Identification and Mapping of Fishing Banks on the Outer Continental Shelf of the Gulf of Mexico

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ABSTRACT

The Bureau of Land Management (BLM) began leasing in Gulf federal waters for oil, gas, and sulfur in 1954. Between 1954 and 1971, 23 lease sales were held with the value of the prospects the principal factor guiding the sales. In 1971, formal environmental impact statement preparation began and by 1973 concern for fishing banks, shrimping areas, shipwrecks, and coral reefs brought about special stipulations in the Florida Middle Ground, Stetson Bank, East and West Flower Garden banks, and 18 Fathom Lump.

Regional maps of fishing grounds in the lease areas were sketchy and detailed bathymetric maps for the Gulf of Mexico were limited to 1:1,000,000 maps and Coast and Geodetic Survey (C&GS) – National Ocean Survey Nautical Charts. The BLM in New Orleans prepared a series of visuals for impact statements displaying undersea features. These have become a popular item for those people not already familiar with Gulf bathymetric features, fishing banks, and coral reefs.

Much of the information shown on the BLM visuals was derived from areas shown by commercial fishing publications, nautical charts, and locations given to us by seagoing biologists and geologists (from universities, state and federal agencies, and offshore operators) as well as sport divers and fishermen.

The National Ocean Survey (NOS) has completed nine 1:250,000 scale bathymetric maps covering areas from the Rio Grande to Florida Middle Ground. These maps are useful guides to pinpointing many Gulf fishing banks. The precision of water depths, locations, and configurations of these areas is proving helpful in managing oil and gas operations near these banks. The 1:250,000 scale maps from the areas of Big Boy near the SEADOCK fairway to Sackett Bank near the LOOP fairway detail the salt dome related snapper banks along the shelf edge. Breton Sound, Pensacola, and Destin Dome sheets detail hardbanks, sand ridges, submerged channels, and islands important to fishing in this area.

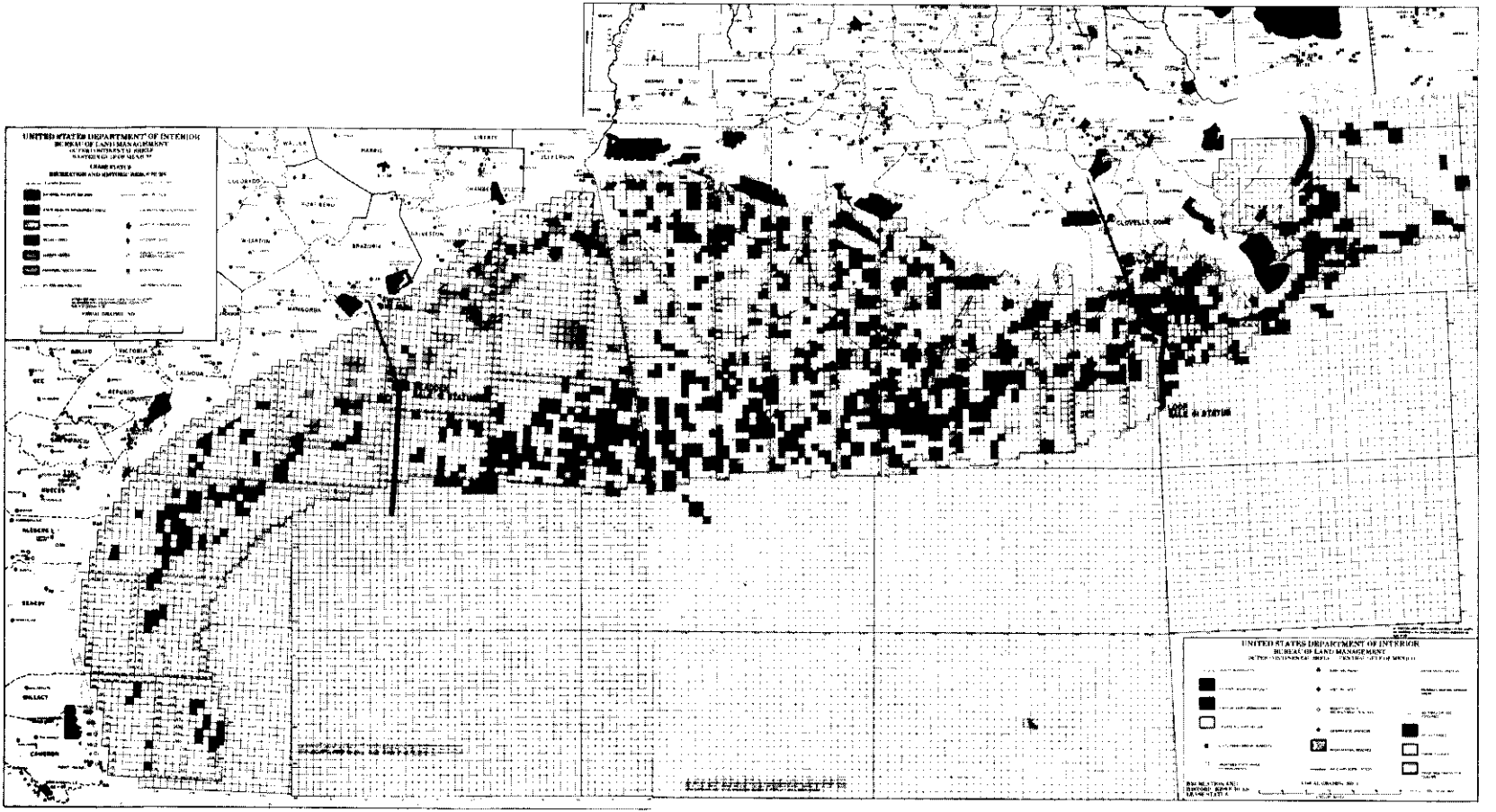
Additional detailed maps on a 1:12,000 (1 inch = 1,000 feet) scale have been prepared for BLM on hardbanks in offshore Texas by Texas A & M, Lorac, and Decca survey companies. Fifteen banks from Mysterious Bank off Port Mansfield, Texas to 28 and 29 Fathom banks, directly east of the Flower Garden banks are now available.

Fishing grounds related to bathymetric and geologic features for the Gulf of Mexico can be accurately mapped with modern navigation, side scan sonar, and narrow beam soundings. We hope to add additional details to fishing grounds by use of BLM, NOS, and industry data taken in the course of special studies for impact statements, baseline investigations, archaeologic, and geologic hazard surveys for the Gulf of Mexico and South Atlantic continental shelf and slope.

INTRODUCTION

The Bureau of Land Management (BLM) began leasing the Gulf of Mexico Federal OCS (Outer Continental Shelf) for oil, gas, and sulfur in 1954. Between

Figure 1. Lease status prior to Sale 41 showing the LOOP and SEADOCK areas proposed for deepwater terminals.



1954 and 1971, 23 lease sales were held with the value of the prospects the principal factor guiding the sales. In 1971, formal environmental impact statement (EIS) preparation began and by 1973 concern for fishing banks, shrimping areas, shipwrecks, and coral reefs brought about special stipulations in the Florida Middle Ground, Stetson Bank, East and West Flower Garden banks, and 18 Fathom Lump. Figure 1 illustrates the leasing activity in the central and western Gulf of Mexico. These maps are available as color visuals for Final Environmental Impact Statement (FEIS), proposed OCS Sale #41.

IDENTIFICATION OF BANKS

At the outset of EIS preparation, regional maps of fishing grounds in the lease areas were sketchy and detailed bathymetric maps for the Gulf of Mexico were limited to 1:1,000,000 maps and Coast and Geodetic Survey (C&GS) – National Ocean Survey Nautical Charts. The BLM in New Orleans prepared a series of visuals for impact statements displaying undersea features. They have become popular items for those people not already familiar with Gulf bathymetric features, fishing banks, and coral reefs. Figure 2 shows the location of such features as the Flower Gardens, Stetson, Southern Bank and many other banks. Figure 3 is a set of two color visuals constructed for FEIS Proposed OCS Sale #41 showing underseas features of the northern Gulf of Mexico.

Much of the information shown on the BLM visuals was derived from commercial fishing publications, nautical charts, and locations given to us by seagoing bologists and geologists (from universities, state and federal agencies, and offshore operators) as well as sport divers, and commercial and sports fishermen. A list of our principal contacts for the construction of visual No. 4, (Figs. 2 and 3) as well as the MAFLA (Mississippi-Alabama-Florida) area is shown in Table 1.

Additional information on fishing bank locations can be gathered for offshore Texas and Louisiana from the OFFSHORE FISHING CHART series published by Tidewater Fishing Publications, Inc., Seabrook, Texas. More detail for the western Gulf and particularly the bays, channels, and estuaries is given by fishing charts published by the Bookmap Corporation, San Antonio, Texas. Fishing information in the eastern Gulf is detailed in two publications by Moe (1963 and 1970). We also recommend the following agencies for information regarding each state and its offshore fishing areas

(a) Texas Parks and Wildlife Department
Marine Laboratory
Rockport, Texas

(b) Louisiana Wildlife and Fisheries Commission
Oysters, Water Bottoms, and Seafoods Division
New Orleans, Louisiana

(c) Gulf Coast Research Laboratory
Marine Fisheries Section
Ocean Springs, Mississippi

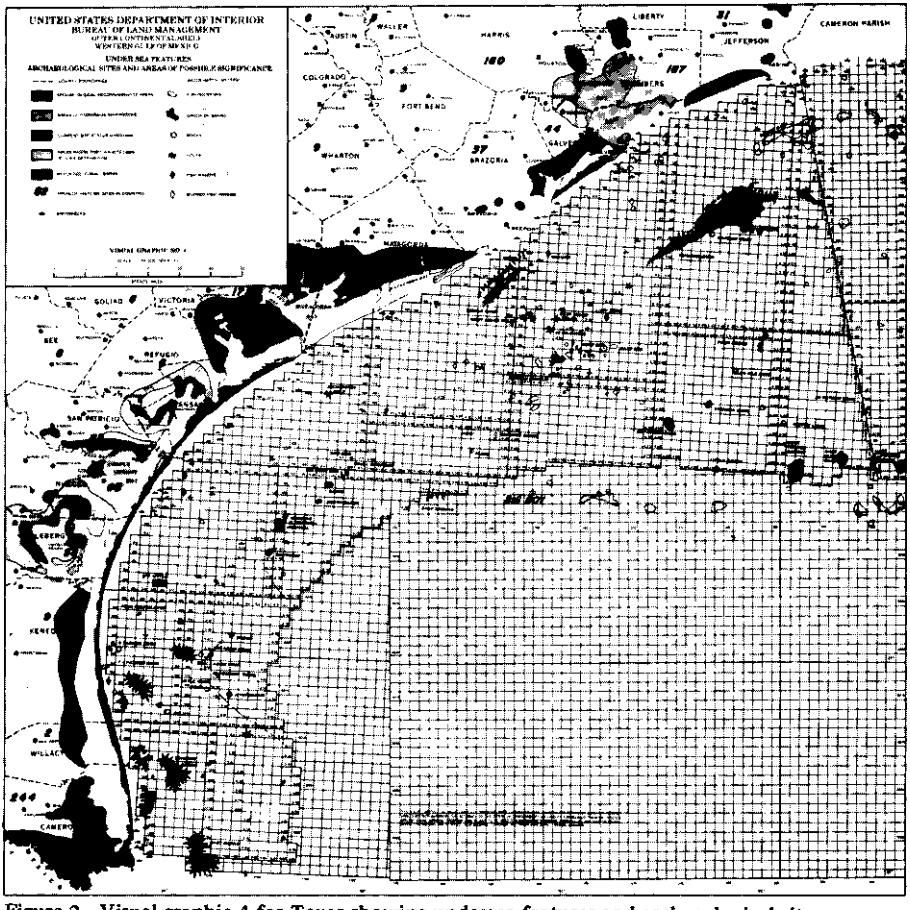


Figure 2. Visual graphic 4 for Texas showing undersea features and archaeological sites.

(d) Alabama Department of Conservation and Natural Resources
Marine Resources Division
Dauphin Island, Alabama

(e) Florida Department of Natural Resources
Marine Research Laboratory
St. Petersburg, Florida

Offshore Louisiana oil and gas platform locations are shown by the WELLS FISHING MAPS published by Fishing Publications, Inc., Houston, Texas. Platform locations farther offshore and the locations of the banks along the edge of the continental shelf commonly referred to as "Snapper-grouper banks" or the "Galveston lumps" are shown by C&GS, National Ocean Survey Charts 1115, 1116, and 1117. The A series of these charts (i.e. 1117A) includes a red lease block graticule. The Flower Garden banks, Little Sister, and 18 Fathom Lump

are part of this group of banks caused by an alignment of salt dome intrusions that were situated at elevations above the level of sediment burial.

Many of these banks are reported to have hard or coralline caps above the salt layers (Edwards, 1971; Bright and Pequegnat, 1974), and the conditions of the reefs generate an excellent habitat for fish. Carbonates associated with these banks have been discussed as early as 1937 by Shepard, and research particularly on the Flower Gardens began in the 1950s by Carsey (1950), Ekman (1953), Greenman and LeBlanc (1956), Parker and Curry (1956), Shepard (1960), Pulley (1963), and Stoddard (1969). Edwards (1971) reports a history of investigations in "The Geology of West Flower Garden Bank" through 1971. Submersible investigations of the West Flower Garden were organized by Alderdice in 1972 and the East Flower Garden by Bright in 1974. The locations of these salt dome related banks generally extend from Big Boy Bank (Fig. 2) in the west near the proposed SEADOCK fairway to the eastern border of Figure 3 along the edge of the continental shelf. Leasing for oil and gas now encompasses the area near several of these features (Fig. 1).

Table 1. List of Primary Contacts

PERSONS CONTACTED	AFFILIATION	LOCATION
Philip Oetking, Ph.D.	Southwest Research Institute	Corpus Christi, Texas
Louis Rizzo	Bookmap Corporation	San Antonio, Texas
Steven Frishman	South Jetty Newspaper	Port Aransas, Texas
Donald Wohlschlag, Ph.D.	Marine Science Institute - University of Texas	Port Aransas, Texas
C.E. Bryan and others	Texas Parks & Wildlife Dept.	Rockport, Texas
Robert Alderdice	Consultant	Galveston, Texas
Thomas Bright, Ph.D., and others	Department of Oceanography - Texas A&M	College Station, Texas
Nugent Brashear	Consultant	New Orleans, Louisiana
Farley Sonnier	Attorney	Lafayette, Louisiana
James Meachin	Exxon Oil Company	Houston, Texas
Wayne Swingle	Alabama Dept. of Conservation	Dauphin Island, Ala.
Richard Geyer, Ph.D.	Dept. of Oceanography - Texas A&M	College Station, Texas
Sherwood Gagliano, Ph.D.	Coastal Environments, Inc.	Baton Rouge,Louisiana
James Prunty	Mobil Oil Company	New Orleans,Louisiana
James Barkuloo	U.S. Fish & Wildlife Service	Panama City, Florida
Rolf Juhl and others	National Marine Fisheries Service	Pascagoula, Mississippi
Larry Ogren	National Marine Fisheries Service	Panama City, Florida
Charles Futch and others	Florida Dept. of National Resources	St. Petersburg, Florida
Martin Moe	Aqualife Research	St. Petersburg, Florida
Thomas Hopkins, Ph.D.	University of Alabama	Dauphin Island, Ala.
Thomas Pulley, Ph.D.	Houston Museum of Natural History	Houston, Texas
Eugene Shinn	Shell Oil Company	Houston, Texas
Joseph Colson and John Thompson, Ph.D.	Gulf States Marine Fisheries Commission	New Orleans, Louisiana

MAPPING OF BANKS

The Bureau of Land Management has an interest in the protection of fishing grounds, particularly fishing banks with unique assemblages of biota, through

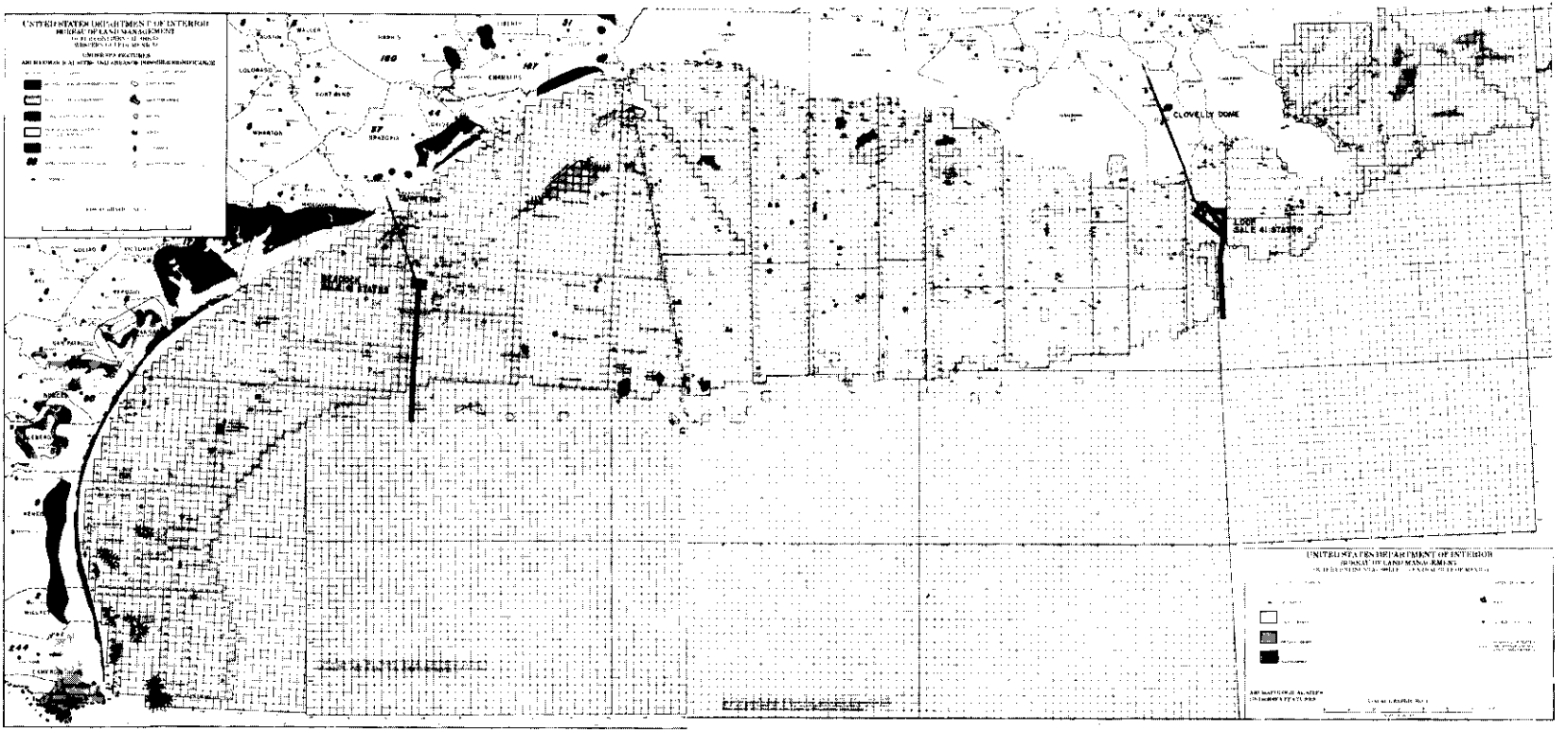


Figure 3. Visual graphic 4 for Texas and Louisiana showing undersea features in reference to the LOOP and SEADOCK deepwater terminals.

BLM's multi-use functions of managing oil and gas leasing operations in conjunction with other values and uses of the Federal OCS. Much of the early BLM efforts to protect these areas continues in the compilation of information about these areas, such as their exact position, relief, extent, biological assemblages, and use in commercial or recreational activities. Table 2 lists some of the BLM requirements for accurate bathymetry in multi-use management of the OCS.

Table 2. Requirements for Accurate Bathymetric Maps Are Listed below as Used in Managing Offshore Oil and Gas Operations

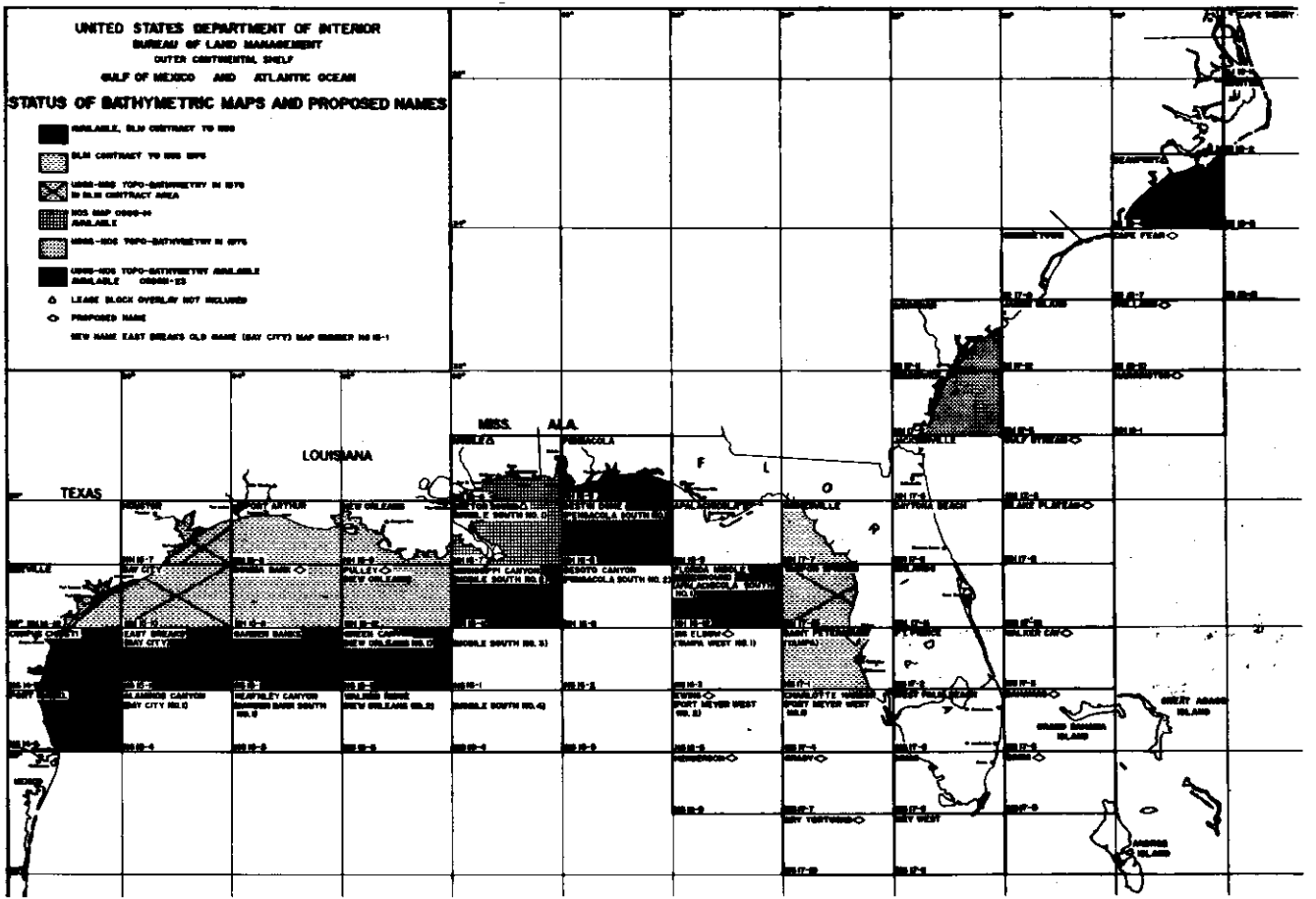
1. Determination of slope gradients in mudslide areas for geologic hazards.
2. Base maps for plotting individually reported geologic hazards, as mud lumps, gas seeps, and faulting.
3. Determination of bathymetric features such as high and low relief areas, fishing banks, coral reefs, and other features.
4. Determination of high probability areas for shipwrecks and submerged aboriginal (Indian) living sites.
5. Determination of the upper and lower limits of practical use of geophysical instrumentation for archaeological and biological survey stipulations.
6. Depth requirements on shunting of drill cuttings.
7. Location of favorable areas for recreational uses (such as diving and underwater parks).
8. Base map for almost all offshore environmental information such as shoaling areas for tornadoes, cable and pipeline burial requirements, depth information for tract selection, depth information for EIS and Sale Matrix.
9. Location of favorable areas for other uses of the seafloor and subbottom.

The original intent of the BLM environmental visuals was to identify areas of important undersea features with a generalized (not site specific) accuracy. However, coral and fishing areas with applicable special stipulations have grown from 5 to approximately 50 in the past year and a variety of maps, including the BLM visuals, were used to locate these areas until accurate bathymetric maps of the operating areas could be obtained.

Under a Bureau of Land Management contract, the National Ocean Survey (NOS) has completed nine 1:250,000 scale bathymetric maps covering areas from the Rio Grande River to the Florida Middle Ground (Fig. 4). These maps are now available from the Bureau of Land Management, New Orleans, Louisiana, and the National Ocean Survey, Rockville, Maryland. They were constructed from original Coast and Geodetic Survey work dating from 1937 and supplemented by modern survey data contributed by oil companies, university research, and U.S. Navy surveys.

The Corpus Christi and Port Isabel maps (Figs. 5 and 6) contain additional detailed information from maps on a 1:12,000 (1 inch-1,000 feet) scale for hardbanks surveyed by Texas A & M University, Lorac, and Decca survey companies under contract with the Bureau of Land Management. Fifteen banks from Mysterious Bank east of Port Mansfield, Texas to 28 and 29 Fathom banks, east of the Flower Garden banks were surveyed in 1974 and 1975. Maps of these areas are available in the Texas A & M final report to BLM at a scale of

Figure 4. Status of bathymetric mapping in the Gulf of Mexico and South Atlantic OCS areas.



1:12,000. These data were reported by Bright and Rezak (1975) showing the banks at a preliminary scale. Hospital Bank was previously surveyed by Oetking in 1969 for Southwest Research Institute and mapped at a scale of approximately 1:6,600.

DETAILING AREAS

Soundings for BLM mapping specifications are contoured at a 2-meter interval out to the 200-meter depth and a 10-meter interval for greater depths. Identification of low relief areas requires a 2-meter contour interval. A 1-meter contour interval would in some cases be more desirable; however, special survey conditions preclude a 1-meter interval for routine surveying in varying sea conditions. Electronic navigation is necessary to maintain proper track-line spacing and place the survey in the modern network used in offshore oil and gas operations for precise drill site locations. Narrow beam bathymetry linked with dual sidescan sonar and supplemented by minisparker or boomer (vibrating plate) high resolution seismic profiling is the most feasible equipment for mapping of bathymetric features.

Surveys that do not utilize the above equipment do not obtain total coverage of the sea floor or give the flexibility needed to interpret sea floor conditions necessary for modern map interpretation for continental shelf operations. Most survey companies use these modern methods and produce multipurpose bathymetric and geologic hazard maps useful in decision making in operating near environmentally hazardous or sensitive areas.

Sidescan operations are normally restricted to water depths of 10 to 100 meters due to towing difficulties (Henderson, 1975). Precise navigation is generally limited by transmitter tower height, power transmission, and coastline configuration to ranges of 200 to 400 km maximum. Line spacing is a function of navigational precision and sidescan capabilities. Normal line spacing for sidescan coverage ranges from 150 to 300 meters.

Detailed submersible mapping began at the West Flower Garden Bank under auspices of the Flower Garden Ocean Research Center (Bright and Pequegnat, 1974) and Stetson Bank was studied for Burmah-Signal Oil Co. by Bright, et al. in 1974.

Detailed studies of the central and southern bank areas are in preparation by U.S. Geological Survey, Corpus Christi and Texas A & M, College Station. Berryhill (1975) and Bright and Rezak (1975) presented summaries of geological results from BLM funded baseline study contracts in this area. Prior to these studies only generalized information was available for these banks. Early sparker surveys showed that these banks appeared to rest on a flat lying formation that was broken by low normal faulting. Some of the banks (Mysterious, Big and Small Adam, and the Snapper Bank region to the south) were nearly buried by a layer of unconsolidated sediment from 10 to 20 meters in thickness. These banks rise from as little as 4 to 6 meters above the sediments. Only Hospital Bank (Oetking, 1969) had been adequately surveyed showing the maximum relief in this area at 22 meters, rising from 78 to 56 meters at the eastern end of

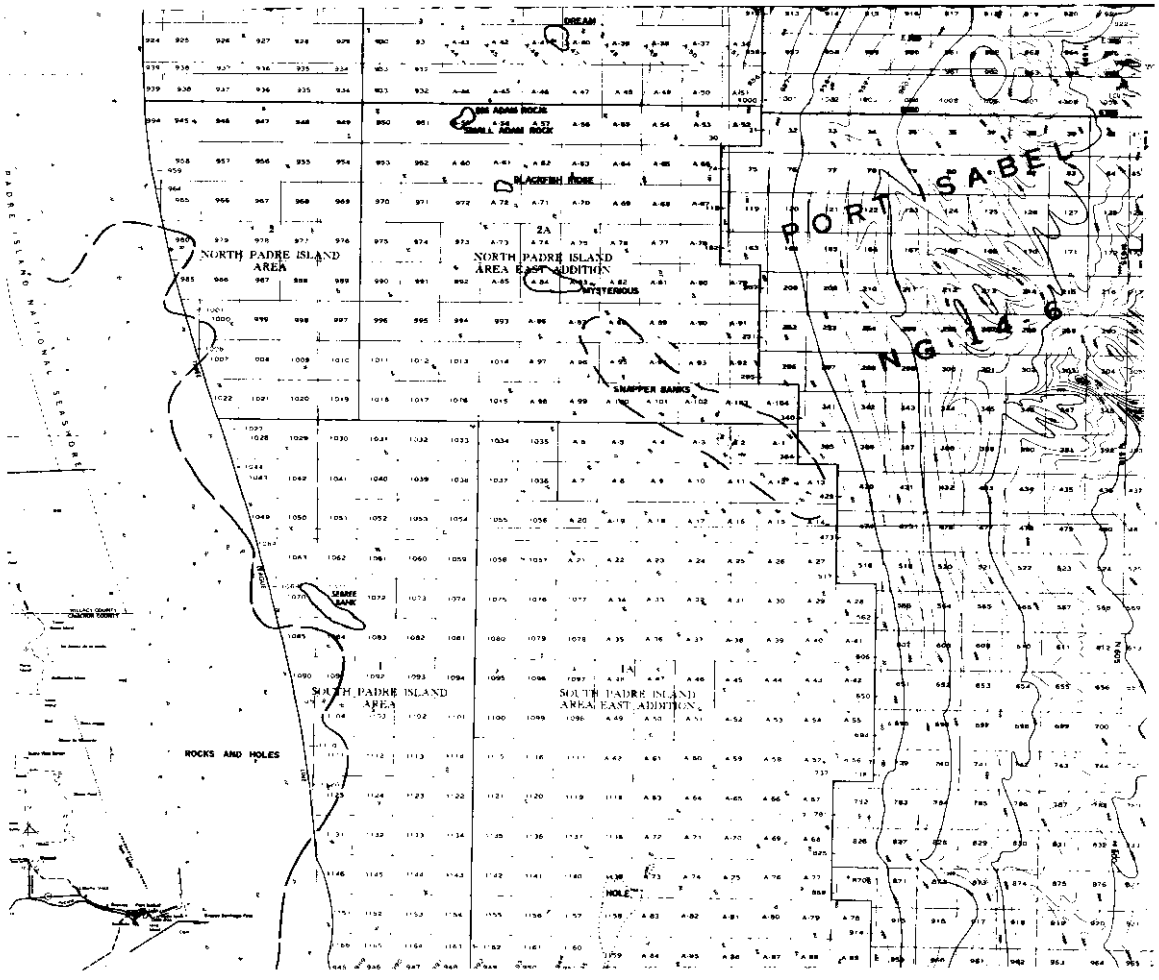


Figure 5. Port Isabel and Brownsville 1:250,000 maps NOS NG 14-6 (OCS) showing the southern hardbank areas.

the bank. Most of these banks had been located by C&GS surveys in the late 1930s and the OFFSHORE FISHING CHARTS further defined their locations by Loran A coordinates and headings from the nearest fishing ports.

It was recognized by fishermen that even a 2-meter rise in the flat ocean floor in the Port Isabel-Corpus Christi map areas (Figs. 5 and 6) constitutes reliable fishing areas particularly for snapper (Bryan, 1975; Johnston, Adams, and Foster, 1975). Inspection of the Corpus Christi and Port Isabel maps illustrates

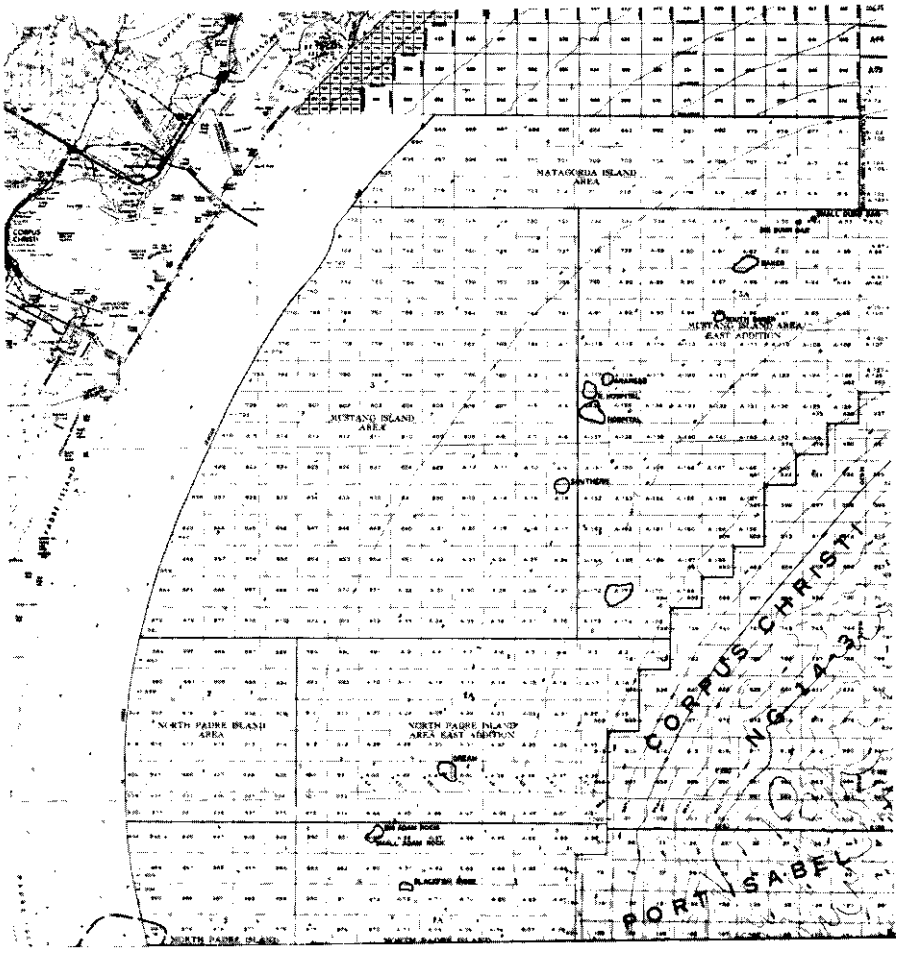


Figure 6. Corpus Christi 1:250,000 maps NOS NG 14-3 showing the central hardbank areas.

that the central bank area (Fig. 5) is an arcuate group of banks extending from Big and Small Dunn Bar (Mustang Island Block A-54) through Hospital and Southern Bank to a smaller bank in Mustang Island Block A-171. The southern banks extend in an arc from Dream through Mysterious and the Snapper banks region (Fig. 6).

THE ORIGIN AND FATE OF THESE BANKS

The age of these banks is relatively young in terms of geologic time; and early Indians could have fished these banks in their infancy (Gagliano, 1975). The growth of coralline areas is particularly affected by water depth and temperature

as well as water clarity and chemistry. Deeper banks could have been shoal during the last glaciation when the sea level was lowered to near 100 meters (Fig. 7, Fairbridge, 1960) as the ice accumulated to a maximum extent on the continents. Areas in South Texas and along the Louisiana-Texas shelf break could have been in an environment similar to the present day Bahama Islands with shallow water lagoons and coral growth occurring in arcuate barriers (Figs. 5 and 6). Banks such as the group including Mysterious and Baker would have become drowned to such depths (after approximately 11,000 years ago) that growth in elevation would essentially have ceased. At that time the lower portions of 18 Fathom Lump and Stetson would have been situated in shallow water. Now they are considered to be in a stressed condition by deep submergence. Also on the borderline but still producing divergent biota are the Flower Gardens and Florida Middle Ground. Sea level has not appreciably changed in the past 6,000 years (Fig. 7) and the Flower Gardens and Florida Middle Ground should continue their status as growing coral banks.

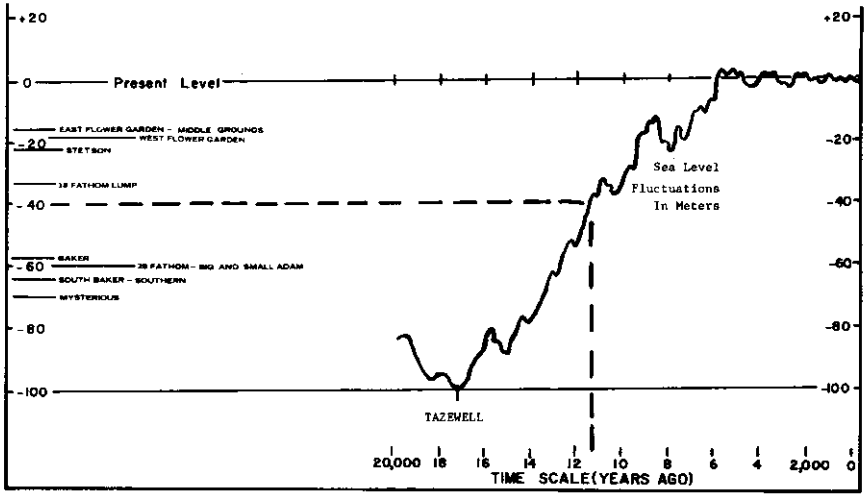


Figure 7. The rise and fall of sea level following the Wisconsin glaciation (from R.W. Fairbridge, 1960).

Drilling operations began near these banks in 1974 and protective stipulations developed by the Department of the Interior will not permit drilling or dumping of cuttings and muds on the coral banks. Monitoring of operations before, during, and after drilling, particularly at the Flower Gardens and Stetson Bank, has commenced. The status of environmental stipulations and monitoring around the important fishing banks will be the subject of a later report.

Relatively stable sea level and temperature regimes have been advantageous to the growth of coral banks as well as to man's activities in the coastal zone. Careful operations around the biologically sensitive areas are a mutually agreeable situation between industry, federal and state agencies; monitored in most

cases by university or private researchers concerned with the environment. The most dangerous petroleum pollution viewed is the nearly uncontrolled dumping of crank case oil by private citizens and garages in upland storm sewers, and the cleaning of tankers while underway or anchored on prominent banks. (Office of Technology Assessment, 1975).

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