FINAL REPORT

MISSISSIPPI COASTAL GEOLOGY

AND

REGIONAL MARINE STUDY

1990 - 1994

VOLUME 1

Mississippi Office of Geology / U. S. Geological Survey
Cooperative Agreement No. 14-08-0001-A0827

Submitted to:

U. S. Geological Survey
Center for Coastal Geology and Regional Marine Studies
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by

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progressive evolution from one geomorphic feature to another.

The video survey method developed by the Louisiana Department of Natural Resources, which involves the use of high-resolution video cameras to document coastal changes, was developed to characterize and inventory storm effects and their processes. This method has been used to assess and manage coastal resources, and its results have been used to inform coastal management policies and practices. The video survey method provides a powerful tool for understanding the dynamic nature of coastal environments and for informing coastal management decisions.

**Executive Summary**

Stephen M. Otvana

By
The barrier islands of Mississippi are preserved in their natural state as part of the Gulf Islands National Seashore, and provide an ideal platform on which to study geomorphic evolution. The islands show numerous geomorphic features resulting from previous storm and hurricane impacts. A hummocky dune terrace is the most common feature found on the islands, and it represents evolution from a previous storm washover terrace. All of the islands show erosional scarps along most of the shorelines as a result of normal seasonal erosion. Eolian features are prominent on the south and east shores of the islands due to the predominant southeast wind direction. The survey method developed for this study will be used to monitor future geomorphic evolution on the islands and to document changes in the event of a hurricane impact.

The mainland coast of Mississippi can be roughly divided into several geomorphic types based on man-made and natural influence and geographic position. Naturally eroding marsh shorelines are present at the western and eastern ends of the coast. Harrison County, in the center of the coast, as well as eastern Hancock County is dominated by an artificial beach placed in front of a continuous seawall. Central Jackson County contains a bare seawall and several highly industrialized ports. The only natural beach on the mainland coast is found in western Jackson County at Belle Fontaine, and a detailed analysis of this beach is presented in Mississippi Office of Geology Bulletin 130 attached to this report.

Beach and nearshore profiles are maintained along most of the mainland shoreline to monitor natural and man-made changes and provide a baseline for storm monitoring. The profiles recorded for several years are presented in this report.

A quick and economical method for bathymetric surveying developed during this study was used to update the bathymetry of the Mississippi Sound. Using two small boats, chart recorders, and GPS position equipment, the entire Mississippi Sound can be surveyed in approximately two weeks. The method does, however, require relatively quiet water conditions.

**Historical Shoreline Change and Development**

The history of the Mississippi coast and human development of the shoreline is summarized from archival research with numerous historical maps and photos. Major human modifications include the
seawall and artificial beach in Harrison County and Hancock County, expansion and development of the Biloxi waterfront, building and expansion of new land area at the ports of Gulfport and Pascagoula, and filling of wetlands as a result of residential and industrial development. Additions to the Harrison County shoreline are documented from official records and historical maps to better understand the sediment budget of this highly modified shoreline segment. Over 16 million cubic yards of documented fill have been added to the Harrison County shoreline, resulting in an areal expansion of approximately 1150 acres.

Historical shoreline changes in Mississippi were documented from U.S. Coast Survey and USGS T-sheets and aerial photo interpretations which were digitized, standardized, and compared in ARC/INFO. Since the first official maps were made in the 1850s, the mainland coast of Mississippi has lost approximately 3148 acres to erosion up until 1986. Approximately 1725 acres have been reclaimed by various methods, primarily beach nourishment and subaerial dredge material disposal. The highest shoreline retreat rates on the mainland (1.5 - 2 meters/year) are found in the natural marsh areas at the east and west ends of the coast. The barrier islands are migrating from east to west, and have lost approximately 2655 acres due to erosion between the 1850s and 1986. The erosion rate on the islands shows a three-fold increase after the turn of the century when shipping channels were dredged and maintained between the islands for access to mainland ports. Reversal of this island erosion trend will require a change in channel maintenance practices and relocation of the channels.

**Coastal Land Use/Land Cover Changes**

Land use/land cover change trends in the Mississippi coastal zone (below the 15-foot contour) are documented from previous U.S. Fish and Wildlife Service studies in the 1950s and 1970s and compared with a new interpretation of 1991-92 aerial photos with an emphasis placed on wetland area changes. The Cowardin classification system was collapsed into 7 categories and applied to 19 USGS topographic quadrangles for each of the three time periods studied. Wetland/marsh loss is greatest in the eastern part of the coast due to erosion and in the western portion of the coast due to erosion and development. Developed land expansion is greatest in the Gulfport/Biloxi area and around Pascagoula and Bay St. Louis. Total marsh area in the Mississippi coastal zone
This report. The project data for several years are presented in
future use. The project data for more effective beach nourishment methods for
beach protection against erosion due to natural wave action in an
area will be monitored as it degrades due to natural wave action. The
new beach established in Hancock County prior to the placement of a new beach
protection and sediment distribution patterns were

Hancock County Beach Project

between the two river sources.

suspended sediment concentration from light reflection data

Specialized and Local Projects

attachment to this report.

is also delivered in both digital and published formats as
an approach to geographic information system. This
leads to a database of geographic information system
which is a digital database for future use. The
was previously known from data collected in the Massepissett Sound area. The
geometry of the study area to interpret the
depth and map of the Massepissett Sound. The data
depth zonation during the study period and in interpreting the
geologic framework and

Geologic Framework

increased by 29,738 acres during the same time period.

decreased by 8387 acres between the 1950s and 1992. Developed area
Round Island Project

Round Island, located offshore from Pascagoula, is partially owned by the City of Pascagoula, and is the site of a National Historic Lighthouse endangered by erosion of the island. Twenty-one vibracores were recovered around the island in a search for sand resources which might be used to restore the island. Approximately 1 million cubic yards of suitable sand were found near the island, and the Holocene/Pleistocene contact was mapped around the island from the core data. Sand isopach and Top of Pleistocene maps are included with this report, as well as descriptions of the cores.

Belle Fontaine Project

Belle Fontaine contains the only remaining natural beach on the Mississippi mainland shoreline. The Mississippi Office of Geology, funded by the USGS, and the Mississippi Bureau of Marine Resources, funded by the U.S. Environmental Protection Agency, sponsored a joint research project to define and model the processes acting on this section of coastline. The Shoreline Evolution Model developed in the project is used to predict future erosion rates and trends and to evaluate possible erosion control methods in the area. Mississippi Office of Geology Bulletin 130, included as an attachment to this report, describes in detail the results of this project. This project formed the basis for a grant from the EPA Gulf of Mexico Program to Jackson County to test the Shoreline Evolution Model with sand nourishment.

Mississippi DEQ GPS Base Station Network

Global Positioning System (GPS) equipment is used extensively by the Office of Geology to accurately measure shoreline positions and sample and core locations in the field. A GPS base station network was established in Mississippi to post-process GPS field data for maximum accuracy. The network was funded by a grant from the EPA and contributions from various DEQ agencies, and is maintained by the Office of Geology. Numerous state, federal, local and private users are now using the network on a daily basis to correct field GPS data.
Later geomorphic interpretation. Also determined aerial photography video of the Mississippi coast for interpretation on the Mississippi coast from archival records. The State University was contracted to document historic coastal human activity and aerial photography was also contracted for purchase in 1971, 1972, 1973, 1974, 1975, 1976 coverage of the shoreline. Actual photography products were digitized for interpretation on the Mississippi GIS system (GIS). 1979 for incorporation in the Geographic Information System (GIS) program. The Louisiana Geographic Survey was contracted to digitize the USGS data from 1947, 1949, 1951, 1953, 1955, and 1957. The Office of Geology within the Office of Geology and Acquisition of a personal and equipment to carry forward the tasks started in year 1. The first year of the study was dedicated to establishing a coastal section within the office of geology and to develop the co-operative agreement.

Year 1: October 1, 1990 - September 30, 1991

OBJECTIVES AND SCOPE OF WORK

No coastal research staff or capabilities existed during this time. No coastal research staff was assigned to the Office of Geology. A coastal resources program and storm event monitoring, at the time the Office of Geology had no coastal section. As part of the Office of Geology, the study of the coastal geology and marine processes of the State of Mississippi. The four major topics designated to be covered by the Mississippi Geographic Survey entered into a cooperative agreement to jointly study the coastal geology and marine processes of the State of Mississippi.

Stephen M. Ottoman

Project Chronology
Geologic framework investigations included joint seismic cruises with the USGS and LGS in the Mississippi Sound, particularly Hancock County, to explore for sand resources. Dr. Ervin Otvos with the Gulf Coast Research Laboratory was contracted to locate and inventory all previous core and drillhole information pertaining to the Holocene and Pleistocene sediments on the Mississippi Gulf Coast, and to compile a comprehensive bibliography of all previously published material pertaining to Mississippi coastal geology.

Equipment purchases during the first year included the Sun Sparcstation and ARC/Info software needed to set up the GIS, a total station for shoreline and nearshore profile surveying, and a Boston Whaler workboat for offshore work in the waters of Mississippi. Stephen M. Oivanki was hired as principal investigator for the Coastal Section of the Office of Geology, and Barbara Yassin, a data-processing and GIS specialist, was hired to run the computer equipment purchased.

**Year 2: October 1, 1991 - September 30, 1992**

Year 2 saw a continued building of the Coastal Section of the Office of Geology with additional equipment and research capabilities. Additional personal computers and software were added, as well as video monitoring and soft-sediment vibracoring equipment and GPS receivers for field location measurements. A pontoon workboat was acquired to facilitate vibracoring in the Mississippi Sound and seismic acquisition in shallow water.

Shoreline change research involved incorporation of the digital products delivered by LGS in Year 1 into the Coastal Section GIS. Geomorphic analysis of the Mississippi barrier islands was begun with Dr. Mario Caputo from Mississippi State University using the aerial video acquired from LGS in 1991. Beach and nearshore profiles were established along the Mississippi coast to monitor normal shoreline changes and serve as a baseline for measuring storm event changes. Klaus Meyer-Arendt was contracted to begin a historical analysis of wetlands changes on the Mississippi coast, including an interpretation of 1991-92 aerial photography for wetlands distribution.

Geologic framework research included a contract with Dr. Otvos to gather and deliver to the Office of Geology all available core
Circuclar 5, included as an attachment to this report.

The draft report was expanded and published as Office of Geology by Dr. Steve Wightman of the Massachusetts Departed on the Position Workshop at the University of Massachusetts Department of the Marine Mineral Technology Center. The report was reviewed by the Massachusetts Geological Survey, the U.S. Geological Survey, and the Massachusetts Department of Environmental Protection. Additional seismic data were acquired utilizing the Harrison County with the core data collected by the seismic data acquisition. Dr. L. Harrington was contracted to integrate the existing seismic data into the drill site data acquired in previous years. Dr. Harrington framework research was primarily concerned with the short-term changes which have occurred on this highly modified coastal stretch. Harrington's interest in the history of coastal sedimentology of Harrison County, Massachusetts, provided a unique perspective. The study area was chosen for its potential to reveal significant changes in the geology of the region, particularly in terms of the processes that have shaped the coastal environment. The research, conducted by Klaus Meyer-Arendt, was designed to contribute to our understanding of the coastal evolution and the factors that have shaped the region over time.

SHORT TERM CHANGE RESEARCH INCLUDED MAPPING AND PRESENTATIONS

YEAR: October 1, 1992 - September 30, 1993

Research for sediment analysis and data entry:

1. Phillip White, a part-time student intern, was added as a lab technician for sediment analysis and data entry.
2. Peter Hutchins, geologist, was added as a co-investigator.

There were two additions to the Coastal Section Staff in Year 2. Dr. Scott Dunbar and Mr. Peter Hutchins were added to the Coastal Section. The Massachusetts Bureau of Marine Resources was begun at better prominence with the Coastal Section. A joint project with the Massachusetts Department of Environmental Protection on Southern Massachusetts and East River revealed significant results. Ground truthing of the plan was conducted by the Massachusetts Geological Survey at the end of the second year. The project was successful and additional funding was requested for future work. The project was successful and additional funding was requested for future work.
Field work and manuscript preparation for the Belle Fontaine project were completed, and publication preparations were begun for the Office of Geology Bulletin 130 which is included as an attachment to this report.

Michael Fayard, a recent geology graduate from Mississippi State University, was hired for the summer field season of Year 3 to assist with field work and data entry.

Year 4: October 1, 1993 - September 30, 1994

The Office of Geology was informed just prior to Year 4 that the co-operative study would not be continued for five years as previously planned. Year 4, therefore, was dedicated to finishing up the studies and projects already started and documenting the results for this final report.

Shoreline change research for this year included a re-survey of the beach profiles already established, detailed analysis of the new beach pumped in front of the seawall in Hancock County, and GPS shoreline surveys of the barrier islands and the mainland coast of Mississippi. The wetlands change project begun previously is being prepared for publication next year.

Vibracores and seismic collected around Round Island in Jackson County have been analyzed for possible sand resources to be used to rebuild the island and mitigate erosion there. The Belle Fontaine bulletin (130) was published this year. Video collected during the previous three years in Mississippi was edited into a coastal erosion video, which is included with this report.

The sections of this Final Report are composed of individual reports on the results of the various projects completed during the four years of the co-operative USGS/Office of Geology agreement. Numerous presentations of these results have been made during the four years, both published and unpublished, and the published abstracts and reports are included in Appendix D and Appendix E. Some of the work originally scheduled for this study could not be completed due to cancellation of the fifth year of the study. This work will be done in the future as additional time and funding are made available.
different years can also be accommodated and a statistical analysis of shoreline change characteristics for the same shoreline segment, year, and feature statistics to allow indirect dual analysis, shoreline statistics functions by MARIS also incorporate comparison and correlation.

The system developed by MARIS is included as Appendix C of this section.

MARRS is included as Appendix B of this report. A copy of the user documentation reference list to the Shoreline, A Guide to the Video Interpretation and Shoreline to Spottivity orient the video interpretation and shoreline display to geomorphology. The Mississippi Shoreline Survey of the Mississippi Shoreline Survey (MISS) was contracted to develop software in Arc/Info to catalog and coastal.

all of the natural and man-made features found on the Mississippi.

The two classifications were consistent to accommodate most of the features identified earlier on the barrier islands and including those man-made features found only on the mainland. The geomorphologic classification of the mainland is shown in Mississippi. The geomorphologic classification was developed by Stephen Otvanchak and Klaus Meyer-Arendt by Stephan Otvanchak and Mario Caputo to reflect the features present. The geomorphologic classification of the barrier islands was developed for this purpose, obtaining aerial video from a helicopter by the Louisiana Geologic Survey (Jepessen & al., 1997) was used. The method developed by the geomorphologic features present. The method developed by

order to characterize the Mississippi Shoreline as to...

Introduction

GEOMORPHOLOGIC CHARACTERISTICS AND INVENTORY

Stephen M. Otvanchak

MISSISSIPPI SHORELINE GEOMORPHOLOGY
Acknowledgments

The geomorphologic classification used in this project was developed with assistance from Mario V. Caputo, Klaus J. Meyer-Arendt, and Shea Penland. The profile surveys on the barrier islands were done with assistance from Jack Moody, Peter Hutchins, Philip White, and Michael Fayard. Karen Westphal identified the plant types shown on the island profiles. Bobby Smith and Neal Smith at MARIS were especially helpful in developing the Mississippi Shoreline Geomorphology System which forms the basis for analysis and display of the data presented in this report.

Geomorphic Classification Development

The first geomorphic classification system developed in this study was done for the barrier islands. Only those features which were easily visible in the aerial video surveys were included. The predominant geomorphic character of the shoreline was the determining factor in identifying features where there was a proliferation of different features in one segment of shoreline. As the classification developed, it was clear that there was definite progression or evolution of features over time. Coppice dunes evolved into irregular dunes, which evolved into dune ridges and hummocky dune terraces. Washover flats and washover corridors were replaced by washover terraces and hummocky dune terraces. Features offshore, such as various bar types, were not included since they were not always visible in every video due to camera angles and reflections.

Actual mapping of the barrier island shorelines was done at a scale of 1:10,000 on mylar overlays over aerial photographs of the same scale taken in 1992. Geomorphic classification and mapping of the mainland shoreline was done at a scale of 1:10,000 on mylar maps with geographic and cultural features for location reference. Interpretation of the video is done by noting the linear extent of the geomorphic features present and entering codes for each feature on data sheets corresponding to the shoreline grid locations. The minimum shoreline length classified is 31 meters. Features smaller than 31 meters are classified as point features and indicated by symbols on the final output maps. The main features are indicated by color or hatch patterns in the center bar of a shore-parallel 3-bar set similar to that used by LGS. Foreshore and backshore modifiers are placed in the front or back bars of the set. Ground
checking of individual feature classification is done where necessary, and ambiguous feature locations are verified in the field using GPS.

The barrier island classification contained primarily natural features. When the mainland classification was developed, a number of man-made features were added to complete the final classification system. The following is a listing of the geomorphic features identified and a brief description of each:

- **coppice dune** - small singular dune on a flat surface.
- **coalesced coppice dune** - several coppice dunes forming a ridge.
- **irregular dune** - larger separate dunes with no particular orientation.
- **hummocky dune terrace** - coalesced irregular low dunes which form an elevated terrace, usually with some form of continuous ground cover, generally above even storm tides.
- **degraded dune** - a large mature dune which has been eroded by wind or wave action, usually topped with trees or mature vegetation.
- **dune ridge** - a shore-parallel line of dunes.
- **precipitation dune** - an interior feature where dunes have migrated into another geomorphic type, usually a maritime forest.
- **artificial beach** - man-made beach, mainland feature.
- **uplands** - stable, consolidated, higher shoreline with old-growth forest, usually Pleistocene in age.
- **perched beach** - stranded beach deposit surrounded by new growth of marsh.
- **coastwise spit** - shore-parallel spit reflecting longshore migration of sand, found on the Gulf shores of the barrier islands, used as a foreshore modifier.
bulkhead/seawall - man-made shore protection on the mainland; vertical, curved, or stepped design.

recurved spit - shore-parallel or terminal spit with end or ends curved toward the shore, used as a foreshore modifier.

washover flat - storm washover feature, low relief and bare of vegetation.

washover corridor - constrained storm washover feature wider than 31 meters, generally crosses the full width of an island, bare of vegetation.

washover terrace - storm washover feature which has been colonized by vegetation with a hummocky appearance, generally lower relief than the surrounding landscape.

maritime forest - pine forest, usually on a mature terrace or dune ridge.

marsh - wetland-type grass vegetation in water or in a depression.

tidal flat - low, flat area awash at normal high tide.

open marine water - open water at the ends of the islands and in bays.

pond/lake/lagoon - enclosed or semi-enclosed water body.

major tidal channel - tidal channel wider than 31 meters.

scarp - near-vertical erosion scarp, used as a foreshore modifier only.

riprap - rubble placed in the foreshore for erosion protection.

marina/harbor - man-made feature with visible dock facilities.

breakwater - offshore wave protection structure, used as a foreshore modifier or a primary feature.
The geomorphologic features of Mississippi's barrier islands are

**DISCUSSION OF 1991 BARRIER ISLAND DATA**

adjacent to the geomorphic classification bars on the final maps. These point features are coded separately from and in addition to the

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>man-made</td>
<td>Built on or near the shoreline, usually with a visible seawall or pier.</td>
</tr>
<tr>
<td>structure</td>
<td>Structure extending into the foreshore, found only on the beach.</td>
</tr>
<tr>
<td>storm outlet</td>
<td>Open or closed storm water drainage.</td>
</tr>
<tr>
<td>jetty</td>
<td>Large, man-made, shore-normal structure.</td>
</tr>
<tr>
<td>groin</td>
<td>Man-made, shore-normal structure built to trap waves.</td>
</tr>
<tr>
<td>access canal</td>
<td>Dredged interior waterway.</td>
</tr>
<tr>
<td>offshore</td>
<td>Man-made structure built for access into the bay.</td>
</tr>
<tr>
<td>pier</td>
<td>Man-made structure built on the barrier islands.</td>
</tr>
<tr>
<td>man-made path</td>
<td>Obvious worn or built walkway, only found on the barrier islands.</td>
</tr>
<tr>
<td>interior storm</td>
<td>Interior storm washover delta.</td>
</tr>
<tr>
<td>washover</td>
<td>Crosses a narrow part of an island.</td>
</tr>
<tr>
<td>chule</td>
<td>Small linear washover feature, usually not obvious outside of a storm.</td>
</tr>
<tr>
<td>ebb-tidal flow</td>
<td>Sand delta in the foreshore resulting from the ebb-tidal flow.</td>
</tr>
<tr>
<td>tidal delta</td>
<td>Small tidal channel less than 31 meters wide.</td>
</tr>
<tr>
<td>material</td>
<td>Obvious land build-up utilizing dredged material.</td>
</tr>
</tbody>
</table>
| dredge spot    |"
westward and show a steady trend of erosion. Their emergence from sand shoals offshore is evident in the interior accretion ridge morphology of the older portions of the islands.

Because the Mississippi barrier islands are much wider than those in Louisiana, it was decided to incorporate a classification of the island interior into the system as well. To do this an additional shore-parallel bar set was constructed. Using the same grid system, the second bar set is coded to reflect the geomorphologic features in the interior of the islands as they are seen on the video. Features near the shore are placed in the bar farthest from the shore, those farther inland are placed in the middle bar, and the most distant features are placed in the bar nearest the shore, thus reflecting the view of the interior as seen by the interpreter's eye. Because the islands are classified from both the north and south shorelines in this manner, a cross-check for classification accuracy is provided. This additional interior inventory will be helpful in identifying changes on the islands as a result of hurricane events, which in the past have overwashed the islands, causing extensive interior modifications.

Typical cross-island profiles were surveyed with a total station on each barrier island. The profiles were geographically located with GPS, and vertical orientation was referenced to mean sea level on the date of each survey. Karen Westphal, with the Louisiana Geological Survey, identified plant and ground cover types along each profile in order to associate particular plants and plant groups with individual geomorphic features. These profiles are included in Appendix A at the end of this section along with the barrier island geomorphic interpretation maps.

Shoreline Features

Ship, Horn, and Petit Bois islands all show a similar trend of shoreline geomorphic features. The predominant shoreline type is a hummocky dune terrace. This reflects the mature nature of the geomorphology of these islands, since a hummocky dune terrace is the common end result of the evolution of other storm-produced features. It has been almost 10 years since the islands have felt the impact of a hurricane (Hurricanes Elena and Juan in 1985). Most of the scars from these events have long since healed. As an example, the area known as "the flats" on Horn island, just east of profile number 4, was almost completely washed out by Hurricane
barrier islands, and this is reflected in the range and

different evolutionary history from the other

beach sheltered by the scarp. A low percentage of shoreline scarp on the island, the wind
pronounced dune ridge morphology and also explains the relatively
tower shoreline angle of wind influence produces a more
exposed to more direct onshore winds than Horn and Petel bogs. It tends more north-northeast-southwest, and thus is
Petel bogs. It tends to be slightly different than Horn and
orientation of shore island is slightly different than Horn and
established the present tidal pass. Shore island has the
result of Hurricane Camille in 1969, which overwhelmed the island
Camille cut which separates east salt marsh and west shore islands is the
Camille, and shows the greatest storm-induced geomorphic character.
stable island interaction is needed away.

The shoreline features of all the islands show a pronounced
ends of the islands. Reflected erosion on the dune platforms at the eastern
barrier islands, reflecting erosion at the eastern ends of Petel bogs and Horn
beach dunes are found at the eastern ends of Petel bogs and Horn
survived due to the coastal evolutionary history of these features.
shoreline are found on the south, windward sides of the
islands. Cammell dunes are also found on the north shores of the islands. Given the predominant south
prominent north shores. Given the predominant south

and spring storms wash over them on a regular basis.
are located near the low-terrace ends of the islands where water
plant cover. All of the washover areas currently on the islands
smoothing surface as larger dunes are composed by stable
camellia. In 1969, it has evolved from a washover that to a hummocky
islands are found on the

The only marsh shorelines on the islands are found on the

end of this page.
features such as marlimestone forest and marsh tend to obscure other
and therefore include duplication of some features. Prominent
interior features include distribution of both interglacial bar
series and ice sheet terminations. The
interior features map are very subjective at best. The
interior features of the islands are not
interior features, as seen on the
interior features, but it lacks the
costing of interior features is designed to give a general feel for
coastal mapping where all the
features are very subjective at best. The
interior features of the islands yield fairly
distribution of shoreline features on the islands yield fairly
whereas description and statistical analyses of the
interior features

The barrier islands is shown in Figures 1, 3, and 4.

The protected water barrier is shown in Figures 1, 3, and 4.

The barrier islands is shown in Figures 1, 3, and 4.

The protected water barrier is shown in Figures 1, 3, and 4.

The protected water barrier is shown in Figures 1, 3, and 4.
Figure 1

West Shorelines
Geomorphologic Distribution
CAT ISLAND SHORELINE

16.0%
Washover Terrace
12.3%
Hunmochy Bay Terrace
12.2%
Irregular Dune
2.8%
Beachridge Dune
1.4%
Tidal Channel
1.8%
Tidal Flat
38.7%
Forested Beach
24.6%
Marine Forest

East Shoreline
Geomorphologic Distribution
CAT ISLAND SHORELINE

82.4%
Forest
51.5%
Dune Ridge
17.1%
Washover Terrace
3.1%
Cutline Dune
1.2%
Hunmochy Bay Terrace
1.3%
Irregular Dune

SHIP ISLAND SHORELINE
Geomorphic Distribution

North Shoreline

- Irregular Dune 26%
- Washover Terrace 10%
- Washover Flat 11%
- Maritime Forest 6%
- Tidal Flat 5%
- Other 2%
- Hummocky Dune Terr. 39%

Foreshore Scarp - 83%

SHIP ISLAND SHORELINE
Geomorphic Distribution

South Shoreline

- Hummocky Dune Terr. 28%
- Irregular Dune 20%
- Washover Flat 22%
- Washover Terrace 2%
- Maritime Forest 5%
- Dune Ridge 23%

Foreshore Scarp - 43%

Figure 2
Figure 3

South Shoreline
Geomorphologic Distribution
HORN ISLAND SHORELINE

Foreshore Scarp - 70%
- Hummocky Dune Ter. 25%
- Degraded Dune 2%
- Washover Pit 2%
- Tidal Flat 2%
- Coppice Dune 20%
- Irregular Dune 49%

North Shoreline
Geomorphologic Distribution
HORN ISLAND SHORELINE

Foreshore Scarp - 96%
- Washover Terrace 6%
- Washover Corridor 1%
- Irregular Dune 4%
- Marsh 6%
- Maritime Forest 8%
- Washover Pit 4%
- Degraded Dune 16%
PETIT BOIS ISLAND SHORELINE
Geomorphic Distribution

North Shoreline
Hummocky Dune Terr. 62.8%
Washover Flat 7.3%
Degraded Dune 1.0%
Tidal Flat 2.2%
Marsh 3.6%
Washover Terrace 23.2%
Foreshore Scarp - 90%

PETIT BOIS ISLAND SHORELINE
Geomorphic Distribution

South Shoreline
Hummocky Dune Terr. 71.9%
Dune Ridge 9.8%
Other 1.0%
Irregular Dune 4.4%
Tidal Flat 2.2%
Washover Terrace 5.8%
Washover Flat 5.8%
Foreshore Scarp - 84%

Figure 4
more subtle features, and thus are over-estimated. Ponds and lagoons are under-estimated due to their low relief. Hummocky dune terrace features are probably over-estimated by default, since their appearance from a distance resembles several of the other geomorphic features.

Cat and Horn islands are the largest and most stable of the barrier islands in Mississippi. Their interior is colonized by old growth maritime forest, and there has been relatively little storm overwash into the central portions of these islands. This is reflected in the geomorphic feature distribution charts. Ship Island shows a greater percentage of irregular dunes, reflecting the greater eolian influence discussed previously. Petit Bois Island is dominated by a hummocky dune terrace which covers most of the western portion of the island. This low-relief area was probably overwashed by the most recent hurricanes, and is showing the normal evolutionary recovery sequence from washover flat to washover terrace to hummocky dune terrace that we see on the other islands. The large ponds and interior lagoons on the islands are still in the same place they were when the islands were first mapped in the 1850s. There is active marsh accretion into these water bodies, and future surveys should show this, barring any major storm events.

DISCUSSION OF 1991 MAINLAND DATA

Interpretation Method

The mainland shoreline of Mississippi was also interpreted for geomorphic feature distribution using the 1991 video flyby conducted by LGS. The shoreline interpretation grid system was designed in segments in order to keep the grid as parallel as possible to the shoreline without creating too many segments and to avoid overlap. Only the shoreline is interpreted, since interior features are covered adequately by other mapping agencies. Round and Deer islands are included as part of the mainland system, since they are interior to the Mississippi Sound. Portions of Hancock, Harrison, and Jackson County shorelines have multiple man-made structures in the foreshore. Where this occurs the main feature is mapped as predominant, and the features shoreward or landward of this feature are mapped as modifiers. For example, a riprap revetment modifies the seaward edge of an artificial beach, which has a shoreward modifier in the form of a seawall. The interior
The beach is mapped as the primary feature along this shoreline.

Harrison County

As shown graphically in Figure 9, discontinuous seawall, geomorphic distribution in Hancock County, exposed at the eastern end of this section flanked by a resistant part of the shoreline. The pre-Holocene uplands are from the 1967 beach nourishment here. Numerous piezometer measurements from the entire section with several man-made beach remnants.

The west Hancock County shoreline section is entirely man-made. A seawall

on the Pearl River, set.

Clear section. A single man-made canal (redetected entity) is found near the Pearl River, set.

Hancock County

Section.

Data analyses discussed here will begin at the west end of the

Shoreline Data Discussion

The U.S. Highway 90 bridges across the bay.

Table 2. River, Biloxi Bay, Harrison Bay, and the Passaquada River

portions of St. Louis, Bay, Biloxi Bay, and the Passaquada River.
with the seawall as an interior modifier. In those portions where harbors are present the seawall is not mapped, since it is covered by harbor and road construction. The primary point modifiers along this section are storm-water outfalls. The entire stretch of U. S. Highway 90 along this shoreline is drained under the beach to the outfalls exposed along the water line. These outfalls also act as groins, trapping the normally westward migrating sand of the beach. The eastern end of the Biloxi set is considerably more complicated than could be mapped at the scale of this method. The current casino-building boom in this area will simplify the interpretation in future mapping efforts. Harrison County geomorphic distribution is shown in Figure 10.

Jackson County

The Ocean Springs set contains a diverse range of geomorphic features, both man-made and natural. Most of the shoreline is fronted by a seawall with an artificial beach in front of it. Due to the protected nature of this section in the lee of Deer Island, natural marsh habitat has begun to colonize the beach shoreline. Upland Pleistocene is exposed just east of the Ocean Springs small craft harbor, and it exhibits a sharp erosional scarp along the shore. At the eastern end of this section the uplands are fronted by a marsh habitat where they are protected from wave action by the west end of Marsh Point to the south. Numerous piers and outfalls punctuate the shoreline in this section.

The West and East Belle Fontaine sets also show quite a diversity in geomorphologic types. West Belle Fontaine is primarily a washover terrace fronting an extensive marsh habitat. This washover terrace is actually a storm tide sand berm, the result of continual washover into the marsh of the narrow sand beach fronting this section. The beach is only exposed at very low tide, and at normal tide the erosional scarp of the underlying marsh substrate is exposed and mapped in this survey. Several actively prograding marsh sectors occur as a foreshore modifier in the western part of this section. The uplands mapped in the central part of the West Belle Fontaine set are Pleistocene Gulfport Formation sand deposits, which contribute sand to the narrow beach in the area (see Bulletin 130 attached to this report). Some of the uplands are bulkheaded to prevent further erosion. Numerous piers and groins are present along the occupied portion of this section.
The East Belle Fontaine set contains the only natural beach on the Mississippi mainland in the western part of the section. This beach area is mapped as a hummocky dune terrace with an erosional foreshore scarp. The shoreline is entirely occupied by homesites, and numerous piers and groins are present. A number of homeowners have bulkheaded their property, as shown on the map. The uplands shown on the map are again Pleistocene Gulfport Formation, and the erosional scarp shown on the map is actually up to 12 feet (3.6 meters) high. The washover terrace shown in the central part of this section is similar to that described in the West Belle Fontaine set. Toward the east end of the East Belle Fontaine set the shoreline becomes more protected from southeast wave action by the Pascagoula River delta and Singing River and Round islands. This results in active marsh progradation in front of the uplands along that portion of the shore.

The Pascagoula River delta is composed of numerous small marsh islands in various stages of progradation or erosion. One data set is mapped in this area from video of the east bank of the river shot from the center of the river channel. The habitat is marsh with various tidal channels.

Singing River Island is a dredge spoil island built as the site of the Navy homeport of Pascagoula. It is mapped as dredge spoil, although vegetation has begun to transform the island into an upland habitat. The island shows erosional scarping on all sides exposed to wave action. The west side of the Ingalls Shipyard is shown on this set. This shipyard was built on dredge spoil and dirt fill placed in the area over the past 70 years. Some of the spoil is still evident with an active marsh growth in front of it, and the rest has been converted to uplands with industrial development.

The Pascagoula shoreline is entirely man-made. A curved-face seawall fronts most of the shore. The west end of this set contains dredge spoil with riprap protection at the entrance to the Port of Pascagoula. The artificial beach shown on this set is a protected beach surrounded by a concrete bulkhead in front of the seawall.

The Bayou Casotte set is a large industrial area. Greenwood Island at the west end of the set is an active dredge spoil disposal area. The large tidal channel in the center is Bayou
Barrier has been placed around the historic lighthouse at the mouth of the Escambia River. The resulting erosion was evident, a result of the wave action. The abundance of sand in the area has resulted in the formation of the wave terrace extending further seaward. This area was once exposed by the Grand Bay, now abandoned (Casserly, 1977; Oviedo, 1895). It was used for defensive purposes, and the area was once a delta of the Escambia River.

The next two sets (Grand Bay east and west) are shown in Figure 11. The area is being rapidly undercut and washed away as the exposed marsh is being rapidly undermined. This section shows the historical shoreline change. The two depressed canals and numerous small channels cut into the surface. The marsh is bordered by an extensive marsh habitat inland. The marsh is a triangular area with a narrow strip of land. The west side is protected by the wave terrace, which has been extensively dredged and modified into a coastal marsh.
The office of Geography plans to do

The Massachusetts Academy of Sciences. The results were presented at the

Stephen Orkans (1994), and the results were presented at the

between the 1989 and 1994 surveys was done by Mario Caputo and

retreat shoreline changes which occurred on the barrier islands

development changes on the mainland. A curiosity look at non-storm-

developed protected to evaluate storm changes on the islands and

done. The geomorphic classification and inventory presented here was

future.

undoubtedly increase the percentage of man-made features in the

43.2% natural shoreline, continued development of the coast will

geomorphic inventory is composed of 56.8% man-made features and

The mainland case of Massstesipp, according to the current

The mainland case of the Massstesipp coast.

of continuous development of the Massstesipp coast.

managed keeps up with the shoreline changes which occur as a result

also serve as a convenient tool to help coastal planners and

Massstesipp shoreline should a hurricane strike the coast. It can

will serve as a rapid method for evaluating changes to the

The Massstesipp shoreline geomorphology system presented here

CONCLUSIONS

Island.

Figure 13 shows the geomorphic distribution on Deer

and of the island is mostly marsh which is rapidly retreated under

along all of the south shore and most of the north shore. The east

the set is built of riprap. The island shows an erosional scarp

hard core wave action. The breakwaters shown at the east and of

hazard to the deer’s ability to cross over a mature maritime

composed of a recent prehistoric beach ridge with a mature maritime

Bay, is a remnant portion of the mainland. It is primarily

Deer Island, located just offshore of the entrance to Boston

Round Island.

direction, Figure 12 shows the geomorphic distribution on

moving west in response to the predominant southeast

the island is formed by sand and pebble from the islands and

southwest tip of the island and filled with dredged sand. The
a detailed comparison of the 1989 and 1991 data in the future using the statistical functions of the system as time allows. Future video flights will also be conducted to update the 1991 coverage.

REFERENCES CITED


APPENDIX A

BARRIER ISLAND GEOGRAPHY MAPS AND PROFILES
# MISSISSIPPI SHORELINE GEOMORPHOLOGY SYSTEM

## Map Legend

<table>
<thead>
<tr>
<th>Geomorphic Features</th>
<th>Modifiers</th>
<th>Reference Features</th>
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</thead>
<tbody>
<tr>
<td><strong>Primaries</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coppice Dune</td>
<td>Tidal Flat</td>
<td>Coastline</td>
</tr>
<tr>
<td>Coalesced Coppice Dune</td>
<td>Open Marine Water</td>
<td>Manmade Coastal Features</td>
</tr>
<tr>
<td>Irregular Dune</td>
<td>Pond / Lake / Lagoon</td>
<td>Primary Highways</td>
</tr>
<tr>
<td>Hummocky Dune Terrace</td>
<td>Major Tidal Channel</td>
<td>Other Roads</td>
</tr>
<tr>
<td>Degraded Dune</td>
<td>Erosional Scarp</td>
<td>Railroads</td>
</tr>
<tr>
<td>Dune Ridge</td>
<td>Riprap</td>
<td>Rivers</td>
</tr>
<tr>
<td>Precipitation Dune</td>
<td>Marina / Harbor</td>
<td>County Boundaries</td>
</tr>
<tr>
<td>Artificial Beach</td>
<td>Breakwater</td>
<td></td>
</tr>
<tr>
<td>Uplands</td>
<td>Dredge Spoil</td>
<td></td>
</tr>
<tr>
<td>Perched Beach</td>
<td>Minor Tidal Channel</td>
<td></td>
</tr>
<tr>
<td>Coastwise Spit</td>
<td>Tidal Delta</td>
<td></td>
</tr>
<tr>
<td>Bulkhead / Seawall</td>
<td>Washover Chute</td>
<td></td>
</tr>
<tr>
<td>Recurved Spit</td>
<td>Washover Splay</td>
<td></td>
</tr>
<tr>
<td>Washover Flat</td>
<td>Manmade Path / Trail</td>
<td></td>
</tr>
<tr>
<td>Washover Corridor</td>
<td>Pier</td>
<td></td>
</tr>
<tr>
<td>Washover Terrace</td>
<td>Access Canal</td>
<td></td>
</tr>
<tr>
<td>Maritime Forest</td>
<td>Groin</td>
<td></td>
</tr>
<tr>
<td>Marsh</td>
<td>Jetty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storm Outfall</td>
<td></td>
</tr>
</tbody>
</table>
LEGEND
PLANT DISTRIBUTION PROFILES

MAJOR OCCURRENCE  

MIXED OCCURRENCE  

MINOR OCCURRENCE  


Alteranthera philoxeroides
Cyperus sp.
Daubentonia punicea
Eleocharis sp.
Helianthemum corymbosum
Hydrocotyle sp.
Ilex vomitoria
Ipomoea pandurata
Iva frutescens
Juncus roemerianus
Myrica cerifera
Opuntia pusilla
Pinus elaua
Quercus geminata
Serenoc repens
Smilax sp.
Cakile edentula
Cenchrus incertus
Fimbristylis castanea
Heterotheca subaxillaris
Ipomoea stolonifera
Iva imbricata
Panicum sp.
Paspalum distichum
Schizachyrium littorale
Spartina patens
Uniola paniculata
Cakile edentula
Cenchrus incertus
Croton punctatus
Ipomoea stolonifera
Iva imbricata
Panicum sp.
Paspalum distichum
Schizachyrium littorale
Uniola paniculata
Mississippi Shoreline Geomorphology System

Vicinity Map

Hancock County

Jackson County

Coverage Area

Map Scale

Horn Island East

Geomorphology: 1991
Shoreline: 1993
LEGEND

PLANT DISTRIBUTION PROFILES

MAJOR OCCURRENCE

MIXED OCCURRENCE

MINOR OCCURRENCE
Bacharis halimifolia
Cakile edentula
Croton punctatus
Cyperus sp.
Distichlis spicata
Fimbristylis castanea
Heterotheca subaxillaris
Ipomoea stolonifera
Iva imbricata
Panicum sp.
Schizachyrium littorale
Spartina patens
Uniola paniculata
Cakile edentula
Croton punctatus
Fimbristyliis castanea
Heterotheca subaxillaris
Ipomoea stolonifera
Iva imbricata
Panicum sp.
Schizachyrium litorale
Sporobolus sp.
Uniola paniculata
HORN ISLAND 3

NORTH

FEET

20

10

0

2000

2500

SOUTH

FEET

20

10

0

Baccharis halimifolia
Cakile edentula
Ceratiola ericoides
Croton punctatus
Cyperus haspan
Cyperus strigosus
Eulera scirpoidea
Hydrocotyle bonariensis
Ilex vomitoria
Ipomoea stolonifera
Juncus sp.
Odontonia corymbosa
Opuntia humifusa
Panicum repens
Physalis australifolia
Pinus elliottii
Polygonum procumbens
Salvia sp.
Schizachyrium litorale
Serenae repens
Uniola paniculata
Baccharis halimifolia
Cakile edentula
Ceratloa ericoides
Croton punctatus
Cyperus sp.
Distichlis spicata
Eriocaulon deanguilare
Fimbristylis castanea
Helianthemum corymbosum
Heterotheca subaxillaris
Hydrocotyle bonariensis
Ilex vomitoria
Ipomoea stolonifera
Iva imbricata
Juncus sp.
Myrica cerifera
Odontonychia corymbosa
Panicum sp.
Pinus elliottii
Salvia sp.
Schizachyrium littorale
Sesnaca repens
Sesuvium portulacastrum
Spartina patens
Uniola paniculata
Fimbristylis castanea
Ipomoea stolonifera
Iva imbricata
Panicum sp.
Schizachyrium littorale
Sesuvium portulacastrum
Spartina patens
Uniola paniculata
HORN ISLAND 6

Cakile edentula
Ceratiola ericoides
Fimbristylis castanea
Helianthemum corymbosum
ilex vomitoria
Ipomoea stolonifera
Iva imbricata
Panicum sp.
Quercus geminata
Salvia sp.
Serenoa repens
Uniola paniculata
Asclepias philoxeroides
Cakile edentula
Ilex vomitoria
Ipomoea stolonifera
Iva imbricata
Lepidium virginicum
Limonium carolinianum
Odontonychia corymbosa
Panicum sp.
Paspalum distichum
Rubus trivialis
Schizachyrium littorale
Sesuvium portulacastrum
Spartina patens
Tridescantia virginiana
Uniola paniculata
APPENDIX  B

Mainland Geomorphology Maps
# MISSISSIPPI SHORELINE GEOMORPHOLOGY SYSTEM

## Map Legend

### Geomorphic Features

<table>
<thead>
<tr>
<th>Primaries</th>
<th>Modifiers</th>
<th>Reference Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coppice Dune</td>
<td>Tidal Flat</td>
<td>Coastline</td>
</tr>
<tr>
<td>Coalesced Coppice Dune</td>
<td>Open Marine Water</td>
<td>Manmade Coastal Features</td>
</tr>
<tr>
<td>Irregular Dune</td>
<td>Pond / Lake / Lagoon</td>
<td>Primary Highways</td>
</tr>
<tr>
<td>Hummocky Dune Terrace</td>
<td>Recurved Spit</td>
<td>Other Roads</td>
</tr>
<tr>
<td>Degraded Dune</td>
<td>Erosional Scarp</td>
<td>Railroads</td>
</tr>
<tr>
<td>Dune Ridge</td>
<td>Riprap</td>
<td>Rivers</td>
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<td>Precipitation Dune</td>
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<td>Artificial Beach</td>
<td>Breakwater</td>
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<td>Uplands</td>
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<td>Bulkhead / Seawall</td>
<td>Washover Splay</td>
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</tr>
<tr>
<td>Recurved Spit</td>
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<td>Washover Flat</td>
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</tr>
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<td>Jetty</td>
<td></td>
</tr>
<tr>
<td>Marsh</td>
<td>Storm Outfall</td>
<td></td>
</tr>
</tbody>
</table>
Mississippi Shoreline Geomorphology System

Vicinity Map
Hancock County        Jackson County

Map Scale

Feet  Miles
000  0  0.30
2000 0.76 1.52
3000 1.52 3.05

Meters  Kilometers
1219 0.40 1.22
2438 1.32 4.44

POINT CLEAR
SET 1
Geomorphology: 1991
Shoreline: 1986
Mississippi Shoreline Geomorphology System

GULFPORT EAST
SET 1
Geomorphology: 1991
Shoreline: 1986

Vicinity Map
Harrison County
Jackson County
Hancock County

Map Scale
Feet
Miles

Coverage Area
Mississippi Shoreline Geomorphology System

Vicinity Map

Hancock County
Harrison County
Jackson County

Coverage Area

Map Scale

Feet  Miles
1500  0.37  0.64  1.32
1500  0.55  1.04  3.13

Meters  Kilometers
1500  0.37  0.64  1.32
1500  0.55  1.04  3.13

E BELLE FONTAINE
SET 1
Geomorphology: 1991
Shoreline: 1986
Mississippi Shoreline Geomorphology System

Vicinity Map

Hancock County
Harrison County
Jackson County

Map Scale

Feet  Miles
1500  0.94
1250  0.60
1000  0.36
750   0.24
500   0.12

Coverage Area

Singing River Isl.
Geomorphology: 1991
Shoreline: 1986
Mississippi Shoreline Geomorphology System

Vicinity Map

Hancock County
Harrison County
Jackson County

- Coverage Area

Map Scale
- Feet
- Miles
- Meters
- Kilometers

DEER ISLAND
Geomorphology: 1991
Shoreline: 1986
The two bars of a set are illustrated depending on linear extent. The two bars of each row are set apart, with the number of cells per row varies for each row. The outline rows height is 127.05 meters, the cell width for each two outline rows height 72.41 meters, the following diagram illustrates central rows height is 72.41 meters, the cell width for each central row is deformed with parallel plate on either side of the axis, to each set, except cat, the sets were then constructed axes for each strain, except cat, the sets were then constructed axes for each strain, except cat. Each strain, except cat, strain, has two sets, constructed one set, each strain, except cat, strain, has two sets, constructed into two groups of three rows each, an internal data graph constructed a group comprised of 3 rows of 3 columns each, the internal data graph constructed a group comprised of 3 rows of 3 columns each, the internal data graph constructed a group comprised of 3 rows of 3 columns each, the internal data graph constructed a group comprised of 3 rows of 3 columns each.

To illustrate the geomorphology of the four stands, MARIS software. It is an integrated database and application software. It is a software developed on MARS's Digital Information System (GIS) Interface System using ARC/INFO geographic information software and application software.

6.0.1. Software.

Microsystems, Inc, SUN SPARC II workstation with ARC/INFO version 5.0.1. Software. It was then ported to DSG office of geography's SUN software. It was then ported to DSG office of geography's SUN software. It was then ported to DSG office of geography's SUN software. It was then ported to DSG office of geography's SUN software. It was then ported to DSG office of geography's SUN software.

The objective of MARIS is to produce graphics and related geographic areas may be addressed. A flexible system to which new options may be added and/or other

OVERVIEW

MISSISSIPPI SHORELINE GEOMORPHOLOGY SYSTEM DOCUMENTATION

APPENDIX C
separated from each other by a distance of 508.2 meters. The exceptional shape of Cat Island necessitated the creation of six sets.

For a given set, the individual bar which is closest to the island shore is tagged as bar type '1' and is designed to represent the nature of the island interior. The other bar is tagged bar type '2' and represents the island shoreline. Within bar type '1', the row closest to the island is labeled row '1', the central row is row '2', and the third row is row '3'. Rows are numbered identically for bar type '2', with the closest row to the island labeled row '1', the central row is tagged '2', and the outside row is referred to as row '3'. To uniquely identify a row, a user must specify the island name, set number, bar type, and row number. Cells within rows are numbered in ascending order beginning with 1 to coincide with the direction of the reconnaissance flights as per maps provided by DEQ, Office of Geology.

For geomorphic interpretation of the mainland shoreline a similar set of bar graphs was constructed parallel to the mainland shoreline. Because the orientation of the mainland shoreline varies along its length, separate graphs were constructed for each section of shoreline having the same general orientation. A total of 26 bar graphs were necessary to completely cover the shoreline as well as Deer and Round islands in the Mississippi Sound. Each graph consists of three rows similar to those used on the barrier islands. No interior bar set was constructed for the mainland shoreline. In order to minimize the number of maps needed to display the bar sets, individual sets were combined where possible on single maps.

The remainder of this manual is divided into two main portions: 1. User documentation, and 2. Program documentation. The User Documentation section explains how each menu option functions and is supported with graphic replicas of all system menus. The final section, Program Documentation, contains listings of all interface software developed, arranged as it is accessed by the main menu. At the end of this section, a sub-section is included which lists the data dictionary and use of some special INFO files which were developed and are used by various system programs.
All data input is done through the MODIFY DATABASE heading of the MSG-MAP menu. Upon selecting the MODIFY option under the calendar year, note that only one set of data may be input for an indeterminate coverage.

The item is identified by naming convention as to the survey year. The point attributes of the appropriate island point coverage cells in an item in the polygon attribute table of the appropriate polygon coverage cells (polygons). The polygon classes are stored as attributes of each row of each bar of each set. A table of each row of each bar of each set.

The other coverage is a polygon coverage that has an indeterminate conversion as to the survey year represented. The item is identified by naming island polygon coverage. The item is identified by naming polygon coverage, where four polygons were created and polygon coverage, where three polygons were created. Each island polygon coverage, except car island polygons, were constructed for each island or shoreline segment. Two coverage classes are represented geographically classes. Two types, input data, represent geographic classes. There are two types.

Data Input

menu is redisplayed. To obtain the cursor arrow keys and hit return on the desired option to execute, must point and click with a mouse or move the highlight box with the arrow keys. System functions are accessed through this menu and the MSG-MAP menu is displayed. Report module is initiated, and the MSG-MAP menu is displayed. The user is transferred to the correct workspace, the dataset is opened by typing MSG >DSR from the ARC prompt. This opens a user session in the MassGISPP Shower几何摄影 system.
and clicking the End Input option, a data input menu is displayed. The specific menu depends on the feature type entered, P or M. In the case of polygon data (feature type P), the data input menu displays the island name, set, bar, and row numbers, and number of cells per row, and prompts the user for beginning and ending cell numbers of a cell range and the polygon class number. The beginning and ending numbers of the range are inclusive. A single cell can be specified by giving the same beginning and ending cell number. In the case of point data (feature type M), the data input menu displays the same information, but prompts the user for only a cell number and class number. Cell ranges cannot be specified.

At any time the user may view the appropriate class list by clicking on the View Class List option. When the user has entered the certain cell number(s) and a class number, the End Input option must be selected. Input data are then checked for logic and input to the data base. The user is queried about more data entry for the same island, set, bar, and row. A positive response will result in the appropriate menu being redisplayed to repeat the data input process. Erroneous data entry may be edited by simply re-entering the data, as the program always overwrites any data that may already be in the data base. The data input process can be halted at any time by clicking on the Cancel Input option.

The following pages are graphic representations of the screen menus the user will view during the data entry process. The first is the MSG main menu. Selecting the MODIFY option displays the next menu. Supplying the appropriate information will cause display of either the polygon input menu or point input menu. The final two pages are the class lists that would be displayed by clicking on the View Class List option on either of the data input menus.
End Session

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

SUMMARY COMP.
COMPARE
SUB-ISLAND

ONE YEAR
ISLAND

EDIT REPORTS

INITIALIZE
ISLAND

MODIFY

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

DATAFILE

DISPLAY

REPORTS

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

MAIN MENU

*Sub-menu of: This is the main menu of the system.

Menu file name: MG-MAIN.MENU

*
Enter the Following Information

Thursday
September 24, 1992

*****************************************************************************
Island Name: Survey Year:
Set#: Bar#: Row#: 

Feature Type: P

*****************************************************************************

End Input
CANCEL Input
End Input

CANCELL Input

VIEW CLASS LIST

******************************************************************************

CLASS: 0

Ending cell: 0

Beginning cell: 1

******************************************************************************

Cells per row: 480

I  I  I
Set# Bar# Row#

ISLAND: SHIP

September 24, 1992

Thursday

and geomorphic class

Enter the beginning and ending cell number

[ SUB-MENU OF: DATABASE/MODIFY ]

* Menu File Name: DATABASE.MENU

*
Enter the cell number and geomorphic class

Thursday
September 24, 1992

Island: SHIP

<table>
<thead>
<tr>
<th>Set#</th>
<th>Bar#</th>
<th>Row#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Cells per Row: 480

Cell#: 1
Class#: 0

View Class List

End Input          CANCEL Input
<table>
<thead>
<tr>
<th>Class Number</th>
<th>Geomorphic Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>Bridge Spout</td>
</tr>
<tr>
<td>26</td>
<td>Breakwater</td>
</tr>
<tr>
<td>25</td>
<td>Marina/Harbor</td>
</tr>
<tr>
<td>24</td>
<td>Riffler</td>
</tr>
<tr>
<td>23</td>
<td>Scrub</td>
</tr>
<tr>
<td>22</td>
<td>Major Tidal Channel</td>
</tr>
<tr>
<td>21</td>
<td>Pond/Lake/Lagoon</td>
</tr>
<tr>
<td>20</td>
<td>Open Marine Water</td>
</tr>
<tr>
<td>19</td>
<td>Tidal Flat</td>
</tr>
<tr>
<td>18</td>
<td>Marsh</td>
</tr>
<tr>
<td>17</td>
<td>Maritime Forest</td>
</tr>
<tr>
<td>16</td>
<td>Washover Terrace</td>
</tr>
<tr>
<td>15</td>
<td>Washover Corridor</td>
</tr>
<tr>
<td>14</td>
<td>Washover Plate</td>
</tr>
<tr>
<td>13</td>
<td>Recurved Spit</td>
</tr>
<tr>
<td>12</td>
<td>Buttehead/Seawall</td>
</tr>
<tr>
<td>11</td>
<td>Coastal Spit</td>
</tr>
<tr>
<td>10</td>
<td>Blured Beach</td>
</tr>
<tr>
<td>9</td>
<td>Uplands</td>
</tr>
<tr>
<td>8</td>
<td>Artificial Beach</td>
</tr>
<tr>
<td>7</td>
<td>Precipitation Dune</td>
</tr>
<tr>
<td>6</td>
<td>Dune Ridge</td>
</tr>
<tr>
<td>5</td>
<td>Beaded Dune</td>
</tr>
<tr>
<td>4</td>
<td>Hummocky Dune Terrace</td>
</tr>
<tr>
<td>3</td>
<td>Irregular Dune</td>
</tr>
<tr>
<td>2</td>
<td>Contorted Coarse Dune</td>
</tr>
<tr>
<td>1</td>
<td>Coarse Dune</td>
</tr>
</tbody>
</table>

Polygon Class List

Mississippi Shoreline Geomorphology System

* Text Title name: PLASSES.TXT
Mississippi Shoreline Geomorphology System

Point Class List

*******************************************************************************

<table>
<thead>
<tr>
<th>Class Number</th>
<th>Geomorphic Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minor Tidal Channel</td>
</tr>
<tr>
<td>2</td>
<td>Tidal Delta</td>
</tr>
<tr>
<td>3</td>
<td>Washover Chute</td>
</tr>
<tr>
<td>4</td>
<td>Washover Splay</td>
</tr>
<tr>
<td>5</td>
<td>Man-made Path or Trail</td>
</tr>
<tr>
<td>6</td>
<td>Pier</td>
</tr>
<tr>
<td>7</td>
<td>Access Canal</td>
</tr>
<tr>
<td>8</td>
<td>Groin</td>
</tr>
<tr>
<td>9</td>
<td>Jetty</td>
</tr>
<tr>
<td>10</td>
<td>Storm Outfall</td>
</tr>
</tbody>
</table>

PREV  END  FULL  OK
the cells to initialize.

The following two pages illustrate the sequence of:

- Selecting the INITIALIZE option in the display of the next bar, row, and feature type. The first is the MSG main menu.
- Initializing the class values for a given Island, survey year, set, point data tables is the only method to zero all values on a selected row, survey year, and feature type. Row, survey year, and feature type zero class values on the polygon input menu. However, for a row, survey year, and feature type, class values are given a zero value. The same effect could be obtained by entering the entire range of cells for a row, survey year, and feature type. After selecting this information and the number, and feature type, clicking the Input button, Logic checks are performed and the row, survey year, and feature type, for the specific Island, survey year, set number, bar type, row, survey year, and feature type is prompted, the user is prompted upon selection of the INITIALIZE option.
***Mississippi Shoreline Geomorphology System***

MAIN MENU

Thursday
September 24, 1992

**************************************************************************
DATABASE DISPLAY REPORTS MAP GEN.
**************************************************************************
MODIFY ISLAND EDIT REPORTS ISLAND
INITIALIZE SINGLE SET ONE YEAR SUB-ISLAND
                  COMPARISON
                  SUMMARY COMP.

**************************************************************************

End Session

91
CANCEL Input

End Input

**********************************************
Feature Type: P
Set#: Bar#: Row#: Survey Year:
Island Name:

**********************************************
September 24, 1992
Thursday

Enter the following information

[sub-menu of: DATABASE/INITIALIZE]
[menu title name: GETBAR-MENU]
[*]
Screen Display

Two screen display options are available for viewing data input to the Mississippi Shoreline Geomorphology System. The only difference is that one option displays all sets for a selected island/shoreline segment and survey year, and the other option displays a selected set for a selected island/shoreline segment and survey year. Polygon classes are shaded in various colors and point class are drawn with marker symbols. The display is complete with a legend and north arrow. The individual selected island or shoreline segment is rotated so that the bars are displayed horizontally.

The following pages represent the menus that will be displayed if either of the two options are chosen. The first menu is the MSG main menu from which the ISLAND option under DISPLAY may be chosen. The next menu is then displayed prompting the user to identify the island and survey year to display. After entry of this information, the End Input button must be clicked. The appropriate island the bar data are then drawn to the screen. When the user is finished viewing, a <cr> will re-display the MSG main menu.

The next page is again the MSG main menu from which the other option, SINGLE SET, under the DISPLAY heading may be chosen. The final page of this group is the succeeding menu to prompt the user for the Island name, survey year, and set number for display. After entry of this information, proceed as above.
**SUMMARY COMP**  
**COMPARE**  
**SUB-ISLAND**  
**ONE YEAR**  
**EDIT REPORTS**  
**INITIALIZE SINGLE SET**  
**MODIFY ISLAND**  
**DATABASE**  
**DISPLAY REPORTS**  
**MAP GEN**

September 24, 1992  
Thursday

**MAIN MENU**

***MISSISSIPPI SHORELINE GEOMORPHOLOGY SYSTEM***

---

* Sub-menu of: This is the main menu of the system.  
* Menu title name: MSC-MAIN.MENU
Enter the Following Information

Thursday
September 24, 1992

**************************************************************************

Island Name:
Display Year:

**************************************************************************

End Input
CANCEL Input
End Session

****************************************
SUMMARY COMP.
COMPARISON
SUB-ISLAND
ONE YEAR
EDIT REPORTS
ISLAND
INITIALIZE
ISLAND
MODIFY

****************************************
REPORTS
DISPLAY
DATABASE

September 24, 1992
Thursday

MAIN MENU

****MISSISSIPPI Shoreline Geomorphology System****

* Sub-menu of: This is the main menu of the system.
* Menu File name: MSG-MAIN.MENU
Enter the Following Information

Thursday
September 24, 1992

*********************************************************************************

Island Name:
Display Year:
Set Number:

*********************************************************************************

End Input

· CANCEL Input
The COMPARE option generates a matrix table comparing class means. Each row represents a separate set of data, and each column represents a selected class. The table displays the mean, standard deviation, and number of students for each class.

The COMPARE option requires that the data be organized into separate sets. The mean and standard deviation are calculated for each class, and the number of students is also displayed. The results are then used to generate a matrix table comparing the means of the different classes.

The COMPARE option is accessed by selecting it from the menu. The user is prompted to enter the name of the matrix table, the year, and the set number. The results are then displayed in a matrix format, allowing for easy comparison of the means across different classes.
included in this report are: 1. bar type 1, row 2 (Central Interior); 2. bar type 2, row 2 (Shoreline); and 3. bar type 2, row 3 (Fore Shore). The y-axis or rows of the matrix table are the classes from the base survey year and the x-axis or columns of the matrix table are the classes from the comparison survey year. The table is populated with the number of cells occurring at the class intersections. Separate tables are generated for the polygon and point classes.

The SUMMARY COMP. report under the REPORTS heading of the MSG main menu generates a gross comparison of class occurrence for a selected set of a selected island for two survey years. Initiating this report is identical to the COMPARISON report described above. Structurally, this report generates a separate page for each row of each set included in the report. For each class, the report lists the total number of cells, percent of the row, and linear distance (for polygon classes on the shoreline rows) for the base report year and the comparison year.