell Reefs, Submerged Grassbeds, and Marshes	+	+	+	+	+
9	Avoid or Minimize Damages to Important Spawning, Nesting, Nursery or Rearing Areas	--	•	•	•	--
10	Avoid Adverse Impacts on Areas of High Biological Productivity or Irreplaceable Resource Areas	--	•	--	•	•
11	Utilize Proceedures to Protect Sea Turtles and Their Nests Between May 1 and Oct. 30	--	--	--	--	•
12	Use Existing Corridors, ROWs, Canals and Streams	--	+	+	--	--
13	Permanent Blockage of Surface Drainage is Prohibited	--	--	•	--	--
14	Avoid or Minimize Clearing of Natural Vegetation from River or Stream Banks, so that a Screen of Natural Vegetation is Left in the ROW	•	--	--	•	--
15	Dredging Shall Not Traverse Barrier Islsands (Nor Adversely affect Barrier Islands)	--	•	•	•	--
16	If Beach, Tidal Pass, Reef or other Natural Gulf Shoreline Must be Traversed, It Must be Restored Immediately Upon Completion of Construction	--	•	--	•	•

• Always Required
+ Required to Maximum extent Feasible/Practicable
-- Not specifically Noted

1 Texas general office 1975.
2 La. Dept. of Nat. Resources 1980, Troy 1983.
3 Ms. Dept. of Wild. Cons. and U.S. Dept. of Commerce 1983, Ladner et al 1984.
4 Al. Dept. of Cons. & Nat. Resouces 1982, Environmental Mgt. 1985.
5 Fl. Dept. of Nat. Resources, Div. of Beaches and Shores. n.d.

The 16-in line has increased in width from 26 m to 39 m between 1974 and 1985 and the bulkhead in the southern terminus of the canal has had to be rebuilt. However, shoreline change associated with this pipeline canal has been masked by other man-made activities in the area, including maintenance dredge material deposition from Belle Pass to the East, construction of an west jetty with a wing extension, and dredging of a rig cut in the marsh across the front of the canal.

The beach crossing of the 6–in pipeline is not discernable and had to be located by projecting an inland portion of the alignment seaward. The location of this line may have been obscured also by beach nourishment activities in the area.

The shore parallel flotation canal for the 24-in line on Grand Terre widened from 20 m in 1956 to 31 m in 1983 but the bulkheads remained intact and the canal has filled with sediment from bank slumpage and overwash. The infilled eastern end of the canal is vegetated by smooth cordgrass and has a very small, sinuous drainage channel through the middle of the former canal site.

Of the three pipelines studied in the North Central Gulf Coast System, one was a 20-in line installed in 1970 in a push-pull ditch that was backfilled. The site is now revegetated primarily by smooth cordgrass, but remains at a slightly lower elevation than the surrounding marsh which is dominated by blackrush (Juncus roemerianus). This line shows no accelerated rate of erosion at the shoreline or at bulkheaded waterway crossings.

The other two lines are 30- and 36–in pipes installed in 1958 and 1965, respectively, in parallel flotation canals which have only been bulkheaded near Lake Borgne. These canals, now 1.8 to 2.4 m deep, remain open at all other water body crossings and erosion has scoured the marsh on the west side of the bulkhead. The spoil bank formerly separating the canals has almost disappeared. The 30-in line canal widened from 18 m in 1969 to 22 m in 1985, while the 36–in line canal increased in width from 22 m to 27 m during this same period of time. The natural, sinuous east-west drainage channels in this area were severed by the construction of this straight, double canal network. This resulted in the shallowing of some channel segments by spoil deposition and the creation of new drainage divides in the area. However, the continuous spoil banks along the canals do not appear to have impounded marsh drainage and no indirect marsh loss is evident.

Observations on the impacts of the Matagorda Ship Channel, Mermentau to Gulf of Mexico Ship Channel and Belle Pass are presented in the final report. There is also a general discussion of the impact of selected OCS-related facilities. Future impacts are tabulated based on observations of past impacts of various emplacement techniques in the four coastal systems and present regulations governing emplacement in the Gulf Coast States.

ABSTRACT

WETLANDS MITIGATION:
A STUDY OF MARSH MANAGEMENT

Prepared for presentation at the:

Spring 1989 Ternary Studies Meeting

Sponsored by the:

Minerals Management Service
Gulf of Mexico OCS Regional Office
1201 Elmwood Park Boulevard
New Orleans, Louisiana

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21 March 1989

WETLANDS MITIGATION:
A STUDY OF MARSH MANAGEMENT

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presented to
Minerals Management Service
at the
Spring 1989 Ternary Meeting
New Orleans, LA

Abstract

INTRODUCTION

The purpose of this two-year study is to determine the suitability of marsh management practices for mitigating wetland loss in the varied habitats of coastal Louisiana. This is being accomplished through a review of the administrative framework and environmental conditions within which marsh management occurs, the public interest goals of marsh management, engineering and construction techniques employed, secondary literature sources, environmental monitoring data, and the ecological consequences of management.

PROJECT ACCOMPLISHMENTS

The first three of seven volumes of the final report have been completed in draft form - Administrative Concerns, Public Interest Goals, and Annotated Literature Review. These volumes are currently under review by MMS. The issues related to Administrative Concerns and Public Interest Goals were discussed at the ITM meeting in October. Our literature review presents 100 citations concerning mostly structural marsh management in the southeastern U. S., particularly Louisiana. Discussions of the other facets of the study are presented below.

Engineering and Construction Techniques. A draft report on the types and impacts of structures typically used in marsh management is being prepared. The section on water control structures has been completed and the narrative on impoundments commenced. Fourteen structures have been evaluated as to their use, affect on the environment, feasibility, construction and engineering design, and costs.

General Study Area Conditions. Our evaluation of the general conditions of the study area is based on a review of the feasibility of marsh management (in a general sense), the environmental conditions of the Louisiana coastal zone including mapping, and permit file data to generate a profile of typical marsh managment plans.

Feasibility. Three factors that are most likely to affect marsh management feasibility were selected for evaluation - soil type, relative sea level rise, and habitat stability. Areas in the coast where each of these variables is poorly suited for marsh management are being identified and mapped. Based on our preliminary findings, areas of low feasibility are primarily confined to portions of Breton, Barataria, and Terrebonne basins and the Mississippi delta. Working maps are being compiled and a draft narrative is partially complete.

Environmental Characteristics. Our description of the environmental characteristics of the coast includes a discussion of vegetative zones and habitats as well as a review of the hydrologic and geologic conditions for each basin. The latter includes an evaluation of water quality, soils, tides and basin water levels, river flow and sediment load, and coastal geology and geomorphology for each hydrologic basin. Most required data has been collected except for 1986-1987 state water quality report. A soil classification system has been devised and applied to coastal Louisiana. Draft maps of major hydrologic structures and data stations have been completed except for plotting DEQ water quality stations. Data on maximum and minimum stages, and bankfull and low water stages has been tabulated for the New Orleans District. Long-term suspended sediment data sets have been evaluated. A draft narrative has been written of the introduction, background geology, approach and methods for the soils classification, and approach and methods for the sediment data analysis.

Mapping. The marsh management atlas presented at the last ternary meeting has been updated to include state and federal refuges. The 1956 and 1978 digital habitat maps have been completed for each basin as has the 1985 habitat map based on satellite thematic mapper data. Change maps for 1956 to 1978 and 1978 to 1985 are being produced for each basin. Quantitative analysis of habitat change rates will commence once the maps are complete.

Marsh Management Plan Profile. Since October 1988, variables for the computerized data set have been selected, data formats identified, all permit files reviewed, data coding completed, a data input screen developed, data updating procedures established, and data input commenced. Data verification and data analysis should be complete by May 1989.

<u>Monitoring Program</u>. Monitoring data has been compiled from DNR permit files. Very few permitted marsh management operations provide any monitoring data. For those that do, the data collections range from irregular and incomplete to regular and extensive.

The historical analysis of aerial photographs for sixteen management plans and associated control areas was commenced in early November. Fifteen of the sixteen plans to be analyzed have been selected and the sixteenth plan is currently being reviewed by our staff and the Technical Steering Committee. Photointerpreting, digitizing, and computer mapping/analysis of 1956, 1978, 1981 to 1983, 1985 and 1988 habitats and habitat change are all ongoing. Prints of the 1988 imagery needed to complete the task are not yet available but should be out by next month. Nine of the plans have been interpreted, four partially interpreted, eight digitized, and six computer-mapped. Additional funding for this portion of the study is being provided by the U. S. Environmental Protection Agency.

The field monitoring effort was commenced at Fina-LaTerre, Inc. and Rockefeller Refuge and associated control areas. Sampling sites have been selected to monitor vegetation composition and growth, sediment and nutrient flux, sediment accumulation, hydrologic conditions, and fisheries composition and biomass. Data collection has commenced but data are too preliminary at this time to warrant analysis and detailed discussion. Sampling of fish in shallow water managed habitats required development of a new sampling gear. Four types of trawls were tested before selection of a new design. Monitoring of water levels was delayed because of delays in equipment (i.e., water level gauges) deliveries. Water level gauges have been established at Fina-LaTerre, Inc. but will not be established at Rockefeller until later this month.

ABSTRACT

PETROLEUM STRUCTURES AND THE DISTRIBUTION OF SEA TURTLES

Prepared for presentation at the:

Spring 1989 Ternary Studies Meeting

Sponsored by the:

Minerals Management Service
Gulf of Mexico OCS Regional Office
1201 Elmwood Park Boulevard
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21 March 1989

PETROLEUM STRUCTURES AND THE DISTRIBUTION OF SEA TURTLES

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INTRODUCTION

More than 4000 platforms are documented in the 1988 U.S. Coast Guard data base offshore of Louisiana. Current regulations require the removal of nonproductive petroleum platforms from federal waters. A common method uses explosives to shear the platform's support structures below the sediment line.

Loggerhead (Caretta caretta) and hawksbill (Eretmochelys imbricata) sea turtles have been reported to frequent hard bottoms and underwater structures (Hopkins and Richardson 1984). In the northern Gulf of Mexico, hawksbills are believed to be uncommon but loggerheads are probably the most common sea turtle (Carr et al. 1982). All sea turtles in the Gulf are protected by the Endangered Species Act. The probability of sea turtles being near platforms, and perhaps injured or killed by the explosions used to remove platforms, has not been reported.

In June 1988, supported by Minerals Management Service's Environmental Studies Program, we begin a 12-month study of the association between sea turtles and platforms offshore of Louisiana. Our study was primarily designed to study whether sea turtles were attracted to platforms. Additionally, our study addressed three other research questions having direct bearing on sea turtle conservation: are sea turtles similarly abundant among different habitats, are sea turtles similarly abundant seasonally, and are any other marine animals reliable indicators of habitats preferred by sea turtles?

METHODS

Five study areas, ranging from about 900 to 1300 km^2, offshore of Louisiana were selected. Areas with varying platform densities, ranging from none to many per unit area, occur in each study area. Sediment types vary among study areas. Water depths range from about 2 to 200 m but, in each study area, water depth is a constant among the differing platform density areas. One study area is east of the Mississippi River and near the Chandeleur Islands. These islands are used by nesting loggerheads. The other four study areas are west of the river, not near any known sea turtle nesting beaches, and range from near shore to about 150 km offshore.

In this paper we have used data from the June through December surveys for density and distribution analyses. Each study area was surveyed 4 or 5 times, depending on random selection, per month. Each survey consisted of a series of systematic transects from a single random starting location in each study area. Systematic transects insured similar coverage of the different platform density areas.

A Twin-Otter aircraft was flown at 229 m altitude and about 204 km/h ground speed. Two observers, one on each side of the aircraft, reported observations to the computer operator. Two types of sea turtles, leatherbacks (Dermochelys coriacea) and chelonids, were easily differentiated. Chelonids were segregated to most probable species or classed as unidentified. The majority of chelonids were either loggerheads or not identified. In addition to sea turtles, similar data was collected for about 40 other types or species of marine animals, 7 types of pollution, and 10 types of human activities. The computer was interfaced with a LORAN-C receiver and automatically recorded the study area, date, time, and location for each data record. Many observer supplied variables described the survey environment and animal behavior. A high resolution video camera, mounted in a open porthole, recorded, the transect tracklines.

Line transect data analysis methods were used to estimate surfaced sea turtle abundance. For this paper we used two methods to study sea turtle association with platforms. We generated 10 repetitions of 100 random points in each study area. Correlations between the distances from each point to the nearest platform and the nearest turtle location were tested with Kendall's measure of rank association and Spearman's measure of rank correlation (Upton and Fingleton 1985). The cumulative probabilities of observed and expected distances from turtle locations to the nearest platforms (Hamill and Wright 1986) were compared. We used radii increasing in 100 m increments to compare observed versus expected numbers of turtles sightings per distance interval. We used the Kolmogorov test statistic (Conover 1980) to test for significant differences between the observed and expected cumulative probability distributions.

Surface sea temperatures have been monitored by two methods. During the summer and early fall a high resolution, precision radiation thermometer was mounted on the aircraft and used to record temperatures at intervals along each transect and whenever a marine animal was sighted. At least twice a month, the NOAA-9, NOAA-10, or NOAA-11 satellites were accessed for sea surface temperatures. Resolution of these images was about 1 km^2. In addition to estimating sea surface temperatures at marine animal locations, these images provided an overall assessment of how sea surface temperatures were changing.

RESULTS

From June through December, a total of 142 sea turtles were sighted. Thirteen were leatherbacks, the other 129 were identified as chelonids. Eight (62%) of the leatherbacks have been observed in one study area west of the river, usually associated with jellyfish. Surfaced chelonids abundance was dissimilar among study areas. Seventy-eight (60%) of the chelonids were observed in the study area offshore of the Chandeleur Islands (Figure 1). In that study area, the average surfaced chelonid density (June through November) was 0.028 turtles/km^2, much greater than the average surfaced chelonid densities for the same time period in the other four study areas (range 0.007 to 0.001 turtles /km^2).

Chelonids offshore of the Chandeleur Islands have shown a significant affinity for the petroleum platform area. Both Kendall's and Spearman's tests found chelonid locations positively correlated with platform ($P < 0.01$). Hamill and Wright's test for dispersion indicated the association became significant in the 900 to 1000 m distance interval ($P < 0.05$), and maximum significance occurred in the 4800 to 4900 m distance interval ($P < 0.001$).

Surfaced chelonids were not associated with platforms in the other study areas (Kendall's and Spearman's tests; $P > 0.20$ for these studies). Results from the tests for dispersion indicated chelonids were somewhat repulsed from the platforms in two of the study areas and randomly dispersed in the other study area. Too few sea turtles have been sighted in the deep water study area to allow significance testing.

Surfaced chelonids in the study area offshore of the Chandeleur Islands have been most abundant in the southern portion, the area where platforms are most abundant. Fourteen percent of the turtles have been within 500 m of a platform, 30% within 1000 m, and 45% within 1500 m. West of the river, 7% of the surfaced turtles have been within 500 m, 14% within 1000 m, and 23% within 1500 m of the nearest platform.

If we assume adult loggerheads spend about 8% of the daylight hours on the surface (Nelson et al. 1987), we can use a factor of 12.5 to calibrate estimated surfaced turtle abundance to total loggerhead sea turtle abundance. If we assume that the chelonids are not territorial, that is, one turtle being near a platform does not affect the probability of another being nearby, and then randomly pick a Chandeleur Island study area platform, the probability of one or more chelonids being within 500 m would be about 0.27, within 1000 m about 0.50, and within 1500 m about 0.65. West of the river, the probability of one or more chelonids being within 500 m of a randomly selected platform would be about 0.04, within 1000 m about 0.08, and within 1500 m about 0.13.

Summer (June through September) sea surface temperatures in the study areas were uniformly 22 to 24 C. In the fall, the surface sea temperatures began to stratify and in February the surface temperatures ranged from about 12 C nearshore to 20 C about 150 to 180 km offshore. Compared to the "summer" abundance and distribution, surfaced sea turtles observed from November through March, were more or less similar in abundance and distribution pattern.

DISCUSSION AND CONCLUSIONS

Offshore of the Chandeleur Islands, the greater abundance of sea turtles, along with either an attraction for platforms or an attraction for the platform area, increases the probability that a chelonid, probably a loggerhead, will be near a platform. West of the river, because chelonids are more uncommon, because they do not appear to be attracted to platforms or platform areas, and because the density of platforms is so great, the probability of a sea turtle being near any randomly selected platform is much less, but not inconsequential.

In temperate areas, loggerhead sea turtles are believed to migrate and brumate as a response to either decreasing water temperatures and/or decreasing photophase periods (Carr et al. 1980, Ogren and McVea 1981, Dodd 1988). We observed surfaced sea turtles during the winter months in study areas where surface sea temperatures were about 14 to 16 C. To what extent the moderate 1988/89 winter weather may have influenced sea turtle behavior is not known.

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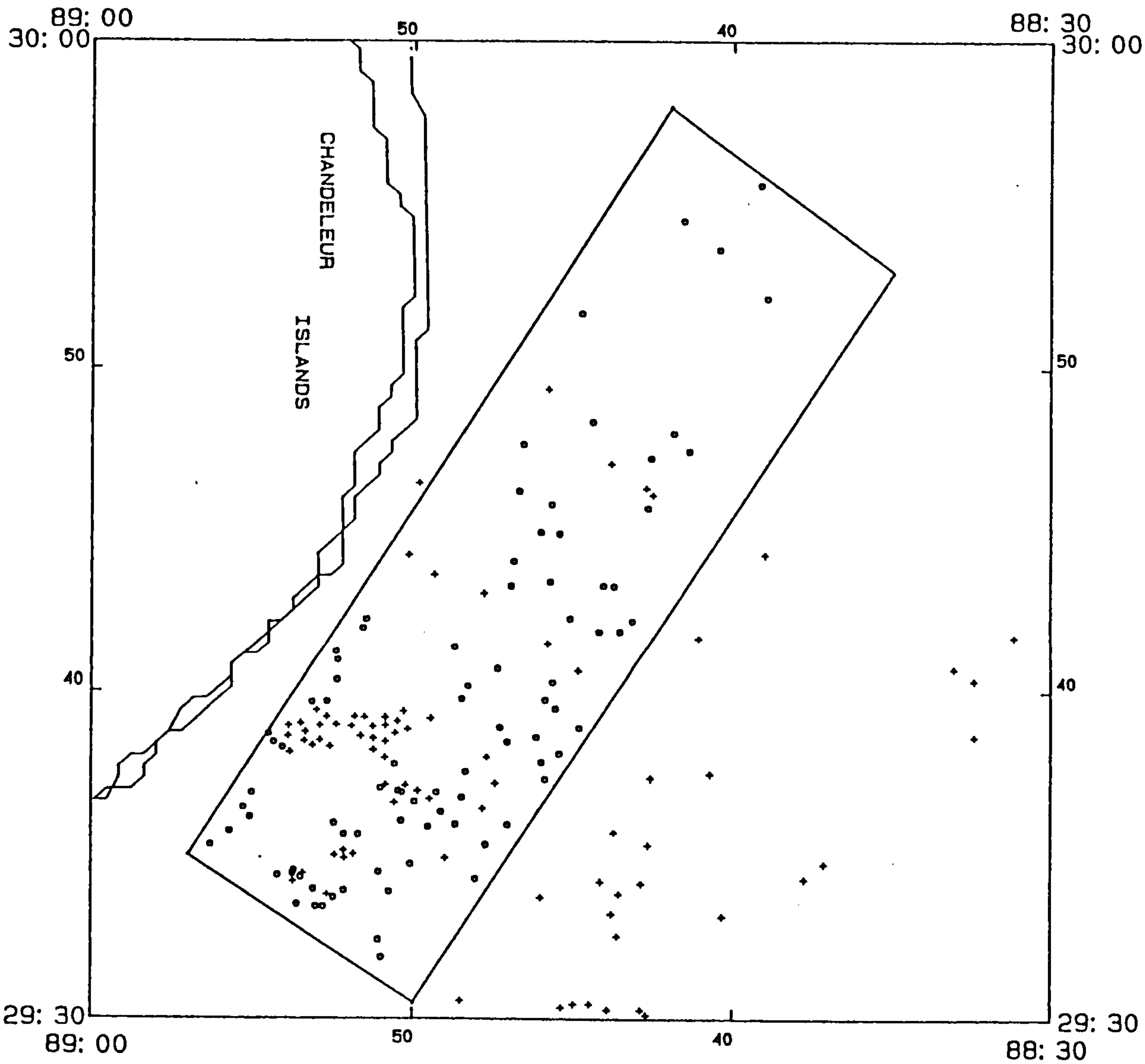

Figure 1. Locations of surfaced Chelonids (circles) observed during the June through February surveys. Platform locations are crosses and the parallelogram delineates the study area.

ABSTRACT

HISTORICAL SHIPWRECK PATTERNS, MAGNETIC ANOMALIES, SIDE-SCAN SONAR CONTACTS CHARACTERIZATION AND CRMZ1

Prepared for presentation at the:

Spring 1989 Ternary Studies Meeting

Sponsored by the:

Minerals Management Service
Gulf of Mexico OCS Regional Office
1201 Elmwood Park Boulevard
New Orleans, Louisiana

Prepared by:

Ervan G. Garrison, Charles P. Giammona,
Frank E. Kelly, Anthony R. Tripp, and Gary A. Wolff

21 March 1989

HISTORICAL SHIPWRECK PATTERNS, MAGNETIC ANOMALIES, SIDE-SCAN SONAR CONTACTS CHARACTERIZATION AND CRMZ1

Ervan G. Garrison, Charles P. Giammona, Frank E. Kelly, Anthony R. Tripp and Gary A. Wolff

ABSTRACT

This paper presents some historical and natural factors linked to the patterns of shipwrecks in the northern Gulf of Mexico--shipping routes, port development, winds and currents, hurricanes, reefs and hazards--such that their relationship is more clearly seen. Spatial and numerical techniques were used to evaluate a digital data base compiled from a variety of sources for historic Gulf shipwrecks. The shipwrecks have followed historic trends in colonization, population, and economic activity in the Gulf. Natural factors such as reef and shoal hazards, together with storms, have combined to create the shipwreck distribution we observe today.

Additionally, we summarize the results of a study to characterize and differentiate these historic shipwrecks from modern marine debris using magnetometry and side-scan sonar. These instrumental techniques for cultural resources surveys have been found to be effective if a more intensive methodology is used. Combining these results with that of the study of shipwreck factors leads to a revision of both the existing Cultural Resources Management Zone 1 (CRMZ1) and the existing instrumental survey methodology.

The historic data support a new boundary for CRMZ1 within 10 kilometers of the coast. Further, the distribution and clustering of historic shipwrecks at specific locations of ports and hazards support creation of 22 high probability areas where a revised survey methodology can more readily locate these historic shipwreck sites. These areas have been defined using numerical methods on the pre-1900 shipwreck data.

By merging the results of the two studies of shipwreck factors and instrumental characterization, a more effective use of existing resources can be achieved. Finally, it should be noted that the CRMZ1 is not a static entity. Many vessels of a post-1900 date are historically significant or will be in the near future. Recognition of this fact is important to the updating and management of CRMZ1.

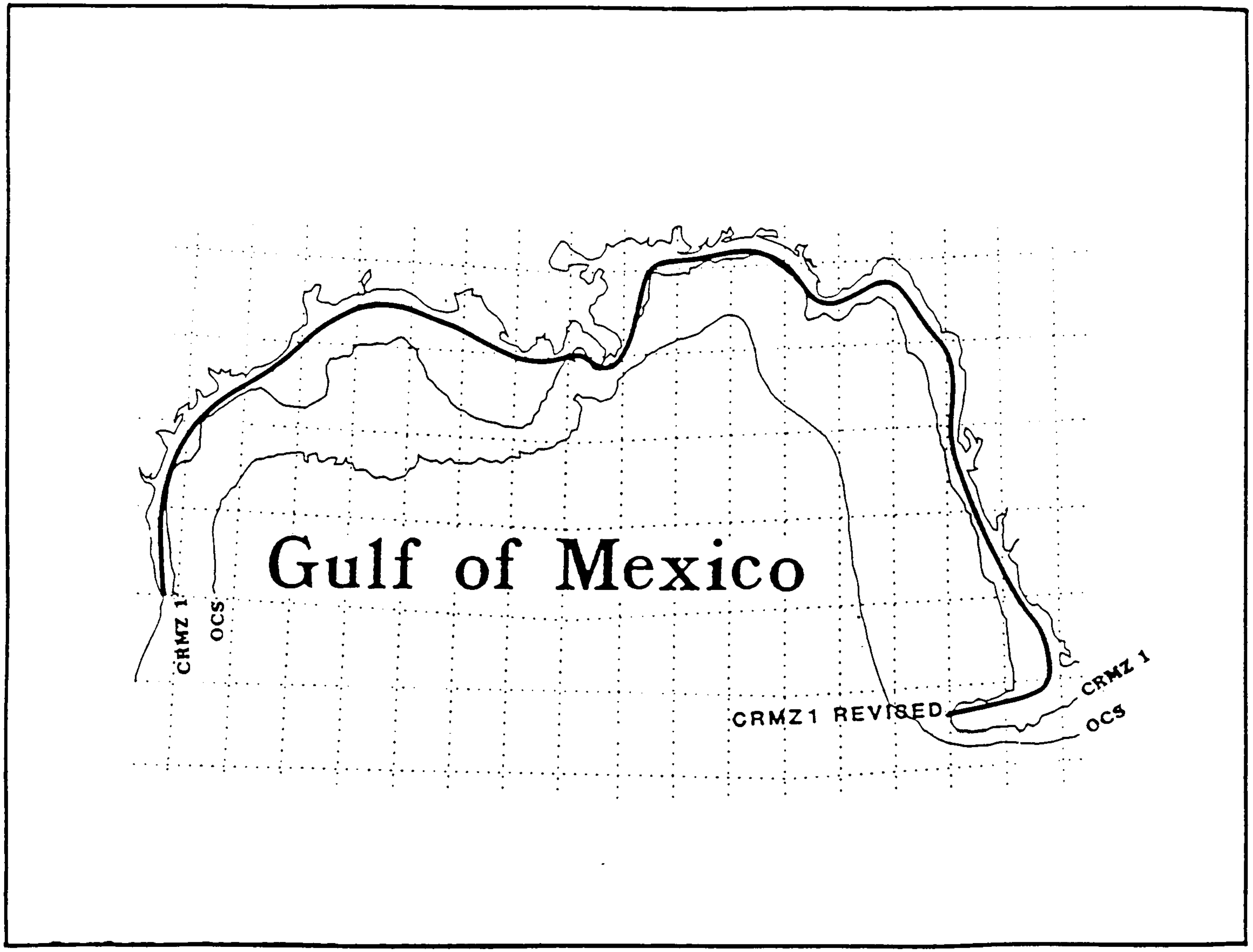

Figure 1. Gulf of Mexico coastline.
CRMZ 1 - Cultural Resources;
OCS - Continental Shelf.

ABSTRACT

TOPOGRAPHIC FEATURES OF THE MISSISSIPPI-ALABAMA CONTINENTAL SHELF

Prepared for presentation at the:

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Sponsored by the:

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21 March 1989

Topographic Features of the Mississippi-Alabama Continental Shelf

J.M. Brooks, C.P. Giammona, R. Darnell, T.J. Bright, and S.R. Gittings

ABSTRACT

Within the boundaries of the Mississippi-Alabama Marine Ecosystems Study, MMS requested complete side-scan coverage and selective video reconnaissance of topographic features in the following area which consists of a number of sites of known or suspected hard-bottoms:

	Latitude	Longitude
Northwest Corner	29°25'24"N	88°01'48"W
Southwest Corner	29°14'24"N	87°56'54"W
Southeast Corner	29°26'06"N	87°23'36"W
Northeast Corner	29°36'40"N	87°28'30"W

Reported results are from a preliminary analysis of side-scan and subbottom surveys conducted in the fall of 1987 and spring and summer of 1988. Video reconnaissance was conducted with a Benthos RPV-2000, medium-sized, remotely operated underwater vehicle in 1987. The camera capability of the unit consisted of a Subsea Model CM-8 low light sensitive S.I.T. black-and-white video camera, a Benthos Model 378 35 mm camera, one strobe, and three banks of two flood lights each. The Geochemical and Environmental Research Group (GERG) upgraded the photographic capabilities of the ROV by installing a 3-CCD Photosea 3000 series color video camera and a Photesea 2000 Series Series 35 mm stereo camera. The video camera is a modified Sony DXC-3000 3-CCD video unit with two underwater optical lasers. These lasers are in a parallel configuration allowing for size and scale determinations on video and stereo images. The ROV has a present depth capability of 600 meters. It is acoustically tracked with ultra-short baseline navigation using a Ferranti/ORE Trackpoint II system.

The results of the preliminary side-scan and subbottom data analysis indicated a surprisingly diverse habitat. Many topographic features within the study area are of sufficient relief that they support communities distinct from those of nearby habitats.The features in this area included:

- wave fields (closely spaced, low relief waves on bottom)
- spaced ridges (spaced 100-200 m apart; if troughs exist, most seem to be in-filled with soft sediments)
- areas of patchy hard bottom returns
- ridges
- shorelines (these may be previous still-stand erosional features)
- fields of small reefs
- fields of what appear to be small depressions in the bottom
- features of low topographic relief
- features of moderate topographic relief
- features of major topographic relief (some over 15 m vertically; some are smooth topped, some knobby; some broad and some spire-like)

- wrecks and/or sunken oil platforms (two within study area, one which is a sunken platform)

Continuing ROV work should be conducted to provide information on what may be a fairly large number of distinct biotic assemblages. Future cruises will include visits to locations that are expected to be representative of a number of sites within the study area exhibiting similar topographic characteristics.

ABSTRACT

PHYSICAL OCEANOGRAPHY PROGRAM

Prepared for presentation at the:

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Sponsored by the:

Minerals Management Service
Gulf of Mexico OCS Regional Office
1201 Elmwood Park Boulevard
New Orleans, Louisiana

Prepared by:

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21 March 1989

March Ternary Meeting
Physical Oceanography Program

A B S T R A C T

Introduction

MMS initiated a multi-year, regionally phased Physical Oceanography Program in 1983 which is to obtain and synthesize field observations to provide an improved understanding of key circulation patterns and processes in the Gulf of Mexico (GOM). Present activities are in the fifth and final year of the program sequence.

The Year 5 emphasis is on the shelf, slope and deep regions of the north central GOM (Figure 1). A broad range of information is being integrated to provide the resulting characterization. The suite of observations includes:

- In-situ currents/temperature/pressure
- Ship-and Plane-based surveys
- Ship-of-Opportunity Program
- Satellite Thermal Imagery
- Satellite-tracked drifters
- Inverted echo sounder (IES)
- Transmissometry
- Marine Optics
- Selected GEOSAT Altimetry.

Separately and collectively, these are building an improved picture of conditions in the study area. In deeper water, a series of Loop Current (warm core) eddies have been documented both in the vicinity of program moorings and further west by using composites of station data taken as part of this and complementary programs (Figure 2). During one group of surveys, a cyclonic (cold-core) eddy was on the slope (Figure 3). This feature had no thermal signal above about 200 m. and is apparent only by looking at the deeper isotherms. This particular eddy motion was seen in the trajectory of a drifter and in the subsurface current observations.

Subsurface cyclones were also seen in deep water (depth $\geq$ 3,000 m). A combination of subsurface temperature and inverted echo sounder data clearly show a cyclonic feature which is leading (in front of) a major LC eddy (Figure 4). This feature has little signal in the upper portion of the water column and thus would not be visible in thermal imagery. From the calibrated IES data, it would appear that the deep Gulf has a rich and varied current field much of which is associated with eddies of varying size (Figure 5). Considering what is seen in other ocean basins, this is not surprising, however, until now it has not been well documented in the Gulf.

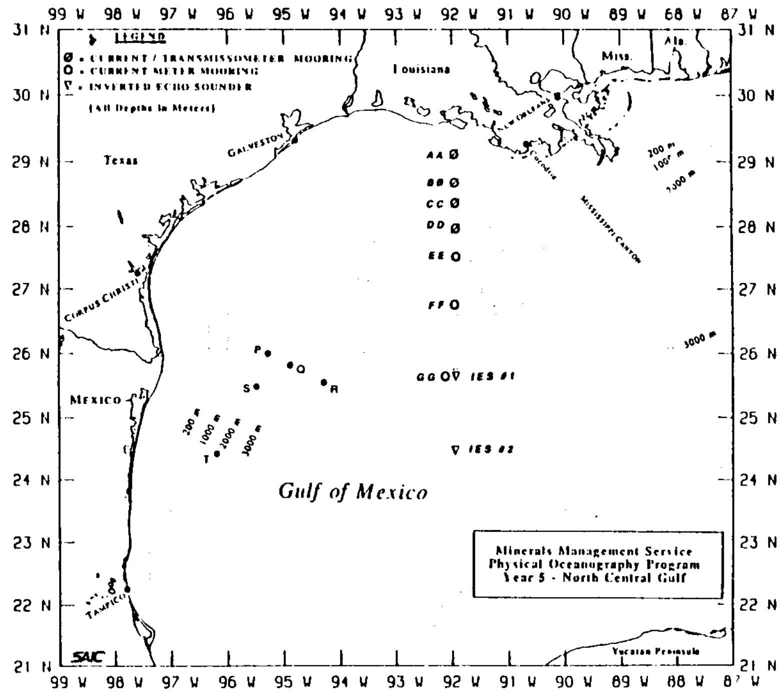

Figure 1. Map of study area. Moorings P-T were deployed during the Yr. 3 field measurements.

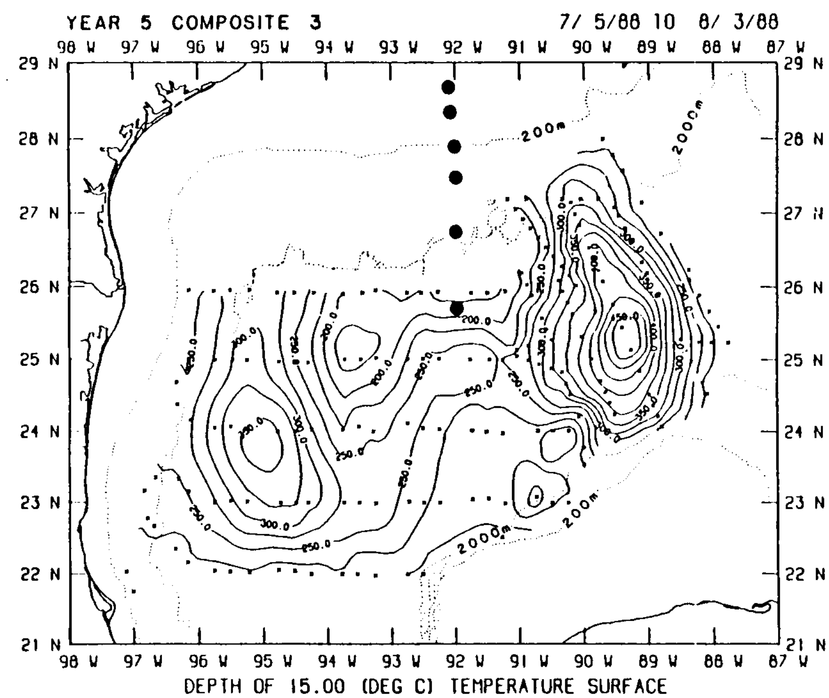

Figure 2. Composite of MMS/AXBT survey and XBT data provided by V. Vidal showing two LC eddies - a new eddy around 89.5°W with a "teardrop" shape and an older, mature eddy in the western Gulf around 95°W.

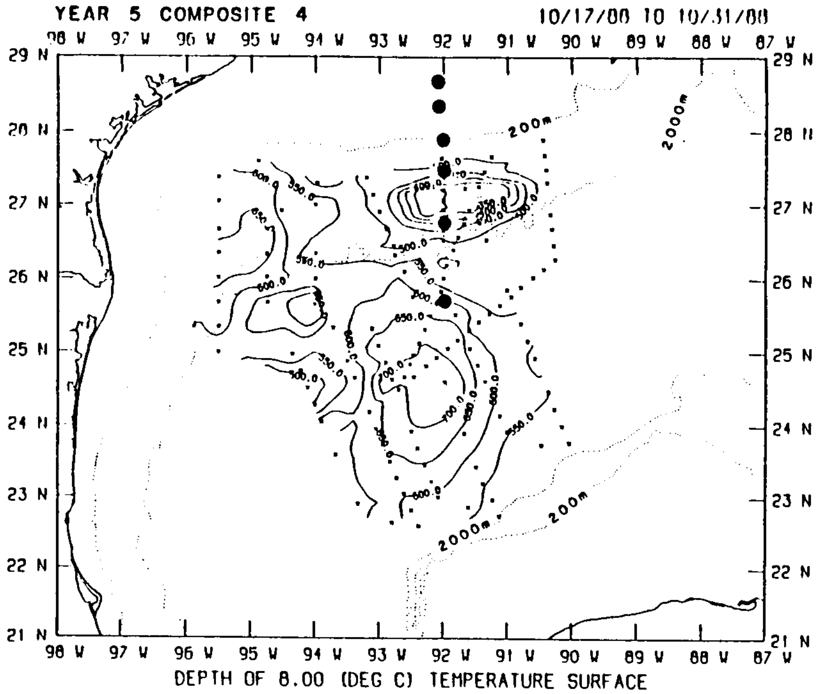

Figure 3a. Composite of three MMS surveys and a cruise of the R/V Gyre showing a warm eddy centered at 92°W, 25°N. Between Moorings EE and FF a subsurface, cold core eddy is seen.

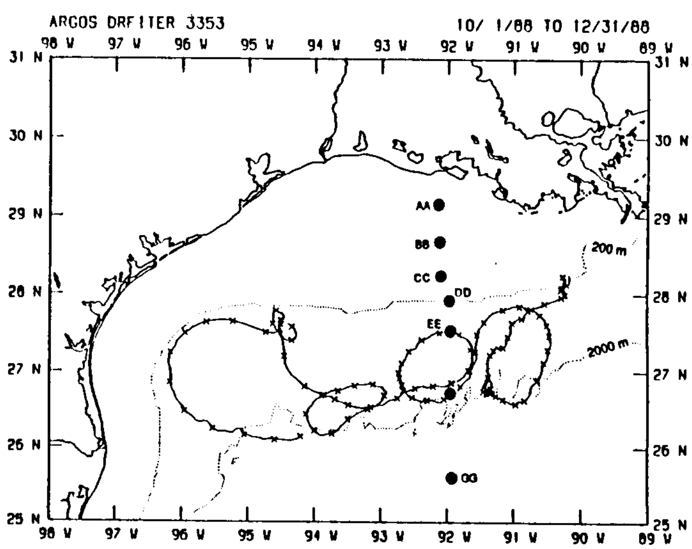

Figure 3b. Drifter trajectory during period of cruises in Figure 3a. The drifter moved around the cold core feature about two weeks following the survey period.

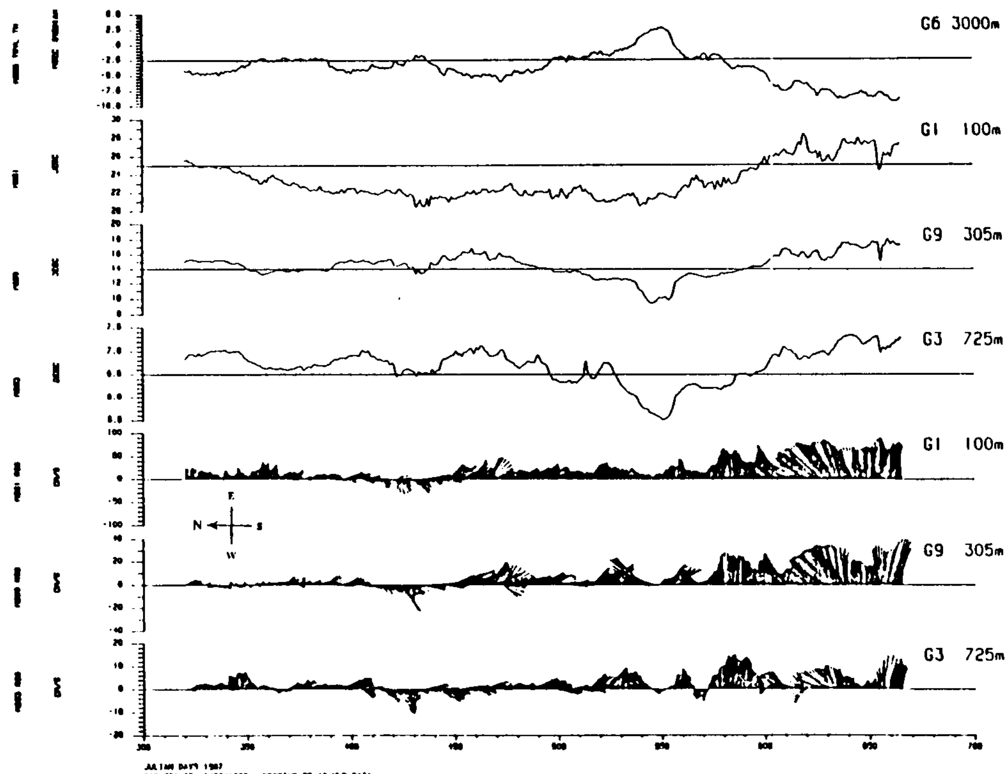

Figure 4. For Mooring GG and the IES, time series plots of IES travel time variation, temperatures at indicated levels, and velocity vector plots at the same water depths. Around Day 550 a subsurface cyclone moves over the instruments and is followed by currents associated with a LC (warm-core) eddy.

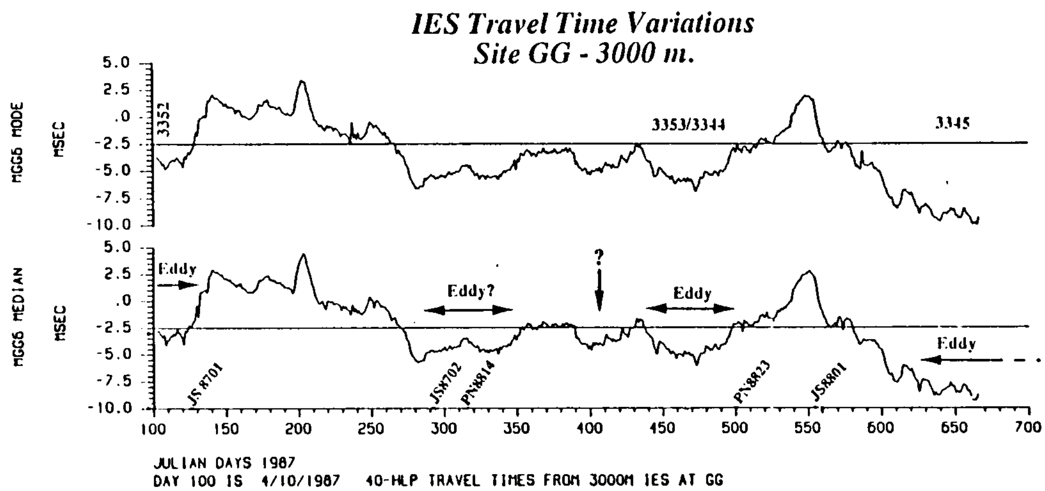

Figure 5. Inverted Echo Sounder travel time data for 18 month period. Numbers on upper graph show when buoys and eddies were near IES. Across bottom, cruise identifiers are shown. Data clearly shows both warm and cold-core eddies in deep water. Cold-core eddies probably have little surface thermal signal although the associated horizontal circulation probably extends upward to the surface.

LIST OF REGISTERED ATTENDEES

Mr. Ken Adams, Deputy Regional Supervisor, Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Boulevard, New Orleans, LA 70123-2394

Ms. Eileen Angelico, Public Affairs Assistant, Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Boulevard, New Orleans, LA 70123-2394

Mr. Rik Anuskiewicz, Archaeologist, Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Boulevard, New Orleans, LA 70123-2394

Dr. Robert Avent, Oceanographer, Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Boulevard, New Orleans, LA 70123-2394

Mr. Jim Barkuloo, Supervisor, U.S. Fish & Wildlife Service, 1612 June Avenue, Panama City, FL 32405

Mr. Richard T. Bennett, Biologist, Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Boulevard, New Orleans, LA 70123-2394

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The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.