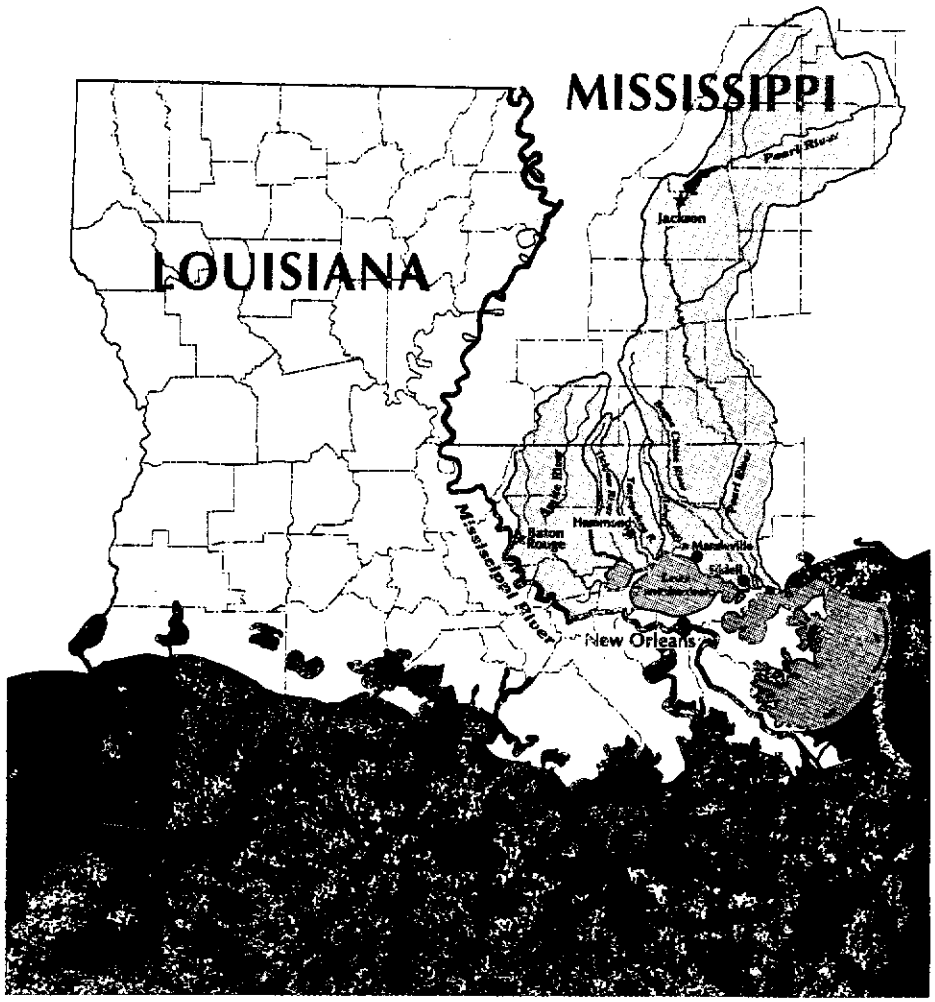
BASICS OF THE BASIN RESEARCH SYMPOSIUM

Addressing the Condition of the Lake Pontchartrain Basin



May 14 - 15, 1992

University of New Orleans

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Contents

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List of Participating Organizations

Federal Agencies:

-U.S. Army Corps of Engineers (New Orleans and Vicksburg)
-U.S. Fish and Wildlife Service
-National Wetlands Research Center
-U.S. Geological Survey
-Southern Forest Experiment Station

Universities:

Tulane University
-College of Public Health and Tropical Medicine
-Department of Geology

University of New Orleans
-Department of Biological Sciences
-Urban Waste Management Research Center
-College of Urban and Public Affairs
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The Lake Pontchartrain Basin Bibliography

The Lake Pontchartrain Basin Bibliography was compiled for the 1992 Basics of the Basin Research Symposium. It is largely the product of a merge between two major existing bibliographies: The Lake Pontchartrain Bibliography compiled by Rod E. Emmer and Coastal Management, Inc. in 1984 and The Lake Pontchartrain--Lake Maurepas Estuarine Complex: A Bibliography by Mary Grace Curry compiled in 1984 with updates in 1986 and 1987. Without these works, the Lake Pontchartrain Basin Bibliography would not have been possible. The committee would also like to thank Bill Herke, Ervin G. Otvos, and John Burns for their contributions to the bibliography.

The bibliography distributed at the conference is in WordPerfect 5.1 format on a 1.2M 5 1/4 inch disk. At present, the bibliography has not been put on a database. The Lake Pontchartrain Basin Foundation intends to put it on dBASE this summer.

If you have any additions, corrections, or suggestions for the bibliography, feel free to contact Clifford Kenwood at the Lake Pontchartrain Basin Foundation at P.O. Box 6965, Metairie, LA 70009-6965.

AGENDA

THURSDAY, MAY 14,1992

8:00 INTRODUCTORY COMMENTS by John A. Lopez

SESSION I: PHYSICAL PROCESSES

MODERATORS: Shea Penland and John A. Lopez

8:15 Louis D. Britsch and Joseph B. Dunbar: Land Loss Trends in the Pontchartrain Basin

8:40 A. G. Calix, E. Seeger, L. Velado, J. Rucker, L. R. Handley: Shoreline Changes of Lake Pontchartrain 1955-1990

9:05 Shea Penland, M. R. Byrnes, L. Wayne, S. J. Williams: Character of Coastal Land Loss in the Pontchartrain Basin

9:30 R. V. Rholi: Deviations Between Modeled and Measured Runoff in the Lake Pontchartrain Basin

9:55 BREAK

10:10 J. W. Hardy: Freshwater Input into Lake Pontchartrain

10:35 Anthony J. Vega: Long-term Climatic Variability of Modeled and Measured Runoff within the Lake Pontchartrain Basin

11:00 B. D. Keim: Storm Frequencies and Storm Runoff into Lake Pontchartrain

11:25 Sue K. Smith: North Shore Source of Suspended Sediment in the Surface Runoff to Lake Pontchartrain

11:50 LUNCH with a Luncheon lecture by Rez Darnell entitled "Lake Pontchartrain--What it was"

1:30 J. C. Francis, V. Wijesundera, D. E. Barbe, M. M. Mulino, M. A. Poirrier: Historic Changes in Secchi Disk Transparency in Lake Pontchartrain

1:55 J. A. Lopez: Potential Significance of Active Faults in Lake Pontchartrain

2:20 E. G. Otvos: Lake Pontchartrain Basin Evolution: Late Pleistocene-Holocene Geological History

2:45 A. Thomson and R. J. LeBlanc: Geological History of Lake Pontchartrain

3:10 BREAK

SESSION II: ECOLOGICAL PROCESSES

MODERATORS: Michael Poirrier and Matt Gould

3:25 Richard Condrey: Historical Ecology of Lake Pontchartrain - Lake Borgne: 1699-1950

3:50 R. A. Goyer, G. J. Lenhard, J. L. Chambers and V. R. Van Sickle: Herbivory in Baldcypress: A Threat to the Pontchartrain Basin

4:15 Margaret S. Devall and Bernard R. Parresol: Assessing the Effectiveness of Several Protective Measures against Herbivory of Cypress (Taxodium distichum) Seedlings

4:40 Bruce A. Thompson: A Review of Fish Studies in Lake Pontchartrain

POSTER SESSION 5:15 - 7:00

R. W. Boebel and Frank C. Crawford: The Lake Borgne and Lake Pontchartrain Commercial Seafood Production from 1970 to 1989, Volumes and Variations

J. W. Burns, M. A. Poirrier and K. Preston: The Occurrence of Potamogeton Perfoliatus L. (Clasping Pondweed), A Rare Submerged Aquatic Vascular Plant in Lake Pontchartrain

R. D. DeLaune and C. W. Lindau: Stable Nitrogen Isotopes Studies: Fingerprint Surface Water Inorganic Nitrogen Sources Entering the Lake Pontchartrain Basin

R. D. DeLaune and J. H. Pardue: Distribution of Heavy Metals in Bayou Trepagnier Bottom Sediment

Charles R. Demas and Charles R. Garrison: Water Quality Monitoring Activities of the U. S. Geological Survey in the Lake Pontchartrain and Lake Maurepas Basins

C. A. Dranguet and Roman J. Heleniak: Man in the Basin: Habitation and Forest Exploitation in the Lake Pontchartrain Basin

L. E. Ellis and J. C. Francis: Determination of Fecal and Total Coliform Levels in Lake Pontchartrain by Polymerase Chain Reaction (PCR)

Robert W. Sabate, Edmund L. Dewailly, and Arthur V. Stiffey: Algal Bioluminescence in Toxicity Testing

6:00-8:00 **RECEPTION**

FRIDAY, MAY 15, 1992

SESSION II: ECOLOGICAL PROCESSES (continued)

MODERATORS: Michael Poirrier and Matt Gould

8:00 G. Binet and A. B. Ensminger: Habitat Degradation of the Lebranche Wetlands and an Approach to its Restoration

8:25 K. P. Preston, M. A. Poirrier, and J. W. Burns: Community Structure and Distribution of Submerged Aquatic Vegetation in Lake Pontchartrain, La.

8:50 K. C. Duffy and D. M. Baltz: The Influence of the Introduced Eurasian Milfoil (Myriophyllum spicatum) and Native Aquatic Vegetation on Fish Nursery Habitat in Lake Pontchartrain

9:15 James L. Wee, Dennis J. Booth, Micheal A. Bossier: Synurophycean Algae from the Lake Pontchartrain Region: A Preliminary Survey from the Southern Atlantic Coastal Plain of North America

9:40 William S. Perret, L. Brandt Savoie, John F. Burdon and Karl A. Mapes: The Fisheries of the Pontchartrain Basin

10:05 BREAK

10:20 E. B. Seeger, A. G. Calix, L. Velado, J. Rucker and L. R. Handley: Historical Comparative Analysis of Marsh Breakup in the LeBranche Wetland

10:45 Robert W. Hastings: Surface Drift Movement of Larval Marine Fishes and Other Organisms Through passes of the Upper Lake Pontchartrain Estuary

11:10 M. V. Farabee and R. C. Cashner : Distribution of Fishes and Community Stability in Bayou Lacombe

11:35 LUNCH

(Continued)

SESSION III: ENVIRONMENTAL ISSUES

MODERATORS: Dale Easley and George Flowers

11:35 R. E. Emmer: Shrinkage of the Lake Pontchartrain Basin, the Need for a Cooperative Regional Approach

1:15 A. B. Rheams: Lake Pontchartrain Basin: Urban Nonpoint Source Pollution Problems and Solutions

1:40 S. P. Powers, M. A. Poirrier, and P. O. Yund: The Effects of New Orleans Urban Runoff on the Benthic Community of Southern Lake Pontchartrain

2:05 D. W. Davis: New Orleans--North America's Premier Below Sea Level City

2:30 BREAK

2:45 G. C. Lawler and L. Hartzog: Baseline Pollution Data on the Water Column, Sediment, and Bivalve Tissue Samples from the Inner Harbor Navigational Canal, Chef Pass and the Rigolets

3:10 A. Thiyagarajah and M. J. Ledet: Histopathological Assessment of Two Species of Fish from the Bayou Trepagnier

3:35 A. C. Anderson: Recreational Impact of Fecal Loading on Lake Pontchartrain Basin Streams

4:00 J. H. Turbeville Jr.: The Geology and Geohydrology of an Area Representative of Near Surface Aquifer Systems on the Mississippi River Flood Plain in South Louisiana

4:25 CLOSING

Abstracts

RECREATIONAL IMPACT OF FECAL LOADING ON LAKE PONTCHARTRAIN BASIN STREAMS

Anderson, A. C., Tulane University School of Public Health and Tropical Medicine, New Orleans, LA.

There have been several epidemiological studies addressing the health implications of exposure to pathogens in recreational waters. These data, including the study done at Lake Pontchartrain, are reviewed. Based on these studies, EPA recommended new bacteriological criteria for recreational water quality: 126 E. coli / 100 ml fresh water or 33 enterococci / 100 ml fresh water. Levels of these indicators and sources of contamination are discussed using the Tangipahoa River as a model for fecal loading of Pontchartrain Basin streams. The impact of fecal contamination on other basin streams is also discussed. The status of adoption of the new criteria organisms as bacteriological standards for recreational water is reviewed. The steps being taken to improve recreational water quality in the Pontchartrain Basin are outlined.

HABITAT DEGRADATION OF THE LABRANCHE WETLANDS AND AN APPROACH TO ITS RESTORATION

Binet, G., St. Charles Parish, Hahnville, LA, and Ensminger, A. B., Wetlands and Wildlife Management Co., Inc., Belle Chasse, LA.

Considered the most productive wetlands within the Lake Pontchartrain Basin, the LaBranche Wetlands south of Lake Pontchartrain consists of over 14,000 acres of brackish to fresh marsh and forested swamp. Before natural and man-made processes produced massive degradation and habitat changes of the LaBranche Wetlands, the entire area was a freshwater swamp and marsh complex. Between 1970 and 1980, one-fourth of the LaBranche Wetlands habitat was lost due to saltwater intrusion, natural subsidence, channelization, and shoreline erosion. Major contributing factors to the LaBranche decline has been the dredging of access channels for the construction of I-10, the construction of the Mississippi River Gulf Outlet that periodically brings saltwater into Lake Pontchartrain from the Gulf of Mexico, shoreline retreat of over 15' per year due to Lake Pontchartrain wave action and, of course, natural sediment depletion and marsh subsidence.

In 1984, a comprehensive marsh management plan was developed for the 12,460 acres of LaBranche Wetlands owned and managed by the St. Charles Land Syndicate. The area under management is generally bounded by Lake Pontchartrain, the Jefferson/St. Charles Parish line, US Highway 61, and Bayou LaBranche. In February 1987, the Louisiana Department of Natural Resources/Coastal Management Division issued a

coastal use permit for the plan, and a Section 404 Permit was received from the US Army Corps of Engineers in May 1988. Since that time, the LaBranche area north of the Illinois Central Railroad (just south of I-10) has been passively managed as a brackish to intermediate marsh and the wetlands south of the Illinois Central Railroad have been actively managed as a fresh marsh and swamp complex. Structural modifications that plug or regulate water flow through man-made canals has greatly improved LaBranche's habitat for both fisheries and waterfowl production, has halted saltwater intrusion in the area, and has increased the land to water ratio within the entire complex. Steps have also been taken to diversify marsh plants by implementing an annual re-vegetation program aimed at introducing non-native and more salt tolerant plant species to the area.

The LaBranche Wetlands is an excellent example of an environmental public/private partnership. Over $2 million worth of marsh management techniques have been implemented in LaBranche since the inception of the plan, utilizing funds in the form of grants, mitigation, donations, and landowner and Parish participation. The landowner and the Parish realize the major habitat role LaBranche plays to the Lake Pontchartrain Basin, and has assumed an active role in preserving and enhancing its valuable habitat.

THE LAKE BORGNE AND LAKE PONTCHARTRAIN COMMERCIAL SEAFOOD PRODUCTION FROM 1970 TO 1989, VOLUMES AND VARIATIONS

Boebel, R. W., Consultant, New Orleans, LA, and Crawford, Frank C., Crawford & Associates, Inc., New Orleans, LA.

Landings data compiled by the National Marine Fisheries Service, U.S. Department of Commerce, show that the volume of seafood harvested and sold commercially from Lake Borgne and Lake Pontchartrain significantly increased in the twenty year span, 1970-1989. The year 1989 is the last year that this federal agency recorded fishery data from these two lakes.

Six types of seafood (three fish and three shellfish), comprising more than 99% of the total harvest, show an increase in total poundage and total exvessel value from 2,075,100 pounds and $492,777 for year 1970 to 8,946,150 pounds, and $6,103,237 for year 1989. The species included are drum (black), sea trout (spotted, white), sheepshead (Atlantic), blue crab (hard, soft, peeler), shrimp (brown, white), and oyster. All species increased over the period studied except oysters. Black drum, sheepshead, and blue crab showed the most dramatic expansions of catch.

Substantial volume variations are present for some species within this time span. Causal factors may include economic changes, shifting demographics, and regulatory forces. The introduction of Mississippi River freshwater and silt into these brackish water lakes probably caused some fluctuations. Other physical changes in the environment were occurring over this period. Nevertheless, in 1989 Lake Borgne and Lake Pontchartrain were not hostile to these members of the biota. Marine life was alive, well, and

harvested in large volumes by the commercial fishing industry.

LAND LOSS TRENDS IN THE PONTCHARTRAIN BASIN

Britsch, Louis D., U.S. Army Engineer District, New Orleans, LA, and Dunbar, Joseph B., U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

The U.S. Army Engineer District, New Orleans, and the U.S. Army Engineer Waterways Experiment Station have recently completed the final phase of a study to determine the rates, trends, and location of land loss in coastal Louisiana. The study documents on maps the land loss that has occurred during each of 4 successive time intervals beginning in the 1930's. The time intervals mapped were the 1930's to 1956-58, 1956-58 to 1974, 1974 to 1983, and 1983 to 1990. From these data, land loss trends were identified for the Pontchartrain Basin as a whole and for specific areas located within the basin. This information is being combined with engineering geology, depth to the Pleistocene, and subsidence data in a Geographic Information System (GIS). The GIS allows the Corps to analyze the various factors contributing to land loss, and to determine the site-specific causes of the loss. These data are being used to make site characterizations for various planning studies for land-loss mitigation and restoration.

THE OCCURRENCE OF POTAMOGETON PERFOLIATUS L. (CLASPING PONDWEED), A RARE SUBMERGED AQUATIC VASCULAR PLANT IN LAKE PONTCHARTRAIN

Burns, J. W., Urban Waste Management and Research Center (UWMRC), Poirrier M. A., Biological Sciences/UWMRC and Preston, K., Geography/UWMRC, University of New Orleans, New Orleans, LA.

Submersed plants of both freshwater and marine origin comprise important communities within estuaries, but their ecology in estuarine habitats is poorly understood. Potamogeton perfoliatus L. (Clasping Pondweed) is a submersed aquatic vascular plant which is listed as a sensitive species in the coastal zone of Louisiana and is considered extremely rare. Louisiana collections of P. perfoliatus are limited and restricted to Lake Pontchartrain and its surrounding marshes.

Potamogeton perfoliatus was first recorded for Lake Pontchartrain by Riddell in 1838 near the Tchefuncta River Lighthouse. Clair A. Brown also collected a specimen from the beach at Mandeville in 1945. Although Suttkus, Darnell and Darnell; Perret et al.; Chabreck; Turner, Darnell and Bond conducted studies which noted the submerged vegetation of Lake Pontchartrain in 1953-1954, 1971, 1972 and 1980 respectively, P. perfoliatus was not reported in the lake for the following 28 years. Montz reported P. perfoliatus to be abundant both before and after the 1973 opening of the Bonne Carré Spillway, at Pointe aux Herbes in the southeastern sector of the lake. A 1978 icthyologi-

cal survey by Thompson and Verret, which noted submerged aquatic vegetation at specific stations located around the perimeter of Lake Pontchartrain, did not list P. perfoliatus as a species encountered. During the summer of 1985, a survey of aquatic vegetation in the lake by Mayer did not find P. perfoliatus. Efforts to relocate P. perfoliatus in 1988 by Lester were unsuccessful during an ecological inventory of the sensitive plants and animals for the coastal zone of Louisiana. Brantley and Platt recorded a 7 m x 17 m submerged bed of P. perfoliatus 1500 m west of Bayou Lacombe in June 1990. Additional smaller beds, which yielded fruiting specimens, were located in the same area in August 1990.

Recent surveys beginning August 1991 to the present have located submerged beds of P. perfoliatus on both the north and south shores of Lake Pontchartrain. South shore beds have been located at Pointe aux Herbes (39 m x 26 m) and at the confluence of Irish Bayou with Lake Pontchartrain on the west side of the Pointe aux Herbes peninsula (50 m x 50 m; 15 m x 12 m; 20 m x 15 m). North shore beds were located between Goose Point and the confluence of Bayou Lacombe with Lake Pontchartrain (15 m x 20 m; 10 m x 15 m), approximately 4.0 km east of Bayou Lacombe near Point Platte (150 m x 120 m) and off the swimming beach at Big Point (several individuals). Attempts to relocate P. perfoliatus at Big Point during December 1991 were unsuccessful. Submersed beds of P. perfoliatus reported by Brantley and Platt were also relocated near Bayou Lacombe.

Factors affecting the distribution of P. perfoliatus in Lake Pontchartrain are not known. Some areas have been repopulated after an absence of 18 years, and growth is occurring in previously unreported sectors of the lake. Its status in Lake Pontchartrain is currently being monitored and examined for factors which affect its distribution.

SHORELINE CHANGES OF LAKE PONTCHARTRAIN 1955-1990

Calix, A. G., Seeger, E., Velado, L., and Rucker, J., TGS Technology, Inc., U.S. Fish and Wildlife Service, National Wetlands Research Center, Slidell, LA, and Handley, L. R., U.S. Fish and Wildlife Service, National Wetlands Research Center, Slidell, LA.

Lake Pontchartrain plays an important role in the wetland ecosystems of Louisiana. Over the past few decades the lake has been directly affected by the urban development of New Orleans and surrounding areas. Shell dredging, saltwater intrusion, shoreline development, and pollution, are some of the factors contributing to the lake's problems. Recently, efforts have been made to restore the lake to an ecologically sound and economically viable habitat for Louisiana. The purpose of this study is to cartographically demonstrate the changes in the shoreline of Lake Pontchartrain using historical maps and recent aerial photography.

HISTORICAL ECOLOGY OF LAKE PONTCHARTRAIN - BORGNE BASIN: 1699-1950

Condrey, Richard, Coastal Fisheries Institute and Department of Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, LA.

Once Iberville had passed the buffalo plains and cypress swamps which were to become New Orleans (because the area had a fine path which led to Bayou St. John and then Lake Pontchartrain), he began looking for the right fork of the Mississippi. Failing to find it (since he was on it and failed to recognize Bayou Lafourche as its left fork), he took a small bayou "chocked" with huge log jams (Bayou Iberville, now Bayou Manchac) through Lake Pontchartrain-Borgne.

Come on a voyage of discovery as we reexamine this system through the writings and illustrations of the early explorers and visitors. From Iberville and Collot, through Audubon, and Lafcadio Hearn and Rebecca Harding Davis, watch the massive ecological changes brought by European settlement. Ponder what the system was as you consider what it might become.

NEW ORLEANS--NORTH AMERICA'S PREMIER BELOW SEA LEVEL CITY

Davis, D. W., Louisiana Geological Survey, P.O. Box G, University Station, Baton Rouge, LA.

In the current popular and scientific literature one reads with repeated frequency articles related to the greenhouse effect on sea level rise. As the world turns up its global thermostat, melting the polar ice caps and enlarging the world's seas through thermal expansion, coastal cities will be at risk. With nearly two-thirds of the planet's population and more than 40 of its largest metropolitan centers within the coastal lowlands, even a small upward movement in the earth's seas is significant. A change in temperature of as much as 4° C has been predicted by 2030. The subsequent rise in sea level may flood New Orleans and other coastal municipalities.

From its inception, New Orleans was isolated from the mainland by cypress/tupelo swamps, marshes, and Lake Pontchartrain. It was an "island city" delineated by water courses. When surveyed in 1720 every block was defined by shallow ditches. From its beginning these small channels established New Orleans' dependence on a drainage network. Levee construction began as early as 1718. By 1720 all inhabitants were instructed to enclose their land in "palisades" or forfeit their property. Ten years later an embankment 1.6 km long protected the "Vieux Carre'." Levees, therefore, are an old and integral part of the urban landscape. New Orleans is part of an environmental setting that requires an extensive levee and pump system to manage the region's excess water.

The "Vieux Carre'" is the older section of the "Crescent City" and is built on abandoned or modern natural levees. At 4.5 m above sea level, these features are the region's high ground. They furnished the earliest inhabitants with a relatively dry, firm

foundation for residential and commercial construction. Draining the surrounding wetland was a major undertaking. When the water was removed the soils shrank and settled and eventually subsided below sea level. Even so, relatively rapid urbanization required additional space. The only property available were the swamps and marshes that framed the initial natural levee site. What was delineated as "uninhabitable wasteland" was slowly reclaimed as the region's incorporated limits increased.

Much of the New Orleans metropolitan complex has subsided to the point where in order to drain properly pumps siphon excess rainfall up into Lake Pontchartrain. Human-induced negative land surfaces are producing, in many instances, below sea-level citizens. Regional governments have learned, nevertheless, to live with this and other environmental dilemmas. Canals, pumps, and large-diameter drainage pipes assist in keeping the neighborhoods relatively dry. With much of the urbanized area less than 3 m above mean sea level, the margin of safety is exceedingly small. This is particularly true for those sections of the levee-protected metropolitan region 2 m to 4 m below sea level. Inasmuch as arable land has always been in short supply, the only practical and realistic solution was to reclaim the "uninhabitable" swamps and marshes. Soils associated with these aquatic habitats are subaqueous in origin and high in organic detritus. When air dried, these histosols lose nearly 85% of their mass. The end result is the surface subsides because of the loss of volume within the soil column.

The product of reclaiming these marginal tracts is that the New Orleans metropolitan region is sinking. With a projected rise in sea level of 1.2 mm/yr, coupled with a constant battle with subsidence, the New Orleans metroplex faces a challenging future. In addition, the metropolitan area is at risk from hurricanes. Under the right conditions, a tropical depression moving across Lake Pontchartrain's southeastern quadrant would move considerable water over the lakefront levees into the below-sea-level bowl that distinguishes parts of Jefferson and Orleans parishes. For more than two and a half centuries the "Crescent City" and its satellite communities have been at odds with the elements. Despite these issues, the region has developed, prospered, and flourished within this inhospitable environment, but the future must be considered carefully.

STABLE NITROGEN ISOTOPES STUDIES FINGERPRINT SURFACE WATER INORGANIC NITROGEN SOURCES ENTERING THE PONTCHARTRAIN BASIN

Delaune, R. D., and Lindau, C.W., Wetland Biogeochemistry Institute, Louisiana State University, Baton Rouge, LA.

Estuaries such as Lake Pontchartrain are generally nitrogen limiting. Nitrogen entering the system can influence water quality of the lake. A recent study investigated the use of natural abundance variations in $^{15}N/^{14}N$ ratios for identification and tracing surface water inorganic N sources entering the Pontchartrain Basin. Surface water samples were collected from selected streams with distance from a point source in the northern Basin and analyzed for NH_{4+}-N, NO_3-N and associated $^{15}N/^{14}N$ ($\delta^{15}N\%$) concen-

trations. Ammonium-N from domestic sewage sources entering the Basin was found to have distinct $\delta^{15}N$ ranges. Domestic sewage discharge was traced for about 30 km downstream from discharge point using $^{15}N/^{14}N$ ratios. At the sewage point source NH_4^+ $\delta^{15}N$ values averaged +43% and increased linearly to +162% with distance from the discharge. Surface water NO_3^--$\delta^{15}N$ values generally ranged from +1 to +99% and no significant association was observed between $\delta^{15}N$ values with distance from the domestic sewage point sources. The discrete NH_4^+-$\delta^{15}N$ signatures of domestic sewage compared to downstream surface water. NH_4^+-$\delta^{15}N$ values demonstrated that N isotopic ratios can be used as tracers for identifying the sources of nitrogen entering the Pontchartrain Basin. Such sources include the nitrogen in dairy manure entering the Tangipahoa river and septic and sewage being introduced into the Amite and Tickfaw rivers. Expanded studies are currently being initiated to quantify further nitrogen sources entering the basin.

DISTRIBUTION OF HEAVY METALS IN BAYOU TREPAGNIER BOTTOM SEDIMENT

Delaune, R.D and Pardue, J.H., Wetland Biogeochemistry Institute, Louisiana State University, Baton Rouge, LA.

The depositional pattern of metals was determined in bottom sediment of Bayou Trepagnier (located in the La Branche Wetland bordering Lake Pontchartrain). The majority of flow into the Bayou is from an industrial outfall. Eight cores were taken from Bayou Trepagnier and one core from Mississippi Bayou (a control site) along a transect extending to Lake Pontchartrain. Results indicated that Bayou Trepagnier sediment was contaminated with chromium, lead, and zinc. Chromium levels of over 5,000 mg/kg of sediment were measured in sediment profiles. Lead concentrations on the order of several thousand mg/kg were observed in the lower sediment profile taken near the industrial discharge sites. Zinc concentrations of greater then 1,000 mg/kg of sediment were recorded. Concentrations of metal increased with depth in the profile. Metal concentrations were normalized to Al in the sediments and compared to uncontaminated sites in Louisiana. Bayou Trepagnier sediments were shown to be highly enriched with respect to Cr and Pb when compared with other areas of the state. Sedimentation in recent years (determined from ^{137}Cs dating) was burying or removing metals from the surface environment where bioavailability is greatest.

WATER QUALITY MONITORING ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN THE LAKE PONTCHARTRAIN AND LAKE MAUREPAS BASINS

Demas, Charles R., and Garrison, Charles R., Water Resource Division, U.S. Geological Survey, Baton Rouge, LA.

The Louisiana District of the U.S. Geological Survey Water Resources Division has been involved in monitoring the water quality of surface- and ground-water resources of the Lake Pontchartrain and Lake Maurepas basins since 1927. Surface-water samples and volumetric flow rate discharge measurements have been made at 210 sites

in these two basins. Surface water quality samples have been collected at 102 sites, accounting for 2,187 water samples to date. Bed samples have been collected at 28 of the above sites, accounting for 30 samples. Water and bottom material have been analyzed for suspended sediment, nutrients, bacteria, major ions, trace metals, and pesticides. Currently, there are three active water-quality sites within the two basins. These data were collected as part of cooperative programs with the Department of Transportation and Development, the U.S. Army Corps of Engineers, and the U.S. Geological survey NASQAN program.

Ground water has been sampled at approximately 1,160 sites within the basins, accounting for 3,823 samples. Ground water has been analyzed primarily for major ions and selective nutrients, although synthetic organic compounds, trace metals, and bacteria have been run at selective sties. Ground-water data have been collected as part of cooperative programs with the Department of Transportation and Development, the Jefferson Parish Department of Water, and the St. John the Baptist Parish Department of Water.

The U.S. Geological Survey also has completed several interpretive studies within the Lake Pontchartrain and Lake Maurepas basins. Studies completed or ongoing include: movement of bacteria in shallow ground water; assessment of trace metals in coastal streams (Pear River, Tickfaw River); hydrology of Fritchie marsh, coastal Louisiana; and ground-water resources of southern Tangipahoa Parish.

ASSESSING THE EFFECTIVENESS OF SEVERAL PROTECTIVE MEASURES AGAINST HERBIVORY OF CYPRESS (TAXODIUM DISTICHUM) SEEDLINGS

Devall, Margaret S. and Parresol, Bernard R., Southern Forest Experiment Station, New Orleans, LA.

Second growth cypress remains an important source of lumber and is important for its ecological and aesthetic role, and for wetland preservation. Louisiana contains a larger inventory of baldcypress than any other state, but subsidence and hydrological modification are reducing natural regeneration. Planting programs have been instituted, but nutria and swamp rabbits have become serious deterrents to the success of cypress plantings in Louisiana. This study examines the effect of treatments offering possible protection against herbivory by nutria and swamp rabbits, and assesses seedling growth (height and root collar diameter) with various treatments. Treatments include application of tanglefoot, a sticky resin; application of ropel, a rodent repellent; and the use of plastic tree guards. Study sites are a marsh that was formerly a cypress swamp on the U.S. Fish and Wildlife Service's Bayou Sauvage Wildlife Refuge and a marsh on Southeastern Louisiana University's Turtle Cove Research Station near Pass Manchac. The study is in its second year.

MAN IN THE BASIN: HABITATION AND FOREST EXPLOITATION IN THE PONTCHARTRAIN BASIN

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Man's entrance into the Pontchartrain Basin has been marked by a degradation of the cypress swamp that at one time surrounded Lake Pontchartrain. The coming of the railroad to the western shore of the lake in 1854 opened the area to commercial exploitation. Through war, flood, and man's utilization of the basin's resources, the gradual shrinking of the forest was inevitable.

The purchase of vast tracts of virgin cypress stands by commercial lumber interests in the 1880's sealed the fate of the forest. A short one hundred years elapsed between the introduction of modern transportation and logging techniques, the establishment of communities, and the final destruction of the swamp habitat.

THE INFLUENCE OF THE INTRODUCED EURASIAN MILFOIL (MYRIOPHYLLUM SPICATUM) AND NATIVE AQUATIC VEGETATION ON FISH NURSERY HABITAT IN LAKE PONTCHARTRAIN

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Quantitative samples in monospecific stands of submerged aquatic vegetation (SAV) and bare sand habitats have been collected on a monthly basis from three stations in the northeastern area of the Lake Pontchartrain estuary since July, 1991. The samples of the community associated with the SAV beds are being collected with a Wegener ring (1.2 m), in a microhabitat approach to describe the population responses of fish, invertebrate and SAV species to environmental variables. These data are being used to evaluate the impact of an introduced SAV species on the community structure of coastal fishes and invertebrates in Lake Pontchartrain and its adjacent waters. Historically, the dominant native SAV species were Vallisneria americana and Ruppia maritima; however, Myriophyllum spicatum became established and abundant in the 1970's. In this study, we have seen dynamic changes in the SAV species composition that may be seasonal or directional and related to recent changes in lake water quality. Presently, 9 fish and 9 invertebrate species have been identified. From the preliminary samples, the mean numbers per sample (range) for fishes and invertebrates, respectively, are 12.5 (0-39), and 235.7 (11-508). Species of commercial and recreational interest include juvenile spotted seatrout and blue crab, and post-larval penaeid shrimp.

DETERMINATION OF FECAL AND TOTAL COLIFORM LEVELS IN LAKE PONTCHARTRAIN BY POLYMERASE CHAIN REACTION (PCR)

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Fecal coliform and total coliform levels were monitored in Lake Pontchartrain over a several month period using oligonucleotide primers for detection of the lacZ and uid DNA sequences by PCR. A good correlation was observed between the PCR detection method and standard analytical procedures. Refrigerated storage of water samples prior to PCR analysis was also evaluated. Bacteria were detected in samples for 10 days, but showed significant declines after 48 hours. High fecal and total coliform levels in Lake Pontchartrain appear to be associated with high turbidity of the water.

SHRINKAGE OF THE PONTCHARTRAIN BASIN, THE NEED FOR A COOPERATIVE REGIONAL APPROACH

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The Pontchartrain Basin is shrinking in our perception of its size, the remoteness of the headwaters, the vastness of its waterbodies, the supply of natural resources, and the rapidity of population growth and how soon their presence is felt by neighbors. Tradition segments the basin into four regions: metropolitan New Orleans or the south shore; the river parishes from St. Charles to Iberville Parish; the north shore of St. Tammany, Washington, and Tangipahoa Parishes; and the distant headwaters, the Amite River watershed including East Baton Rouge, Livingston, East Feliciana, and St. Helena parishes. These regions have historically acted independently for several reasons. Culturally, they were distinct, i.e., Anglo-Saxon vs. French vs. The City. Second, the regions were separated by distance. Trips between regions as late as the 1940s were major excursions because of the absence of all-weather roads and bridges over major waterbodies such as the Rigolets, Pass Manchac, and the many rivers. Third, the economic foundation of each region was different. Finally, popular beliefs and attitudes ranged from Laissez les bons temps rouler to strict Biblical followings.

Communities were scattered clusters of homes and businesses along the Mississippi River; isolated groupings of stores and residences at cross-roads or spaced along the bayous, railroads, and highways. Because these enclaves were small they were insulated from their neighbors and, thus, were little affected by or had little effect on the nearest villages, much less Lakes Maurepas or Pontchartrain. The Pontchartrain Basin was sufficiently large and the people distributed so there were minimal if any significant adverse impacts extending beyond the boundaries of the community. Post World War II growth, improved highways, the automobile, and industrial development have changed the basin from overall rural to an emerging suburban/urban system. Time and space are

compressed and with an increasing population problems are magnified. The basin has become one community whether it wants to be or not. In turn, our common problems must be approached in new ways.

The Pontchartrain Basin as one community faces many institutional and environmental problems. Federal, state, and local laws and jurisdictions overlap and, in many instances, conflict in mission and authority. In addition, private landowners are concerned with their right to use property in a way that benefits them. Water quality, wetland loss, harvesting of renewable resources, and extraction of minerals are issues that confront decision makers in the basin and can no longer be ignored. Planning offers the vehicle for addressing these issues in a timely and systematic manner. Former Governor of California Edmund G. Brown said, "planning is thinking ahead intelligently ..." and this is what must be done in the basin. Unfortunately, planning is not an idea that has received wide acceptance. In fact, it is methodically avoided by many parishes and municipalities. Such a negative attitude requires modification if the institutional and environmental problems of the basin are to be solved in a timely fashion. The Lake Pontchartrain Basin Foundation through a grant from the Environmental Protection Agency is undertaking a basin planning process that will confront many of the most difficult institutional and environmental problems in the basin. What evolves will be a formal regional cooperative mechanism for formulating positive actions that result in a healthier and safer place to live for the people in the basin.

DISTRIBUTION OF FISHES AND COMMUNITY STABILITY IN BAYOU LACOMBE

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Bayou Lacombe is a relatively small drainage system tributary to the northeastern section of Lake Pontchartrain. Based on records from fish collections made since 1951, a total of 77 resident and migratory species have been documented for the system. Bayou Lacombe has been the focus of four major ichthyofaunal surveys. The most extensive study was done by Sobczak, in which 10 stations were sampled monthly from August, 1973 to August, 1975, and the most recent survey included monthly samples at five sites from November, 1988 to October, 1989.

Numerical dominants in the upper reaches of Bayou Lacombe include grass pickerel, chubsuckers, black bullhead, bayou topminnow, mosquitofish, dollar sunfish, and warmouth. The middle of the river has greater numbers of cyprinids, blackspotted topminnow, brook silverside, and longear sunfish. The longitudinal pattern of distribution of fishes in Bayou Lacombe is characterized by a rather abrupt change in the fauna between upper, middle, and lower reaches, rather than addition of species. Morisita's Index (I_m) and Percent Similarity Index (PSI) indicate that the greatest dissimilarities between fish assemblages occur between the lowermost stations and those above tidal influence. Stations near the mouth of Bayou Lacombe are characterized by euryhaline

forms, such as bay anchovy, Gulf menhaden, inland silverside, sciaenids, and gobies. Community similarities were calculated for five common stations between the 1973-75 and 1988-89 surveys. Relatively low values for I_m and PSI may indicate less stability and persistence of fish communities over time than reported for midwestern streams. The most abundant species, the blacktail shiner, collected during the 1973-75 study was not represented in any of the 60 collections made during the 1988-89 survey.

HISTORIC CHANGES IN SECCHI DISK TRANSPARENCY IN LAKE PONTCHARTRAIN

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A major environmental concern about Lake Pontchartrain is an assumed long-term decrease in water clarity. Available data on Secchi disk transparency in Lake Pontchartrain from 1953 through 1990 were examined to determine if changes in water clarity had occurred. Linear regression analysis of Secchi disk transparency versus time indicated a statistically significant (5% level) decrease in transparency with time.

The relationship between Secchi disk transparency and two environmental factors, salinity and wind speed, were studied using regression analysis. The analysis revealed a statistically significant, positive relationship between water clarity and salinity, and a statistically significant, negative relationship between water clarity and wind speed. Further analysis indicated that neither average annual salinity nor average annual wind speed had realized a statistically significant change during the period from 1953 through 1990.

Secchi disk transparency data were adjusted for the effects of salinity, wind speed, and both salinity and wind speed. The base for adjustment in each case was the long-term average of the variable for which adjustment was being made. Regression of Secchi disk transparency versus time, with adjustment for salinity, revealed a statistically significant relationship, indicating that adjusting the data for the effect of salinity had not removed the long-term decrease in water clarity. However, regression of Secchi disk transparency versus time, with adjustment for wind speed, indicated that there was no longer a statistically significant relationship between Secchi disk transparency and time. Adjusting the data for the effect of wind speed had removed the long-term decrease in water clarity. Also, regression of Secchi disk transparency versus time, with adjustment for both salinity and wind speed, revealed no statistically significant relationship, indicating that adjusting the data for the effects of both salinity and wind speed had removed the long-term decrease in water clarity.

Analysis of variance of monthly salinity data from 1953 through 1990 revealed a statistically significant monthly seasonality with the highest values occurring in November and the lowest values occurring in May. Similarly, analysis of variance of monthly wind speed data from 1953 through 1990 revealed a statistically significant monthly seasonality with the highest values occurring in February and the lowest values occurring in August. These seasonal effects are not equally represented in the available data on Secchi disk transparency in Lake Pontchartrain. When the seasonal bias is removed from the data set, it no longer supports the conclusion of a statistically significant change in Secchi disk transparency from 1953 to 1990.

HERBIVORY IN BALDCYPRESS: A THREAT TO THE PONTCHARTRAIN BASIN

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The future of the baldcypress is closely linked to its ability to withstand environmental, biological and man-caused stresses. Currently, all three of these categories of stress are impacting cypress in south Louisiana and, particularly, threaten trees in and near the Pontchartrain Basin. Studies underway by the authors are evaluating the impact of an herbivore - the fruit tree leafroller (Lepidopter: Tortricidae) - on baldcypress. Further evaluations are being conducted to ascertain the interaction(s) of herbivory with flooding caused by man made and environmental changes (e.g., global warming and associated changes in hydrology). Studies to date have revealed continued expansion of fruit tree leafroller populations into the periphery of the Pontchartrain Basin. In areas having experienced repeated defoliation of cypress, radial growth has shown marked reduction. Additionally, crown deterioration, increased transparency and dieback have occurred along with scattered tree mortality. The threat to baldcypress results from herbivory coupled with changes in hydrology. Sapling and pole-sized cypress exhibiting high live-crown ratios appear most heavily browsed. Transect evaluations presently underway are aimed at evaluating severity of herbivory in relation to seasonal flooding regimes. Rates of refoliation on both mature and young saplings are compared to further elucidate the ability of cypress to respond to herbivore and flooding stresses.

FRESH WATER INPUT INTO LAKE PONTCHARTRAIN

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Monthly fresh water volumes inputed into Lake Pontchartrain for the time period 1961 through 1990 will be examined. Fresh water input into Lake Pontchartrain from the entire basin will be estimated using the combination of 2 sources: 1) Measured runoff from the rivers dissecting the Florida Parishes, and 2) Surplus values from Thornthwaite's water budget model. Measured river runoff at gauging stations along Highway 190 for

the Amite, Tickfaw, Natalbany, Tangipahoa, and Tchefuncte rivers will provide one component of freshwater input. For areas outside the gauged river basins, the Thornthwaite water budget model will be used to estimate the surplus water, hence, the ungauged fresh water input into Lake Pontchartrain. Actual evaporation and the change in soil moisture storage will be subtracted from precipitation to give the surplus for the ungauged uplands. The freshwater input into Lake Pontchartrain from the ungauged swamps, marshes, and lakes will be found by subtracting potential evaporation from precipitation.

Continuous monthly water budgets will be run for 9 precipitation stations: Covington, Slidell, N.O. Audubon, New Orleans AP, Reserve, Carville, Baton Rouge, Pine Grove, and Hammond. Thiessen polygons will be constructed to weight these 9 stations. Surplus values for each polygon will be multiplied by the proportion that polygon occupies of the ungauged area. Then the adjusted surplus values for each polygon will be added together to get the volume of freshwater input into Lake Pontchartrain from the ungauged area. Finally, the freshwater volume from the gauged area will be added to the volume of freshwater contributed by the ungauged area to find the total volume of freshwater inputed into Lake Pontchartrain for each month.

SURFACE DRIFT MOVEMENT OF LARVAL MARINE FISHES AND OTHER ORGANISMS THROUGH PASSES OF THE UPPER LAKE PONTCHARTRAIN ESTUARY

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The fish fauna occurring in the oligohaline upper Lake Pontchartrain estuary consists of about half freshwater species and half marine. Freshwater species are present throughout the year but most marine species are seasonal in their occurrence, leaving the upper estuary for the winter. A major influx of such species occurs in the spring as larvae and early juveniles. Surface plankton net sampling has been conducted to monitor patterns of movement for several fish species, such as bay anchovy (Anchoa mitchilli), gulf menhaden (Brevoortia patronus), gulf pipefish (Syngnathus scovelli), naked goby (Gobiosoma bosci), and tidewater silverside (Menidia beryllina), as well as several invertebrates such as blue crab (Callinectes sapidus). Samples have revealed significant seasonal, diel, and spatial patterns of occurrence for several species common in the estuary. Thus they may exercise significant control over their movements, even though they are small and appear to be poor swimmers. Although open waters of the upper estuary are clearly used as nursery habitats for such species, their use of enclosed marsh canals and bayous may be more limited. Studies are continuing to address such movement (or lack of movement) of small planktonic organisms into enclosed waters, and how diel variation in activity patterns affects their abundance in surface plankton samples.

NEW ORLEANS STORM FREQUENCIES AND STORM RUNOFF INTO LAKE PONTCHARTRAIN

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The large number of recent heavy rainstorms in New Orleans, Louisiana has raised concerns about changing frequencies and magnitudes of heavy rainfall in the area. A changing heavy rainfall climatology in New Orleans may have noteworthy impacts on Lake Pontchartrain water quality resulting from increasing urban runoff and changing salinity levels in the lake due to the delivery of large volumes of fresh water over short periods. As a result, this paper examines the temporal variability of New Orleans heavy rainfall events to evaluate the severity of recent storms with respect to the long-term climate record. Furthermore, the synoptic situations and seasonality associated with heavy rainfall in the area are also investigated.

Temporal analysis of nearly 90-years of storm frequencies are conducted on events in excess of 125 mm (5 inches). Two time periods (pre-1936 and post-1947), divided by a period of missing data, provide two time samples which are tested against one another. Despite enormous interannual variability, the mean annual number of storms in the city increased by over 20 percent between the two time periods. However, the t-test, Mann-Whitney test, and chi square test for goodness of fit leads us to conclude that there is no significant difference in the means, distribution locations, and frequency distributions of the two samples.

Changing magnitudes of storm rainfall in New Orleans is investigated through an examination of the annual maximum storm series since 1871 at the New Federal site located in downtown New Orleans. An annual maximum storm is defined as the largest storm (in terms of vertical water depth) of the calendar year. Although a significant long-term trend is not found in the time series, the Mann-Whitney test leads us to conclude that magnitudes since 1978 are significantly different from the preceding 107-year period.

Analysis of the synoptic situations of storm rainfall in excess of 125 mm (5 inches) found that 66 percent of all events recorded in New Orleans since 1900 were induced by frontal weather systems, 23 percent were classified as gulf tropical disturbances, and 11 percent were air mass thundershowers. Seasonality of events shows a bimodal tendency with peaks in April and September with minimal occurrences in July, August, and November through January.

BASELINE POLLUTANT DATA ON WATER COLUMN, SEDIMENT, AND BIVALVE TISSUE SAMPLES FROM THE INNER HARBOR NAVIGATION CANAL, CHEF MENTEUR PASS, AND THE RIGOLETS

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The Army Corps of Engineers, as part of an environmental impact statement addressing the Lake Pontchartrain and Vicinities Hurricane Protection Plan, initiated an investigation to determine seasonal and spatial distributions of pollutants in the water column, sediment, and tissues of selected bivalves of the Inner Harbor Navigation Canal, Chef Menteur Pass, and the Rigolets. This investigation was designed to include a methods development and design phase (Phase I) and an active sampling phase (Phase II). In Phase I, methods were developed, the three passes were screened for pollutants, and replicate samples were analyzed to determine the number of samples required to achieve reasonable analytical precision. Phase I culminated with the production of a sampling protocol report, which included various sampling options and tables relating number of samples to analytical precision. Phase II, which was designed to detect seasonal fluctuations and spatial occurrences of pollutants, was aborted when the hurricane barrier alternative of the Hurricane Protection Plan was abandoned. The first samples were collected for analysis in May of 1980. The data generated from these and subsequent analyses qualify as baseline data for these locations and matrices because the analyses were carried out under rigorous conditions of quality assurance and the analytical techniques employed were state-of-the-art. The major analytical effort was directed toward detecting and quantifying EPA designated "priority pollutants". In addition, organic fractions were routinely searched for compounds of probable anthropogenic origin. Water samples were analyzed for asbestos, heavy metals, base-neutral and acid extractable organics, organochlorine pesticides and polychlorinated biphenyls, volatile organics, acrolein and acrylonitrile, total cyanides, and total recoverable phenolics. Sediment samples and bivalve tissue samples from oysters (Crassostrea virginica) and clams (Rangia cuneata) were analyzed for heavy metals, total base-neutral extractable organics, individual base-neutral extractable organics, organochlorine pesticides and polychlorinated biphenyls, and volatile organics. The results of these analyses were compiled in seven data reports submitted to the Army Corps of Engineers in association with the Nutrient and Toxic Substance Chemistry of Chef Menteur Pass, the Rigolets, and Inner Harbor Navigation Canal, Lake Pontchartrain, Louisiana program. The results of dissolved inorganic nutrient analyses conducted on the water samples were included in the data reports. In addition, an annotated bibliography on the concentration and movement of nutrients in coastal passes and estuaries of the United States with special emphasis on Lake Pontchartrain was prepared.

POTENTIAL SIGNIFICANCE OF ACTIVE FAULTS IN LAKE PONTCHARTRAIN

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Examination of conventional seismic data collected in Lake Pontchartrain leads to the compelling conclusion that the eastward extension of the Baton Rouge-Denham Springs faults system is within Lake Pontchartrain and not as previously mapped on the northshore of the lake. The Pleistocene/Holocene contact previously mapped as faults on the north shore is probably a depositional contact. The faults within the lake are presently active as is the Baton Rouge/Denham Springs fault system. Evidence for recent movement on the faults within the lake is strongly indicated by offset of the bridges which cross the lake. Offset varies from 2 to 6.5 inches depending on the age of the bridge. Movement on the fault is approximately 1 inch per decade (.25 cm / year). Less detailed mapping shows the fault system extends into Chandeleur Sound. Thus the Baton Rouge-Denham Springs fault system is a regional basement fault system extending 120 miles from Baton Rouge to Chandeleur Sound. One of the probable effects of this fault system is to trigger small earthquakes, such as the 1987 Irish Bayou earthquake. Other historic earthquakes located 5 to 20 miles south of the fault trace may have also been related to the fault system. Past activity suggests that an earthquake hazard is minimal.

Other consequences or significant questions in relation to the active faults are: 1) The current high rate of movement on the faults is probably higher than in the geologic past. So why does movement on the faults appear to have accelerated in the Holocene? 2) The coincidence of the regional fault system within Lakes Maurepas, Borgne, and Pontchartrain suggests a genetic relationship. Do prior models for the formation of Lake Pontchartrain need to re-evaluated? 3) At least two significant studies of ground water aquifers in Lake Pontchartrain indicate that some of the faults do seal some of the aquifers. Since the faults are a series of discontinuous faults the hydraulic connection of fresh and saline aquifers is complex and probably intimately related to faulting in the lake. 4) The high rate of fault movement conflicts with the interpreted top of the Prairie Terrace accepted by most workers. Is the second weathered surface and not the first weathered surface in the lake truly the top of Prairie Terrace?

Some of these questions may be academic and others may have more civic significance, but all of these and others can be addressed with further basic research. Much can be gained by research efforts by greater exchange of data and ideas between professionals which generally operate in different institutional or commercial spheres.

LAKE PONTCHARTRAIN BASIN EVOLUTION: LATE PLEISTOCENE-HOLOCENE GEOLOGICAL HISTORY

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The Pleistocene sedimentary cycle that preceded Holocene evolution of the lake