OCS Study
MMS 96-0017
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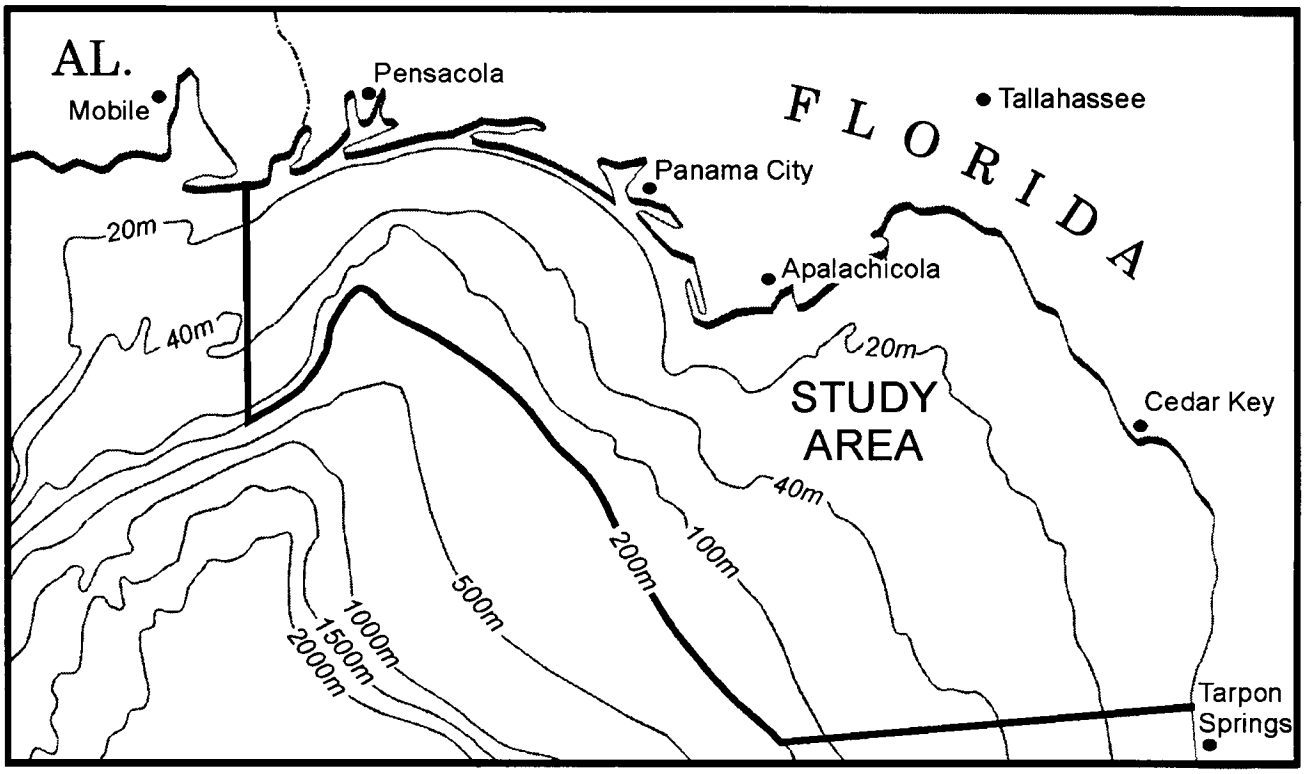
Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Data Search and Synthesis, Annotated Bibliography

Appendix C: Geology



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National Biological Service
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Thanks are extended to Paul Blankinship whose knowledge of Papyrus was essential to integrating the results of the many different electronic search formats. Those from outside this project who made our job more manageable by locating and sending the requested electronic copies of existing bibliographies include:

- Dr. Worth Nowlin and Maureen Reep, Texas A&M University
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All the above are thanked for their efforts. A number of others went to considerable effort in locating and sending printed versions of existing bibliographies. They too are thanked.

Alphabetic Index

Allen, H.H. and J.W. Webb. 1982. Dredged Material Research. Notes, News, Reviews, etc. Volume D-82-3. Influence of Breakwaters on Artificial Saltwater Marsh Establishment. NTIS. Washington, DC. 8 pp.

Abstract. The U. S. Army Engineer Waterways Experiment Station (WES) conducted a study to test the feasibility of artificially establishing saltmarsh on dredged material in a high-energy wind-driven wave climate. The U.S. Army Corps of Engineers District, Mobile, sponsored the study because they planned to plant saltmarsh grass along a dike on one side of a dredged material disposal island in Mobile Bay. Technical assistance and other support were provided through DOTS. The District planned to use the marsh grass primarily for erosion control on the dike, a practice demonstrated by numerous investigators. They also hoped that the saltmarsh would serve as wildlife habitat. The District considered whether or not marsh grass transplants could be established in the high wave-energy environment without protection. The alternatives were to plant marsh grass without protection or to erect some type of wave-stilling device and plant behind it. Various types of wave-stilling devices were considered for possible use in this situation. The WES and the District considered two breakwaters, a floating tire breakwater (FTB) and a fixed breakwater. Costs and labor requirements for both breakwaters seemed too high. This led to the decision to conduct a small-scale demonstration study where marsh grasses were planted without protection on a portion of the planting site. Later, marsh grasses were planted behind an FTB and a fixed breakwater to evaluate their effectiveness in protecting plants from waves.

Allen, W.J. 1989. Soil survey of Jefferson County, Florida. Prep. in coop. with Univ. Fla., Inst. Food and Agric. Sci., Agric. Exp. Stn. and Soil Sci. Dep., and Fla. Dep. Agric. and Consum. Serv. US Dept of Agriculture, Soil Conservation Service. Washington, DC. 193 pp.

Anon. 1972. Channel From Apalachicola to Two Mile and Breakwater at Two Mile Apalachicola Bay, Florida. (Report No.: ELR-5370) Draft environmental impact statement. NTIS. Washington, DC. 18 pp.

Abstract. The report describes the proposal for the project which will provide a new channel and breakwater at Two Mile, Florida. Channelization will be by hydraulic dredge. A summary of adverse and beneficial environmental effects is given.

Anon. 1973a. Apalachicola Bay, Florida (Maintenance Dredging). (Report No.: ELR-73-1543) Draft environmental impact statement. NTIS. Washington, DC. 39 pp.

Abstract. The project proposes to maintain the required depths of 10 feet in the St. George Island Channel and six feet in the East Point and Two Mile Channels as required. The St. George Island Channel normally requires annual maintenance dredging and the East Point and Two Mile Channels are on a five-year schedule. Spoil from the East Point and Two Mile Channels is in open-water sites, while spoil from the St. George Island Channel is used for beach nourishment. While maintaining capacity of the channels for efficient and safe movement of commercial and recreational navigation, the action will destroy a relatively small amount of benthic organisms on the affected channel bottoms and on open-water spoil disposal sites, and will temporarily increase turbidity and siltation near the dredge and the open-water disposal areas. The action may, if

uncontrolled in-water spoil disposal is employed, create sufficient levels of siltation and turbidity to be detrimental to the larvae and/or eggs of various aquatic species, and/or to the general productivity of the areas in the vicinity of the action.

Anon. 1973b. Dredging, Santa Rosa Station, Santa Rosa Island, Florida. (Report No.: ELR-0239) Draft environmental impact statement. NTIS. Washington, DC.

Abstract. The project provides for redredging of the channel at the U. S. Coast Guard Station, Santa Rosa, and containing the spoil within retaining levees constructed along the eroded shoreline in order to restore the shoreline to its more original condition. Significant environmental impacts in the project area are not anticipated. The eroded beach area on the station property will be restored by the dredge spoil.

Anon. 1973c. East Pass Channel (Maintenance Dredging) Okaloosa County, Florida. (Report No.: ELR-73-1864) Prepared by Mobile District Corps of Engineers, University of Alabama Marine Science Program, and Dauphin Island Sea Lab, Ala. NTIS. Washington, DC. 33 pp.

Abstract. The proposal is for a continuation of routine maintenance dredging of Federally authorized navigation project consisting of a 12 foot deep by 180 feet wide channel for about 8000-9000 feet from the Gulf of Mexico to Choctawhatchee Bay through East Pass at Destin, Florida. A six foot deep by 100 foot channel from East Pass into Old Pass Lagoon will also be maintained over a length of about 500 feet. The proposed action will provide an adequate channel for pleasure and commercial watercraft. Temporary degradation of water quality, coast line alteration, minor loss of invertebrates, and environmental enhancement is expected for Old Pass Lagoon and Choctawatchee Bay.

Anon. 1973d. Escambia River-Escambia Bay, Florida (Maintenance Dredging). (Report No.: ELR-73-1863) Draft environmental impact statement; Prepared by Mobile District Corps of Engineers, University of Alabama Marine Science Program, and Dauphin Island Sea Lab., Ala. NTIS. Washington, DC. 39 pp.

Abstract. The proposal is to maintain channel dimensions of 10x100 feet from the 10 foot contour in Escambia Bay to Escambia River, Mile 7, a total distance of 12.5 miles. Maintenance dredging is normally required about every two years. All spoil will be placed on upland sites. The proposed action will provide capacity of the channel for efficient and safe movement of commercial and recreational navigation. Routine maintenance removes accumulations of sludge and other materials from the channel. Natural production of vegetation and wildlife will be periodically disrupted by the spoil disposal operations.

Anon. 1973e. Port St. Joe Harbor, Florida (Maintenance Dredging). (Report No.: ELR-73-1202) Draft environmental impact statement; Prepared in Cooperation with Environmental Engineering, Inc., Gainesville, Fla. NTIS. Washington, DC. 28 pp.

Abstract. It is proposed to maintain the required depths in the entrance channel and the inner harbor channels in St. Joseph Bay, Florida. All spoil material will be placed in diked areas on land. While maintaining the capacity of the channels for efficient and safe movement of

commercial and recreational navigation, the action will result in the destruction of benthic organisms in the channel bottoms and a temporary, limited increase in turbidity near the dredge.

Anon. 1973f. Proposed Maintenance Dredging of the Channel from U.S. Coast Guard Santa Rosa Station Mooring to Navigable Watershed in Pensacola Bay. (Report No.: ELR-73-2010) Final environmental impact statement; Supersedes report no. EIS-FL-73-0239-D. Coast Guard District (8th). New Orleans, LA. 23 pp.

Abstract. The proposed project provides for maintenance dredging of the channel from the moorings at the U.S. Coast Guard Station Santa Rosa to navigable waters in Pensacola Bay, FL. The channel is 12 feet deep by 100 feet wide and about 300 yards long. Redredging of the channel will insure safe operation of Coast Guard boats to carry out search and rescue missions, pollution surveillance and enforcement operations, and aids to navigation maintenance. Disposal of the spoil behind retaining levees along the beach will restore the shoreline to its more original condition. Temporary increase in turbidity near the dredging operations will have minimal effects on the environment.

Anon. 1976. Dredged Material Research. Notes, News, Reviews, Etc., Volume D-76-8. NTIS. Washington, DC. 6 pp.

Abstract. The major section in this note describes work unit 4E02, designed to test the efficacy of establishing seagrass meadows on dredged material placed in subtidal situations. As a part of 4E02, shoal grass was transplanted from one location in St. Joseph Bay, Florida (above), to a barren dredged material substrate nearby. The article describes newly initiated Task 4E: Aquatic Habitat Development. Also included is a brief discussion of interim guidelines published for implementation of section 404(b)(1) of Public Law 92-500 (Federal Water Pollution Control Act Amendments of 1972).

Anon. 1978a. Aeromagnetic map of part of the Pensacola, 1 degrees by 2 degrees quadrangle, Florida. US Geological Survey. Magnetic Survey Map. Map OF 78-0716. Scale 1:250,000.

Anon. 1978b. Aeroradioactivity map of part of the Apalachicola, 1 degrees by 2 degrees quadrangle, Florida. US Geological Survey. Geophysical Survey Map. Map OF 78-0715. Scale 1:250,000.

Anon. 1978c. Aeroradioactivity map of part of the Pensacola, 1 degrees by 2 degrees quadrangle, Florida. US Geological Survey. Geophysical Survey Map. Map OF 78-0717. Scale 1:250,000.

Anon. 1978d. Wetland Habitat Development with Dredged Material: Engineering and Plant Propagation. (Report No.: WES-TR-DS-78-16) Final rept; Report on Dredged Material Research Program. Also available as Engineering Manual 1110-2-5020. NTIS. Washington, DC. 163 pp.

Abstract. Marsh habitat development using dredged material as a substrate was shown by the Dredged Material Research Program (DMRP) to often be a feasible alternative to traditional dredged material disposal operations. This report synthesizes pertinent literature and research of the DMRP including six major marsh development field sites: Windmill Point in the James River, Virginia, Buttermilk Sound on the coast of Georgia: Bolivar

Peninsula in Galveston Bay, Texas; Miller Sands, Columbia River, Oregon; Drake Wilson Island in Apalachicola Bay, Florida; and Salt Pond No.3, South San Francisco Bay, California. Guidelines for developing marsh habitat are presented: (a) planning the project in relation to the proposed site and project goals; (b) engineering construction of the site including dredging operations; (c) propagation, maintenance, and monitoring of the site as habitat, including potential problems that may be encountered; and (d) costs. Emphasis is placed on two major areas: engineering and plant propagation. Engineering aspects and design of potential sites are discussed and include protective and retention structures, substrate and foundation characteristics, dredging operations, and elevation and drainage requirements. Phases of plant propagation are detailed in the text tables: selecting plant species for the site, collecting and storing plant materials, selecting a propagule type, planting the site, maintaining and monitoring the site, pilot studies, costing the work, and allowing natural colonization.

Anon. 1979a. Hurricane Frederic, Aug 29 - Sept 13, 1979. (Natural disaster survey rept). NOAA-80070708

Abstract. Hurricane Frederic, with winds reaching 145 mph, moved over Dauphin Island (near the mouth of Mobile Bay) and inland just west of Mobile, Alabama, between 10 a.m. and 11 p.m. CDT on Wednesday, September 12, 1979. Storm tides of 8 to 12 feet above normal were reported from Pascagoula, Mississippi to western Santa Rosa Island, Alabama. The damage estimate of $2.3 billion makes Frederic the costliest hurricane ever to hit the United States, exceeding the $2.1 billion attributed to the widespread floods from Hurricane Agnes in 1972. Based on information from preparedness officials, 250,000 persons were safely evacuated in advance of Frederic. It was the first hurricane to strike Mobile directly since 1926.

Anon. 1979b. Land use and land cover, 1972-73, Apalachicola, Florida. US Geological Survey. Land Use and Land Cover Maps. Map L-0005. Scale 1:250,000. (Colored environmental geology map).

Anon. 1979c. Land use and land cover, 1972-74, Tallahassee, Florida; Georgia; Alabama. US Geological Survey. Land Use and Land Cover Maps. Map L-0015. Scale 1:250,000. (Colored Environmental geology maps).

Anon. 1979d. Land use and land cover, 1973, Pensacola, Florida. US Geological Survey. Land Use and Land Cover Maps.

Anon. 1981. Mississippi-Alabama Sea Grant Consortium Annual Report for January 1, 1980-June 30, 1981. (Report No.: MASGP-81-024; NOAA-84060101; See also PB84-198894). Sponsor: National Oceanic and Atmospheric Administration, Rockville, MD, Office of Sea Grant. NTIS. Washington, DC. 45 pp.

Abstract. Contents: Environment research; Marine technology; Legal studies; Education; Advisory Services; Publications; The Program.

Anon. 1984. Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi. (Report No.: COESAM/PD-EE-84-009) See also Executive summary, AD-A152 060 and Appendices, AD-A152 061. NTIS. Washington, DC. 1006 pp.

Abstract. An analysis has been undertaken of the physical biological and socioeconomic effects of hydrocarbon exploration and production activities in coastal Alabama and Mississippi and adjacent Federal waters of the Gulf of Mexico. The analysis consists of two parts: effects and generic unit actions, and cumulative effects of postulated hydrocarbon-related activities in the region over the next 30 years. Four subregions are considered in the analysis: the forested and seasonally-flooded Mobile-Tensaw River Delta, the shallow coastal estuaries of Mobile Bay and Mississippi Sound, and the Alabama and Mississippi state waters of the Gulf of Mexico. The main short-term adverse environmental effects would be turbidity resulting from well site and pipeline construction activities, and the temporary loss of habitat and biological productivity during pipeline construction and during the drilling period at well sites that are eventually abandoned as dry holes. Long-term adverse environmental effects include the reduction or loss of biological productivity and the alteration of habitat value at producing well sites and along wetland pipeline corridors, which would continue for many years until a well field is abandoned.

Anon. 1994. Pipeline carries potable water under Pensacola Bay. Public Works. 125(9):48.

Abstract. Today, potable water flows underwater through one of the longest, large-diameter polyethylene pipelines in the US. Completed in April 1994, the line was installed for Florida's Escambia County Utilities Authority (ECUA). The 3-1/2-mile, 24-in. diameter HDPE pipeline carries potable water from Wayside Park, Pensacola under Pensacola Bay to serve Pensacola Beach and eventually the city of Gulf Breeze and surrounding areas.

Antoine, J.W. 1967. Geophysical research in the Gulf of Mexico. pp. 7-8. *In* R.A. Geyer, ed. Oceanography of the Gulf of Mexico; progress report. Texas A&M University, Dept of Oceanography, College Station, TX.

Anuskiewicz, R.J. 1987. Preliminary archaeological investigations at Ray Hole Spring. pp. 416-418. *In* Anon., ed. Proceedings: Eighth annual Gulf of Mexico Information Transfer Meeting. Minerals Management Service, New Orleans, LA. (Eighth annual Gulf of Mexico information transfer meeting, New Orleans, LA, Dec. 1-3, 1987).

Arthur, J.D., S. Melkote, J. Applegate and T.M. Scott. 1986. Heavy Mineral Reconnaissance off the Coast of the Apalachicola River Delta, Northwest Florida. (No. 95). (Report of Investigations). Florida Geological Survey. Tallahassee. 61 pp.

Abstract. A systematic examination of heavy mineral concentrations and granulometry along the inner continental shelf of the northeastern Gulf of Mexico. The study area extends from offshore of Apalachee Bay to offshore of Pensacola Bay. Granulometric techniques from Visher (1969), and Friedman (1961, 1962) are used to support the fluvial origin of the sediments in the study area. These sediments have been transported to the shelf primarily by the Apalachicola River during low sea level stands of the Pleistocene. The heavy mineral suite represented in the study area indicates that the sediments were derived from the crystalline rocks of the southern Appalachians but are presently contributed from a reworked offshore sediment source.

Arthur, J.D., S. Melkote, J. Applegate and T.M. Scott. 1989. Heavy-mineral reconnaissance off the coast of the Apalachicola River delta, northwest Florida: A summary and new interpretations. Mar. Geol. 90(1-2):51-57.
Abstract. Two hundred and fifty sediment samples were collected for heavy-mineral and textural analysis along the northwest Florida coastline from approximately 24 km offshore of Apalachee Bay to the same distance offshore of Pensacola Bay. The heavy-mineral suite characterizing sediments within this region consists of opaque minerals, kyanite, staurolite, tourmaline, zircon and rutile. Minor constituents of this suite include epidote, sphene, amphibole, sillimanite, garnet and leucoxene. The average heavy-mineral concentration within these sediments is approximately 0.12 wt. %. Specifically, the 2 to 3 phi grain-size interval contains an average of 0.51 wt. %, whereas the 3 to 4 phi interval contains an average of 4.39 wt. % heavy minerals. Note that the 3 to 4 phi interval typically represents only 4% of the sample volume. There is a general westward increase in heavy-ineral concentrations throughout the study area. Superimposed on this regional trend, areas of maximum heavy-mineral concentration occur within sediments offshore of St. George and Santa Rosa Islands. The primary source of sediments in the region is the crystalline rocks of the southern Appalachians. Granulometric analyses of these sediments reveal a westward increase in values of sample meangrain size, and decrease in standard deviation, and percent fines. It is postulated from these data, in addition to the interpretation of sample grain-size distributions, skewness, and kurtosis, that these inner continental shelf sediments are primarily fluvial in origin. These sediments have been transported to the shelf by the Apalachicola and surrounding major rivers during Pleistocene low sea-level stands. Data also indicate evidence of reworking by coastal or marine offshore wave processes.

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Ball, M.M. 1989. Continental dynamics in the eastern Gulf of Mexico (Florida and the western Florida shelf). GSA Abstracts with Programs. 21(6):282. Dymek, Robert F., Shelton, Kevin L. Geological Society of America, 1989 annual meeting, St. Louis, MO, Nov. 6-9, 1989.

Ball, M.M. and N.K. Soderberg. 1989. Multichannel seismic-reflection profiles collected in 1979 aboard M/V Seismic Explorer on the western Florida shelf. U.S. Geol. Surv. Open-File Rep. OF-89-0157:3. US Geological Survey, Denver, CO.

Ball, M.M., R.G. Martin, J. Leinback and D. Taylor. 1987a. Reflection seismic measurements on the western Florida shelf. pp. 5-6. *In* F.J.M.R. Maurrasse, ed. Symposium on South Florida geology, Memoir of the Miami Geological Society, Volume 3. (Memoirs of the Miami Geological Society, 3). Miami Geological Society, Miami, FL. (Symposium on South Florida geology, Coral Gables, FL, Mar. 31-Apr. 2, 1983).

Ball, M.M., N.K. Soderberg, D.R. Nichols, B.T.F. O', J.E. Dodd and B.J. Irwin. 1987b. Multichannel seismic-reflection profiles collected in 1982 aboard R/V Gyre Cruise G8212, on the western Florida shelf. U.S. Geol. Surv. Open-File Rep. :4. U. S. Geol. Surv., Denver, CO.

Ball, M.M., R.G. Martin, R.Q. Foote and A.V. Applegate. 1988. Structure and stratigraphy of the western Florida shelf; Part I, Multichannel reflection seismic data. U.S. Geol. Surv. Open-File Rep. 88-0439:1-60.

Balsillie, J.H. 1975. Analysis and interpretation of littoral environment observation (LEO) and profile data along the western panhandle coast of Florida. U.S. Army Corps of Engineers, Technical Memorandum. 49:104.
Abstract. A 100-mile segment of the Florida panhandle coast was studied, from St. Andrew Bay to Pensacola Bay. Includes information on beach profiles, longshore transport and currents, winds and storms.

Balsillie, J.H. 1985a. Calibration aspects for beach and coast erosion due to storm and hurricane impact incorporating event longevity. (No 85-1) (Beaches and Shores Technical and Design Memo.). Florida Department of Natural Resources. Tallahassee, FL. 38 pp.

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Bedford, K.W., O. Wai, P. Velissariou, R. Van Evra and J. Lee. 1991. Fine material entrainment and flux at a shallow-water dredged mound. pp. 260-264. *In* Marine Technology Society, ed. Proceedings. 1991 Marine Technology Society (MTS '91). An Ocean Cooperative: Industry, Government, and Academia; New Orleans convention Center, Nov 10-14, 1991. Marine Technology Society, Washington, DC.
Abstract. High speed acoustic sediment concentration profile measurements were made along with turbulence resolving current meter data at a dredged material placement site south of Mobile Bay, Alabama in the Gulf of Mexico. The response of the bottom sediment to tides, wind driven

currents, wind waves and bottom topography is summarized in this article. The first portion of the record is dominated by traditional wave and current sediment distributions and was weakly depositional. The second portion was marked by longshore flow reversal and bathymetry-induced upwelling. The advective upwelling dominated turbulent flux and settling creating a strong resuspension flux. Available theoretical models will not handle this type of transport. Further, the bathymetric enhanced erosion and mobility should be minimized.

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Abstract. This report is the second in a series of reports on the results of model tests on the Mobile Bay model. Report 1 covers the verification and effects of proposed Theodore Ship Channel and Disposal Areas on tides, currents, salinities, and dye dispersion. Model tests in this report (Report 2) were chiefly designed to determine the impact of widening and deepening of the navigation channels and the accompanying dredged material disposal islands on tides, currents, salinities, and dye-dispersion patterns in Mobile Bay. The test results consist of comparable measurements of tide heights, current velocities, salinities, and dye-dispersion patterns for existing and proposed conditions. There was very little change in the tide heights in the bay for any plan. In general, for all plans an increase in maximum velocity occurred at stations in the low-velocity regions (the central region of the channel) and essentially, no change or a slight reduction in maximum velocity occurred at stations in the high-velocity regions (the upper and lower reaches). Enlargement of the channel seemed to be the dominant cause of salinity changes in the bay. All the plans generally raised the average salinity of the upper (north) bay and lowered the average salinity in the lower (south) bay. No plan maintained status quo (change at 0.5 ppt or less) in all four critical oyster-bed areas for area-average salinity or average bottom salinity.

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Abstract. The Florida Department of Natural Resources conducted resource assessments following Hurricane Elena (September 1985) to determine the storm's impact on commercially valuable oyster reefs along Florida's northern Gulf Coast. The Apalachicola Bay system, Franklin County, was identified as most severely damaged. Oyster production was reduced to

levels that would not support commercial harvesting. A comprehensive management plan was developed to protect surviving resources, mitigate economic hardship, and promote resource recovery.

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Abstract. The northeastern Gulf of Mexico, from the Mississippi River to DeSoto Canyon, is a complex of interrelated dynamic depositional systems. Fluvial- deltaic, estuarine, barrier-island and marine-shelf systems characterize this part of the Gulf. The Pearl, Pascagoula, and Mobile fluvia-deltaic systems are major sources of sediment in the area. This complex is similar to that of the Texas coastal zone, but specific facies, geometry, and spatial relations differ. Recognition of these aspects of the Alabama, Mississippi, and western Florida coastal-zone depositional systems is an important consideration in planning and developing a petroleum exploration program.

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Brooks, G.R. and L.J. Doyle. 1991. Geologic development and depositional history of the Florida Middle Ground; a mid-shelf, temperate-zone reef system in the northeastern Gulf of Mexico. pp. 189-203. *In* R.H. Osborne, ed. From shoreline to abyss; contributions in marine geology in honor of Francis Parker Shepard. (46) (Society of Economic Paleontologists and Mineralogists, Special Publication). SEPM, USA.

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Abstract. Biological, physical, chemical, and geological characteristics were studied in a series of five cruises between March 1987 to March 1988 along three north-south transects across the continental shelf of Mississippi and Alabama. Four stations in depths of approximately 50, 100, 150 and 200m were sampled along each of these transects. Side-scan, ROV, and underwater color photographs and video data were collected around topographic features in the study area. Subbottom profiler records indicate that the shelf edge is built upon delta-front forest beds that were truncated by erosion during the last low stand of sea level in the Pleistocene. Topographic features constructed on top of these sediments were generally of three classes: (1) pinnacles; (2) linear ridges; and (3) enigmatic features. Sediments contained a mixture of biological and petroleum hydrocarbons. Biological hydrocarbons were predominantly plant biowaxes with a possible minor planktonic input. Petroleum hydrocarbons were present as polynuclear aromatic compounds (PAH), a complete suite of n-C, and an unresolved complex mixture. Sediment PAH's on the shelf are on average six times lower than PAH's analyzed in sediments in adjacent bays. High hydrocarbon concentrations were generally at the seaward ends of the transects between the 100 and 200 m isobaths with stations closest to the delta containing the highest concentration of hydrocarbons. Sediments varied greatly in iron and trace metal content, but the variations seem to be largely the result of natural variability in grain size and mineralogy. Deep water sediments were more enriched in iron and trace metals than those in shallow water, but all were typical of unpolluted Gulf of Mexico shelf sediment. Satellite data positioned fronts associated with the Loop Current, warm core eddy, warm intrusions reaching into the region from the top of the Loop, warm intrusions from the Loop, and a cold ridge extending southward from the study area. Biological studies showed polychaetes were the dominant benthic macroinfauna taxon, both in numbers of species and numbers of individuals. No species appeared to dominate the community. There were no discernible patterns of diversity or abundance that could be attributed to inshore-offshore or east-west gradients. The largest numbers of species collected in the macroepifauna samples were at stations in 100m depths and the largest numbers of individuals were collected at the 150 and 200m stations. Demersal fish trawls sampled 2,839 specimens representing 98 species and 37 families.

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Abstract. Several management tools (i.e. fire, harvest and fertilization) were considered in this study, and their effects on the structure and productivity of the vegetation, on decomposition and microbial processes, and on the benthic faunal community were investigated. Two marsh

communities each in St. Louis Bay, Mississippi and Dauphin Island, Alabama were utilized during 1977 and 1978 to evaluate these tools on the productivity of both above ground (leaves and stems) and below ground (rhizomes and/or roots) portions of Juncus roemerianus, Spartina alterniflora and S. cynosuroides.

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Campbell, M.G.S. 1991. Sediment acute toxicity testing utilizing short-term bioassays. Ph.D. Dissertation. University of Florida, United-States. 171 pp.

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Cecil, T.M. 1983. Variability of bottom nepheloid layers near the Flower Garden Banks, Gulf of Mexico. Master's Thesis. Texas A&M University. 139 pp.

Ceryak, R. 1981. Significance of the Cody Scarp on the hydrogeology of north central Florida. pp. 24-29. *In* Anonymous, ed. Karst hydrogeology and Miocene geology of the Upper Suwannee River basin, Hamilton County, Florida - Field Conference Guidebook (Tallahassee) vol. 23.

Ceryak, R., M.S. Knapp and T. Burnson. 1983. The geology and water resources of the Upper Suwannee River basin, Florida. (Report of Investigations - Florida, Bureau of Geology vol. 87). Florida Geological Survey. Tallahassee, FL. 165 pp.

Champion, R.W. 1985. Design and construction -- Theodore Ship Channel. pp. 1-12. *In* R.W. Champion and J.B. Herbich, eds. Proceedings of the eighteenth dredging seminar (including some papers presented at WEDA VII), October 16, 1985, Portland, Oregon (held in conjunction with Western Dredging Association annual meeting, WEDA VII). (Rep. Tex. A&M Univ. Sea Grant Program, CDS Rep. No. 284. Grant NA85AAA-D-SG128). Texas A&M Univ. Sea Grant College Program, College Station, TX.

Abstract. Environmental impacts, greater technological capabilities and improved evaluation techniques make the disposal of large quantities of dredge material more complex and involved. Also, a marked decrease in the number of available upland disposal areas has become more evident as the U.S. coastline becomes more populated, mandating accurate forecasting techniques to be used in the selection of dredge disposal sites. This paper summarizes methods used in the planning, design, and construction of the Theodore Ship Channel and the disposal island (Gaillard Island) in Mobile Bay.

Chandler, R.V. and J.D. Moore. 1983. Fresh ground water resources of the Dauphin Island area, Alabama. Geologic Survey of Alabama. Circular No. 109:95.

Abstract. This report results from a study of the fresh ground-water resources of Dauphin Island, Alabama. The purposes of the study were to assess the fresh ground-water regime of the Dauphin Island area in terms of geometry, hydrogeology, and water-quality degradation caused by salt-water encroachment and to provide information useful in the future management of the fresh-water resources of the area. An inventory of water wells and test wells was conducted to determine the number, distribution, and location of the wells and to collect information related to depth, construction, yield, water level or artesian head, use, and hydrogeologic unit tapped by each well. Water samples were collected from selected water wells and test wells and analyzed for selected physical, chemical, and bacteriological parameters. A limited test-drilling program and geophysical surveys were conducted to obtain subsurface information.

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Abstract. The technical papers presented during the scientific sessions on the first day of the 1976 Barrier Islands Workshops, held on May 18th and 19th at Annapolis, Maryland are reported. Titles of papers are: Barrier Islands as significant ecosystems; Comparative ecology of East Coast Barrier Islands--hydrology, soil, vegetation; The wildlife resources of Barrier Islands; The national interest in Barrier Islands and beaches--natural resource values; Barrier Islands as natural storm dependent systems; Barrier Beachfronts; Environmental considerations and the management of Barrier Islands--St. George Island and the Apalachicola Bay System; Barrier Island preservation--the Virginia Coast reserve system; Critical area designation--the coastal zone soup bowl; The Florida critical area program--ideas for Barrier Island protection; Barrier Islands, Barrier Beaches, and the National flood insurance program; and aesthetic and recreational factors in Barrier Island planning.

Clark, R.R. 1990. Beach conditions in Florida. (Beaches and Shores Technical and Design Memo, 89-1). Florida Dept of Natural Resources. Tallahassee, FL.

Clarke, D. and T. Miller-Way. 1992. Environmental Assessment of the Effects of Open-Water Disposal of Maintenance Dredged Material on Benthic Resources in Mobile Bay, Alabama. U.S. Army Corps of Engineers, Waterways Experiment Station, Miscellaneous Paper. WES/MP/EL-D-92-1:173.

Abstract. Investigations were conducted to assess the spatial and temporal extent of impacts on benthic resources caused by open-water disposal of maintenance dredging materials in Mobile Bay, Alabama. Sediment profiling imagery was used in conjunction with conventional benthic grab samples to determine boundaries of a dredged material overburden and its effects on benthos immediately after disposal and at intervals of several months thereafter. Substantial effects were observed in terms of reduced benthic biomass, reduced redox potential discontinuity depth, and altered surface sediment relief. All effects were confined to within 1,500 m of the discharge point, and recovery of the benthos occurred within 12 weeks. Bay-wide surveys of benthic habitats yielded little evidence of cumulative effects of open-water disposal on benthic communities. Detected differences in benthic community parameters can be attributed to natural physical processes within the estuary, such as wind-driven circulation and sediment resuspension and prevailing salinity gradients, and do not appear to be present as a consequence of maintenance dredging open-water disposal practices.

Clarke, D.G., J. Homziak, R.L. Lazor, M.R. Palermo and G.E. Banks. 1990. Dredging Operations Technical Support Program: Engineering Design and Environmental Assessment of Dredged Material Overflow from Hydraulically Filled Hopper Barges in Mobile Bay, Alabama. WES/TR/HL-90-4; AD A227913. U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS. 354 pp.

Abstract. Barge overflow was investigated as a cost-effective option for future dredging needs in Mobile Bay, Alabama. Tests of hopper barge loading characteristics with overflow operations were conducted in Mobile Bay. In theory, overflow would allow denser materials to settle within the barge while less dense materials were shunted overboard. Increased density of barge-held materials would then translate to cost savings via a reduced requirement for transport to a distant approved disposal site. Thus, one major objective of the study was an engineering evaluation of equipment

performance during the tests. A second major objective was to obtain field data for an assessment of the environmental consequences of overflow. In support of both objectives, modeling studies were performed to simulate overflows that would be associated with routine dredging operations. Eight separate tests were conducted. Three tests occurred at a site in lower Mobile Bay, and five tests at an upper bay site. Three tests (one lower bay, two upper bay) involved dredging in maintenance materials, and five tests (two lower bay, three upper bay) involved new work or deepening materials.

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Corso, W., J.A. Austin and R.T. Buffler. 1989. The early Cretaceous platform off northwest Florida: Controls on morphologic development of carbonate margins. Mar. Geol. 86(1):1.

Coultas, C.L. 1980. Soils of marshes in the Apalachicola, Florida estuary. Soil Science Society of America Journal. 44(2):348-353.

Crane, J.J. 1980. The origin of the railroad embankment of Cape San Blas, Florida. pp. 491-538. *In* W.F. Tanner, ed. Shorelines, past and present - Proceedings of the Symposium on Coastal Sedimentology No. 5. Vol. III.

Crane, J.J. 1986. An Investigation of the geology, hydrogeology, and hydrochemistry of the lower Suwannee River Basin. Florida Geological Survey, Report of Investigations. 96:205. Florida Geological Survey, Tallahassee, FL.

Abstract. The purposes of this study were two-fold: (1) to conduct a unified comprehensive investigation of the hydrogeology of a basin located in a carbonate terrain; and (2) to collect baseline data to determine the present state of the Lower Suwannee River system for future comparisons. This study defines the geologic and hydrogeologic characteristics of the Lower Suwannee River Basin, Florida. These data were utilized in an interpretation of how geologic characteristics of the basin influence groundwater conditions and how groundwater and surface waters interact. This research is believed to be the first basin study that incorporates multivariate factor analysis and uranium disequilibrium methodology as an integral part of a carbonate basin study. All of the area within the Lower Suwannee River Basin is underlain by limestones and dolomites. Except for the portion of the basin covered by Miocene and younger sands and clays, these deposits lie at or near the surface. Solution of the carbonates has resulted in the development of a karst plain. Examination of 222 sets of well cuttings, 67 sets of auger samples and six cores permitted the construction of geology cross sections that show the Ocala Group limestones and, to a lesser extent, the Suwannee Limestone as the major lithologic components of the Upper Floridan aquifer. Utilizing R-mode factor analysis and correlation coefficient analyses, it was possible to distinguish water samples from wells completed into a surficial aquifer from those completed into the Floridan aquifer. Three water masses were delineated in the Upper Floridan aquifer utilizing the same analyses. Analyses for uranium parameters were performed on water samples from 62 wells, 32 springs, and five river sites. Factor analysis showed an inverse relationship between the U-238 concentration and the U-234/U-238 activity ratio; however, the uranium parameters were not associated with any of the other parameters measured. The activity ratios for wells and springs ranged from 0.39±0.02 to 2.57±0.60. The uranium concentrations ranged from less than 0.02 parts per billion (ppb) to 44.8±0.11 ppb. Generally, high ratio-low concentration values are associated with areas of very low to moderate recharge to the Floridan aquifer, whereas the low ratio-high concentration values are usually associated with areas of high recharge. The Lower Suwannee River is almost totally dependent on groundwater contributions for its flow. Both river hydrochemical data and the uranium disequilibrium results supported this conclusion.

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Abstract. Laboratory and field transmissometer studies on the effect of suspended particulate material upon the appearance of water are reported. Quantitative correlations were developed between remotely sensed image density, optical sea truth data, and actual sediment load. Evaluation of satellite image sea truth data for an offshore plume projects contours of transmissivity for two different tidal phases. Data clearly demonstrate the speed of change and movement of the optical plume for water patterns associated with the mouth of Mobile bay in which relatively clear Gulf of

Mexico water enters the bay on the eastern side. Data show that wind stress in excess of 15 knots has a marked impact in producing suspended sediment loads.

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Abstract. The long-term effects of beach nourishment on the benthic infauna and surface sediments of Panama City beaches were investigated. Forty-seven stations located on nine transects between West Pass and Philips Inlet, and two nourishment borrow sites were sampled in November-December 1979 and May 1980. The data collected were compared to prenourishment base-line information collected by Saloman (1976).Abiotic parameters, water temperature, dissolved oxygen and salinity were measured. Sediments were analyzed for particle-size distribution, percent organic carbon and percent carbonate. Benthic macroinvertebrates were represented by 162 taxa of 14 major animal phyla. Species composition and faunal densities varied seasonally. Polychaetes and amphipods were the most abundant animal groups; a small number of species were dominant at nearly all stations and highes offshore. Sediment composition was similar to that of Saloman's (1976) study within limits of sampling and processing errors. Faunal composition was found to be different from 1976 but was attributed to normal seasonal and spatial variations. Based on benthic community analyses and sediment parameters, no significant differences were found between nourishment borrow sites and surrounding areas and in the nearshore areas where beach nourishment was conducted. No long-term adverse effects of beach nourishment were detected.

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Davis, R.A., Jr., A.C. Hine and E.A. Shinn. 1992. Holocene coastal development on the Florida peninsula. pp. 193-212. *In* J.F. Wehmiller and C.H. Fletcher, eds. Quaternary Coasts of the United States: Marine and Lacustrine Systems. (SEPM Special Publication No. 48). SEPM, Tulsa, OK.

Abstract. The Florida peninsula contains five distinct coastal sections, each resulting from its own spectrum of coastal processes and sediment availability during a slowly rising, late Holocene sea level. The east coast barrier system is wave-dominated and has a large cuspate foreland (Cape Canaveral) near its middle. The Florida Keys and reef tract represent the only coastal carbonate system in the continental United States. An open-marine mangrove coast characterizes the low-energy, tide-dominated southwest part of the State. The central Gulf barrier system displays a mixed-energy morphology in a microtidal, low-energy setting. The open-coast marsh system of the Big Bend area that is north of the barrier system is also tide dominated, and is developed on a sediment-starved carbonate platform. The oldest preserved coastal Holocene section is the Florida Keys area where, at about 6 to 8 ka, sequences accumulated during the Holocene. Most of the remainder of the peninsular coast is

characterized by terrigenous sequences less than 3 ka. The younger sequences accumulated almost exclusively from reworking of older strata without benefit of additional sediment supply from land.

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Abstract. The major objective of the project was to determine the validity of using multi-species laboratory systems to evaluate the response of estuarine benthic communities to an introduced stress. In a 5-year period, experiments in Apalachicola Bay, Florida, and the York River, Virginia, sought to develop criteria for microcosm tests to evaluate the capacity of microcosms to model natural communities in the presence and absence of pollution-induced stress, and assess the validity of extrapolating test results of one location to another. Individual species response patterns in the microcosms were highly variable and seldom showed good agreement with patterns in the field. Species richness in the microcosms and field sites showed good temporal agreement and provided a conservative indicator of community response to a toxic stress.

Dinnell, S.P. 1988. Circulation and sediment dispersal on the Louisiana-Mississippi-Alabama continental shelf. Ph.D. Dissertation. Louisiana State University, Baton Rouge, LA. 173 pp.

Dobson, L.M. and R.T. Buffler. 1991. Basement rocks and structure, Northeast Gulf of Mexico. pp. 191-206. *In* D. Schumacher and N.C. Rosen, eds. 41st annual convention, Houston, TX, Oct. 16-18, 1991, Gulf Coast Association of Geological Societies. Gulf Coast Association of Geological Societies, Austin, TX.

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Abstract. High-resolution seismic surveys and sedimentologic studies in the northeastern Gulf of Mexico reveal multiple late Quaternary fluvial erosion surfaces. The Apalachicola River, largest river in the northeastern Gulf, incised a network of large channels which today lie buried 5-40 m beneath the present-day inner shelf and the estuary of the modern river. An abundance of coastal and estuarine borehole data enables the seismic records to be quantified to yield paleohydrologic information. The paleohydrologic data show that the Apalachicola was a

river of significantly higher discharge before the late Holocene, prior to migrating eastward to its present location. Available evidence indicates that the Apalachicola Delta began prograding in its present location at least 2000 years ago. Much of the near-surface sedimentologic and geomorphologic features of the inner shelf of the northeastern Gulf of Mexico, including perhaps the Florida Middle Ground reef tract, are the result of earlier episodes of migration and delta-building by the Apalachicola River.

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Abstract. Heavy mineral-rich beach sands, concentrated by wave and wind action, have been found to contain significant gamma radioactivity, due primarily to trace amounts of uranium and thorium found in monazite and zircon. Heavy mineral sands on the barrier islands ringing Apalachicola Bay in northwest Florida are detrital products of southern Appalachian crystalline rocks. Sand deposits within the shore zone are highly mobile, with observed radioactivity fluctuating by an order of magnitude within months. By combining field measurements with laboratory heavy mineral analysis and gamma spectrometry, bulk volume of heavy mineral-containing sand within a given area can be estimated; changes in measured radioactivity as a function of time and position can be used to describe sand redistribution patterns.

Donoghue, J.F. and W.F. Tanner. 1992. Quaternary terraces and shorelines of the panhandle Florida region. pp. 233-241. *In* J.F. Wehmiller and C.H. Fletcher, eds. Quaternary Coasts of the United States: Marine and Lacustrine Systems, SEPM Special Publication 48. SEPM, Tulsa, OK.

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Donoghue, J.F., M.B. Greenfield and R.J. Demeijer. 1988. Measuring barrier island erosion and accretion, Northwest Florida, USA. EOS, American Geophysical Union Transactions. 69(44):1238-1239. AGU, 1988 Fall Meeting, San Francisco, CA, Dec. 6-11, 1988.

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Abstract. Since the beginning of the Tertiary the sedimentology of the Gulf of Mexico Basin has been dominated by the depositional activity of the Mississippi River. The sedimentologic influence of the Mississippi diminishes with distance east or west of the Louisiana shelf, however. The Texas and northwest Florida shelf margins, for example, are characterized by a series of smaller deltas. In the inner and mid-shelf areas of these regions the near-surface sedimentary units include infilled stream channels and small deltas. Such features are commonly observed in sub-bottom seismic records from the middle and inner shelf of the northeastern Gulf, along the Apalachicola River coast of northwest Florida. The Apalachicola River is the principal source of clastic sediment to the northeastern Gulf of Mexico. During the late Holocene virtually all of the river's sediment load has been deposited in the modern Apalachicola Delta and in the river's estuary. Apalachicola Bay, which has been filling rapidly. During the Quaternary lowstands, prior to the development of the modern estuary, the river traversed the present-day inner and mid-shelf, incising a network of channels. Based on seismic records, many of these buried shelf channels were considerably larger than their modern counterparts. During lowstands the Apalachicola River also deposited coarse sediment on the shelf as deltaic and associated river-mouth sediments. These deposits comprise the modern near-surface sediments of the inner and middle shelf. An investigation of subsurface sedimentary features observed in seismic profiles provides details on the late Quaternary development of the northeastern Gulf of Mexico shelf. Seismic reflection profiles obtained on the inner and mid-shelf regions of northwest Florida reveal an approximately 50 m thickness of late Quaternary sediments, comprised of two and sometimes three discrete clastic sequences. Two lower fluvial sequences total as much as 40-50 m in thickness. A transgressive marine sand deposit overlies the older features in some places, varying in thickness form 0 to 5 m. Identification of seismic facies, combined with stratigraphic data from a suite of coastal boreholes, enables correlation of offshore seismic stratigraphic units with late Tertiary and Quaternary coastal stratigraphy.

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Abstract. The beaches are important present-day concerns at Dauphin Island, Alabama. Several steps have recently been taken to address beach management problems. One, a group of local, state, and federal officials have met monthly for several years to discuss decisions concerning management of the east end of the island. Two, a planning study by several academic institutes developed an outline of a long-term management plan for the east end of the island. Three, a technical study of the coastal processes of the island quantified the erosion problem and made recommendations concerning the management of the beaches. The present and future island's development has been modified as a result of these activities. The implementation of several recommendations is underway but many decisions are still facing the island.

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Abstract. The initial field investigation indicated that the primary problem affecting the water quality of the two-mile long by 1,000-foot wide lagoon was poor circulation. The selected alternative, a pumping system, was superior in regard to costs, environmental impacts, and met with satisfaction by the permitting agencies as well as the local citizens. The NWFWMD prepared construction plans to install an off-shore intake structure, almost 2,000 linear feet of 84-inch pipe, and a pumping station capable of moving 50,000 gpm of salt water from the Gulf into the upper end of the lagoon. The pump is intended for operation only on the out going tide so as to simulate natural conditions. The 110 cfs of displaced lagoon water will merge by tidal action with the 40,000 cfs flowing from Choctawhatchee Bay into the gulf. The flow from the pump is projected to replace the water in the lagoon in approximately 17 days.

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Abstract. In June 1988, the Naval Ocean Research and Development Activity (NORDA) collected some 'in-water' data using its Towed Underwater Pumping System (TUPS) in the near-shore waters off St. Andrews State Park, Shell Island, Florida. These in situ data include latitude; longitude; depth in meters; narrow-band upwelling at 465 nm, 507 nm, and 532 nm; broad-band downwelling collected at the surface; temperature; salinity; and transmissivity. In this paper, we investigate the relationship between depth and the normalized upwelling irradiance (upwelling divided by downwelling) in the three bands. Algorithms used to calculate water depth

from remotely sensed airborne and satellite multispectral data are applied to the TUPS data and results compared. The TUPS data have the advantage over most aircraft- and satellite-collected data because they were collected over an essentially uniform bottom type (smooth sandy bottom with steady slope) and have no atmospheric contamination. A new algorithm for depth calculation is proposed.

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Abstract. A 1,700-acre, triangular-shaped dredged material island was constructed by both barge haul and hydraulic placement of the dredged material excavated from the Theodore Ship channel. Approximately 6 miles of perimeter dikes were constructed on very soft bay bottom soils at the northwest junction of the Mobile and Theodore ship channels. The dike area exposed above mean low water(mlw) was approximately 320 acres. In addition, an area exposed of about 350 acres inside the containment area was exposed at mlw. The new work dredging consisted of the removal of

about 33.5 million cu yd of material. The material dredged was either hydraulically pumped or barged to the disposal area for use in constructing the dikes. The project consisted of dredging a deep draft ship channel about 5.2 miles long, 400 ft wide, and 40 ft deep linking the mobile Ship Channel with the Middle Fork Deer River shoreline at Theodore, Alabama. An inland ship channel about 1.9 miles long, 300 ft wide, and 40 ft deep was also dredged to join a 42-acre ship turning basin with a 6,500-ft-long barge channel. About 95 percent of the material dredged from the bay cut and about 52 percent of the material from the land cut was clay that readily formed clay balls. The remaining channel material was primarily sand with small amounts of shell and gravel.

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Abstract. Shows the areas flooded along the shores of Santa Rosa Sound and the Gulf of Mexico from Pensacola Beach eastward to The Narrows near Fort Walton Beach, Fla. The areas flooded along the shores of Pensacola, Escambia, Blackwater and East Bays were not delineated; however, floodmark elevations were determined.

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Abstract. Shows the areas flooded along the shores of Big Lagoon, Pensacola Bay, Santa Rosa Sound and the Gulf of Mexico from Seaglades eastward to Pensacola Beach. Inundated areas along the shores of Pensacola Bay north to a line from Chevalier Field to Fair Point were not delineated; however, floodmark elevations were determined.

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Abstract. Florida's coastal zone contains numerous significant historical and archaeological sites, including the submerged remains of wrecked or abandoned watercraft. These sites represent non-renewable cultural resources that are being threatened statewide by beach erosion, coastal development, dredging, and salvage activities. In order to assemble a long-term research and management plan for these resources, the Florida Division of Historical Resources, Bureau of Archaeological Research developed a pilot study to inventory and assess a cross section of sites in the Pensacola bay and river system. The goal of the Pensacola Shipwreck Survey was to assemble and test a regional management model for potential future application elsewhere in the state. Thirty-three

significant sites were identified, assessed, and recorded over a period of six months. Data from the study sites were applied to a proposed Shipwreck Matrix model, which classified each site by age and integrity. Within the matrix the sites were assigned a priority rating to determine the range of proposed management options viable for each site. Recommendations for further fieldwork were proposed, as well as specific recommendations to other state and federal agencies.

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Abstract. The distributions and speciation of germanium were investigated in three very different estuaries: (1) Ochlockonee Bay, a small, pristine, low-productivity estuary in NW Florida (2) Charlotte Harbor, a large, nutrient-rich (N,P), high-productivity estuary in SW Florida, and (3) the Tejo Estuary, a large, industrially-polluted bay near Lisbon, Portugal. In all three estuaries at least three species of germanium were detected: inorganic germanic acid (Ge sub(i)), monometylgermanium (MMGe), and dimethylgermanium (DMGe). The source of Ge sub(i) is weathering of silicate rocks. The sources of MMGe and DMGe are presently unknown, but presumably are oceanic. Trimethylgermanium (TMGe) was detected (trace quantities less than or equal to 5 pM) in the most polluted portion of the Tejo Estuary, and thus may have an anthropogenic source.

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through an opening in the west side of the ebb-tidal delta and moved parallel to the coast. A stable front developed between the low salinity water of the buoyant plume (11 ppt and the high salinity coastal water (>23ppt) that was being forced landward by the prevailing winds. Despite the shallow water depth of 6 m, measurements of currents, temperature, and salinity show large shears and density gradients in both the vertical and the horizontal directions. At a station outside of the buoyant plume, currents at 0.5 m and 1.5 m below the surface were in the same direction as the wind. Inside the plume, however, currents at 0.5 m below the surface were parallel to the coast, 45 degree off the direction of the wind and the magnitude was 45% larger than the magnitude of the surface currents outside the plume. Beneath the level of the plume, the currents were identical to the wind-driven currents in the ambient water south of the front. Our observations suggest that the wind-driven surface currents of the ambient water converged with the buoyant plume at the front and were subducted beneath the plume. The motion of the ambient coastal surface water was in the direction of the local wind stress, however, the motion of the plume had no northerly component of motion. The plume also did not show any flow toward the front, suggesting a balance between the northerly component of wind stress and the southerly component of buoyant spreading. In addition, the motion of the plume did not appear to affect the motion of the underlying ambient water, suggesting a lack of mixing between the two waters.

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Abstract. The vegetation colonising dredge spoil is described from the first year following massive beach nourishment. Dredge spoil was deposited in late 1990 gulfward of mean high water on Perdido Key, a barrier island off the coast of the Florida panhandle, for a distance of 8 km and averaging 150 min width. A grid of permanent plots was used to measure density and cover of the colonizing species. With a density of 997 plants per ha in Summer 1991, Cakile constricta was the most abundant of ten species colonizing the dredge spoil. Other species with a density of more than 50 plants per ha were Uniola paniculata, Iva imbricata, Panicum amarum, and Oenotherahumifusa.

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system. Some evidence suggests that sediment composition differences east and west of Cape San Blas reflect different sources. Magnitudes of profile changes are approximately a direct function of wave height up to average heights of 30 cm and more. Thereafter, increasing wave height apparently does not markedly increase the rate of sand level variation. Volumes of sand transported in longshore drift, however, are directly related to wave height, but show considerable variation from month to month and day to day. Net sand transport is to the west and apparently is actively prograding the large spits of the area from Mobile Bay to Pensacola. Wave energy decreases west of Mississippi Sound and transport diminishes.

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jetties and sandy bay bottoms. A moderate amount of shallow grassbed communities occur along the bayside of Shell Island. Marine fishes, shorebirds and various invertebrate marine life are prodominant. The preserve lies adjacent to St. Andrews Bay State Park which receives heavy recreational use. Portions of the preserve adjoin exclusive residential development and military facilities. Water quality in and around the St. Andrews Bay area has deteriorated in recent years from sewage discharge and stormwater runoff. The inlet area, the Gulf and the inner bay area also support some of the heaviest boating traffic in northern Florida. The high recreational use, the increases in water pollution, and the continued development of adjoining uplands threaten the long term maintenance of the preserve and necessitate resource planning for the area.

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Abstract. An ample literature exists documenting the destructive effects hurricanes have upon offshore barrier islands and coastlines. The Gulf of Mexico region has been especially heavily impacted because of its unique position with respect to the storm track of tropical cyclones and the large area of unprotected shoreline around its perimeter. While abundant descriptions can be found documenting effects of storms on exposed geomorphological features, little information is available illustrating changes involving submarine erosion. From a geological standpoint, these are equally striking. Studies carried out in Apalachicola Bay, Florida and Mobile Bay, Alabama have shown that the passage of hurricanes can not only incise sizable submarine channels but can also remove vast quantities of sediment. The passage of Hurricane Elena near Apalachicola Bay in 1985 removed some 87 million tons of sediment from the bay; Hurricane Frederic's near miss of the Mobile, Alabama area in 1979 removed an incredible amount of sediment that was estimated at nearly 300 million tons. When placed in a geological framework, the latter hurricane's passage swept a volume of sediment from the bay equivalent to that deposited by the Mississippi River in a one year period.

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Abstract. Mobile Bay is the third largest drainage basin in the United States. As is true for any estuary, the ecology of the Bay is influenced by pollution, salinity, temperatures, turbidity, tides, and the biotic populations. Since protoza lie at the base of the food web and feed on diatoms, algae, bacteria and each other, they form a major transition point at which plant protoplasm is converted to animal protoplasm. Because of their basal position in the food web, they must be successful in the biotype before most of the higher forms can be successful. For this reason a survey of the protozoa of Mobile Bay was undertaken. The scale drawings and taxonomic descriptions will be of great value to protozoologists.

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Abstract. The Mobile District of the U.S. Army Corps of Engineers is currently evaluating the feasibility of a hurricane and storm damage reduction project at Panama City Beach, Florida. Under Corps criteria, a project is considered economically feasible if the economic benefits are equal to or greater than the economic costs. The major economic benefit of a project at Panama City Beach will be from the reduction in the economic costs of hurricane and storm damages. Benefits may also be realized from increased recreation, land enhancement, lost land reduction, and reduced maintenance of infrastructure. The benefits of a project for hurricane and storm damage protection equal the amount of hurricane damages without

the proposed project minus the amount of hurricane damages with the project. The methodology used for computing the benefits of hurricane and storm damage reduction, the composite damage reduction method, is described in this paper. This methodology considers damages to structures from inundation, waves, storm-induced recession and long-term erosion. The economic model will also take into account other factors such as rebuilding constraints and structural impediments to erosion.

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Abstract. The feasibility of developing marsh on fine-grained and coarse-grained dredged material in a brackish water intertidal environment was tested at a dredged material disposal site in Apalachicola Bay, Florida. Smooth cordgrass (Spartina alterniflora) and saltmeadow cordgrass (Spartina patens) sprigs were planted at different spacing intervals to evaluate optimum conditions for growth. Natural invasion of plant species was also documented during the period of study. Results indicate that the development of marsh plants on dredged material can be readily accomplished in the area of study.

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Abstract. Over the past 11 years, seven dredged material sites located in US Army Engineer Waterways Experiment Station (WES). Wetland sites are located at Windmill Point in the James River, Virginia; Buttermilk Sound in the Altamaha River, Georgia; Drake Wilson Island in Apalachicola Bay, Florida; Bolivar Peninsula in Galveston Bay, Texas; Salt Pond 3 in south San Francisco Bay, California; and Miller Sands Island in the Columbia River, Oregon. Upland sites are located at Nott Island in the Connecticut River, Connecticut; Bolivar Peninsula; and Miller Sands. In addition, four dredged material sites developed by Corps Districts are being monitored informally at other site visits. Southwest Pass at the mouth of the mouth of the Mississippi River, Louisiana (New Orleans District), are wetland sites only; Gaillard Island in lower Mobile Bay, Alabama (Mobile District), and Pointe Mouillee in western Lake Erie, Michigan (Detroit District), are both wetland sites.

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Abstract. Model tests were conducted to determine the impact of the proposed Theodore Ship Channel and accompanying material disposal islands on tides, currents, salinities and dye dispersion patterns in Mobile Bay, Alabama. Parameters used in the model were verified with actual measurements from the bay. The Mobile Bay model was a fixed-bed model constructed to linear scale ratios of 1:1000 horizontally and 1:100 vertically. The model reproduced about 268 square miles of the Gulf of Mexico from Pine Beach on the east to about the west end of Dauphin Island, and in a southerly direction to about the -70-ft contour in the Gulf; all of Mobile and Bon Secour Bays; a portion of Mississippi Sound;

and the Mobile and Tensaw Rivers and adjacent marshes to the junction of the two rivers at Mt. Vernon, some 40 miles upstream from Mobile. The model was equipped with the necessary appurtenances for accurate reproduction and measurement of tides, tidal currents, salinities, freshwater inflows, density effects, and other important prototype phenomena. The purpose of the model study was to determine the impact of a proposed access channel, referred to as Theodore Ship Channel, and the necessary islands designed to hold the initial construction material and subsequent maintenance dredging on salinities and flow patterns with special interest centered on the oyster industry at the lower end of Mobile Bay.

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Abstract. Cohesive sediment dynamics as effected by salinity intrusion are described for the Suwannee River Estuary, a large estuary flowing over the very shallow limestone shelf of Florida's Big Bend coastline on the Gulf of Mexico. The pattern of cohesive sediments deposited as wide shallow mudflats in the estuary results from the inflowing transport of fine sediment particles by the large river discharges and the normally slow offshore sediment transport along the low energy coastline. This cohesive sedimentation process is relevant to the many coastal areas with estuarine resources effected by the salinity intrusion from artificial river discharge reductions and channel dredging.

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indicators of levels of pollution are discussed individually. Sediments used for the Standard Elutriate Test evaluation and subsequent bioassay research were from the Trinity River, Houston Ship Channel turning basin, Port Aransas Channel, and Corpus Christi Bay, Texas; Mobile Bay, Alabama; Bridgeport, Connecticut; and Ashtabula, Ohio. The oxygen content of the elutriate was found to be one of the most important factors influencing the release of chemical contaminants from dredged sediments during the test. However, the test was found to be insensitive to many other parameters, such as shaking time, method of agitation, solid-to-liquid ratio, and various filtration procedures.

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Light, H.M., M.R. Darst, M.T. MacLaughlin and S.W. Sprecher. 1993. Hydrology, vegetation, and soils of four North Florida river flood plains with an evaluation of State and Federal wetland determinations. USGS Water Res. Investigations. WRI 93-4033:94. Prepared in cooperation with the Florida Department of Environment Regulation, USGS, Reston, VA.

Livingston, R.J. 1975. Diurnal and Seasonal Fluctuations of Organisms in a North Florida Estuary. (Report No.: NOAA-76090903) Sponsor: National Oceanic and Atmospheric Administration, Rockville, Md. Office of Sea Grant.; Environmental Protection Agency, Washington, D.C. NTIS. Washington, DC. 30 pp.

Abstract. Monthly samples of demersal fishes and invertebrates were taken in an unpolluted, river-dominated estuary in north Florida (Apalachicola Bay) for a 2-yr period. Several species richness and diversity indices were compared. Regular diurnal and seasonal variations of such parameters were related to complex interactions which included river flow, salinity variations and temperature changes. The various species diversity indices were highly correlated in spite of theoretical distinctions. There were basic differences in species composition and numbers of individuals of invertebrates taken throughout a 24-h period. Seasonal peaks of numbers of individuals, numbers of species and species diversity usually occurred during summer and fall periods. Apalachicola Bay was seen as an

unpolluted system that underwent considerable seasonal fluctuations of richness and diversity in response to extreme variations of natural (physical) functions.

Livingston, R.J. 1980. The Apalachicola Experiment: Research and Management. Oceanus. 23(4):14-21.

Abstract. Since 1971, a continuous, multidisciplinary research program has been carried out in the Apalachicola Bay system in northern Florida. The project originated as a routine assessment of the estuary, including monthly evaluations of water quality and biological productivity. Initial studies indicated relatively high levels of phytoplankton productivity and virtually no pollution from organochlorine compounds. The delicate hydrologic and nutrient regimes of the bay system were observed. To protect this ecosystem, ecologically sensitive lands were purchased by the state in order to establish sanctuaries.

Livingston, R.J. 1983. Resource atlas of the Apalachicola Estuary. Report No. 55. Dept. of Biol. Sci., FL. State Univ., Sea Grant College. Gainesville, FL. 64 pp.

Abstract. The colored charts and LANDSAT photographs in this small resource atlas vividly illustrate the environment, ecology, and potential of this unique coastal area of western Florida (where Alabama and Georgia touch on Florida). The public relations information type of presentation gives, on two-page spreads each, pictorial, topographic, and statistical data with textual summaries on the following subjects: 1) general overview of the river and bay system and the National Estuarine Sanctuary; 2) physical and chemical features of the barrier islands: depths, tides, and currents; temperature and salinity of surface and bottom waters; water quality features; rainfall and river flow; and nutrients and organic detritus; 3) biological features, covering emergent vegetation, submergent vegetation, microbial ecology, zooplankton, benthic macroinvertebrates, oysters, crabs, shrimp, anchovies, spot, croaker, sand seatrout, commercial and sport fisheries, food webs, and community organization; and 4) regional economics and planning of resource management. An extensive bibliography is appended. Seasonal and annual rainfall, river flow, and temperature variations are shown on bar charts and explained in the text.

Livingston, R.J. 1985. Application of scientific research to resource management: Case history, the Apalachicola Bay system. pp. 103-125. *In* N.L. Chao and W. Kirby-Smith, eds. Proceedings of the International Symposium On Utilization of Coastal Ecosystems: Planning, Pollution and Productivity, 21-27 Nov. 1982, Rio Grande, Brazil. Vol. 1. (Int. Symp. on Utilization of Coastal Ecosystems: Planning, Pollution and Productivity, Rio Grande (Brazil), 21 Nov. 1982).

Abstract. An account is given of some of the results of a research program conducted in the Northeast Gulf of Mexico, examining applications to resource management. The Apalachicola River and Bay system is one of the areas under study and is an important unpolluted and highly productive resource in the southeastern United States. The extensive scientific data base has been used as the basis of a comprehensive resource planning and management effort for the entire Apalachicola basin. This combination of research and planning has led to a variety of management applications,

which include the purchase of ecologically sensitive wetlands and barrier islands and the development of advanced land-use plans at the local, state and federal levels.

Livingston, R.J. 1991. Historical relationships between research and resource management in the Apalachicola River estuary. Ecological Applications. 1(4):361-382.

Abstract. A continuous field effort has been carried out in the Apalachicola River estuary since March 1972. The information generated from this interdisciplinary study has been directly applied to the management of the Apalachicola resource by means of close associations among local, state, and federal officials and university scientists. During the early years, scientific data were instrumental in the prevention of the impoundment of the Apalachicola River. A series of regional studies was carried out to evaluate various forms of effects due to forestry activities, pesticides, and stormwater runoff from urban areas. A review was made of fisheries problems associated with dredging, overfishing, and marine pollution. Results of such studies were directly applied to local management questions. Research that linked the river wetlands with the estuary, in terms of the input of freshwater, nutrients, and organic matter, served as the basis for the purchase of extensive bottomland tracts. Other initiatives were carried out that were designed to protect the naturally high productivity of the river estuary. Further purchases of estuarine wetlands and barrier island properties were made that formed an almost continuous buffer of publicly held lands between upland developments and critical habitats and important populations of the bay system. A regional management plan was adopted that was designed to limit local municipal development in the estuarine region. Analyses of the long-term scientific data indicated that dominant, commercially important estuarine populations are associated with river flow, local salinity characteristics, and biological (perdition, competition) interactions with the salinity regime and food web structure. Such interactions are not straightforward, however; they reflect complex interactions of the freshwater influxes and biological response in the estuary that are not well understood. Species-specific responses to the principal driving factors further complicate the biological relationships of the Apalachicola system. The management of a river-dominated estuary should be based on protection and control of freshwater sources, nutrients, and organic matter with a minimization of physical alterations that often lead to increased salinity stratification and the associated loss of the nursery function of the estuary. There is growing evidence that changes in upland characteristics and within-system habitat alterations are associated with changes in nutrient distributions and salinity relationships and that such changes can have serious impacts on estuarine systems. Issues involving basic changes in estuarine productivity and associated food webs are far more important than those involving species diversity in the management of such resources. Processes such as nutrient flow and salinity alteration underlie the very basis of estuarine productivity and usefulness. Over the past decade, there has been a gradual reduction in the importance of research as an integral part of the planning and management process in the Apalachicola system. This regional trend follows a national pattern. Dredging effects on the river and bay have gone on without effective challenge even though such activities are damaging productive habitats of the system. The once

influential Apalachicola oyster fishery remains in disarray following a series of natural disasters and poor management practices. There is a growing problem with the deliberate obstruction of the generation and use of scientific data to determine management policies by various state and federal agencies. The substitution of public relations activities for the development of needed scientific information concerning factors such as the importance of sustained freshwater input to estuaries is further evidence that even the most elaborate and well-conceived management plans can be reversed by political manipulations and short-sighted bureaucratic policies.

Lloyd, J.M. and C.H. Tootle. 1994. 1992 and 1993 Florida petroleum production and exploration; including Florida petroleum reserve estimates. Florida Geological Survey, Information Circular. 110:30.

Abstract. Florida oil production began to decline in 1979 and generally has continued to do so. However, statewide production increased during 1992 and 1993 due to increased production at the Jay field, the largest producing field in Florida. Exploration activity during 1992 and 1993 was very limited. Only five onshore exploratory wells were drilled during 1992 and 1993. Three of these were in the Florida panhandle in Escambia and Santa Rosa Counties; two were in south Florida in Hendry and Collier Counties. All five exploratory wells were plugged and abandoned as dry holes. Geophysical exploration conducted during 1992 and 1993 was limited to the Florida panhandle and only covered 41.4 miles of seismic lines. In addition to this completed geophysical exploration, a permit expired for an extensive offshore seismic, gravity, and magnetic survey. This exploration would potentially have explored a dense grid off of Florida's Gulf coast extending from offshore of Apalachicola, Franklin County to offshore of Naples, Collier County. One exploratory well permit was pending in federal waters off Florida at the close of 1993. This well would be the third to be drilled in the Destin Dome area by Chevron. The two previously drilled wells were classified by the federal government as producible Norphlet gas discoveries.

Locker, S.D. and L.J. Doyle. 1987. Stratigraphy of the northwestern Florida inner shelf from high resolution seismic reflection data. GSA Abstracts with Programs. 19(7):748.

Locker, S.D. and L.J. Doyle. 1992. Neogene to recent stratigraphy and depositional regimes of the northwest Florida inner continental shelf. Mar. Geol. 104:123.

Abstract. The late Neogene to Recent depositional history of the inner shelf off northwest Florida was investigated using high-resolution seismic reflection data. Two principal sedimentary provinces, the Apalachicola Embayment and the Alabama-Florida Shelf, are distinguished by different structural trends and sequence stratigraphy. A transition from carbonate to terrigenous clastic deposition occurs vertically and laterally from east to west. The dominant controls on deposition have been sea level history and location of fluvial systems advancing southward and infilling the Apalachicola Embayment. In the Apalachicola Embayment, the upward carbonate-to-terrigenous transition correlates with a change from relatively flat lying reflections, to prograding clinoforms, and then chaotic and reflection-free sequences. Carbonate deposition in the middle and late Miocene is inferred to have occurred during highstands of sea

level with minor input of terrigenous material. In the late Miocene, a major erosional unconformity and associated river valley entrenchment cut deeply into the flat-lying carbonate section. Subsequent deposition is distinguished by broad prograding clinoforms and an increase in terrigenous material in an open shelf environment. In the late Pliocene, sea-level fluctuations generated a stratigraphic record dominated by offlapping, seaward-thickening sequences. The interaction between sea level and fluvial supply to the shelf became very important as shifting river inputs resulted in locally thick depocenters bounded by erosional unconformities. Four primary areas of fluvial-deltaic input in the Plio-Pleistocene are identified based on the distribution of channels and prograding clinoforms interpreted to be delta front deposition. The present inner shelf is a sediment-starved clastic depositional regime.

Locker, S.D., L.J. Doyle, A.C. Hine and N.J. Blake. 1990. Complex carbonate and clastic stratigraphy of the inner shelf off west-central Florida. AAPG Bulletin. 74(5):707.

Locker, S.D., A.C. Hine and E.A. Shinn. 1991. Sea level geostrophic current control on carbonate shelf-slope depositional sequences and erosional patterns, South Florida platform margin. AAPG Bulletin. 75(3):623.

Loftin, T.L. and J.F. Donoghue. 1987. Investigation of the sedimentation rates in the Apalachicola Bay estuarine-deltaic system using lead-210 geochronology. GSA Abstracts with Programs. 19(2):95.

Logue, K.T. and L.J. Doyle. 1988a. Bed form patterns and sedimentary processes along a mixed energy inner shelf; northwestern Florida. AAPG Bulletin. 72(2):214.

Logue, K.T. and L.J. Doyle. 1988b. Bed form patterns and sedimentary processes along a mixed energy inner shelf; northwestern Florida. The AAPG Bulletin. 72(2):214.

Looney, P.B. and D.J. Gibson. 1993. Vegetation monitoring of beach nourishment. pp. 226-241. *In* Anon., ed. Proceedings of the 8th Symposium on Coastal and Ocean Management. (New Orleans, LA,; Beach Nourishment Engineering and Management Considerations Coastal Zone) ASCE, New York, NY.

Abstract. The Gulf Islands National Seashore portion of Perdido Key, Florida is the site of a five year project established to monitor the response of undisturbed native barrier island plant communities to massive beach nourishment. This note describes the primary succession of colonizing species on the nourished beach and discusses potential long term effects on established vegetation. refs.

Lowery, T.A. 1992. Apalachicola Bay's proclivity for sediment export during hurricanes and its impact on oyster production from 1960-1985. J. Shellfish Res. 11(2):461-466.

Abstract. Chesapeake Bay's response to Tropical Storm Agnes in 1972 included mass sediment import and a concomitant degradation of estuarine health. Apalachicola Bay's response to Hurricane Elena in 1985 included mass sediment export and improved estuarine health. The depositional event that occurred in Chesapeake Bay in 1972 resulted from the flooding associated with Tropical Storm Agnes while the erosional event that

occurred in Apalachicola Bay in 1985 resulted from the high winds associated with Hurricane Elena. These two events represent the extremes of episodically driven estuarine sediment deposition and erosion. Chesapeake Bay's response to Tropical Storm Agnes was well documented and is well known within estuarine science circles, but Apalachicola Bay's response is documented but not well known. This paper reviews Apalachicola Bay's proclivity for sediment export during hurricanes and its impact on oyster landings (1960-1985) as a surrogate indicator of ecosystem perturbance.

Lucas, J.R. and D.J. Stetz. 1980. Flood plain inundation in the Apalachicola River basin. U.S. Geol. Surv. Prof. Pap. 117:303-304.

Ludwick, J.C. 1964. Sediments in northeastern Gulf of Mexico. pp. 204-238. *In* R.L. Miller, ed. Papers in marine geology. Macmillan Company, New York, NY.

Abstract. Investigators of continental shelf sediments in the northern Gulf of Mexico have concluded that changes in late Quaternary sea level have strongly influenced patterns and kinds of surficial sediments and fauna. The purpose of this paper is to describe and interpret the distribution pattern of modern surficial sediment deposits on the continental shelf and nearshore areas. Seafloor samples were taken along 11 sampling profiles from 1952 to 1954. Utilizing these cored and dredged samples a recent history of sedimentation is reconstructed.

Magoon, O.T., S. Laska and A. Puffer. eds. 1993. Coastlines of the Gulf of Mexico. (Proceedings of the 8th Symposium on Coastal and Ocean Management, New Orleans, LA, Series ed.: O.T. Magoon. Coastlines of the World. ASCE. NY NY. 247 pp.

Abstract. This volume contains 20 papers to be presented at the conference. Some of the topics discussed by the papers are the following: an overview of Louisiana's 1991-1992 Christmas Tree-Brush Fence Program; dredging related sea turtle studies along the southeastern U.S.; a classification of the coastal dunes of Louisiana; revitalizing the Florida coastal management program; a man-machine partnership for map production: an application of image classification and auto-vectorization in charting coastlines; impacts of winter storms on sediment transport within the Terrebonne Bay Marsh complex; performance of an upland source nourishment project Honeymoon Island, Florida; a method for classifying land loss by geomorphology and process; the diversification of a Louisiana coastal community; shoreline changes along the North Yucatan Coast; bio-engineering methods to establish salt marsh on dredged material; bank erosion at the Aransas National Wildlife Refuge; berm placement study at Breton Island, Louisiana; from planning to construction in coastal Louisiana (with a cast of thousands); and Dauphin Island, Alabama beaches: real decisions in the real world.

Mancini, E.A., R.M. Mink and B.L. Bearden. 1986. Upper Jurassic Norphlet Petroleum Potential - on and off Mississippi, Alabama, and Florida. Oil Gas J. 84(4):142-148.

Abstract. Although hydrocarbons were discovered in the Upper Jurassic Norphlet formation in 1967 at Pelahatchie field in Mississippi, in 1968 at Flomaton field in Alabama, and in 1972 at Mt. Carmel field in Florida, the Smackover formation has been the principal Jurassic exploration

objective in the tristate area. However, with the 1979 discovery of significant quantities of natural gas in Norphlet sandstones at the Lower Mobile Bay-Mary Ann field, off Alabama, the Norphlet has become one of the primary exploration targets in the tristate area. To date, 24 Norphlet fields have been established in the tristate area. Five additional Norphlet natural gas discoveries have been announced for the offshore part of the tristate area.

Mars, J.C. 1991. Geologic framework and Holocene evolution of Mobile Bay in southern Alabama. Master's Thesis. University of Alabama, Tuscaloosa, AL. 144 pp.

Abstract. Mobile Bay, located in southwestern Alabama, is approximately 50 km long and covers an area of 1058 km^2. To the north, the Alabama and Tensaw Rivers discharge into Mobile Bay while to the south, the bay empties into the Gulf of Mexico. Thus the bay forms a large estuarine mixing system. Present-day facies represented by surficial sediments in Mobile Bay are: beach, marsh, near-shore, open-bay, and delta front. Vibracores were used to sample shallow (>30 m) subsurface sediments for comparison to present-day lithofacies. Accretionary-bank deposits seen in other present-day estuarine systems but not in present-day Mobile Bay are also interpreted in vibracores. Vertical stacking of facies seen in vibracores and boring logs indicates a deepening trend. This deepening trend produces a fining-upward sequence as beach, marsh, or near-shore facies deposited in shallow water are overlain by open-bay muds. In the bay-head delta and the Dauphin Island-Morgan Peninsula barrier complex, local progradation of the delta and barrier system over open-bay muds has produced a deepening and then shallowing sequence. By using sea-level curves, seismic lines, borings, vibracores, and radiocarbon dating, Holocene evolution of bay inundation has been reconstructed. A paleotopographic map of the bay during Pleistocene lowstand indicates that an entrenched river valley occupied the present-day bay area. Transgressive vertical sequences of open-bay mud overlying near-shore and beach deposits are the result of sea-level rise of over 100 m during the last 18,000 years. Bay inundation commenced approximately 7,500 years b.p. and proceeded in two phases. The first phase, from 7,500 to 6,000 years b.p., was a period of rapid sea-level rise in which 70% of the bay was inundated. The rate of sea-level rise was greater than the sedimentation rate, resulting in a bay that extended farther north and was slightly deeper than the present-day bay. The rapid inundation quickly submerged areas below normal wave base and produced a low-energy open-bay setting in the central part of the bay. In these areas of the bay, vertical sequences are characterized by thin near-shore and beach deposits (<1 m) overlain by a thick layer of open bay mud (>5 m). The second phase from 6,000 years b.p. to present was a period of slow sea-level rise. Slow inundation resulted in more time for sediments to be reworked and to accumulate above normal wave base. Thus vertical sequences from the slowly inundated bay margins contain thick sections of nearshore and beach facies (>5 m) overlain by thin sections of open bay mud (<1 m). During this phase of inundation, the bay sedimentation rate was greater than the rate of sea-level rise. Bay volume decreased as the bay-head delta prograded and the bay filled. Shallowing of the bay has enhanced mixing of marine and riverine waters by wave action and has caused a down-bay shift of marine water throughout Holocene time.

Marsh, O.T. 1962. Geology of Tertiary rocks in Escambia and Santa Rosa counties, western Florida. pp. D59-D61. *In* Geological Survey Research 1962. (US Geological Survey Professional Paper). US Geological Survey, Reston, VA.

Martin, E. 1991. Rocky Bayou Aquatic Preserve Management Plan. Sponsor: National Oceanic and Atmospheric Administration, Washington, DC. Office of Ocean and Coastal Resource Management.; Florida State Dept. of Environmental Regulation, Tallahassee. Office of Coastal Management. Contract No.: NA90AA-H-CZ809. NTIS. Washington, DC. 94 pp.
Abstract. The Rocky Bayou Aquatic Preserve is located in the northern panhandle of the state in Okaloosa County, and covers approximately 480 acres in size. Rocky Bayou is a fresh to brackish water system situated along the northern edge of Choctawhatchee Bay. The bayou contains healthy stands of submerged and shoreline vegetation. Rocky Creek flows into Rocky Bayou and represents one of the only known habitats in the U.S. for the Okaloosa darter, a federally endangered species. The northern side of the preserve is experiencing increasing residential developments along the shoreline. Habitat loss, increased impacts from recreational use, water quality degradation are the major threats. This area will come under increased development pressures if a proposed bridge is constructed across the Choctawhatchee Bay.

Martin, E. 1992. Fort Pickens Aquatic Preserve Management Plan Adopted January 22, 1992. Sponsor: National Oceanic and Atmospheric Administration, Washington, DC. Office of Ocean and Coastal Resource Management.; Florida State Dept. of Environmental Regulation, Tallahassee. NTIS. Washington, DC. 102 pp.
Abstract. Fort Pickens Aquatic Preserve is located in Escambia and Santa Rosa counties, covering approximately 27,000 acres. The preserve includes the western end of Santa Rosa Island and the eastern end of Perdido Key. Both of these islands are typical examples of undeveloped barrier islands. The submerged land of the preserve along the north sides of these islands are characterized by shallow, extensive seagrass beds and salt marshes. These communities are currently providing habitat for birds and other wildlife, especially since these islands and adjacent submerged lands are some of the only undeveloped coastal areas in the region. As development continues to increase adjacent to the preserve, degradation of these habitats will occur.

Martin, H.W. and W.G. Harris. 1992. Mineralogy of clay sediments in three phreatic caves of the Suwannee River Basin. NSS Bulletin. 54(2):69-76.
Abstract. Bottom surface clay was sampled from two cave systems in Ocala Limestone draining into the Suwannee River (Peacock and Telford Springs Caves) in Suwannee County, Florida and one cave system in Suwannee Limestone draining into the Withlacoochee River (Madison Blue Spring Cave) in Madison County, FL. The dominance of kaolinite may be evidence for the depositional (allochthonous) rather than in situ (autochthonous) origin of these materials.

Mason, W.T.J. 1991. A survey of benthic invertebrates in the Suwannee River, Florida. Environmental Monitoring and Assessment. 16(2):163-187.
Abstract. Of the total 186 benthic invertebrate taxa, 82% had quality values that indicate overall 'clean water' conditions. The predominant benthic

invertebrates in the Suwannee River were detritivorous and the communities reflected oligotrophic to mesotrophic waters. Benthic invertebrate communities were surveyed in a 233 km reach of the middle and lower Suwannee River in Northwestern Florida in the winter 1987 and early summer 1988 to determine their abundance and distribution as potential foods of the Gulf sturgeon, Acipenser oxyrhynchus desotoi, and to determine the effects of possible natural and human-induced disturbances to the communities. In substrates of the tidal oligohaline to mesohaline lower reach of the East Pass site I (km 2) and site II West Pass (km 5) near the Gulf of Mexico, densities of tube dwelling and free swimming amphipods, polychaetes, oligochaetes, and dipterans in the PONAR grabs were moderate to abundant. Also, at sites I and II, low to moderate densities of dipteran Chironomidae and o live nerite snail were collected in hardboard multiplate artificial substrate samplers. Diversities of benthic invertebrates were relatively low. Upriver from site I and II, the transition from an oligohaline tolerant benthic community to a freshwater one was abrupt due to strong freshwater flow. At sites III (km 48) and IV (km 89), benthic invertebrate populations were low to moderate. In the middle reach (km 101 to km 233), aquatic insects were predominant and included: chironomids, mayflies, and beetle s; freshwater gammarid amphipods, gastropods, and the Asian clam were also present. In winter, the bottom substrates at sites VII (km 153) and VIII (km 205) contained diverse and dense populations of Chironomidae (5932/sq m) which was the greatest density for a major taxonomic group recorded in this survey. Crayfish were collected in low densities only in artificial substrate samplers from sites IV to IX. Leeches were widespread in the study area. Empirical Biotic Index values that reflect impacts of organic wastes on benthic invertebrate communities were within a narrow range, 3.16 to 6.38, and indicated slightly enriched to enriched water. Of the total 186 benthic invertebrate taxa, 82% had quality values 0 to 5 that indicate overall clean water conditions. The predominant benthic invertebrates in the Suwannee River were detritivorous and the communities reflected oligotrophic to mesotrophic waters. (Author's abstract).

Mattraw, H.C., Jr. and J.F. Elder. 1980. Nutrient yield of the Apalachicola River flood plain, Florida; water quality assessment plan. USGS Water Res. Investigations. WRI 80-15:26. USGS, Reston, VA; NTIS number: PB-81-144-545.

Mattraw, H.C., Jr. and J.F. Elder. 1984. Nutrient and detritus transport in the Apalachicola River, Florida. USGS, Water-Supply Paper. 2196-C:62.

Abstract. The Apalachicola River in northwest Florida flows 172 km southward from Jim Woodruff Dam near the Florida-Georgia border to Apalachicola Bay on the Gulf of Mexico. The basin is composed of two 3100-km^2 subbasins, the Chipola and the Apalachicola. The Apalachicola subbasin includes a 454-km^2 bottom-land hardwood flood plain that is relatively undeveloped. The flood plain contains >1500 trees/ha which annually produce approx. 800 metric tons of litter fall per square kilometer. Spring floods of March and April 1980 carried 35,000 metric tons of particulate organic carbon derived from litter fall into Apalachicola Bay. The estuarine food web is predominantly detrital based and represents an important commercial source of oyster, shrimp, blue crab, and various species of fish. The water budget of the Apalachicola basin is heavily dominated by

streamflow. For a 1-yr period in 1979-1980, 28.6 km^3 of water flowed past the Sumatra gage on the lower river; 80% of this volume flowed into the upper river near Chattahoochee, FL., and 11% was contributed by its major tributary, the Chipola River. Contributions from groundwater and overland runoff were <10%. Streamflow increases downstream were accompanied by equivalent increases in nitrogen and phosphorus transport. The nutrients were released to the river by the flood plain vegetation, but were subject to recycling. The increase in the amount of organic carbon transport downstream was greater than streamflow increases. The flood plain is an important source of organic carbon, especially in detrital form. Several methods for measuring detritus in the river and flood plain were developed and tested. The detritus data from the flood plain added semiquantitative evidence for transport of detritus from the flood plain to the river flow, probably explaining most of the coarse particulate organic material carried by the river. During the 1-yr period of investigation, June 3, 1979-June 2, 1980, 2.1 X 10^5 metric tons of organic carbon were transported from the river basin to the bay. Nitrogen and phosphorus transport during the same period amounted to 2.2 X 10^4 and 1.7 X 10^3 metric tons, respectively. On an areal basis, it was calculated that the flood plain contributed 70 $g/m^2/yr$ of organic carbon, 0.4 $g/m^2/yr$ of nitrogen, and 0.5 $g/m^2/yr$ of phosphorus. The flood plain acts as a source of detrital carbon, but for the solutes, nutrient release is approximately balanced by nutrient retention.

May, E.B. 1973. Environmental effects of hydraulic dredging in estuaries. Ala. Mar. Resour. Bull. 9:1-85.

Abstract. Hydraulic channel and shell dredging and open water spoil disposal have little significant immediate effect on water quality in Alabama estuaries. Almost all of the sediment discharged by dredges settles very rapidly and is transported by gravity along the bottom as a separate flocculated density layer and potentially harmful components of the mud are not dissolved into the water. There is a limited, temporary reduction in benthic organisms in areas affected by dredging. Spoil piles from channel dredges can indirectly affect the ecology and usefulness of estuaries by interfering with water circulation and altering salinity. The basic hydrological concepts which determine the effects of dredging should be applicable in other areas. Extensive regulations apparently are not necessary to protect water quality in open water dredging situations but spoil disposal practices from channel dredges must be reconsidered and appropriate new disposal plans developed. (Author).

May, J.P. 1973. Sedimentary and geomorphic response to systematic variation of wave energy in the nearshore zone. Diss. Abstr. Int. 34(2):719B-720B.

May, J.P. 1974. WAVENRG; A computer program to determine the distribution of energy dissipation in shoaling water waves with examples from coastal Florida. pp. 22-61. *In* Anon., ed. Sediment transport in the near-shore zone. (Proceedings of a symposium offered at the Florida State University, 26 January 1974). (Coastal Res. Notes, Dep. Geol., Florida State Univ. Tallahassee, FL).

Mazur, S. 1983. Rockin' through Florida. Lapidary Journal. 37(8):1158-1164.

Mazzullo, J. and M. Peterson. 1989. Sources and dispersal of late Quaternary silt on the northern Gulf of Mexico continental shelf. Mar. Geol. 86(1):15-26.

Abstract. The surficial sediments of the northern Gulf of Mexico continental shelf consist of large volumes of silt and clay and lesser amounts of sand of late Quaternary age. A study of the roundness and surface textures of quartz silt grains in these surficial sediments was conducted to determine the sources and dispersal patterns of this size fraction and to gain a better understanding of late Quaternary sedimentation on this shelf. The results indicate that there are six distinct silt provinces within the study area that can be distinguished on the basis of grain roundness and surface textures. Three of the provinces are characterized by relatively angular quartz silt grains (on the average) and an abundance of first cycle crystalline quartz grains; the remaining three provinces are characterized by relatively rounded quartz silt grains and an abundance of multicyclic (sedimentary) rounded grains. The dispersal patterns of these six provinces are partly controlled by the late Wisconsinian paleogeography. Thus, a comparison of the dispersal patterns with the locations of the modern and ancient fluviodeltaic depocenters allows the identification of these six provinces as deposits of the Rio Grande, the coastal plain streams of South Texas, the Brazos and Colorado River, the Mississippi, the Mobile River and the rivers of the southeastern United States. However, the dispersal patterns have also been modified by the prevailing shelf and longshore currents, and there is up to 400 km of down current displacement of silt from its Late Wisconsinian sites of deposition on some parts of the shelf.

McCollum, R.A. 1988. Blountstown Reach, Apalachicola River; movable-bed model study. U.S. Army Corps of Engineers, Waterways Experiment Station, Technical Report. 88-17:39.

Abstract. The Blountstown Reach, Apalachicola River, requires approximately 107,000 cu yd of dredging annually to maintain the navigation channel. The model study was conducted to examine the dredged material disposal in the thalweg and within the bank and to develop a system of contraction works to develop and maintain the navigation channel with little or no maintenance dredging. The model, built to a horizontal scale of 1:120 and a vertical scale of 1:80, was of the movable-bed type and allowed for inflow from both the Apalachicola River and Sutton Lake.

Meadows, P.E. 1991. Potentiometric surface of the upper Floridan Aquifer in the Suwannee River Water Management District, Florida, May 1990. U.S. Geol. Surv. Open-File Rep. OF 90-0582, USGS; Reston, VA.

Mehta, A.J. and T.A. Zeh. 1979a. Investigation of the Hydrodynamics of Inlet Plume. pp. 478-485. *In* Proceedings of the Specialty Conference on Conservation and Utilization of Water and Energy Resources, ASCE, held in San Francisco, California on August 8-11, 1979. National Oceanic and Atmospheric Administration, Office of Sea Grant, Rockville, MD.

Abstract. Sikes Cut provides an access to the Gulf of Mexico from Apalachicola Bay, which is a large and shallow oyster producing body of water in Florida. Two objectives of the investigation were to determine the extent of tidal influence of Sikes Cut in Apalachicola Bay and to use Landsat satellite imagery in order to interpret the ebb flow pattern from the inlet into the Gulf. The modeled flood plume in the bay compared

reasonably well with measurements, and it was shown that the plume deflection was produced by Coriolis and cross-flow. For the maintenance of a navigation channel and the control of erosion of nearby beaches, the mechanism by which sand is bypassed across an inlet channel is a matter of considerable interest. Commonly employed means of transferring sand such as cutterhead plants or dredges which utilize diesel or electrical power are becoming increasingly expensive, and its appears reasonable to design inlets wherein a major portion of the energy required for sand transfer is provided by the flow itself. Such a design consideration merits an understanding of the hydrodynamics of flow distribution near the inlet. A study of this nature at a small inlet, Sikes Cut, is reported. Sikes Cut provides an access to the Gulf of Mexico from Apalachicola Bay, which is a large and shallow oyster producing body of water in Florida. Two objectives of the investigation were 1) to determine the extent of tidal influence of Sikes Cut in Apalachicola Bay and 2) to use Landsat satellite imagery in order to interpret the ebb flow pattern from the inlet into the Gulf.

Mehta, A.J. and T.A. Zeh. 1979b. Investigation of the hydrodynamics of inlet plume. pp. 478-485. *In* Anon., ed. Proc. of the Special Conference on Conservation and Utility of Water and Energy Resources. ASCE, New York, NY.

Abstract. For the maintenance of a navigation channel and the control of erosion of nearby beaches, the mechanism by which sand is bypassed across an inlet channel is a matter of considerable interest. Commonly employed means of transferring sand such as cutterhead plants or dredges which utilize diesel or electrical power are becoming increasingly expensive, and it appears reasonable to design inlets wherein a major portion of the energy required for sand transfer is provided by the flow itself. Such a design consideration merits an understanding of the hydrodynamics of flow distribution near the inlet. A study of this nature at a small inlet, Sikes Cut, is reported. Sikes Cut provides an access to the Gulf of Mexico from Apalachicola Bay, which is a large and shallow oyster producing body of water in Florida. Two objectives of the investigation were 1) to determine the extent of tidal influence of Sikes Cut in Apalachicola Bay and 2) to use Landsat satellite imagery in order to interpret the ebb flow pattern from the inlet into the Gulf.

Melkote, S., J. Arthur, J. Applegate and T. Scott. 1986. Sediments of the inner continental shelf, northwest Florida. pp. 228. *In* W. Tanner, ed. Suite Statistics and Sediment History, Proceedings of the 7th Symposium on Coastal Sedimentology. Florida State University, Tallahassee, FL.

Meo, M. 1989. Climate change impacts on coastal environments: implications for strategic planning. pp. 1384-1394. *In* Anon., ed. Coastal Zone '89: Proceedings of the Sixth Symposium on Coastal and Ocean Management, v. 2 (of 5). ASCE, New York, NY.

Abstract. As scientific reports continue to link trace gas emissions with changing climate, concern has grown over the near-term implications of climate change for public policy in general and strategic planning in particular. Coastal environments are especially vulnerable to 'greenhouse effect' impacts such as accelerated sea level rise, reduction of fresh water inflows, and the possible increase in the frequency of extreme storm events. Two major concerns for decision makers are to determine the timing and magnitude of different climate change impacts and to design

rational strategies for responding to them. This paper examines the strategic planning implications of climate change impacts on coastal environments with reference to three coastal regions (Apalachicola Bay and estuary in northwest Florida, the Mississippi River Deltaic Plain in coastal Louisiana, and the Sacramento-San Joaquin Delta in California).

Miller, M.C. and R.D. Reinhard. 1992. Empirical simulation of storm histories for coastal design. pp. 45-53. *In* Anon., ed. Proceedings of the 24th Joint Meeting on Wind and Seismic Effects. (Gaithersburg, MD, USA; NIST Special Publication n 843 Sep 1992) Natl Inst of Standards & Technology, c/o US Department of Commerce, Gaithersburg, MD, USA.

Abstract. Coastal erosion and flooding caused by hurricanes have tremendous potential for economic damage and loss of life in populated areas. The U.S. Army Corps of Engineers is frequently asked to determine the feasibility of coastal protection projects through evaluation of the economic benefits of project alternatives. The development of design criteria for water level, waves, and beach profile change require the evaluation of data collected over long time periods, or the generation of data using tested computer models. A methodology has been developed at the U.S. Army Engineer, Waterways Experiment Station, Coastal Engineering Research Center for determining project feasibility by the application of several environmental models. The economic evaluation depends on the application of a statistical resampling technique known as the 'bootstrap' which allows calculation of expected values of an outcome by sampling, with replacement, from a limited historical data set. This method has been applied to a potential project at Panama City Beach, Florida.

Miller, M.C., W.E. Roper, L.E. Borgman and J.J. Westerink. 1991. Development of water level and wave height design data. pp. 557-567. *In* Anon., ed. Proceedings of the 23rd Joint Meeting of the US-Japan Cooperative Program in Natural Resources Panel on Wind and Seismic Effects. (Tsukuba, Jpn Conference Date: 1991 May 14-17; Special Publication No. 820, Sept. 1991). Natl Inst of Standards & Technology, US Department of Commerce, Gaithersburg, MD.

Abstract. The historical record of tropical storms at specific sites in the Gulf of Mexico is too short to provide adequate statistics for estimates of extreme waves and water levels for engineering design and project economic evaluation. This paper describes a method that has been applied by the Coastal Engineering Research Center (CERC), U.S. Army Engineer Waterways Experiment Station to expand the available suite of storms and sample the historical storm data set to obtain reliable, statistical parameters of storm effects. Parameters from historical storms were used, along with additional, hypothetical storms, to obtain relationships between the parameters associated with storm characteristics and storm effects of wave height, water level, and shoreline recession. Water level estimates were obtained using a finite element storm surge, tide and current model which was recently developed and tested for the Gulf. This model offers considerable advantages over the finite difference models that were previously used for this purpose. The extreme conditions at the site were obtained using a 'bootstrap' statistical technique to reduce the number of storms modeled. The methods described were used to evaluate beach fill design alternatives at Panama City Beach, Florida in the northern Gulf of Mexico.

Miller, R.A., W. Anderson, A.S. Navoy, J.L. Smoot and R.G. Belles. 1981. Water-Resources Information for the Withlacoochee River Region, West-Central Florida. USGS Water Res. Investigations. USGS/WRI-81-11; USGS/WRD/WRI/81-087:143.

Abstract. The ground-water system in the Withlacoochee River region is comprised of up to three different aquifers--the surficial, the secondary artesian, and the Floridan. Little is known about the surficial and secondary artesian aquifers. The Floridan aquifer consists mostly limestones and dolomites, and is as much as 1,500 feet thick. Transmissivities are known to be as high as 25 million feet squared per day. The quality of water within the Floridan aquifer is generally excellent except in two areas where saltwater is present. The majority of the streams have average dissolved-solids concentrations between 100 and 200 milligrams per liter, maximum-observed specific conductance between 250 and 750 micromhos per centimeter, and average total nitrogen concentrations of less than 1.2 milligrams per liter. Summaries were compiled of more than 1,000 wells, 43 continuous-record gagging stations, 21 lakes, and 46 springs.

Mink, R.M., B.H. Tew, S.D. Mann, B.L. Bearden and E.A. Mancini. 1990. Norphlet and pre-Norphlet geologic framework of Alabama and Panhandle Florida coastal waters area and adjacent federal waters area. GSA Bulletin. 140:58.

Montgomery, R.L. and M.R. Palermo. 1976. First Steps Toward Achieving Disposal Area Reuse. (WES-MP-D-76-16) Report on Dredged Material Research Program. Presented at the American Society of Civil Engineers Specialty Conference on Dredging and its Environmental Effects, 27 Jan 76, Mobile, Ala. U.S. Army Corps of Engineers Waterways Experiment Station. Vicksburg, Mississippi. 35 pp.

Abstract. The objectives of research on disposal area reuse are simply to develop procedures for maintaining a dredged material disposal area for an indefinite period while providing environmentally acceptable disposal operations. The reusable dredged material disposal area is a collection and processing site where valuable portions of the dredged material are made available for productive use while unusable material is, if necessary, treated and disposed of. Methods and procedures must provide for continuous or periodic removal of dredged material for use or storage elsewhere in order to increase the life expectancy of the facility. In the Mobile Bay Area, plans for expansion of disposal areas have been abandoned in some cases because of objections from local residents and environmental constraints. Thus, the need for maximizing the useful life of existing sites in this area is pressing. This paper presents results from a field study in the Mobile Bay Area outlining the first steps taken toward the development of a reusable disposal area. Plans and concepts are discussed regarding the long range planning required to maintain use of sites for indefinite periods. This paper does not present a panecea for dredged material disposal problems because it is not available now nor will it be in the future. Each reusable disposal area will have to be developed based on its own needs and local environment. (Author).

Morang, A. 1992a. Inlet migration and hydraulic processes at East Pass, Florida. J. Coast. Res. 8(2):457-481.

Abstract. East Pass, a tidal inlet in the Florida Panhandle between Pensacola and Panama City, connects Choctawhatchee Bay to the Gulf of Mexico. From 1983 to 1991, the U.S. Army Corps of Engineers sponsored a monitoring project to measure waves, currents, tidal elevations, bathymetry, and shoreline changes at the site. Based on these data and on historical records, a three-phase model has been developed which describes the inlet's behavior during the last 120 years. The first phase (pre-1928) is of spit development and breaching and covers the period when the pass was oriented in a northwest-southeast direction between Choctawhatchee Bay and the Gulf. From 1928 to 1968, the inlet was characterized by the second phase: stable throat position but with a main ebb channel that migrated over a developing ebb-tidal delta. This phase covers the time after the inlet breached through Santa Rosa Island in a north-south direction and began to migrate to the east. The third phase, spanning 1968, when rubble-mound jetties were built, to the present is characterized by a stable throat and ebb channel, and ebb-tidal shoal growth. Despite the jetties, East Pass has continued to demonstrate a tendency to move eastward.

Morang, A. 1992b. Study of Geologic and Hydraulic Processes at East Pass, Destin, Florida. Vol. 2. Appendices C through K. Coastal Engineering Research Center. Vicksburg. 168 pp.

Abstract. From 1983 to 1991, the Coastal Engineering Research Center and US Army Engineer District, Mobile, monitored waves, currents, tidal elevations, bathymetry, and shoreline changes at East Pass Inlet, Destin, FL. Based on these data and on historical records, a three-phase model has been developed that describes the inlet's behavior during the last 120 years: (a). Phase 1 (pre-1928), spit development and breaching, covering the period when the inlet was oriented northwest-southeast between Choctawhatchee Bay and the Gulf of Mexico. (b). Phase 2 (1928-1968), stable throat position but main ebb channel that migrated over a developing ebb-tidal shoal. This phase covers the time after the inlet breached Santa Rosa Island in a north-south direction and then migrated eastward. (c). Phase 3 (1968-present), after rubble-mound jetties were built, the throat and main ebb channel were stabilized, while ebb-tidal shoal grew. Despite the jetties, East Pass has continued to try to move eastward. The driving forces of the eastward migration are hypothesized to be (a) wave forces--the predominant wave direction measured in 10-m water depth is from the southwest, while the shore trends east-west; (b) backbay tidal channel and flood-tidal shoal geometry direct ebb currents towards the eastern shore of the inlet; (c) because of freshwater inputs, the ebb flow is longer in duration and higher in velocity than the flood. Maximum measured ebb currents in the inlet are over 5.0 ft/sec (1.5 m/sec), producing a discharge of about 90,000 cu ft/sec (2,500 cu m/sec).

Morang, A. 1992c. Study of Geologic and Hydraulic Processes at East Pass, Destin, Florida. Vol. 1. Main Text and Appendices A and B. Final Report. Coastal Engineering Research Center. Vicksburg. 119 pp.

Abstract. From 1983 to 1991, the Coastal Engineering Research Center and US Army Engineer District, Mobile, monitored waves, currents, tidal elevations, bathymetry, and shoreline changes at East Pass Inlet, Destin, FL. Based on these data and on historical records, a three-phase model

has been developed that describes the inlet's behavior during the last 120 years: (a) Phase 1 (pre-1928), spit development and breaching, covering the period when the inlet was oriented northwest-southeast between Choctawhatchee Bay and the Gulf of Mexico. (b) Phase 2 (1928-1968), stable throat position but main ebb channel that migrated over a developing ebb-tidal shoal. This phase covers the time after the inlet breached Santa Rosa Island in a north-south direction and then migrated eastward. (c) Phase 3 (1968-present), after rubble-mound jetties were built, the throat and main ebb channel were stabilized, while ebb-tidal shoal grew. Despite the jetties, East Pass has continued to try to move eastward. The driving forces of the eastward migration are hypothesized to be (a) wave forces--the predominant wave direction measured in 10-m water depth is from the southwest, while the shore trends east-west; (b) backbay tidal channel and flood-tidal shoal geometry direct ebb currents towards the eastern shore of the inlet; (c) because of freshwater inputs, the ebb flow is longer in duration and higher in velocity than the flood. Maximum measured ebb currents in the inlet are over 5.0 ft/sec (1.5 m/sec), producing a discharge of about 90,000 cu ft/sec (500 cu m/sec.). Choctawhatchee Bay, East Pass, Tidal elevations, Destin, Florida Panhandle, Tidal inlet, Directional wave measurements, Hydraulic measurements, Weir-jetty systems.

Morang, A. 1993. Geologic and physical processes at a Gulf of Mexico tidal inlet, East Pass, Florida. Ph.D. Dissertation. The Louisiana State University and Agricultural and Mechanical College. 340 pp.

Abstract. East Pass, a tidal inlet located in the Florida Panhandle between Pensacola and Panama City, connects Choctawhatchee Bay to the Gulf of Mexico. A three-phase model has been developed which describes the behavior of East Pass inlet during the last 120 years, based on wave, current, tide, bathymetric and shoreline data, and on historical records. The first phase (pre-1928) is of spit development and breaching. This phase covers the period when the pass was oriented in a northwest-southeast direction between Choctawhatchee Bay and the Gulf. From 1928 to 1968, the second phase was characterized by a stable throat position but with a main ebb channel that migrated over a developing ebb-tidal delta. This phase covers the time after the inlet breached Santa Rosa Island in a north-south direction and began to migrate east. The third phase, spanning 1968, when rubblemound jetties were built, to the present, is characterized by a stable inlet throat and ebb channel, and ebb-tidal shoal growth. Despite the jetties, East Pass has attempted to continue moving eastward, resulting in continued maintenance problems and erosion. The eastward migration is caused by: (1) Wave forces. The predominant local wave direction is from the southwest, while the shoreline trends east-west. (2) Backbay tidal channel and flood-tidal shoal geometry direct ebb currents towards the eastern shore of the inlet. Tide and meteorological data reveal that water levels in Choctawhatchee Bay fluctuate rapidly during the winter months in response to the passage of winter cold fronts. Northwest winds that follow fronts cause a setdown of offshore water, leaving Choctawhatchee Bay perched. The resulting outflow can account for as much as a 50 percent increase in the water that flows through East Pass over that due to astronomical tides alone. It is likely that the greatest erosion and sediment transport in the inlet occur during these episodes when current velocities are higher. The large

number and regularity of fronts (261 between 1979 and 1991) suggest that they may be a more important factor causing long-term geological changes than are the infrequent hurricanes that pass through the area.

Morgan, G.S. ed. 1989a. Miocene paleontology and stratigraphy of the Suwannee River basin of North Florida and South Georgia. (Guidebook [Southeastern Geological Society (U.S.)], 30). Southeastern Geological Society. 60 pp.

Morgan, G.S. 1989b. Miocene vertebrate faunas from the Suwannee River basin of North Florida and South Georgia. pp. 26-53. *In* G.S. Morgan, ed. Miocene paleontology and stratigraphy of the Suwannee River basin of North Florida and South Georgia - Guidebook [Southeastern Geological Society (U.S.)]. Vol. 30.

Murali, R.S. 1973. Wave power gradient; an approach to Holocene depositional history. Transactions of the Gulf Coast Association of Geological Societies. 23:364-367.

Nester, R.D. and P.J. Warren. 1986. The effectiveness of a twenty-inch dredge in thin layer disposal. Texas A&M Univ., Sea Grant Program. TAMU-SG-88-102.

Abstract. Fowl River is a small coastal stream in the western shore of Mobile Bay in south Mobile County, Alabama. In 1973, the U.S. Army Corps of Engineers constructed an 8- by 100-foot channel for commercial fishing and recreational boating interests. At the time of construction, open water and wetland areas (where diked disposal areas were constructed) were used for dredged material disposal. The Mobile District, in coordination with federal and state regulatory agencies, devised a plan whereby a combination of upland and open water disposal methods would be utilized during maintenance in 1986. The open water methodology involved what is called "thin-layer" disposal and, in this case, the thin lift after disposal was to be no greater than 6 inches. This paper will discuss the actual process of achieving a thin-layer.

Neurauter, T.W. 1979. Bedforms on the west Florida shelf as detected with side scan sonar. Master's Thesis. University of South Florida, St. Petersburg, FL. 144 pp.

Newling, C.J. and M.C. Landin. 1985. Dredging Operations Technical Support Program. Long-Term Monitoring of Habitat Development at Upland and Wetland Dredged Material Disposal Sites 1974-1982. U.S. Army Corps of Engineers, Waterways Experiment Station, Technical Report. WES/TR/D-85-5:228.

Abstract. During the Dredged Material Research Program, six wetland and three upland habitat development projects were established at seven sites to demonstrate the feasibility of creating productive habitat on dredged material deposits. Wetland sites were Windmall Point in the James River, Virginia; Buttermilk Sound near the Altamaha River, Georgia; Drake Wilson Island in Apalachicola Bay, Florida; Bolivar Peninsula in Galveston Bay, Texas; Salt Pond Number 3 in South San Francisco Bay, California; and Miller Sands Island in the Columbia River, Oregon. Sites were also located in upland areas at Nott Island in the Connecticut River, Connecticut; Bolivar Peninsula; and Miller Sands. These sites have continued to be monitored since their construction (1975-77) until the

present time. In addition, three natural marsh upland reference sites have been selected for comparison to the man-made sites. Data and research results are presented in this report. Results over an 8-year period indicate that all of the sites have developed and stabilized, and that they have all been highly successful. Despite a complete lack of management since construction, the sites maintain plant communities generally comparable to or more productive than those on the reference areas. Wildlife use exceeds that occurring on reference areas, and the sites are compatible with and contributing to the ecosystems of which they are a part.

Nichols, M.M., G.S. Thompson and R.W. Faas. 1978. A Field Study of Fluid Mud Dredged Material. Its Physical Nature and Dispersal. U.S. Army Corps of Engineers, Waterways Experiment Station, Technical Report. :85. Report on Dredged Material Research Program. Prepared in cooperation with Lafayette Coll., Easton, PA.; Contract No.: DACW39-75-C-0121.

Abstract. Open-water disposal of dense suspensions of fluid mud with concentrations of 10 to 480 g/l was studied at field sites in Mobile Bay, Alabama, and the James River, Virginia. The study aimed to determine the significance of fluid mud in dispersal of dredged material and in generation of turbidity. The bulk of the dredged material, more than 99 percent at the Mobile Bay site was dispersed in the form of fluid mud near the bottom, whereas less than 1 percent was dispersed through the water column. As suspended solids flocculate and settle, they contribute to the fluid mud. In turn, fluid mud resists resuspension and reduces turbidity. Disposal created a deposit that spread over an area 5 to 13 times the dredged area in the channel. Disposal raised the bed, forming dense layers in mounds 0.8 to 2.2 m high having slopes 1:125 to 1:2000. Broad spreading at the Mobile Bay site was associated with a high discharge rate over a short period, a low discharge angle, and muds with high plastic and liquid limits. Mounding at the James River site was associated with a moderate discharge rate over a long period, a vertically oriented discharge configuration, and muds with a moderate plastic limit and a relatively low liquid limit. After disposal, the fluid mud consolidated, bulk density increased, and slopes decreased. Height and volume of the James River mound decreased about 50 percent in a year. More field investigations of the movement of fluid mud are needed for a detailed understanding of its dynamics.

Nummedal, D. 1982. Hurricane Impact on Gulf Coast Barriers. (Includes ONR Rept. Nos. TR-2 and TR-3). Final Rept. No. 2. NTIS. Washington, DC. 46 pp.

Abstract. Hurricane Frederic made landfall near Pascagoula, Mississippi at midnight, September 13, 1979. At the time of landfall, the central pressure had dropped to 946 mb; onshore winds in excess of 200 km/hr were lashing the Alabama coastline, and the open coast storm tide peaked at 365 cm at Gulf Shores, Alabama. Vertical aerial photography obtained in 1976 and again 9 days after Frederic made landfall, combined with multiple reconnaissance overflights and ground surveys by the authors, provided the data base for determination of shoreline erosion and the deposition of hurricane scour and sedimentary deposits. Erosion of the Gulf beach at Dauphin Island proved to follow a predictable pattern, controlled by nearshore bathymetry, whereas retreat of the shoreline of the Mississippi Sound margin was an unexpected occurrence. Apparently, this retreat was due to a hydraulic jump as wash-over currents entered

the deep water of Mississippi Sound. Large-scale sediment redistribution on Dauphin Island proper was a consequence of the storm surge flood. The ebb surge, however, was responsible for the reopening of three inlets across Little Dauphin Island. The wave-induced property destruction on Dauphin Island was most intense immediately west of the area of high dunes. This segment of the island, the easternmost portion of the Holocene spit, has been breached twice in this century. During future storm events, breaching, or at the very least severe property destruction, in this area seems inevitable. A sensible land use plan for Dauphin Island should include a search for alternative, and potentially safer, areas for development.

Orhan, H. 1992. Recent history of the St Joseph Peninsula Beaches, Florida, USA. Ocean and Coastal Management. 17(2):137-150.

Abstract. The coasts of Florida (USA) have been changing at different rates, depending on the location. An apparent change has been occurring on St. Joseph Peninsula. These changes have been examined and documented for the period 1868-1983. Drastic coastal changes have been observed along two parts of the peninsula, Cape San Blas and St. Joseph Spit. Coastal changes have been divided into two periods (1868-1934 and 1934-1976), according to the intensity of changes. St. Joseph Spit has been growing northwestward, and Cape San Blas is eroding on its western side but growing to the east. The rate of shoreline changes relative to the monuments of the Florida Department of Natural Resources were different along the coast of St. Joseph Peninsula before 1934. Since then, however the shoreline has been changing at an almost constant rate.

Osking, E.B., A.C. Hine and D.F. Belknap. 1986. Nearshore sedimentation of microtidal, low-energy freshwater influenced shelf embayments; west-central Florida. pp. 86-87. *In* Anon., ed. Abstracts: Society of Economic Paleotologists and Mineralogists. SEPM.

Otvos, E.G. 1981. Barrier island formation through nearshore aggradation: stratigraphic and field evidence. Mar. Geol. 43(3/4):195-243.

Abstract. Core drilling data from the sound and barrier island chain of Mississippi and from the Apalachicola Bay area, old charts and aerial photographs were used to document vertical aggradational formation of barrier islands. Emergence occurs during constructive, fair weather periods where wave-bore currents can transport sand over subtidal shoals and accrete it to high tidal levels. Includes several aerial photos.

Otvos, E.G. 1982a. Barrier island and lagoon evolution, Northeast Gulf of Mexico; coastal elements and interpretation problems. GSA Abstracts with Programs. 14(1-2):71.

Otvos, E.G. 1982b. Santa Rosa Island, Florida Panhandle, origins of a composite barrier island. Southeast Geology. 23(1):15-23.

Otvos, E.G. 1984. Alternate interpretations of barrier island evolution, Appalachicola Coast, northwest Florida. Litoralia. 1(1):9-21.

Otvos, E.G. 1985a. Barrier island genesis - question of alternatives for the Apalachicola Coast, northeastern Gulf of Mexico. J. Coast. Res. 1(1):267-278.

Otvos, E.G. 1987. St. Joseph barrier spit, NW Florida; Quaternary evolution. Journal of the Mississippi Academy of Sciences. 32:34.

Otvos, E.G. 1988. Pliocene age of coastal units, Northeast Gulf of Mexico. Transactions of the Gulf Coast Association of Geological Societies. 38:485-494.

Otvos, E.G. 1992. Quaternary evolution of the apalachicola coast, northeastern Gulf of Mexico. pp. 221-232. In J.F. Wehmiller and C.H. Fletcher, eds. Quaternary coasts of the United States: Marine and lacustrine systems, SEPM Special Publication No. 48. (SEPM Special Publications, No. 48). Society for Sedimentary Geology, Tulsa, OK.

Otvos, E.G., Jr. 1980. Barrier islands and hurricanes, Gulf of Mexico. NOGS Log. 20(11):1.

Outler, B. 1979. The stratigraphy and environment of deposition of the Tuscaloosa Formation in part of Panhandle, Florida. Master's Thesis. Florida State University, Tallahassee, FL.

Overland, J.E. 1975. Estimation of hurricane storm surge in Apalachicola Bay, Florida. United States National Oceanic and Atmospheric Administration, National Weather Service, Technical Report. NOAA TR NWS-17:66.

Abstract. A vertically integrated two-dimensional numerical hydrodynamic model is developed for simulation of hurricane surge in Apalachicola Bay. Standard explicit time differencing is used in conjunction with a single Richardson lattice. Model features include finite amplitude effects, space variable wind velocities, parameterization of flooding of terrain, overtopping of barrier islands, and flow through narrow passes. The model uses the results of C. P. Jelesnianski's SPLASH model computation for open coast surge as input seaward of the Bay and continues the same storm track and wind field as used in the SPLASH computation across the Bay. The Bay model was calibrated for the astronomical tides and verified against hurricane Agnes. The response of Apalachicola Bay has been determined from numerical computations for a variety of hypothetical hurricanes as specified by various storm parameters. Surge heights in the Bay increase with hurricane central pressure depression in a nearly linear fashion as does the open coast surge. An important parameter is the duration that the open coast surge remains high, a function of the forward speed of the storm and, to a lesser extent, the radius of maximum winds. Surge heights in the Bay increased relative to open coast surge values for slow moving storms. For bays of the extent of Apalachicola Bay, basin orientation relative to wind direction, headlands, and marsh areas can produce significant local variations in surge heights.

Owens, C. 1990. Section 107 Detailed Project Report. Fort Gaines Channel (Government Cut) at Dauphin Island, Alabama. (Report No.: COESAM/PDFP-90/002) NTIS. Washington, DC. 165 pp.

Abstract. This report consists of an economic environmental analysis for Fort Gaines Channel Improvement at Dauphin Island, AL. The recommended plan provides for deepening the existing channel to 6 feet plus 2 feet advance maintenance dredging and 1-foot allowable overdepth. The new work dredged material would be approximately 17,258 cubic yards of sandy material and would be disposed of on a beach nourishment site located on Dauphin

Island. Construction of the recommended plan is estimated to cost $143,200. Of this amount the federal cost would be $114,600 and the non-Federal cost would be $28,600. The plan has an average annual cost of $19,000 and benefits of $20,000 which provide a benefit-to-cost ratio of 1.1.

Palacas, J.G., A.H. Love and P.M. Gerrild. 1972. Hydrocarbons in estuarine sediments of Choctawhatchee Bay, Florida, and their implications for genesis of petroleum. AAPG Bulletin. 56(8):1402-1418.

Abstract. Analyses were made on 159 sediment samples from Choctawhatchee Bay, Florida, to determine the distribution and significance of bitumen (benzene-soluble organic substances), particularly the hydrocarbons. Column and gas chromatography was used to characterize the bitumen. Results of this study and related studies show that recent sands contain bituminous substances, including hydrocarbons, in geologically significant amounts. The inference is drawn that, if the bitumen disseminated in large volumes of interconnected sands is converted, even in part, to crude oil and concentrated in pools, the sands themselves may contribute substantial amounts of the petroleum crude oil in sandstone reservoirs.

Palermo, M.R. and P.A. Zappi. 1990. Evaluation of Loading and Dredged Material Overflow from Mechanically Filled Hopper Barges in Mobile Bay, Alabama. U.S. Army Corps of Engineers, Waterways Experiment Station, Miscellaneous Paper. WES/MP/EL-90-16:21.

Abstract. Large mechanical dredges with clamshell buckets are being used for the new-work dredging. Hopper barges are loaded with the dredged material and transported by tug to the disposal site. Mechanical dredging is also the most likely technique for future maintenance. The economic loading of the hopper barges and the potential environmental impact associated with barge overflow during loading are important issues.

Parker, S.J., A.W. Shultz and W.W. Schroeder. 1992. Sediment Characteristics and seafloor topography of a palimpsest shelf, Mississippi-Alabama Continental Shelf. pp. 243-251. *In* J.F. Wehmiller and C.H. Fletcher, eds. Quaternary Coasts of the United States: Marine and Lacustrine Systems, SEPM Special Publication No. 48.

Parker, W.C. 1993. Coastal processes of the Florida Panhandle; an introduction for undergraduates and science teachers. pp. 63-73. *In* S.A. Kish, ed. Geologic field studies of the coastal plain in Alabama, Georgia, and Florida. Southeastern Geological Society, Tallahassee, FL.

Pascale, C.A. and J.R. Wagner. 1981. Water resources of the Ochlockonee River area, Northwest Florida. U.S. Geol. Surv. Open-File Rep. OF 81-1121:114. US Geological Survey, Reston, VA.

Pascale, C.A., J.R. Wagner and J.E. Sohm. 1978. Hydrologic, geologic, and water-quality data, Ochlockonee River basin area, Florida. USGS Water Res. Investigations. WRI 78-0097. US Geological Survey, Reston, VA.

Paull, C.K., R. Freeman-Lynde and T.J. Bralower. 1990. Geology of the strata exposed on the Florida Escarpment. Mar. Geol. 91(3):177.

Paull, C.K., D.C. Twichell and F.N. Speiss. 1991. Morphological development of the Florida Escarpment: Observations on the generation of time transgressive unconformities in carbonate terrains. Mar. Geol. 101(1):181.

Pearman, A.L. and J.W. Stafford. 1975. Final report; Florida coastal policy study; impact of offshore oil development. NTIS, Springfield, VA, United States; Prepared for Florida Energy Office and State University System of Florida. Florida State University, Dept Urban and Reg. Planning. Tallahassee, FL. 273 pp.

Penland, S. and J.R. Suter. 1984. Process response models for Gulf Coast barrier island breaching. Trans., Gulf Coast Assoc. Geol. Soc. 36:397-400.

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Abstract. Three hurricanes hit Louisiana (LA), Mississippi (MS), Alabama (AL), and the Florida (FL) panhandle in 1985, producing dramatic geomorphic changes in a wide variety of coastal environments. The impact zone for hurricanes Danny, Elena, and Juan stretched 1000 km between the Sabine River in LA to the Apalachicola River in FL. Barrier shorelines experienced repeated intense overwash events, producing beach and dune erosion exceeding 30 m, as well as producing classic examples of storm surge deposits. Pre- and post-storm airborne videotape surveys, sequential vertical mapping photography, and field surveys provide the data base for this regional hurricane impact assessment on the northern Gulf of Mexico. Hurricane impacts on the low-profile and high-profile barrier shorelines, as well as on the marine terrace cliffs were systematic and predictable. Controlling the direction of overwash flow

and the impact distribution pattern is the relationship among shoreline orientation, hurricane storm track, and regional wind field. The relationship between shore-zone geomorphology and storm surge overwash controls the impact response.

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Abstract. Most sand ridges in interior Florida are considered to be barrier islands, beach ridges or spits formed along ancient shore lines. Different investigators, however, give different elevations to which ancient seas rose and assign different ages for shore lines and shoreline features (Table 1). Most of the elevations of oldshore lines presented by various workers have been determined from surface studies, primarily from physiographic evidences. Some attempts have been made to use fossil occurrences (Alt and Brooks, 1965). Trail Ridge and the Baywood Promontory are two of the most conspicuous ridges in the northern part of peninsular Florida, as shown in figure 1. Recently two holes were drilled through the sediments forming the southern part of Trail Ridge, and one hole was drilled through the sediments of the Baywood Promontory. By means of a specially designed core barrel, almost 100% recovery of cores of loose to slightly consolidated sands composing the ridges was obtained. Detailed analyses were made of these sands and all other sediments penetrated. The writers are not aware of any previous attempts to utilize characteristics revealed by these kinds of data as aids in studying old shore-line elevations or associated sand ridges in Florida. The purpose of this report is to demonstrate the value of these data to the studies of ancient sea-level stands in peninsular Florida.

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Abstract. Long term erosion of Perdido Key is the product of a general negative sediment budget exacerbated by the dredging of a navigation channel at the updrift margin of the Key. A positive sediment budget on Perdido, in the area managed as a natural region, may be attained as a consequence of a massive dredging project to widen and deepen the channel. The fate of the abundant sediment and the effects of beach fill were investigated through a pilot beach nourishment project on the Key (c. 20% of the total project volume). Changes included a total alteration of the pre-existing dynamics of the island and its characteristics.

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Abstract. Long term erosion of Perdido Key is the product of a general negative sediment budget exacerbated by the dredging of a navigation channel at the updrift margin of the Key. A positive sediment budget on Perdido, in the area managed as a natural region, may be attained as a consequence of a massive dredging project to widen and deepen the channel. The fate of the abundant sediment and the effects of beach fill were investigated through a pilot beach nourishment project on the Key (c.20% of the total project volume). Changes included a total alteration of the pre-existing dynamics of the island and its characteristics. Of especial importance was the tremendous accumulation of sand on the free sand beach which is causing the primary management concern to shift from a focus on dune protection to the preservation of the recreational qualities of the beach.

Psuty, N.P. 1993. Foredune morphology and sediment budget, Perdido Key, Florida, USA. pp. 145-157. *In* K. Pye, ed. The dynamics and environmental context of aeolian sedimentary systems. (72) (Geological Society Special Publications). GSA, USA. (International Symposium on Aeolian Sedimentary Systems, London, Nov. 22-23, 1991; University of Reading, Postgraduate Research Institute for Sedimentology, United-Kingdom).

Abstract. The Perdido Key barrier island has a long history of shoreline erosion, up to 2 m/a for over a century. Sediment availability was altered in 1985 because of beach nourishment. Subsequent re-working of the beach fill has transferred sediment in the along-shore direction as well across-shore. Over three years of survey data, including passage of three hurricanes, and aerial photo coverage portray the morphological changes in the foredune system and the displacement of the shoreline.

Puckett, W.E. 1990. Soils, landscapes, and ground-penetrating radar analysis of the Chiefland limestone plain, in Levy County, Florida. Ph.D. Dissertation. University of Florida, Gainesville, FL. 268 pp.

Pyle, T.E., V.J. Henry, J.C. McCarthy, R.T. Gile and T.W. Neurauter. 1975. Geophysical Investigations for biolithologic mapping of the MAFLA-OCS Lease Area. Vol. V. (BLM/ST-78/34) (Baseline monitoring studies, Mississippi, Alabama, Florida, outer continental shelf, 1975-1976). Bureau of Land Management. Washington, DC. 267 pp.

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Abstract. Seaward spatial distributions of dominant species along the four transects exemplified coenoclines with distinct breaks, noticeable as steep reductions in densities of contiguous dominant species. Coenocline breaks coincided with peak diversity and evenness levels as well as with relatively low total densities at distances between 100 and 200 m from shore, midway along the seaward slopes of transect depth profiles. Nearshore spatial changes in faunal indices among transects corresponded with changes in habitat. The existence of four major faunal zones within the 800 m seaward distance is suggested.

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Abstract. Reconstruction of the supratidal history of St. Joseph peninsula was approached on a granulometric, geometric, and internal-structure basis. Textural and geomorphic evidences supports the hypothesis that the peninsula was integrated from two former barrier islands through subtidal aggradation as well as seaward and lateral progradation. The granulometric characteristics of the platform and subaerial sediment suite suggest a previous history of river and then beach transport. Salinity-biotopes from benthic foraminifera in the sampled core connote a gradual sea level rise accompanying platform aggradation in the Late Holocene. The terminal stages of this sea level rise were characterized by small-scale fluctuations. The pre-Holocene topography suggests that the Cape San Blas area represents the site of the earliest stages of platform aggradation. The oldest areas on the spit appear to have emerged

at least 1,500 years ago. The Cape San Blas tombolo first emerged and hence linked up with Cape Can Blas about 1,000 years ago. Beach ridge growth rates in ridge set "nf" suggest 700 years of progradation history north of Eagle Harbor. Two sediment sources were inferred from this study: Cape San Blas and Bell shoal. Transverse transport was more important earlier in the history of the spit, but littoral drift later became dominant. North of Eagle Harbor, the spit developed under decreasing wave energy conditions. Beach ridge origin on St. Joseph spit based on internal structure alone is equivocal. Both eolian and non-eolian strata were observed although the latter were more widespread. Certain previous work has also shown the internal structure of ridges can form by vegetative trapping. On the backshore of prograding beaches where the subaerial stages of beach ridge history begins, eolian and swash strata are inseparable. Beach ridges are therefore considered to be examples of convergent landforms, evolving initially from swash overtopping during elevated water levels. Some of the eolian traits appear to come from pulses of eolian settling of "dust" as indicated by the tail-of-fines. The standard deviation and the tail-of-fines were the most diagnostic criteria recognizing eolian traits. In general, sediment in the study area revealed an environmental succession from fluvial to beach and (finally) to dune.

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Abstract. A pipeline system was needed to transport natural gas from a discovery in Mobile Block 823 to Mobil's existing system inside Mobile Bay. Sand Island, a small barrier island off Dauphin Island, Alabama, was an unavoidable obstacle along the pipeline route. Because barrier islands are environmentally sensitive and sand transport makes them relatively unstable, Mobil made the policy decision not to dredge through Sand Island. Instead, directional boring was used to install a bundle of four pipelines under the island with minimal disturbance to the environment (Hair, 1989). This paper describes the design of the pipeline bundle, the horizontal boring procedure, the installation of the rig on the barge and the remedial action taken to protect the barge from wave action.

Rocha, C.C.A. 1992. On the effect of alongshore variations in continental shelf topography on shelf sea level and current fluctuations with application to the West Florida shelf. Ph.D. Dissertation. Florida State University, Tallahassee, FL. 89 pp.

Roscigno, P.F., M.E. McNiff, M.C. Watzin and W. Ji. 1993. Use of geographic information system technology to compare the environmental impacts of human development on Mobile bay, Alabama, and Galveston Bay, Texas. pp. 825-837. *In* Anon., ed. Proceedings of the Eighth Symposium on Coastal and Ocean Management. Part 1 (of 2). Vol. 1. (New Orleans, LA, USA; Coastal Zone'93 Coastal Zone: Proceedings of the Symposium on Coastal and Ocean Management) ASCE, New York, NY.

Abstract. Geographic information systems (GIS) can synthesize information rapidly and efficiently from many different sources. GIS-generated maps, which integrate multiple information layers, can provide managers with regional assessment of the impacts associated with development. In this

study, information for Mobile Bay, Alabama, and Galveston Bay, Texas, was processed by using ARC/INFO to produce a regional synthesis of environmental impacts on fish and wildlife resources. The two ecosystems were then compared for similarities and differences in responding to these cumulative impacts. Analyses indicated that while each ecosystem experiences stresses from industrialization and urbanization, the magnitude and duration of these stresses differ. The ecosystems' different responses result from differences in sediment mineralogy, freshwater inflows, salinity patterns, and other factors.

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Abstract. The quantity of sand moved in the nearshore zone is dependent on the characteristics of breaking waves, longshore currents, and the physical characteristics of sediment in the surf zone. The longshore sediment transport on open coasts is related to the longshore flux of energy produced by the breaking waves. In many locations such as closed bays and lakes, waves are generated mainly by local winds. In these locations climatological (wind) data can be used for the prediction of sediment movement. This study uses wind data for evaluation of shoreline changes that occur in Choctawhatchee Bay, Florida. The study indicates that some important features of the shore can be predicted from a knowledge of sand transport derived from wind statistics. A conclusion of the study is that wind data can be useful for the analysis of shore processes in enclosed bays and lakes.

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Rupert, F. 1993. Karst features of northern Florida. pp. 49-61. *In* S.A. Kish, ed. Geologic Field Studies of the Coastal Plain in Alabama, Georgia, and Florida. Southeastern Geological Society, Tallahassee, FL, United States.

Rupert, F.R. and J.D. Arthur. 1990. The geology and geomorphology of Florida's coastal marshes. Florida Geological Survey, Open File Report. 34:13.

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Abstract. A comprehensive study of the hydrography, sedimentology and benthic fauna of Panama City Beach. Includes information on the effect of Hurricane Eloise on the benthic fauna. This study presents basic scientific data on the benthic fauna and surface sediments of the nearshore zone of Panama City Beach, Florida, before restoration of the

beach, and the results of a study on the effect of Hurricane Eloise on the benthic fauna in the swash zone of Panama City Beach. Surface sediments were analyzed for particle-size distribution, percent carbon, organic carbon and carbonate, and statistical factors. The surface sediments exhibited uniformity over time and location. The benthic invertebrates were represented by 170 species in 26 major taxa. The taxon with the most abundant species (69) was the phylum Polychaeta. The fauna was dominated by 14 species which constituted 80 percent of the collected individuals. The number of species and the diversity index were lowest in the swash zone and highest at the offshore stations at the depth of 30 feet. Number of individuals was highest in May and August and lowest in November and February. Of the invertebrate species, 21 may be new to science; 15 of the 21 are amphipods and 4 of these are among the most abundant species occurring in the nearshore zone. Correlation of animal abundance to selected sedimentological parameters was low. Mean grain size was the most significant sediment factor tested. The effect of Hurricane Eloise on Panama City Beach was extensive. The beach and primary sand dune were severely eroded. The number of individuals continued to increase for 6 days following the storm; thereafter, it decreased. The number of species increased also, reaching a peak on the third day after the storm, and then it decreased.

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Abstract. This study presents: (1) basic data on the benthic fauna and surface sediments of the nearshore zone of Panama City Beach, Fla., before restoration of the beach, and (2) the results of a study on the effect of Hurricane Eloise on the benthic fauna in the swash zone of Panama City Beach. Surface sediments were analyzed for particle-size distribution, percent carbon, organic carbon and carbonate, and statistical factors. The surface sediments exhibited uniformity over time and location. Benthic invertebrates were represented by 170 species in 26 major taxa. The taxon with the most abundant species (69) was the phylum Polychaeta. The fauna was dominated by 14 species which constituted 80% of the collected individuals. The number of species and the diversity index were lowest in the swash zone and highest at the offshore stations at a depth of 30 feet. Number of individuals was highest in May and August and lowest in November and February. Correlation of animal abundance to selected sedimentological parameters was low. Mean grain size was the most significant sediment factor tested. The effect of Hurricane Eloise was extensive. The beach and primary sand dune were severely eroded. The number of individuals continued to increase for 6 days following the storm; thereafter, it decreased. The number of species increased also, reaching a peak on the third day after the storm, and then it decreased.

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Abstract. Compares the populations of organisms inhabiting the swash zone, before and after the hurricane that struck in September 1975. The effect of Hurricane Eloise in Sept, 1975 on the benthic fauna inhabiting the swash zone on Panama City Beach, Florida, USA is described. Damage by the storm to the beach and property was considerable. The effect of the storm on the benthic inverte brates was not adverse, as the number of

individuals occurring in the swash zone was about the same after the storm as before. The number of species increased after the storm, but later decreased to approximate numbers before the storm. The increase in the number of species was mainly due to the influx of species that normally occur farther offshore of the swash zone. The lack of heavy rainfall that usually accompanies a hurricane was probably a factor enabling benthic organisms that normally live in high salinities to survive.

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Abstract. A study on the ecological effects of beach restoration at Panama City Beach after Hurricane Eloise. This report discusses the effects of depositing dredged material from offshore on benthic macroinvertebrates inhabiting the swash zone and the first sandbar at Panama City Beach, Florida. The dredged material was similar to existing beach material at most sites. The turbidity was relatively low, except near the area of deposition, because alongshore currents dispersed the turbid water. The numbers of individuals at treated stations in the swash zone were reduced after deposition, and five to six weeks later, populations assumed levels comparable to untreated stations. No notable effects of deposition were observed on fauna inhabiting the sandbar. The significant differences in the number of species and individuals between treated and untreated stations both before and after deposition indicated that community composition, distribution, and abundance of macroinvertebrate fauna at similar stations (swash zone and sandbar) may differ naturally, even when the stations are located along the same beach.

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Abstract. An ecological study of the beach invertebrate populations before and after dredging for beach nourishment. Includes hydrographic and sediment data. This report gives biological and physical oceanographic data from baseline work, and studies of dredged and undredged sediments before and after dredging (9-meter contour) for beach nourishment at Panama City Beach, Florida. These studies were designed to show major short-term environmental effects of offshore dredging and included analyses of hydrology, sediments, and benthos. Hydrological measurements were limited to water temperature and salinity. Analysis of surface sediments included particle-size distribution, carbon chemistry, and statistical properties of mean grain size, sorting, skewness, and kurtosis. Average and extreme periods of water temperature and salinity were recorded. Regional nearshore sediments proved to be fine sand, containing less than 1 percent silt-clay, that was moderately well to well sorted, symmetrical to coarsely skewed, and leptokurtic. Total carbon content averaged less

than 0.30 percent, and most of that occurred in the form of carbonate deposits. Over a postdredging study period of 1 year, sediment samples from borrow pits showed little variation from these general features. In studies of the benthos, 362 species and 58,068 individuals were recorded among 14 invertebrate phyla and bone fishes. Dominant groups by species and abundance included annelida, mollusca, and arthropoda (crustacea). Faunal comparisons between dredged and undredged areas were made on the basis of species richness and abundance, the Shannon-Weaver index of diversity (H'), Pielou's index of equitability (J'), Morisita's index of faunal similarity (together with matrices and classification diagrams derived from that index), and two statistical derivations, based on diversity and abundance data, that were designed to show sample-to-sample faunal variations and the time period required for faunal recovery in borrow pits. Information obtained from these procedures showed that recovery began soon after dredging was complete, or nearly so, within 1 year. These results were similar in most respects to those from study of offshore dredging elsewhere in comparable geographic settings. Even so, the need for close associations between ecological research and coastal engineering programs is emphasized.

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Abstract. A four-channel multispectral scanner (MSS) carried aboard an aircraft was used to collect data along several flight paths over St. Joseph Bay, Florida. Various classifications of benthic features were defined from the results of ground-truth observations. The classes were statistically correlated with MSS channel signal intensity using multivariate methods. Application of the classification measures to the MSS data set allowed computer construction of a detailed map of benthic features of the bay. Various densities of seagrasses, various bottom types, and algal coverage were distinguished from water of various depths. The areal vegetation coverage of St. Joseph Bay was not significantly different from the results of a survey conducted six years previously, suggesting that seagrasses are a very stable feature of the bay bottom.

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Abstract. This paper describes a systematic methodology for predicting the stability of dredged material disposal sites over long periods of time, ranging from months to years. The approach is based on the generation of simulated data bases of wave and current time series which accurately represent the environmental conditions descriptive of the site. These

boundary conditions are used to drive coupled hydrodynamic, sediment transport, and bathymetry change models which provide reliable predictions of the long-term dispersive or nondispersive characteristics of the site. An example application of this site designation approach is made for a dispersive disposal mound located offshore of the entrance to Mobile Bay, Alabama.

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Abstract. Sandstone porosity of the Upper Jurassic Norphlet Formation in southwestern Alabama and vicinity decreases systematically as depth and thermal maturity increase over a wide range. Median porosity is about 25% where equivalent vitrinite reflectance (R//o) is slightly over 0.7% in the northern part of the study area (Clarke County, Mississippi). Median porosity is reduced to 8% where R//o approaches 2.7% in the southern part of the study area (state waters of Mobile Bay). Porosity of the cemented, tight zone at the top of the Norphlet in downdip locations is roughly 10% lower than porosities of facies underlying the tight zone, but nevertheless is slightly above the norm for other sandstones at similar R//o levels. Porosity of dune facies is consistently 2-5% higher than that of interdune facies, other factors being equal. Our data show 3-6% higher porosity in chlorite-dominated intervals relative to intervals where illite is the dominant clay mineral. Norphlet porosity has little or no correlation with position relative to the present-day hydrocarbon-water contact. Based on comparisons at similar R//o levels, median (50th-

percentile) Norphlet porosity exceeds porosities of 'typical' sandstones in other basins by more than a factor of two throughout the study area. Even the lower (10th-percentile) Norphlet porosities are higher than median porosities of sandstones in general.

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tidal return pattern, effected by the cutting of a canal across Shell Island, is probably responsible for the ongoing segmentation of the western portion. Rates of erosion/deposition, determined by comparing bathymetries charted in 1877, 1930, and 1946, demand that these two peninsulas receive material by eastward transport. Furthermore, the longshore drift of both peninsulas is bidirectional, northwesterly and southeasterly. These two drift components are very nearly equal in magnitude immediately west of Shell Island; net easterly drift occurs on Shell Island peninsula. Crooked Island experiences netwesterly and easterly drift; the easterly drift terminates in the Bell Shoal area and does not reach the adjacent St. Joe Spit.

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Abstract. Data describing the evolution of a large beach nourishment project on the Gulf of Mexico at Perdido Key, Florida, are analyzed to describe the sediment transport processes governing the behavior of the beach. Analytical and numerical techniques for prediction of the response of the nourished beach to physical forcing arising from incident wind waves are

tested. Repetitive bathymetric and topographic surveys indicated placement of 4.1 million m^3 of sand in the nearshore zone between November, 1989, and August, 1990, and a net loss of 7% from the monitored area after one year. Beach profiles were surveyed every 3-4 months at 33 locations to monitor the evolving beach, providing over 250 profiles describing the spatial and temporal changes at the site. Directional wave data, sediment samples, tide, and weather data were also collected. Cross-shore sediment transport rates and longshore gradients of longshore sediment transport were computed from the measured changes in the beach profiles. Results indicate that cross-shore sediment transport dominated much of the early evolution of the project. Longshore gradients of longshore sediment transport were found to be strongest on the "shoulders" of the beachfill, where shoreline curvature changes most rapidly. Longshore and cross-shore sediment transport processes were assumed independent to allow separate investigations. A "one-line", numerical model for planform evolution including the effects of background erosion, cross-shore sediment transport, and spatial and temporal variation in the incident waves gave a reasonable description of the longshore gradient of longshore sediment transport along the nourished beach. Beach profile changes at the site were modeled by application of two previously developed numerical models that simulate cross-shore sediment transport. One approach reasonably estimated the volumetric redistribution of sediment for the first post-nourishment survey interval but yielded poor results for profile recovery events. Performance of the second model was poor despite a more detailed description of the cross-shore sediment transport rate. The level of detail included in the assessment and description of long-term sediment transport processes at the site is largely unprecedented. The approach provides information specific to beach nourishment projects as well as more general insight into nearshore sediment transport problems.

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Work, P.A. and R.G. Dean. 1995. Assessment and prediction of beach-nourishment evolution. Journal of Waterway, Port, Coastal and Ocean Engineering. 121(3):182-189.

Abstract. Field data from Perdido Key, Florida, describing the response of an evolving beach nourishment project and the causative forces are analyzed in terms of sediment-transport rates and gradients. Numerical models for planform and profile evolution are applied and tested against the field data. Commonly applied concepts within the coastal engineering community regarding the 'depth of closure,' profile 'equilibration,' and the best-choice coefficient for use in a predictive equation for longshore sediment transport rate are discussed. The results indicate that the beach planform may be described qualitatively by an analytical solution, and a one-line numerical model gives a reasonable quantitative description of the longshore gradient of longshore sediment transport. The depth to which longshore sediment transport gradients affect the profile appears to be much less than the depth to which profile changes are observed, illustrating the importance of cross-shore sediment

transport. An existing profile-response model, slightly modified, yielded good results immediately following nourishment, but poorer results as the beach profile approached a more natural configuration.

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Abstract. Sikes Cut is a man-made inlet on St. George Island which separates the Gulf of Mexico from Apalachicola bay. The inlet is located five miles south across the bay from Apalachicola, on Florida's panhandle. Collected information and computed data in this report are summarized.

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 National Biological Service Mission

As a bureau of the Department of the Interior (DOI), the National Biological Service's (NBS) primary mission is to provide the scientific understanding and technologies needed to support sound management and conservation of our Nation's biological resources. Independence from regulatory and management decision making greatly lessens the chance that scientific results will be viewed as less than objective science or subservient to the needs of policy makers. NBS provides credible, objective, and unbiased information needed by resources managers in the Department of the Interior in a form that allows them to assess, predict, and manage the biological consequences of various policies and management practices. Although the primary focus of the biological research is to meet DOI needs, the activities undertaken with natural resource research funding will also serve the science needs of a wide range of partners, including State governments, other Federal agencies, and private landowners.

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 **Royalty Management Program** 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.