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TECHNICAL REPORT

Water Quality and Natural Resource Monitoring Strategy for Coastal Alabama

March 1993

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
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WATER QUALITY AND NATURAL RESOURCE MONITORING STRATEGY FOR COASTAL ALABAMA

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I. INTRODUCTION

There has been a growing public perception that Alabama's coastal resources are continuing to deteriorate. This perception may be based on some fairly well documented indicators, such as loss of coastal wetlands and seagrasses, issuance of fish consumption advisories, and temporary closures of shellfish beds in Alabama. However, scientific evidence is not sufficient at this time to validate the perception. Coupled with this fact is a growing concern that existing monitoring programs may be inadequate. This concern stems from a wide range of questions, from the public wanting to know if it is safe to swim in the water, to state and federal programs needing to determine compliance with standards or regulations.

The need for, and role of, monitoring strategies and practices has been well chronicled (e.g. NRC, 1990; EPA, 1987) and should be taken into consideration during the development of monitoring programs. Historically, the ADEM's monitoring priorities have been oriented toward facility and/or standards compliance, and determined largely by regulatory mandate. This approach has resulted in the control of specific environmental pollutants, particularly those from large centralized sources. However, such focus provides insufficient data on the effects of pollutants and resultant environmental stress on a larger (i.e. ecosystem) scale. More recently, increasing efforts have been directed toward broader based ambient monitoring at both the state and federal levels with the general intent of detecting long-term trends in environmental quality.

The ultimate goal of this particular effort is to help insure the wise management of Alabama's coastal resources by improving the usefulness of monitoring information. Specifically, this report reviews existing monitoring programs and identifies potential improvements, reviews the status of monitoring technology and sets forth a strategy which, if properly implemented, will provide for better technical information. Intentionally, the report is limited in scope to those resources for which the ADEM has some management responsibility and authority (i.e. water and sediment quality, wetlands, submersed aquatic vegetation, etc.) The methods employed in designing the proposed strategy were adapted from, and closely follow, the works of the National Research Council (1990).

II. THE ROLE OF MONITORING

The role of monitoring in managing Alabama's coastal resources parallels the general role of any monitoring program, i.e. to provide the information needed to develop and set standards, determine compliance with regulations, enhance knowledge of Alabama's coastal ecosystems, evaluate the effectiveness of pollution abatement programs, and establish agency management priorities. Monitoring is an integral part of the regulatory, institutional and decision-making process that constitutes ADEM's coastal resource management program. For example, the results of sediment quality surveys conducted by Coastal Program staff are being utilized by the ADEM to help address the impacts from shipyard activities; efforts undertaken by Coastal Program staff to identify unauthorized solid waste disposal sites resulted in enforcement actions requiring clean-up and closure; water quality monitoring efforts have identified non-compliant discharges and provided information supporting the development of legislation to regulate marinas and discharges from boats, and enhanced both public and governmental knowledge of Alabama's coastal ecosystems.

Often it is difficult to discriminate between significant and insignificant ecosystem change, especially in the dynamic coastal environment. Also, discriminating between naturally occurring and anthropogenic change can be difficult, a factor which often makes absolute determinations impossible. An effective monitoring program cannot answer all questions regarding environmental quality, but if properly designed can provide the information necessary to answer specific questions with a known degree of certainty. With this in mind, an effective monitoring program must strive to clearly pose the questions to be answered, be well designed, periodically reviewed, and not set unrealistic expectations.

III. OVERVIEW OF OTHER COASTAL MONITORING PROGRAMS

Numerous other agencies, both State and Federal, and local citizen organizations working under State and University guidance and support are conducting monitoring within Alabama's coastal waters. As a part of this study, the ADEM evaluated these other monitoring programs to determine if they could positively contribute towards and be incorporated into this Department's monitoring

program. The incorporation of other available monitoring data into ADEM's program, to the extent that it is of usable quality, could result in a better coordinated program that eliminates unnecessary duplication and results in overall cost savings.

The remainder of this section provides a brief overview of existing Federal, State, and citizen monitoring programs.

FEDERAL MONITORING PROGRAMS

EMAP - U.S.E.P.A.'s Environmental Monitoring and Assessment Program

The EMAP program in the Louisianian Province (approximately the northern Gulf of Mexico) is designed to provide a quantitative assessment of the regional (Gulf-wide) extent of coastal environmental problems by measuring change in selected ecological indicators, through a wide array of parameters. The basic strategy employed is long-term probability-based sampling of indicators with known interpretability, emphasizing random sampling in estuarine waters with capability to quantify a twenty percent change in Province-wide conditions in ten years. Since EMAP is a regional program and is sampled on a basis that provides regional findings, application of its findings to smaller portions of the region significantly increases the uncertainties of the EMAP findings.

Sampling under this program was begun in 1991 and continued in 1992. The protocol is that sampling occurs only one time per year, during summer. In 1991, the EMAP sampled 198 sites in the Louisianian Province. Twenty-five of these sites were in coastal Alabama: eight base sampling sites; thirteen supplemental sampling sites to evaluate the benefits of a more intensive sampling grid; one indicator site to verify the reliability of indicators to discriminate between polluted and unpolluted environments; and four index sampling sites in small estuaries. Sampling continued in 1992 and will continue as funding is available.

Core indicators, measured by EPA through an array of parameters, include:

1) Benthic species composition and biomass.
2) Habitat indicators as follows: salinity; temperature; pH; sediment characteristics; and water depth.

3) Developmental indicators as follows:

- Sediment contaminant concentration;
- Sediment toxicity;
- Dissolved oxygen concentration;
- Contaminants in fish and shellfish tissue;
- Gross pathology of fish;
- Relative abundance of large burrowing bivalves;
- Aesthetic indicators, including flotsam, jetsam, odor, and water clarity; and
- Acreage of submersed aquatic vegetation and coastal wetlands.

4) Research indicators as follows:

- Fish community composition;
- Histopathology of fish populations; and
- Suborganismal indicators.

NATIONAL STATUS AND TRENDS PROGRAM FOR MARINE ENVIRONMENTAL QUALITY-NOAA

Through its National Status and Trends Program, NOAA's Office of Oceanography and Marine Assessment uses uniform techniques to monitor toxic chemical contamination of bottom-feeding fish, mussels and oysters, and sediments at coastal and estuarine sites throughout the United States. The program was begun to monitor spatial distributions and temporal trends of contaminant concentrations and biological responses to that contamination. Since 1984 the Benthic Surveillance Project has annually collected benthic fish and sediments at about 50 fixed sites throughout the USA. Since 1986, the Mussel Watch Project has collected mollusks (mussels or oysters) and sediments at about 150 fixed sites throughout the USA.

Chemical contaminants analyzed have included polyaromatic hydrocarbons, polychlorinated biphenyls, chlorinated pesticides, DDT and its metabolites, four major elements and twelve trace elements.

There are only two fixed sites in southwest Mobile Bay that have been sampled as part of this program.

STREAMFLOW DATA - U.S. GEOLOGICAL SURVEY

The USGS maintains a network of stream flow gaging stations. Some of these stations have a long period of record, such as the stations located on the Perdido River at Barrineau Park, Styx River near Loxley, and Fish River

near Silver Hill. Other stations are put in on a shorter term basis for particular studies. Flow records can be made available, and summary data on duration of daily discharge by class, highest and lowest mean discharge, lowest 7-day average flow, estimated 10-year 7-day low flow, and estimated 2-year 7-day low flow is available.

STATE MONITORING PROGRAMS

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, MARINE RESOURCES DIVISION (ADCNR-MRD)

The DCNR-MRD conducts quarterly sampling in Alabama coastal waters at two seine sites, seven beam plankton trawl sites, and nineteen standard trawl sites. In addition, a listing of 122 sites where DCNR-MRD has conducted sampling at various times for varying durations has been made available. Trawl catches are sorted and identified, then individually measured and weighed. Some water quality data is recorded at each station including salinity, water temperature, and dissolved oxygen. These data are obtained from bottom sampling. DCNR-MRD monitoring locations are illustrated on Figures 1, 2, and 3.

DEPARTMENT OF PUBLIC HEALTH, SEAFOOD BRANCH (ADPH)

The ADPH Seafood Branch conducts monitoring of oyster harvesting areas, all in coastal waters, on both a monthly and bi-monthly schedule during oyster harvest season which extends from September to May. The frequency of sampling depends on the oyster harvesting area. Areas I, II, III are monitored monthly. Area IV, corresponding roughly to the northwest third of Mobile Bay, is a harvest restricted area and is monitored bi-monthly. Sixty-one stations throughout Mobile Bay, Bon Secour Bay, Mississippi Sound, Portersville Bay, Grand Bay, Cedar Point Reef area, Weeks Bay, and Bon Secour River area are monitored. Water quality data recorded at each station include surface water temperature and salinity, and samples are taken for fecal coliform analysis. Also, oyster tissue samples are taken and analyzed for <u>E. coli</u> and <u>Vibrio cholera</u>. ADPH monitoring locations are illustrated on Figures 1, 2, and 3.

IV. EXISTING ADEM MONITORING PROGRAMS

Citizen Monitoring Program - Baywatch

The Baywatch citizen monitoring program was begun in

FIGURE 1

EXISTING STATE AGENCY AND CITIZEN MONITORING SITES IN COASTAL ALABAMA

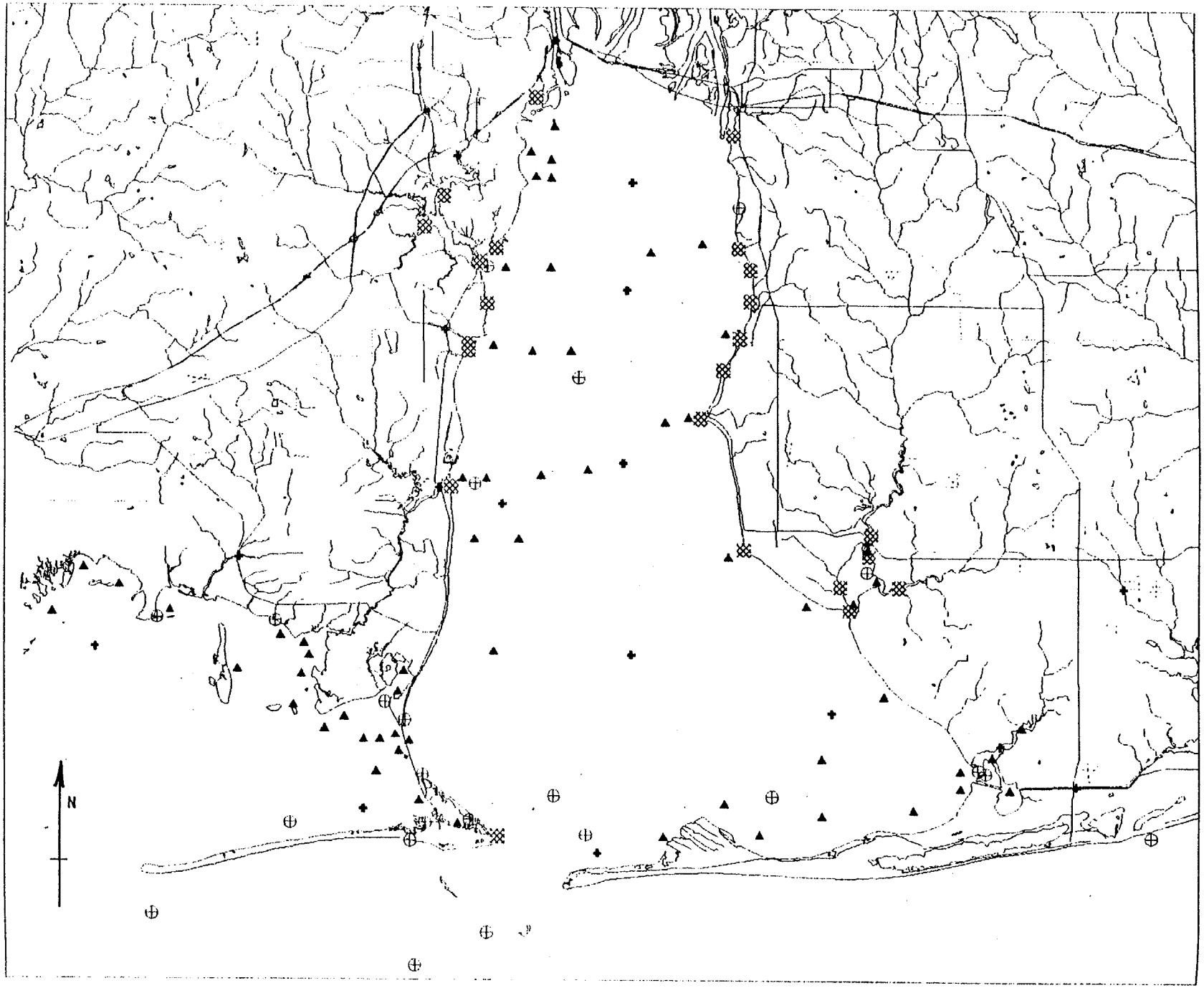


FIGURE 2
EXISTING STATE AGENCY AND CITIZEN MONITORING SITES IN COASTAL ALABAMA

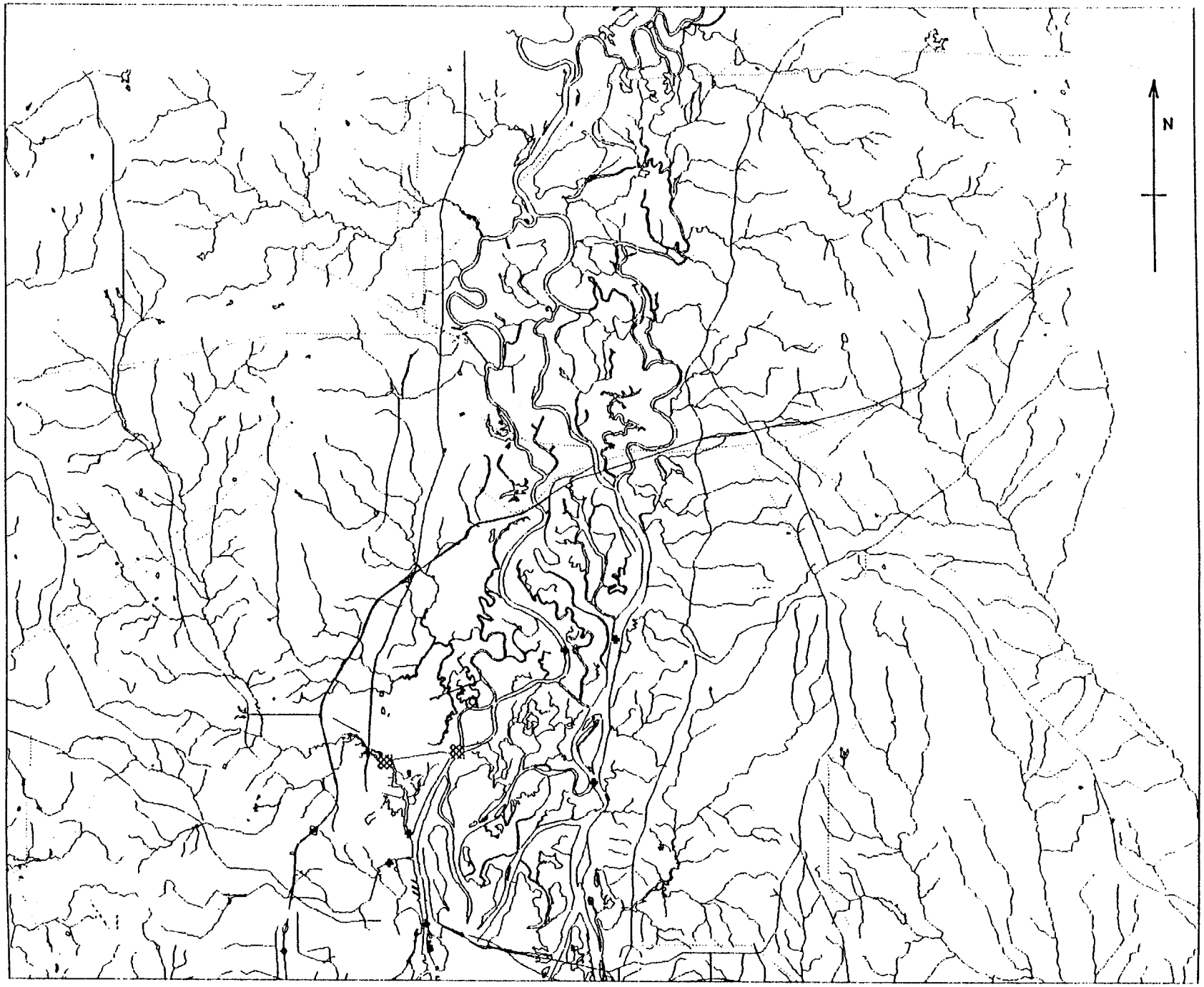
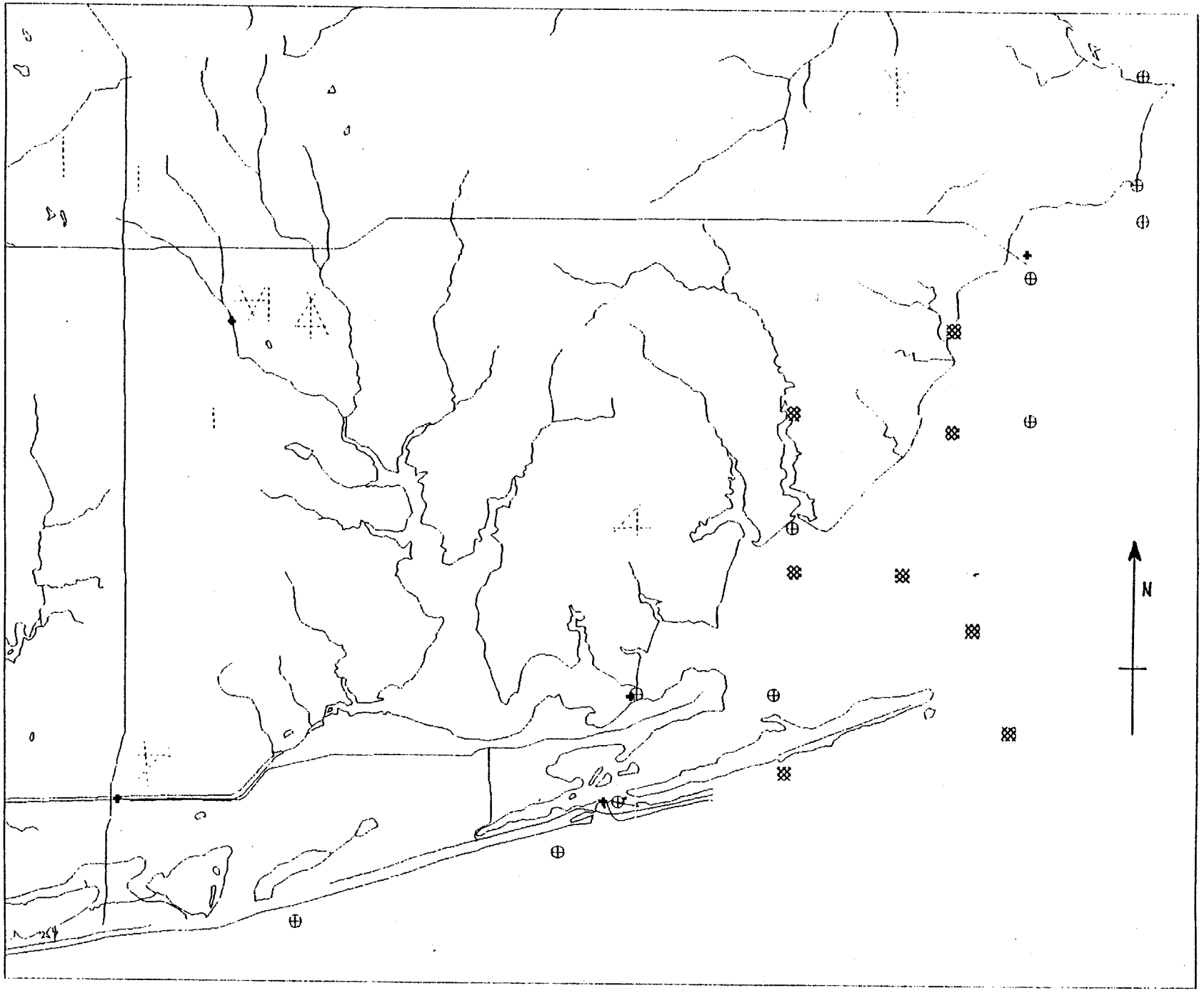


FIGURE 3
EXISTING STATE AGENCY AND CITIZEN MONITORING SITES IN COASTAL ALABAMA



October 1991 in response to citizen concerns regarding the environmental quality of Alabama's coastal waters. The program is actually an outgrowth and expansion of a program begun in 1989 in Perdido Bay called the Perdido Bay Citizen Monitoring Program. Monitoring stations are now located throughout the Alabama Coastal Area. During its first year of operation, Baywatch was run by the Dauphin Island Sea Lab, a research lab comprised of academic personnel from numerous universities, with the Alabama Department of Environmental Management serving a role as Project Director and Quality Control Coordinator.

Volunteers serve in one of three capacities; as dock monitors who sample from shore stations, boat monitors who sample in open water, and rainfall monitors who record daily rainfall amounts. Monitoring is conducted at thirteen monitoring sites in and around Perdido Bay; and at twenty-six monitoring sites in Mobile Bay, its tributaries, and the Mobile-Tensaw Delta. The following parameters are recorded: air temperature; surface water temperature; surface salinity; surface dissolved oxygen; secchi disk depth as a measure of light penetration; and rainfall at select locations. Baywatch monitoring locations are illustrated on Figures 1, 2, and 3.

IV. ADEM's Existing Coastal Monitoring Programs

Ambient Trend Monitoring

In response to a request by the U.S Environmental Protection Agency, states were asked to establish an ambient water quality network so that a nationwide water quality assessment could be made. Alabama established a network of fixed trend stations in 1974 to monitor the quality of the State's surface waters. It was believed that evaluating the results of monitoring on a monthly basis would enable the Department to evaluate short-term changes and/or long-term water quality trends, determine compliance of certain water bodies with stream standards, and measure progress towards achieving national water quality goals.

Fifty-three monitoring stations were established in Alabama in 1974 with eight of the fifty-three locations in Mobile and Baldwin Counties, Alabama's coastal counties. Since its establishment in 1974, Alabama has refined the ambient monitoring network by adding, deleting, or moving monitoring stations, and by supplementing parametric coverage. Since 1986, twenty-four monitoring sites have been added in Mobile and Baldwin Counties to increase monitoring coverage in coastal waters. Today, the Mobile

Branch Office of ADEM monitors water quality at thirty-two locations in Mobile and Baldwin Counties. Thirty of these stations are located in estuarine waters, and range from open bay sites to tidally influenced tributaries.

Each monitoring site is sampled monthly by the staff. Table 1 describes the location, parametric coverage, and denotes stations which are profiled on 0.5 meter intervals. Maps in Figures 1, 2, and 3 also illustrate monitoring site locations.

Fish Tissue Monitoring

In 1991 the ADEM began a five year effort to collect and analyze fish tissue from all major reservoirs and streams in Alabama. The initial emphasis of the program has been to sample freshwater lakes, rivers and streams. It is expected that as the program progresses into its second phase, that the coastal rivers and other estuarine waters will be sampled. This program was initiated in response to concerns surrounding bioaccumulative contaminants in fish and has set up a new sampling protocol to standardize and upgrade the program above previous like efforts conducted in the State. Parameters measured in the fish tissues collected include: PCB's; mercury; Chlordane total; DDT total (includes metabolites); Toxaphene (mixture); Dieldrin; Endrin; Heptachlor; Mirex; and Chlorpyrifos (Dursban).

Permitted Wastewater Discharge (NPDES) Monitoring

The ADEM issues permits, known as NPDES permits, for the discharge of treated wastewaters from industrial and municipal facilities to surface waters of the State. Personnel from the Mobile Branch Office conduct periodic, unannounced Compliance Sampling Inspections, which include monitoring of the discharge to determine 1) compliance with permit limitations, and 2) the validity of the facility's self-monitoring and reporting program. All facilities designated as major dischargers are inspected by the Department during the course of any year, however, not all of these inspections involve monitoring of the discharge. Many other facilities classified as minor dischargers are inspected as well. Approximately thirty-five to fifty-five facility inspections which include discharge monitoring are made by the Mobile Branch staff during the course of a year. Approximately 330 facilities are permitted to discharge to Alabama coastal waters.

Certain dischargers located within Alabama's Coastal Area are required to monitor the effects of their discharge on the living and non-living resources of the Coastal Area. Their NPDES permits are conditioned to require monitoring of their Discharge Information Zone (DIZ) so that compliance with the Department's Coastal Program regulations can be determined. Both water quality and living aquatic resources are monitored and reports are submitted to ADEM for review and analysis.

V. PROPOSED COASTAL RESOURCE MONITORING STRATEGY

The scope and complexity of coastal resource management issues are expanding rapidly. Managers now need more information on the occurrence and impact of anthropogenic influences to make management decisions. It is clear to ADEM that the many programmatic requirements for information can not be met by relying strictly on traditional monitoring programs. Based on the underlying premise that monitoring is crucial to the effective management of coastal resources, the Department is proposing a new, three-part monitoring strategy to consist of: watershed surveys, long-term trend monitoring and wetland and submersed aquatic vegetation (SAV) monitoring. The following sub-sections describe each of these proposed parts.

A. Watershed Surveys

The ultimate goal of (watershed) basin surveys will be to provide the preliminary information necessary to assess the status of the watershed and identify problems or use impairments in a form which facilitates effective protection and management of coastal resources.

Specific objectives for individual surveys may vary based on localized conditions but generally would include:

1. Gathering and reviewing existing information on water/sediment quality, wetland/SAV resources, existing land use, impaired and/or potentially beneficial uses;

2. Identify critical data gaps and collect additional information as appropriate;

3. Describe the basin or sub-basin and current status of coastal resources to include existing impairments and major factors contributing to problems;

4. Identify and prioritize the basin's (or sub-basin's) critical issues, use impairments and problem areas;

5. Develop indicators that, through continued monitoring, will be used to measure the success of the existing or future management/regulatory actions;

6. Prepare a basin characterization and status report for dissemination to, and use by, resource management agencies.

This systematic basin approach will replace some of the existing fixed monitoring stations within each waterway. Most of these fixed stations are not particularly well suited to assessment of non-point source pollution problems. Comparatively little monitoring is now aimed specifically at detecting problems and/or trends associated with non-point source pollution, wetland losses, etc., nor is the existing monitoring approach sensitive to differences between basins (i.e., urban vs. rural.) The resultant characterization reports will be useful in determining what relative emphasis should be placed on use and use controls, non-point source controls, on-going monitoring, wetlands protection efforts, etc., in order to make the greatest contribution, in the most economically efficient manner, toward solving the priority issues in each basin.

The first step toward implementing this approach is to develop a prototype survey and test the methodologies to insure that the survey objectives can be met. This has been funded by NOAA-OCRM and is scheduled for fiscal year 1993. Following verification of the prototype, surveys will be scheduled and conducted during subsequent years, pending the availability of funding. It should be noted that the uncertainties associated with the various funding mechanisms is the biggest continuing threat to any long-term monitoring strategy. Funding for full implementation of this portion of the proposed strategy will be sought primarily from NOAA-OCRM, through sections 306, 309 and 6217, with the State providing matching funds.

B. Long-term Trend Monitoring

ADEM conducted a series of interviews with Departmental personnel who are current or potential users of coastal resource monitoring data. The purpose of these interviews was to determine what questions needed to be answered by a monitoring effort, thereby giving guidance to be used in establishing goals, setting objectives, and ultimately to

design a higher quality and more usable Departmental monitoring program than that which currently exists. The process resulted in the identification of the following goal: Implement a long-term monitoring program with data acquisition and analysis sufficient in quality and number to identify long-term trends in the environmental quality of the larger bodies of water in coastal Alabama.

The objectives of this long-term monitoring program are the following:

- Identify both temporal and spatial trends in living and non-living aquatic resources.
- Generate data suitable for inclusion in Departmental 305(b) reports to Congress, sufficient to provide summary statistics on designated use support (particularly for those waterbodies that are fishable and swimmable), to identify the cause category for waters not fully supporting uses, and to identify areas affected by elevated levels of toxicants in sediments, water column, and fish tissue.
- Provide water quality data suitable for water quality planning purposes by its incorporation into Departmental models.
- Provide background data from various media (water, sediment, biota, etc.) to help support the development and/or revision of standards or regulations for sediment criteria, biocriteria, and others.
- Provide data to help identify and quantify cumulative impacts.
- Maintain "core" sampling stations to provide a continuous long-term monitoring program at original EPA sites.
- Identify "hot-spots" warranting additional study.
- Assess the adequacy of regulatory controls.
- Provide data that can be used to assure the public that environmental standards are being met and that their waters are truly "fishable and swimmable".
- Indicate whether and to what extent additional information is required.
- Provide data to which other Gulf Coast environments can be compared.
- Provide background concentrations of various pollutants for use in developing water quality based permit limits.

As discussed previously in Section III, ADEM evaluated other water-related monitoring programs currently being

TABLE 1. ADEM'S AMBIENT SURFACE WATER MONITORING PROGRAM IN MOBILE AND BALDWIN COUNTIES.

LOCATION	STATION	0.5 M PROFILE	BOD5	COD	NO3-N	TKN	CL-	TSS	TDS	VSS	ALK	HARD	PO4-P	COND	TURB	SAL	NH3-N	FECAL	CN-	CHL-a	TOC	D.O.	AIR TEMP	WATER TEMP	pH
BAYOU LA BATRE	BLB1	N	X		X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
BON SECOUR R.	BS1	N	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X			X	X	X	X
CHICKASAW CK.	CS1	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X	X	X	X
CHICKASAW CK.	CS2	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X	X	X	X
DOG RIVER	DR1	N	X		X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
ESCATAWPA R.	E1	N	X		X		X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
FOWL R.	FR1	N	X		X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
HOLLINGERS CK.	HO1	N	X		X		X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
MOBILE R.	MO1A	N	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X			X	X	X	X
MOBILE R.	MO2	N	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
TENSAW R.	TE1	N	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
TENSAW R.	TE2	N	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
THEODORE IND. CAN.	TC1	N	X		X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
THREE MILE CK.	TM1	N	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
WEEKS BAY	WB1	N	X		X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
WOLF CK.	WO1A	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X
HOG BAYOU	HB1	N	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
FISH RIVER	FI1	N	X		X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X
MISSISSIPPI SOUND	MB1	Y	X		X	X	X	X	X		X		X	X	X	X		X	X			X	X	X	X
MOBILE BAY	MB2	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
BON SECOUR BAY	MB3	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
MOBILE BAY	MB4	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
MOBILE BAY	MB5	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
MOBILE BAY	MB6	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
MOBILE BAY	MB7	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
MOBILE BAY	MB8	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
MOBILE BAY	MB9	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
GRAND BAY	GB1	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
PERDIDO BAY	PB1	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
INTRACOASTAL WW	IC1	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
INTRACOASTAL WW	IC2	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X
ALABAMA POINT	AP1	Y	X		X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X

LOCATION	STATION	PROFILE	BOD5	COD	NO3-N	TKN	CL-	TSS	TDS	VSS	ALK	HARD	PO4-P	COND	TURB	SAL	NH3-N	FECAL	CN-	CHL-a	TOC	D.O.	AIR TEMP	WATER TEMP	pH

implemented in coastal Alabama. Through the course of this grant period, ADEM personnel have met and shared data with EMAP personnel to assess the applicability of this methodology. Portions of ADEM's current monitoring program have been evaluated to determine the representativeness of the sample locations. It was found that the EMAP concept of probability based sampling to identify trends, measuring change in selected ecological indicators of known interpretability, could be tailored to meet the goal and objectives mentioned above.

ADEM proposes to initiate a revised long-term trend monitoring program which will focus on the larger, mostly estuarine, receiving bodies of water within Alabama's Coastal Area, including Mobile Bay, Bon Secour Bay, Mississippi Sound, Wolf Bay and Bay La Launch, Perdido Bay and Bayou St. John, Little Lagoon, and the Mobile-Tensaw River Delta. River stations and randomly selected stations from the afore-mentioned open waterbodies will be chosen with consideration given to subareas having different Water Use Classifications, as defined by ADEM Administrative Code R. 335-6-1. For instance, within Mobile Bay there are four subareas having different Water Use Classifications. The northwest corner is use classified as Fish and Wildlife, south and east of that area is use classified Swimming and Other Whole-Body Water-Contact Sports and Fish and Wildlife, south of that area is use classified Shellfish Harvesting and Fish and Wildlife, and the southeastern fourth of the Bay is use classified Shellfish Harvesting, Swimming and Other Whole Body Water-Contact Sports, and Fish and Wildlife. Every waterbody is use classified. Every water use classification has different standards for water quality that apply to the waters classified as such.

Existing core stations will be maintained and sampled for the same parameters traditionally monitored (See Table 1.) At Delta river stations and randomly selected stations, environmental indicators will be chosen that support achievement of the objectives of this segment of the monitoring program, as mentioned above. These indicators will be measured by a wide array of parameters. Monitoring data from other agencies, as discussed in Part III of this report, will be incorporated. Further, it is envisioned that agreements will be made with other agencies for the sharing of data and perhaps for collection of additional data to take advantage of their sampling presence and minimizing duplication of effort. Since the bulk of this proposed monitoring program is adapted from the EMAP program and

the methodologies are consistent, it is envisioned that both ADEM's and EMAP's data will be compatible and provide benefit to both State and Federal monitoring efforts by increasing the scale of coverage. However, this will be a local program having geographic boundaries that are more meaningful for resource management at the state/local level.

Potential indicators, as measured by a wide array of parameters, include the following:

Water column chemistry and bacteriological analyses;
Sediment character, chemical analyses, and bioassay;
Benthic community structure;
Fish tissue analyses and gross pathology;
Invertebrate tissue analyses.

The frequency with which each of the indicator groups of parameters is monitored, as well as which parameters are monitored, will depend on the water use classification for the waterbody, or subarea, being sampled and funding availability. Initial proposals were made to the US EPA for fiscal year 1993 funding to develop and test this long-term monitoring program. Though funding was not secured, the proposal will be resubmitted. Funding for full implementation will be sought primarily from the US EPA through its Regional Environmental Monitoring and Assessment Program.

Projected work products resulting from the monitoring effort include resource data entered into Federal and Departmental databases, with annual data summary reports. Since the goal of the long-term monitoring program is to identify long-term trends in the water-related quality of Alabama's larger estuarine waterbodies, a five year data summary and detailed trend analysis report will be prepared for submission to the Department's Water Division and Coastal Program, thereby making the results available for further program-related analysis and use.

C. Wetland and Submersed Aquatic Vegetation (SAV) Monitoring

No coastal environmental trends analysis would be complete without a review of the available status and trends of the wetland and SAV resources which are among the most valued assets of the coastal area. Following is a brief discussion of each of these resources in terms of the available status and trends data, the questions which need to be answered regarding their status and trends, and

comments as to possible involvement of Alabama's Coastal Program in gathering data and addressing status and trends questions.

Wetlands

Exact estimates of the wetland acreage within the Coastal Area of Alabama are difficult to glean from the literature available on that subject with the exception of the publication "Wetland Habitats of the Alabama Coastal Zone". This publication was prepared by the Alabama Marine Environmental Sciences Consortium in 1981 for the Alabama Coastal Area Board. Estimates given in this document include 51,282 acres of forested wetlands and 14,638 acres of emergent wetlands which includes both salt and freshwater marsh.

Another publication of interest regarding coastal wetlands is the "Alabama Coastal Region Ecological Characterization - 2. A Synthesis of Environmental Data" published by the Geological Survey of Alabama in 1982. This publication contains a discussion of marshes and forested wetlands which includes a table of acreage estimates of tidal marshes. Three sources are cited in the table from the early to mid-seventies which give acreage figures ranging from 28,224 acres to 34,614 acres. These areas exceed those estimates given in the MESC publication noted above by a large margin. It is not clear whether the difference indicates losses or conversions of this type wetland or if the differences merely represent disparities in the geographical areas considered or the defining characteristics used.

There is a project being developed, primarily under the EPA Gulf of Mexico Program, which is entitled "Mobile Bay Demonstration Project". The major focus of this project is identification and mapping of wetland types in the Mobile Bay area using U.S. Fish and Wildlife Service photography from three time periods between 1958 and 1988. Wetlands are to be identified from the photographs using a computer scanning technique and mapped in digital form for use in a geographic information system. Objectives of the study are to be able to determine wetland acreages and types and to allow characterization of changes noted over time. The changes of course would be in terms of losses and conversions of wetlands from one type to another. The project should now be complete and it is hoped that access to the system will be provided to potential users soon.

In order to effectively manage the wetlands in Alabama's Coastal Area, the Coastal Program must be able to collect data on wetland acreages and determine trends in losses and conversions on a geographic location basis. Questions must be answered as to where losses and conversions are occurring and causes of these changes must be identified. If detrimental changes are found to be due to natural causes such as erosion, subsidence, or sea level rise, the Coastal Program will need to seek ways to reduce the impacts associated with these causes and search for opportunities to replace the lost resources.

Wetland impacts or losses in the coastal area associated with human activities should be controllable through the existing Coastal Program regulations. The Department utilizes its review and certification authority over §404 wetland fill permits administered through the Mobile District Corps of Engineers to minimize wetland losses. Where wetland losses are permitted, compensation is sought through mitigation, which results in creation or restoration of wetlands at an area ratio of at least 1.5:1. Policies on wetland fill are continuously reviewed and strengthened where necessary.

If access can be gained to the GIS from the Mobile Bay demonstration project, the Coastal Program could make use of the resultant maps to assist in the development of a long-term monitoring strategy for wetlands using aerial overflights. This would need to be done in an organized and systematic manner whereby predetermined transects were flown and photographs made of the surface below. Photos could then be compared to the digitized maps to determine wetland losses. In order to assess conversion of wetland types, a periodic overall survey such as that conducted for the Mobile Bay demonstration project would be necessary. Due to the size and expense of such an undertaking, it would likely be done infrequently, such as every five to ten years.

ADEM is currently developing a computer database with a latitude and longitude field for tracking of wetland projects under the Corps of Engineers §404 permitting system. This database will allow trends in wetland fill permitted under this program to be monitored. Monitoring of permitted activities to insure compliance with permit conditions by U.S. COE, ADEM and other resource agencies is estimated at <1% and normally results from complaints and reports from citizens. Unpermitted activities often escape detection until irreparable harm has resulted and currently are not routinely monitored for.

ADEM is currently in the process of negotiating for funding under ss309, from NOAA-OCRM through ADECA, to fully develop a detailed wetland/SAV monitoring effort. Routine overflights of the coastal area to detect unpermitted activities and a commitment to follow-up inspections by project type and/or size are anticipated. Additionally, ADECA work currently in progress will hopefully result in increased detection of unpermitted activities by other resource agencies.

Submersed Grassbeds

Submersed grassbeds were surveyed as a component of the MESC's publication on Wetland Habitats of the Alabama Coastal Zone (1981). That survey indicated that there were 21 species of grasses present wich covered 2,763 acres in the Coastal Area. Most of these grassbeds were located in quiet shallow waters of less than 2 meters depth. Surveys dating back to 1957 are noted in the literature which indicate that more than 12,000 acres of submersed grassbeds may have been present at one time in the past.

Much variability appears to have been documented over the years in terms of species distribution and area coverage of these beds. This variability is attributed to certain water quality parameters such as turbidity and salinity, and also to destruction caused by boat traffic, channel construction and maintenance, and waterbottom fill. Some impacts may also be due to subtle changes in water color caused by certain types of pollutant discharges and/or due to shading from pile supported structures such as piers walkways, and boathouses.

In order for the resource to be managed, the major causes of the changes must be identified. Once these are determined, efforts can be made to determine what the most effective and reasonable methods are to prevent the declines caused by human activity. Efforts to develop techniques for planting and re-establishing certain species of grasses have been supported under Alabama's Coastal Program, however, questions still remain regarding the general applicability of this research in terms of requiring re-establishment of grassbeds as mitigation when an activity has been conducted which damages or destroys an existing bed.

A complete and current survey of submersed grassbeds needs to be conducted and published by a qualified professional in this field. This would be an exceptional asset for

permit reviewers who need to know when or where to consider a proposed project's potential impacts to grassbeds. Also, if possible, the survey should address areas which historically had grassbeds and are now bare, but appear to be capable of supporting grassbeds and may be candidate sites for re-introduction.

As the CZM grant recipient in Alabama, ADECA will be encouraged to seek OCRM funding to accomplish this much needed survey.

VI. ADDITIONAL RESOURCE DATA NEEDS

The proposed strategy has intentionally been focused on the information needs relating to those coastal resources for which ADEM has primary management authority (i.e., water quality, wetlands/SAV, etc.). However, through the ACAMP the Department has an opportunity to assist in the management of other coastal resources by insuring that permitted activities do not result in the destruction of "present-levels" of these resources. In order for the Department to be able to determine a project's potential impacts, certain basic information is necessary.

The following subsections discuss these needs in more detail.

Oyster Reefs

The oyster industry in Alabama has historically been based on oysters harvested from a few public reefs located in the lower end of Mobile Bay and in the Mississippi Sound. Large changes in the volume of oysters harvested from these reefs have been documented over the years with some of the poorest years being those in the late eighties. The three major factors influencing the oyster have been extremes in freshwater inflow, occasional problems of overharvesting, and restrictions on harvesting resulting from high fecal coliform counts and presence of certain strains of the cholera bacteria.

Public oyster reefs were surveyed and mapped in 1971 by the Alabama Department of Conservation and Natural Resources - Marine Resources Division and published in an atlas form. This atlas has been used for many years by permit reviewers as a means of determining when projects should address impacts to oysters in our coastal area. Recent efforts by the Marine Resources Division to develop an oyster management plan in cooperation with area oystermen brought to light a strong belief on some of the

oystermen's part that the atlas is no longer accurate and they believe that a complete new survey is warranted.

The Marine Resources Division and the Alabama Department of Public Health work very diligently to protect the resource from overharvesting and to insure that the oysters are safe to eat so that public perception of locally harvested oysters does not degrade. These management services are provided with little or no direct funding from the industry in terms of license fees. Recent license revenues were reported to be on the order of $10,000 per year. Occasionally, monies are appropriated directly by the state legislature for planting of oyster shell on the public reefs to enhance the reef's ability to attract and hold oysters. One recent appropriation was in the amount of $400,000. There are two major questions which need to be addressed concerning this resource: 1) How can the number of closures due to high fecal coliform bacteria counts be reduced; and 2) Is the existing atlas of oyster reefs too inaccurate to be usable as a management tool?

In addressing the first question, we must attempt to identify the source(s) and evaluate corrective actions in terms of cost, technical feasibility, effectiveness and chance of success. Detection of bacterial sources may be accomplished through the watershed surveys and facility monitoring programs. The Coastal Program should also track long-term water quality trends in terms of fecal coliform concentrations and assist in identification of fecal coliform sources and evaluation of corrective actions needed to adequately control those sources. Alabama's Coastal Program should continue to work with the agencies charged with managing this resource to ensure that the permitting activities of the Coastal Program do not result in adverse impacts to the resource and to provide technical and financial support to their efforts if possible.

In order for the coastal permitting staff to effectively prevent impacts to oyster reefs, it is imperative that reliable information of the geographical coverage of reefs be available. Therefore, the oyster atlas which has come under fire should be updated or another mechanism for insuring that public reefs are protected needs to be developed. Funding for the atlas may be sought in part from OCRM, but the Alabama Department of Conservation and Natural Resources (ADCNR) should bear a portion of the cost. An alternative would be to have ADCNR review all projects in Mobile Bay and other oyster waters and supply

ADEM with a determination regarding impacts. This information could then be used in the permit review and certification process to develop conditions designed to protect the oyster resource. Such an arrangement could be formalized under a memorandum of agreement between ADEM and ADCNR.