Project No. 90-18

October 1990

ALBEMARLE-PAMLICO ESTUARINE STUDY

PROJECT ABSTRACTS FOR FISCAL YEAR 1989 AND FISCAL YEAR 1990

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PROJECT ABSTRACTS FOR THE PERIOD 1989-1991

This is the third year the Albemarle-Pamlico Estuarine Study has compiled project abstracts as a supplement to the Annual Researchers' Review Workshop. The report is a compilation of project abstracts covering the period from 1989 to 1991. The period includes most funded projects during fiscal years 1989-1990 and 1990-1991. Abstracts are organized according to the six categories of information required to facilitate effective management of the program. These categories include resource critical areas, information management, fisheries, public participation, water quality, and human environment.

The resource critical area category includes projects designed to identify specific areas where conflicts between affecting and affected uses are most significant. Projects designed to reduce those conflicts by effective management of these critical areas are also included. Information management efforts will be to provide users with access to data that will aid in addressing the issues associated with each category. The ability to effectively manage the data will be critical to the program's success. Fisheries category consists of projects intended to relate major changes in fisheries health and productivity to human activities. The fisheries processes are isolated from other estuarine relationships because of two specific fishing-related phenomena of declining landings and fish diseases which require special attention. Water quality category includes projects designed to examine the causal relationships between human activities, significant in-stream modifications and the ramifications of changes for estuarine-dependent human activities. This category includes management-oriented investigations of major water quality processes and conflicts. Public Participation is being addressed by an active public participation/public awareness program. Participation is intended to facilitate communication between the public and program administration; to marshal support from local governments and regional institutions; and to allow dissemination of information gathered through this study. The success of this first phase of the program (develop a comprehensive conservation management plan) will determine whether the second phase (implementation of the comprehensive conservation management plan) will become a reality. The final category of human environment involves projects which examine the trends and patterns in the intensity of human uses and the institutional climate where management plans must operate.

These six categories of information gathering and dissemination must be pursued for effective management to take place. There must be an improved understanding of causal connections between human activities and changes in the estuaries for proper management pressure to be exerted on critical relationships in order to reduce conflicts between competing uses.

Critical Area

PROJECT ABSTRACT

HYDE COUNTY SOIL SURVEY

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DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES

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The Hyde County soil survey is of primary importance to APES as a source of scientific data. Soils information is necessary for evaluating environmental impacts of land uses and supports studies and research relating to hydrologic or nonpoint source pollution modeling. The soils inventory is useful in identifying special resource values such as wetlands and critical areas. The survey will serve as a technical guide to landowners, government agencies and others to minimize adverse impacts of land uses, support the best use of soil resources and promote conservation activities.

The Hyde County soil survey is being accomplished through the Cooperative Soil Survey Program. This program requires soil classification according to the national soil taxonomy system and follows standards and criteria established in the USDA National Soils Handbook 1983. Mapping is by trained and experienced DEHNR and SCS soil scientists. Mapping is done in the field and involves inspection by hand augering, observation of landscapes and vegetation and pH determinations. Laboratory analysis of various physical and chemical soil properties supports the mapping and classification. Mapping is compiled on aerial photography 1 to 24,000 scale.

Progress on the survey as of June 30, 1990 includes completed mapping on 236,055 of the county's 393,545 acres. The soil scientists are mapping 33 soil series in the county. Preliminary field sheets on mapped acres are currently available at the Soil and Water Conservation District office in Swan Quarter. The anticipated date for completion of field work is September, 1991.

PROJECT ABSTRACT

Regional Inventory for Critical Natural Areas, Wetland Ecosystems, and Endangered Species Habitats of the Albemarle-Pamlico Estuarine Region: Phase 2

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The rapid development of North Carolina's coastal and tidewater regions has caused an urgent need to protect significant natural resources in this part of the state. However, before protection of natural resources and natural areas can be accomplished, it is important to have background information about these resources, such as locations of endangered and rare species and deliniation and description of critical natural areas. The North Carolina Nature Preserves Act delegates responsibilities to the Natural Heritage Program for maintaining the statewide inventory of important natural areas and rare species habitats.

Funding from APES in 1989 allowed for a reconnaissance inventory to identify, describe, map, prioritize, and make protection recommendations for special natural areas, exceptional wetland ecosystems, and endangered and rare species habitats in ten counties adjacent to Albemarle Sound. Additional funding from APES in 1990 is providing for a similar inventory of seven counties in the vicinity of Pamlico Sound -- Beaufort, Carteret, Craven, Hyde, Jones, Pamlico, and Pitt. Biologists contracted by the Natural Heritage Program have consulted other biologists familiar with these counties, in addition to reviewing soil maps, topographic maps, aerial photos, and other sources to determine sites for survey work that appear to contain significant or critical natural resources.

At least 290 sites have been identified from these various sources during the preliminary screening. Some sites will likely not be visited because of time constraints, and others will be visited and found to lack sufficient biological significance to be included in the final report. It is expected that perhaps 100 of these sites will be described in the report.

The final report will be a compilation of critical natural areas, both those already under protection and those lacking protection, in addition to discussions of endangered and rare species, wetland ecosystems and other natural communities, and the geomorphology of the 7-county region. Data from the project will be recorded in the Natural Heritage Program's central inventory management system, which is used by many other agencies for environmental impact assessment, land use planning, resource management decisions, and conservation planning.

PROJECT ABSTRACT

Mapping and GIS Implementation of Land Use and Land Cover Categories for the Albemarle-Pamlico Estuarine Study

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Department of Environment, Health & Natural Resources

Siamak Khorram
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North Carolina State University

The objectives of this project are to develop a current digital land use inventory of the A/P Study drainage area; to integrate these data into the A/P Study database; and to develop mechanisms for maintaining and updating the land use and land cover data. The goal of the project is to provide base-line data on the area's resources in a form usable by scientists and decision makers to facilitate research and management activities.

Data from portions of five Landsat Thematic Mapper (TM) scenes are being analyzed to develop an inventory for the entire study area. The scenes cover the following general areas:

A - Neuse River Estuary and surrounding area
B - Albemarle Sound, Currituck and Dare counties
C - Middle Coastal Plain to Piedmont North Carolina
D - Virginia (northernmost portion of drainage area)
E - Piedmont surrounding Raleigh

Data are being classified according to a modified Level II classification scheme. The datasets are being spatially registered and integrated with the other data layers in the A/P Study database. Upon completion the data will be available to investigators in a standard data exchange format and will be accessible for use in the A/P Study's geographic information system.

DELINEATION OF SUBMERGED AQUATIC VEGETATION HABITAT IN CURRITUCK, ALBEMARLE AND PAMLICO SOUNDS, N. C.

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Submerged aquatic vegetation, SAV, establishes extensive, critical and vulnerable habitat in the shallow sounds of eastern North Carolina. Best estimates of total SAV habitat (including marine and brackish water areas) are on the order of 200,000 acres. SAV habitat is critical nursery for a wide variety of commercially and recreationally exploited species of fish, shellfish, and waterfowl. SAV habitat also calms the water, filters suspended material out of the water and stabilizes sediments. SAV habitat is, however, vulnerable to: removal, or burial caused by dredge and fill activities; direct physical damage caused by careless boaters, trawlers or mechanical clam harvesters; and indirect damage resulting from excessive turbidity, eutrophication or changing patterns of salinity in our coastal waters. Although conservation and management agencies require knowledge of the location and extent of SAV, there is no comprehensive inventory of SAV in North Carolina at the present time.

This research will inventory SAV in Currituck, Albemarle and western Pamlico Sounds. Conventional color aerial photography at a scale of 1:18,000 is taken by NOAA's Photogrammetry Branch under conditions optimal for visualization of SAV. This photography is interpreted in our laboratory for SAV habitat and compiled on USGS 1:24,000 topographic quadrangles. Photointerpretation is quality assured by extensive surface level survey work during the photographic mission and subsequent to examination of the photography. North Carolina's Center for Geographic Information and Analysis, digitizes the SAV data and generates data summaries and computer map products. Photography and field work are ongoing in Currituck and Albemarle Sounds at the present time (September and October, 1990). Data and maps will be available through CGIA in the fall, 1991. If funds are available, work on western Pamlico Sound will be initiated next year.

Data Management

PROJECT ABSTRACT

INFORMATION MANAGEMENT

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The Center for Geographic Information & Analysis (CGIA), formerly Land Resources Information Service, is carrying out the information management portion of the A/P Study. CGIA operates a geographic information system (GIS) for the State of North Carolina and is using the system to support the A/P Study.

CGIA completed a comprehensive user needs assessment for the A/P Study. The purpose of the assessment was to identify, prioritize, and document the data and software needs of resource managers and researchers. A document, entitled Data Requirements Document, describes 64 cartographic data layers and 60 tabular datasets that comprise the A/P Study database. Many of the data layers are complete and stored in the GIS. Progress continues on completing other data layers. Another document, the Data Inventory, was also prepared as a result of the user needs assessment. This document describes all of the known data holdings for the A/P Study area including reports, aerial photography, and other digital and non-digital datasets.

The software needs of researchers and resource managers are documented in the Functional Description. This document presents the overall functionality required of the GIS and the needs for specialized custom software.

CGIA is supporting the A/P Study by developing and maintaining the data base; preparing needed software; answering data requests from users; providing GIS services to A/P Study research projects; providing information for the Status and Trends Report; and evaluating use of GIS to support future alternative management options.

Early Demonstration

PROJECT ABSTRACT

Early Demonstration/Implementation Project for the
Albemarle Pamlico Estuarine Study

Merchants Millpond
Upper Bennett's Creek Watershed, Gates County

Jim Cummings & Sandi Horton
Nonpoint Source Section
Division of Soil & Water Conservation
Department of Environment, Health & Natural Resources

Dennis Utt, Gates Soil & Water Conservation District

Merchants Millpond is a state-owned park in Gates County, North Carolina. The northern coastal plain watershed (Bennett's Creek) flows into the Chowan River. Typical water depths of the pond are less than two meters and aquatic populations of duck weed, elodea, parrotfeather, etc., are very high. The 60 square miles of drainage for the pond are predominantly forestland. There are over 300 farming operations in the watershed and 30 percent are supporting confined animal operations. Ranged hogs continue to be common place in the wetland areas of Duke Swamp, Middle Swamp and Lassiter Swamp.

For Decades the millpond has served as a trap for sediments, fertilizers, and animal wastes that were washed from agricultural operations upstream. Aquatic plants have thrived in the over-enriched pond and populations are now so dense that recreational uses of the lake are impaired. The APES project was designed to demonstrate that with adequate incentives and adequate supportive technical assistance Best Management Practices (BMP's) would be installed by landowners so that the accelerated over-enrichment of the pond would cease. Many BMP's would be used; including animal waste management systems and sediment and nutrient control practices. Some BMP's to be used were untested and unconventional but would hopefully demonstrate practical methods of managing animal wastes and croplands to protect water quality.

Key elements in the study are funds for additional technical assistance to agricultural operators and for monitoring studies conducted on untested and unconventional BMP's. Cost-sharing incentives to operators who will install conventional as well as unconventional BMP's, and public information programs to inform the farming community on the effects of nonpoint source pollution and how they can help with water quality pollution reduction are key elements in achieving operator participation in the APES project.

PROJECT ABSTRACT

Marsh Grass Protection with Low-Cost Breakwaters
Shoreline Erosion Control Demonstration

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Previous work has shown that a combination of low-cost wooden breakwaters and planted marsh grasses can effectively control erosion along many miles of estuarine shoreline at a substantially lower cost to the owner than bulkheading. By creating fringing marshes on eroding sand beaches, the estuary is benefited by increased primary nursery areas, enhanced capabilities for filtering of upland runoff prior to reaching surface waters particularly around shellfishing areas already being degraded by nonpoint pollution runoff; and improved water quality by reducing sediment and nutrient loading. Property owners, if convinced the method is reliable, should be attracted to the low cost while at the same time creating fringing marshes along exposed shorelines where marshes cannot presently exist. The method can also be used to reduce habitat losses along marshes with high erosion rates. It is proposed to design and construct at least five demonstration projects around the study area, which will convince landowners of the method's reliability and train marine contractors how to build the breakwater and marsh.

As with all erosion control methods, the marsh grass/breakwater method will not be effective in all situations. However, under appropriate conditions, this method appears to offer an environmental enhancement to the estuary as it controls the shoreline erosion threat. It does all this at half the cost when compared to traditional methods (bulkheads) that offer few, if any, environmental advantages. Potentially, several hundred miles of shoreline in the Albemarle/Pamlico system appear to have appropriate conditions for use of the method, Applications at the national level is potentially far greater.

If the effectiveness of the marsh grass/breakwater can be demonstrated to property owners, its low cost will allow it to become the erosion control method of choice on many shorelines. Property owners will then have an incentive to control marsh habitat loss or in many cases new productive marshes and pollution from surface runoff into the sounds.

Fisheries

FOOD AND FEEDING OF LARVAL FISHES IN THE LOWER ROANOKE RIVER AND WESTERN ALBEMARLE SOUND, NORTH CAROLINA

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Studies conducted on the early life history of striped bass in the lower Roanoke River and western Albemarle Sound since 1982 indicate that the food base may not be adequate for good survival of the young. Zooplankton abundance in critical habitat areas of the lower River and Sound is quite low relative to other watersheds containing striped bass larvae. In addition, zooplankton are not uniformly distributed throughout the system but are concentrated only in specific locations, which appears to be dependent on the prevailing river flow. Poor feeding success of striped bass larvae may be due to the quantity of food present (i.e., zooplankton density), poor food quality (few zooplankters of the right size or shape), or both.

Striped bass is an anadromous species; that is, the adults live in ocean waters but swim upstream in coastal waters during the spring to spawn. This life history strategy means that eggs and larvae will be transported downstream from the spawning grounds by prevailing water currents as they develop, eventually being transported to the nursery grounds in Albemarle Sound. In past years, striped bass larvae have not fed successfully because their distribution in the lower River and western Sound was mismatched in both space and time with highest zooplankton concentrations. Since highest concentrations of zooplankton occur in the Roanoke River delta, this means that striped bass larvae have a very limited timeframe, or "window" available in which to start feeding, and feed successfuly, before being transported from the river into Albemarle Sound.

The larvae of resident finfish species, such as sunfishes, minnows, carp, and others are not influenced in their distributions by water currents to the extent exhibited by striped bass larvae. By examining larvae of these other species, we will be able to answer the question, "is poor feeding success exhibited by striped bass larvae a result of food concentration, food quality (size and mobility), or timing between the presence of food and initiation of feeding"?

Larval fish species present in selected samples preserved and stored from our larval striped bass studies have been examined for prey items present in the digestive tract. In the first year of study, samples included those from 1982 to 1985. In the second year of study, we are examining samples collected in 1985, 1986, and 1988. Data are being computerized; analyses will compare food items ingested to zooplankton abundance.

ABUNDANCE AND VIABILITY OF STRIPED BASS EGGS SPAWNED IN THE ROANOKE RIVER, NORTH CAROLINA, IN 1990

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This research is a continuation of the 1988 and 1989 work funded by the Albemarle-Pamlico Estuarine Study. The intent of the study is to continue a 30-year data base established by Dr. W.W. Hassler of NCSU on spawning success of striped bass in the Roanoke watershed below the Roanoke Rapids Dam near Weldon, North Carolina. The information will be combined with the previous two years of effort to determine the effects of hydropower discharge on hourly and daily egg production.

Sampling for striped bass eggs was initiated on 16 April at Barnhill's Landing, the site of Dr. Hassler's egg collection efforts for many years. Field efforts were terminated on 15 June 1990. Striped bass spawning activity in 1990 was early and very prolonged compared to the historical record. Spawning started when water temperatures reached 18 C on 24 April and was continuous until 13 June, when the last egg was collected. This continuous, low level spawning activity may have been due to late winter warm weather heating reservoir waters; water releases from the reservoirs upstream always remained above 18 C throughout the spawning period. Commonly, hydropower releases have caused river temperatures to drop several degrees on the spawning grounds, which results in cessation of spawning activity for days or weeks depending on duration and volume of water release from the reservoirs. Egg production for 1990 and the relationships of egg viability to various water quality parameters have not been calculated.

SHELL DISEASE IN BLUE CRABS FROM THE ALBEMARLE-PAMLICO ESTUARY

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Landings of blue crab in the Pamlico River have been steadily declining since 1984. One factor which might be influencing this decline is disease. Shell disease has recently been commonly observed. This disease has been mostly associated with a bacterial infection of the shell and can ultimately lead to the death of of the crab. While shell disease has been linked to poor water quality, there is no information as to why pollution increases susceptibility. This project is addressing that question by examining the natural bacterial-fighting ability of healthy blue crabs and comparing it with that of individuals with shell disease.

We have isolated bacteria from crabs having shell disease in the Pamlico River and have found that they include a number of bacterial species, including members of the genera Vibrio and Aeromonas. Similar agents have often been associated with shell disease in other crustaceans. Many of these bacteria possess lipase or chitinase enzymes. These enzymes may be used to degrade the outer lipid layer of the shell or the deeper chitinous layer, and thus may be important in invasiveness. However, we have found that the hemolymph (blood) from healthy crabs is capable of inhibiting these organisms. Many of the bacteria isolated from crab shells which we have tested are susceptible to hemolymph. We have also found that there are distinct differences in the bacterial-fighting capabilities of individual crabs. We have identified statistically significant differences in antibacterial activity between crabs collected at different geographic sites in the Albemarle-Pamlico estuary as well as between clinically normal crabs and those having shell disease. The possible implications of these findings to shell disease and the health of the Pamlico blue crab fishery will be discussed.

Project Abstract

An Examination of the Blue Crab Fishery in the Pamlico River Estuary

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Concerns about the status and abundance of shellfish and fish resources in the Pamlico Sound area have increasingly been expressed by numerous individuals and organizations. The decline of the Pamlico and Pungo rivers blue crab fishery and the effect of crab trawling in the rivers on the habitat and associated biota have been a particular concern. In order to optimize yield for this resource, up-to-date fishery dependent data, such as size and sex composition of catches, number and weight of individuals in the catch, and effort data, are needed.

The objectives of this project are to document harvest rates and by-catch in the crab pot and trawl fishery; and to examine the physical injury, immediate mortality and delayed mortality of blue crabs in the pot and trawl fisheries. Data obtained from this study will be used by the Division of Marine Fisheries to prepare management recommendations regarding fishing practices in the Pamlico River Estuary for the North Carolina Marine Fisheries Commission.

The examination of harvest rates, by-catch, physical injury, and immediate mortality will be conducted aboard commercial vessels. The quantification of delayed harvest mortality will be conducted by the Institute for Coastal and Marine Resources located at East Carolina University. All data will become a permanent part of the DMF and AP regional database.

Human Environment

PROJECT ABSTRACT

Public Attitudes Toward Water Quality and Management Alternatives in the Albemarle-Pamlico Estuarine System (PHASE I)

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The major purpose of this project is to evaluate peoples' knowledge and attitudes about natural resources in the Albemarle-Pamlico Estuarine system and the management alternatives designed to protect these resources. The public participation program also will benefit because this work will identify educational needs and provide a scientific mechanism for greater public involvement in decision making. Work is being carried out in two phases. Data collection for Phase I has been completed this year. The specific objectives of Phase I are: (1) to assess public understanding of and concern for the causes, severity, and consequences of water quality problems in the Albemarle-Pamlico system; and (2) to describe and compare the attitudes, knowledge, and behavior of different segments of the public regarding the nature and importance of the resources and related management issues.

We established an advisory committee that includes local and state agency personnel, university scientists, and citizen representatives. This committee has provided advice on the selection of survey respondents, general research procedures and survey instrument design. They also nominated people for in-person interviews. We conducted 30 interviews with individuals from a variety of groups. In-person interview questions focused on topics such as: nature and causes of various problems; evaluation of current and future management strategies; barriers to water quality improvement; nature of public attitudes; and, educational strategies.

We developed a standardized telephone survey instrument based on information from the in-person interviews and a review of other studies. Pretests were conducted to validate the survey. Telephone numbers were randomly generated by a professional sampling firm using a random digit dialing technique. Professional interviewers completed 831 surveys (76 percent response rate) with adults 18 years of age and older. Interviews averaged 22 minutes to complete. The telephone numbers were selected from counties in three major regions: coast, sound, and the drainage basin. The sample was stratified as follows: 344 completed in the upper watershed counties; 269 completed in the counties bordering the sounds; and 218 completed in the coastal counties. Analysis and reporting of the results is underway.

PROJECT ABSTRACT

Public Attitudes Toward Water Quality and Management Alternatives in the Albemarle-Pamlico Estuarine System (PHASE II)

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Effective management programs require better understanding of how different segments of the public perceive issues related to the Albemarle-Pamlico Estuarine system. This project will analyze public attitudes about the appropriateness of particular alternatives for managing the resources of the Albemarle-Pamlico Estuarine system. Work is being carried out in two phases. Data collection for Phase I has been completed and these results will inform the development of Phase II. Planning for Phase II is currently underway. The specific objectives of Phase II are: (1) to determine the attitudes of leaders and the public about the effectiveness, equity, and acceptability of alternative management strategies; (2) to determine public willingness to pay and change behavior to improve and protect resources; and, (3) to recommend strategies to build awareness of and support for the CCMP.

Information will be collected in a scientific survey of a random sample of the public, local political leaders, and interest group representatives. This project will provide detailed information on the nature and extent of different groups' receptivity to alternative policies and programs. Recommendations will be provided for building support for the goals of the Albemarle-Pamlico Estuarine Study. We will continue to work with the advisory committee we established in Phase I. We are considering expanding membership to include representatives of other important groups. We will send a mail questionnaire to 1000 leaders. We will complete 1000 interviews with statewide sample. Our advisory committee and statistical consultants will help us determine sampling strategy and frame. Our committee also will help design our telephone and mail questionnaires.

PROJECT ABSTRACT

The Currituck Sound Drainage Basin: Perceived Issues and Prospective Management Alternatives

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The Currituck Sound drainage basin experienced rapid population growth and development during the past two decades. As a result of the changes that have occurred and are continuing to occur in the watershed, natural resource managers face new management issues.

The objectives of this study were to 1) prepare an up-to-date, computer-accessible bibliography on Currituck Sound and Back Bay, Virginia; 2) identify perceived management issues in the study area; and 3) analyze an array of responsive, prospective management alternatives. Government officials and researchers performing investigations in the study area were consulted for their views concerning management issues in the Currituck Sound drainage basin. Formal and informal interviews were conducted over a one year period from September 1989 through August 1990. In order to determine the general issue perception of the Currituck Sound Watershed Committee, the advisory panel for this project, each member was asked to complete a short questionnaire. Although no clear consensus exists on the nature and extent of problems in the Currituck Sound watershed, the interviews yielded two broad issue categories: 1) Currituck Sound is perceived to be a declining resource with respect to water quality and wildlife habitat; and 2) Responsibility for management of this ecosystem is split among multiple federal, state, and local jurisdictions.

Three categories of prospective alternatives for future management of the Currituck Sound drainage basin were considered:

1. Alternatives which require no new institutions
2. Alternatives which require formation of new, non-statutory institutions
3. Alternatives which require formation of new, statutory institutions.

Each prospective option was examined in terms of advantages and disadvantages. Also, alternatives were analyzed with respect to conformity with attributes of a successful natural resource mangement agency and ability to perform requisite duties. No attempt was made to select a preferred alternative for future management of the Currituck Sound drainage basin as this decision was outside the scope of the current project. It is intended, however, that this work will provide insight to government officials and resource managers charged with making such decisions for the Currituck Sound-Back Bay complex and the larger Albemarle-Pamlico Estuarine Study Area.

PROJECT ABSTRACT

Federal Consistency Review for the Albemarle-Pamlico Estuarine Study

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A Federal consistency review program encourages Federal agencies to cooperate in implementing the Comprehensive Conservation and Management Plan (CCMP). Through the review process, the Albemarle-Pamlico (A/P) Management Conference can scrutinize proposed Federal activities, identify potential conflicts with the CCMP, and negotiate project modifications with the responsible Federal agency.

This project proposes a Federal consistency review strategy for the A/P estuarine study, as required by Section 320(b)(7) of the Clean Water Act. The report also includes a list of Federal assistance programs, direct development activities, and Federal permit and licensing activities which should be reviewed for consistency with the CCMP.

The proposed strategy resulted from examination of existing Federal consistency review programs coordinated by the N.C. Division of Coastal Management (DCM) and the State Clearinghouse. The State Clearinghouse coordinates reviews authorized by Executive Order 12372, the National Environmental Policy Act (NEPA), the North Carolina Environmental Policy Act (NCEPA), and the nonpoint source program under Section 319 of the Clean Water Act.

The proposed strategy integrates the A/P Federal consistency program with both the State Clearinghouse and the DCM consistency review programs. This approach minimizes review duplication and maximizes the A/P Management Conference's authority to review and influence Federal activities. The Clearinghouse provides an existing structure for obtaining notice of Federal activities that might affect the A/P region and acquiring comments from State agencies. The Clearinghouse review process can easily accomodate the addition of an A/P reviewer because the Clearinghouse is structured to accept additional reviewers as new State programs are created. Through the Clearinghouse, the A/P consistency program could gain access to review environmental impact documents submitted under NEPA and NCEPA.

The A/P program gains the ability to stop inconsistent Federal activities through integration with the DCM review process, and also expands A/P review authority to include Federal issuance of licenses and permits. To integrate the A/P and DCM consistency programs, the goals of the CCMP must be incorporated into the North Carolina Coastal Management Program by the N.C. Coastal Resources Commission and the National Atmospheric and Oceanic Administration.

PROJECT ABSTRACT

Evaluation of Federal Program Impacts in the Albemarle-Pamlico Region

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This project addresses the requirement to evaluate existing policy and management systems in the Albemarle-Pamlico (A/P) Work Plan. The project extends the evaluation of State management programs, (contained in A/P Project Number 90-02) to Federal policies, programs, and activities that are important in the A/P study region. The project will also provide information for developing consistency review criteria. The criteria are necessary to implement the strategy proposed in a recent A/P report, Federal Consistency Review for the Albemarle-Pamlico Estuarine Study.

The project results will (1) list Federal programs and facilities with potentially significant water quality and related environmental effects in the A/P study region (2) describe the nature of impacts to be expected from each identified Federal program, and (3) evaluate the effectiveness with which environmental impacts are considered in each program.

PROJECT ABSTRACT

Environmental Management Strategies: Comparative Analysis and Selected Case Studies

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and
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The project addresses the need for comparative information and analysis of applicable management strategies to be tailored to the unique needs and conditions found in the Albemarle-Pamlico region. The project will identify, present and evaluate examples of innovative and successful management strategies from other estuarine regions and other systems of comparable complexity that are applicable to the Albemarle-Pamlico Estuarine System.

Ten case studies will be selected for detailed analysis. Successful management elements that can be utilized in the estuarine environment will be the focus of this analysis. A report will be produced that documents specific management strategies and recommends how these can be incorporated into the APES's Comprehensive Conservation and Management Plan or into other avenues for private or voluntary actions.

As part of the National Estuary Program (NEP), APES has access to many sources of information from other Management Conferences in the NEP with similar problems and needs, such as Sarasota Bay and Puget Sound. The scope of this project includes an examination of programs both inside and outside of the NEP. Special attention will be given to finding examples of federal-state-local partnerships that address natural resource problems from an ecosystem perspective.

We will build on information produced or collected by APES and other environmental management organizations. The information in the APES Five Year Plan is the foundation. The use-conflict approach emphasizes the need to identify the links between human activities, environmental responses and management options so that the management strategies for addressing the problems can be evaluated. The following major use-conflict issues of the Albemarle-Pamlico region require management strategies to help reduce conflicts among these uses: commercial and recreational fisheries; agriculture; residential and commercial development; mining and industrial development ; and forestry.

Water Quality

PROJECT ABSTRACT

Title: "The Potential for Eutrophication and Nuisance Algal Blooms in the Albemarle-Pamlico Estuary"

Principal Investigator: Dr. Hans W. Paerl
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The primary thrust of this research project has been to identify the limiting nutrients controlling phytoplankton growth in the lower Neuse River Estuary, the major southern tributary of Pamlico Sound. This has been accomplished through the use of photosynthetic carbon-14 uptake and chlorophyll production measurements conducted during monthly bioassay experiments involving the natural estuarine phytoplankton communities. Previous results have shown nitrogen to be a limiting factor year-round with nitrogen and phosphorus as co-stimulatory factors during spring. Our 1990 results support this trend. These findings point out the importance of considering both nitrogen and phosphorus when proposing management plans to control eutrophication.

Throughout the project we have monitored the estuarine phytoplankton community for the occurrence of noxious or toxic algal blooms. As with previous years, we have not found these blooms in the lower estuary. However, during January and February of 1990 a bloom of the non-toxic dinoflagellate Heterocapsa triquetra occurred in the lower Neuse, with biomass as chlorophyll a reaching 40 mg/m^3. This organism is associated with low water temperatures and is thought to be indicative of nutrient enrichment. In this context H. triquetra is a potentially useful indicator of enhanced nutrient loading resulting from rainfall and runoff. During summer, filamentous blue-green algae were abundant in the lower estuary, but were not encountered in bloom proportions. The presence of these organisms in elevated numbers leads to the recommendation that monitoring efforts should be continued to assess potential future eutrophication in the lower estuary. While reduced bottom water oxygen levels were occasionally seen at the sampling sites, anoxic conditions were never encountered during the project.

This system supports summer phytoplankton productivity and biomass peaks, typical for temperate estuaries. Furthermore, our data have indicated that additional productivity and biomass pulses are strongly correlated with nitrate input caused by rainfall and runoff into the estuary.

PROJECT ABSTRACT

Reduction of Nutrient Loading: N and P Removal in Coastal Swamps

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Population growth and economic development cause increasing nutrient releases to streams and estuaries from agriculture, urbanization, and industrialization. There is evidence that more nutrients enter headwater streams in North Carolina than reach the estuaries, partly because of removal by bottomland wetlands interposed between nutrient sources and the estuarine sink. Nutrients not removed before reaching the estuary contribute to nuisance algal blooms, hypoxic bottom waters, decreased fish and shellfish harvests, and other problems.

The objective of this study was to increase our understanding of the efficiency with which bottomlands strip out nitrogen and phosphorus from municipal wastewaters discharged to swamp streams. The data may help development of less expensive methods for assessing wetland nutrient removal abilities so that year-to-year changes in removal efficiency of many streams can be determined. The data will help determine how much protection to give swamps and bottomlands to maintain their nutrient-removal function. Incorporation of the results into mass balance models will help predict maximum permissible wastewater nutrient concentrations without overloading swamp nutrient trapping, thereby protecting estuarine water quality while urbanization of the Coastal Plain is increasing.

Based on a one-year study, we selected two swamp-stream sites for intensive study. Samples of water were collected at about ten stations above and below wastewater outfalls every three weeks for two years. A more extensive study consisted of seven additional sites sampled only quarterly to determine variability among bottomland systems. Nutrients were measured and net downstream changes in their concentrations were calculated. Data from the extensive study suggests that efficient removal of nitrate and phosphate generally occurs where wastewater laoding is heavy. Data processing and interpretation for the extensive study should be completed this month. The final report is expected by December 1990.

HYDRODYNAMICS AND CIRCULATION OF THE PAMLICO AND NEUSE RIVER ESTUARIES

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Many of the water-quality, fisheries, and habitat issues, which the multi-agency Albemarle-Pamlico Study is attempting to address, are geographically concentrated in the Pamlico and Neuse River estuaries. In both of these estuaries, nutrient overenrichment has resulted in frequent blooms of nuisance algae, and elevated concentrations of heavy metals have been detected in the sediments. The movement, mixing, deposition, and resuspension of nutrients and contaminated sediments, as well as other pollutants and some living resources, are controlled by the hydrodynamics of the estuaries. Hence, the ability to describe circulation patterns and determine flow rates is essential to the management and restoration of water quality and living resources in the estuaries.

The U.S. Geological Survey, in cooperation with the Albemarle-Pamlico Estuarine Study, is conducting an investigation of hydrodynamics and circulation in the Pamlico and Neuse River estuaries. This is being accomplished by (1) collecting hydrologic, water-quality, and meteorological data, which are used for analysis of physical characteristics, for model boundary conditions, and for model calibration and validation, and (2) developing and applying a flow model for each estuary. A brief description of data-collection activities and some preliminary results from the Pamlico River estuary are presented below.

Water levels are recorded at 15-minute intervals at 6 locations along the Pamlico River. The daily-mean water-level range is about 33 centimeters near Washington, but the mean water-level range decreases to 18.5 centimeters near the mouth of the estuary. Water-level variations are typically nonperiodic. For example, analysis of about 2 years of data collected near Washington revealed that the M2 (principal lunar constituent) tidal range is 7.7 centimeters, or about 25 percent of the total range.

Continuous records of temperature, specific conductance, and dissolved oxygen at 6 locations in the Pamlico River estuary indicate that the estuary was generally well-mixed vertically between May 1989 and May 1990, despite relatively high freshwater inflows in 1989. Occurrences of vertical stratification have been observed, however. Low dissolved oxygen concentrations have sometimes, but not always, been associated with bottom waters during stratified conditions.

Seven recording velocity meters were deployed in the Pamlico River between August 15 and September 7, 1989. Vertical profiles of horizontal velocity, temperature, and specific conductance were measured for 32 hours at 15-minute intervals at 4 locations across the mouth of the estuary on August 28-29, 1989. Velocities were as high as 35 centimeters per second, but values between 15 and 25 centimeters per second were typical. Inflow measurements also were made near Washington during this period; flow velocities at this site generally were less than 25 centimeters per second.

A computational grid for the numerical model has been developed from topographic and bathymetric data. The grid consists of about 25,000 cells measuring 200 meters per side. Water level, velocity, salinity, and constituent concentrations are being computed for each cell.

HYDROLOGIC AND WATER-QUALITY EFFECTS OF ARTIFICIAL-DRAINAGE CONTROL

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Tidegates and flashboard risers are the two primary types of water-control structures used on artificially-drained agricultural lands of the North Carolina Coastal Plain. Water-control structures have on-site benefits to farmers, but the effects of these structures on receiving-water quality have not been fully determined. As part of the Albemarle-Pamlico Estuarine Study, the U.S. Geological Survey is conducting an investigation to (1) evaluate off-site effects of tidegates and flashboard risers on surface flow and the quality of water in tide-affected canals that drain cropland and (2) quantify effects of cropland drainage on receiving-water quality.

For this investigation, data are being collected at three canals in Hyde County, in Rose Bay, at three canals in Beaufort County, and in Campbell Creek. In Hyde County where tidegates are being evaluated, a tidegate will be in place on one canal throughout the data-collection period. At the other two canals in Hyde County, 2 years of data collection preceded by installation of tidegates is being followed by 2 years of post-installation data. The Hyde County canals are directly tributary to Rose Bay Creek, and two recording water-quality monitors have been placed in Rose Bay. A similar approach is being followed in the Beaufort County canals, where flashboard risers are being evaluated. Water levels and water quality are being measured in Campbell Creek, which receives drainage from two of the Beaufort County canals. Five recording salinity monitors are located along the longitudinal axis of Campbell Creek.

Continuous records of flow velocity, water level, discharge, and conductivity are being collected at each of the six canal sites. Bi-weekly and high-flow event determinations of pH, temperature, dissolved oxygen, nutrient concentrations, and sediment concentrations are also made at each of the six sites, as well as in Campbell Creek.

Preliminary results indicate that runoff hydrographs were noticeably more attenuated at the tidegate-controlled site than in the uncontrolled Hyde County canals, although water levels upstream from the tidegate seldom exceeded downstream water levels by 0.1 foot. (Tidegates are designed to open when the upstream water level exceeds the downstream water level by 0.2 foot.) Mean conductivity in the tidegate-controlled canal was 5,500 microsiemens per centimeter (μS/cm), compared with a mean of about 9,200 μS/cm at the adjacent canals under uncontrolled conditions. Conductivities of more than 30,000 μS/cm were observed in the uncontrolled Hyde County canals.

Drainage from the Beaufort County sites contained sediment concentrations that were, on the average, 3 times higher than at the Hyde County sites. Because phosphorus is often bound to particulate matter, drainage from the Beaufort County canals typically contained higher phosphorus concentrations than drainage from the Hyde County canals. Average dissolved nitrate-nitrite concentrations from the Beaufort County sites ranged from 1.85 to 1.96 milligrams per liter (mg/L) as nitrogen (N); Hyde County mean values ranged from 0.31 to 0.50 mg/L--values more typical of receiving water than drainage water. Although nitrate-nitrite nitrogen concentrations in Campbell Creek were about 16 percent of those in the Beaufort County canals, total ammonia plus organic nitrogen was approximately the same in Campbell Creek (0.99 mg/L as N) as in the Beaufort County canals (1.18 mg/L as N). At the tidegate-controlled site, mean concentrations of dissolved ammonia, Kjeldahl nitrogen, and nitrate-nitrite nitrogen were 0.30 mg/L, 1.72 mg/L, and 0.32 mg/L as N, respectively; comparable mean values at the Hyde County sites without tidegates were 0.13 mg/L, 1.41 mg/L, and 0.46 mg/L as N, respectively.

PROJECT ABSTRACT

Baseline Water Quality Monitoring Program

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Department of Environment, Health and Natural Resources

The Baseline Water Quality Monitoring Program was developed from the Division of Environmental Management's existing ambient monitoring program with cooperation from the Division of Marine Fisheries and the United States Geological Survey. The program was designed at the specific request of EPA, in response to the Office of Marine and Estuarine Protection's interpretation of the 1987 amendments to the Clean Water Bill requirements.

The program objective is to provide data for the following purposes:

- construction of a comprehensive baseline dataset to characterize the water quality, sediment and biological resources of the Albemarle-Pamlico system, basinwide - Expand Ambient Water Quality Network and Fish Tissue Sampling;
- evaluation of the differences in parameters (temperature, dissolved oxygen, nutrients, etc.) in regard to time and location of sampling, to allow adequate evaluation of trends in historical and A/P Study-generated datasets - Expand Ambient Water Quality Network, Sediment Oxygen Demand Sampling and USGS Continuous Monitoring Network;
- evaluation and characterization of events such as fish kills and low dissolved oxygen which are not being addressed by the present sampling methods - Pamlico Environmental Response Team.
- collection of data for use with remotely sensed (satellite imagery) water quality datasets - Synoptic Survey July 25, 1989;
- development of a continuing monitoring program which is intended to evaluate the long-term status of this important estuarine system;
- evaluation of the long-term effectiveness of the management strategies implemented.

A total of 94 ambient stations are being sampled as part of the program. These stations are located in the major tributaries, small streams, open sound, and each of the major rivers. Stations are also located at USGS continuous monitoring stations to provide additional information at those locations.

Data collected as part of the program are being computerized and are available to researchers. The results of the Synoptic Survey have been entered into the A/P Study's geographic information system and are available in the report "Albemarle-Pamlico Estuarine Synoptic Survey Data Review July 25, 1989" from the Division of Environmental Management. All other data can be used with the A/P Study's geographic information system or downloaded in a standard data exchange format.

NEUSE RIVER ESTUARINE SYSTEM: HEAVY METAL POLLUTANTS IN ORGANIC-RICH MUDS

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A regional grid of 203 sites were sampled throughout the Neuse River estuarine system representing all possible geographic and geologic conditions, and anthropogenic sources of pollutants. From these sites, 413 subsamples were analyzed for sediment grain size, sediment composition, and chemistry including 7 major elements and 15 critical trace elements (CTE). The 15 CTEs include the 8 EPA priority pollutant metals (arsenic, cadmium, chromium, copper, lead, nickel, mercury, and zinc) and 7 other important trace elements (cobalt, manganese, molybdenum, tin, titanium, vanadium, and the nutrient element phosphorus). Elemental analysis is based on a partial extraction procedure that approximates "bioavailbility" of the elements. Enrichment factors (EF) are determined for each CTE in each sample by comparing the elemental concentration to the Neuse River trimmed mean (NRTM) for surface samples. Areas containing one or more sample sites in which one or more CTEs have EF = to or > 2 X the NRTM are defined as polluted "areas of concern" (AOC). The Neuse River study is now complete and the final report is in the last stages of preparation.

Fourteen polluted and 6 non-polluted "areas of concern" have been identified within the Neuse River estuarine system. Polluted AOC include: 1) New Bern Waterfront (Trent River East, Lawson Creek, Neuse River, and Waste Water Treatment Plant), 2) Bridgeton Waterfront (Neuse River and Mill Branch), 3) Slocum Creek (Upper, East Prong, and Southwest Prong), 4) Fairfield Harbor, 5) Oriental Harbor, 6) Inner Neuse River, 7) Outer Neuse River, 8) Swift Creek, 9) Trent River West, 10) Scotts Creek, 11) Lower Slocum Creek, 12) Oriental Area Creeks, 13) Whittaker Creek, and 14) Upper South River. The 5 underlined polluted AOC have severe sediment pollution problems with multiple sample sites having 2 or more CTEs with concentrations exceeding 2X the NRTM. The nonpolluted AOC include 6 lateral tributaries: 1) Adams, 2) Beard, 3) Upper Broad, 4) Clubfoot, 5) Goose, and 6) Hancock creeks. These 6 nonpolluted AOC have low levels of development and represent fairly pristine estuarine systems. Nonpolluted AOC are also critical, since increasing rates of development within these pristine estuaries will lead to the cumulative degradation of their water quality as reflected by increased sediment pollution if we are not careful.

The 3 most polluted regions have severe levels of CTE contamination in the organic-rich mud sediments. New Bern waterfront has 13 CTEs with the following maximum EFs: Cu (12.8X), Zn (11.6X), Ni (7.0X), Pb (6.9X), Hg (4.7X), P (3.4X), Co (3.2X), Mo (2.9X), As (2.8X), Mn (2.8X), Cd (2.5X), Sn (2.1X), and Cr (2.0X) the NRTM. Bridgeton waterfront has 11 CTEs with the following maximum EFs: Ni (178.7X), Sn (33.4X), Cd (30.4X), Cu (22.8X), Zn (4.5X), Cr (7.6X), Mn (3.0X), P (2.8X), Pb (2.5X), As (2.1X), and Co (2.1X) the NRTM. Slocum Creek has 12 CTEs with the following maximum EFs: Hg (68.5X), Cd (35.6X), Cu (26.9X), Cr (11.5X), Mo (8.9X), Pb (6.7X), P (5.9X), Zn (4.6X), Ni (3.9X), As (2.3X), Mn (2.2X), and Sn (2.1X) the NRTM. These pollutants have accumulated as the result of major point and nonpoint discharges from public, private, and U.S. military facilities connected with multiple urban, industrial, and recreational developments.

ALBEMARLE SOUND ESTUARINE SYSTEM: HEAVY METAL POLLUTANTS IN ORGANIC-RICH MUDS

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A regional sampling grid was developed within the Albemarle estuarine system that included 178 short core (< 0.5m), 19 long core (< 6m), and 22 surface sample sites. These 219 sites represent all possible geographic and geologic conditions, as well as major anthropogenic sources of pollutants throughout the Albemarle system. From these cores, 378 subsamples have been completely processed and analyzed in the sediment laboratory for grain size and sediment composition; consequently, all field work and sediment analyses have now been completed on these samples. Chemical analyses for major, minor, and trace elements are complete on 247 of these samples (66%) at this point in time. The remaining one third of the samples are presently in the analytical mill. Consequently, the results of both the sediment and chemical data are only in early stages of formulation and synthesis.

Discharge of apparently low concentrations of toxic heavy metals and other critical trace elements from various anthropogenic point and nonpoint sources into coastal waters leads to significant pollution problems within the N.C. estuarine environments. High adsorption capacities of clay minerals and high chemical reactivity of organic matter, both major components of suspended and bottom sediments, continuously sequester trace elements discharged into the water column. The cumulative effect of large discharge volumes, even with low toxic metal concentrations over long time periods, leads to significant trace element enrichment in the associated bottom sediments. In addition, storms, biological processes, and man routinely resuspend the mud sediments into the water column. These processes continue to concentrate critical trace elements within the bottom sediments to levels that are orders of magnitude above acceptable water level concentrations. The toxic metals are then potentially available for further concentration and movement through the food chain by abundant filter and detritus feeding organisms living within these organic-rich mud environments. This basin-wide assessment of heavy metal and other critical trace element pollution is prerequisite for future management plans and decisions concerning water quality improvement within our estuarine environments.

DETERMINING THE RELATIONSHIP BETWEEN WATER QUALITY AND ULCERATIVE MYCOSIS IN ATLANTIC MENHADEN

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Ulcerative mycosis (UM) is the most common disease affecting the finfish populations of the Tar-Pamlico estuary. This disease has caused numerous epidemics in Atlantic menhaden (Brevoortia tyrannus) since its first observance in 1984. Similar problems have also been observed in many other commercially important estuarine species. Like most diseases in wild fish populations, we presently know very little of how water quality influences UM prevalence. Understanding the possible importance of pollution requires an awareness of how environmental conditions affect the health of the menhaden population. Thus, the purpose of this study is to determine possible linkages between selected water quality parameters and the development of UM.

Atlantic menhaden are being placed into tanks located at various sites along the Pamlico River and water is being pumped directly from the river into the tanks. While fish are in the tanks, temperature, dissolved oxygen, salinity and pH are measured daily; samples are collected for nitrite and ammonia thrice weekly. These variables are generally considered to be the factors which most commonly affect fish health in aquatic ecosystems. This research is intended to indicate which of these factors merit closer examination, as well as those which are apparently not important to disease susceptibility. Results of a study conducted in fall 1989 showed a higher incidence of disease development in 4-6 ppt salinity than in lower salinities. There was also a suggestion of a relationship between increased disease and both temperature and dissolved oxygen levels; however, the latter two trends were not statistically significant.

CITIZEN MONITORING: ALBEMARLE-PAMLICO ESTUARY
Completion Date: October 1990

ABSTRACT: The Citizen Monitoring program on the Tar-Pamlico River was maintained during the 1989-90 funding year. Water quality monitoring sites were maintained at sixty-three (63) locations ranging from Virginia Beach, VA in the north to near Havelock, NC in the south, and from Louisburg, NC in the west to the Kill Devil Hills-Nags Head area in the east.

All volunteer water quality monitors collect data in the following areas: air and water temperature, turbidity (clarity of the water), salinity, dissolved oxygen, pH, and in fresh water areas, nitrate-nitrogen, and phosphate are monitored instead of salinity. In addition the program has compiled data using other methods of sampling, such as bottom sampling for dissolved oxygen, along with sampling for other chemical parameters such as fecal coliform, bacteria associated with human or animal wastes.

The Citizen Monitoring program has approximately 150 persons involved with monitoring various locations in the estuary. Most sites have more than one person collecting data to avoid problems whenever a monitor is unable to sample. We also have a network of approximately ten (10) volunteers who take a much more active role in the monitoring program, and also serve on a Steering Committee for the Citizen Monitoring program. These people have helped organize groups of interested persons in the Currituck and Albemarle Sound areas, and the Chowan and Neuse River areas. We continue to have a large number of persons interested in the program and look forward to the new Primary Investigator at East Carolina University maintaining the Citizen Monitoring network.

Data that is collected by the volunteers is sent to the coordinator either weekly or bi-weekly. The coordinator checks the data and enters it into a computer program. At regular intervals, the volunteer monitor is contacted and provided copies of the data in graphical and tabular form. Site visits are also done on a regular basis. The PERT team (Pamlico Environmental Response Team) has been working very closely with the Citizen Monitoring network when examining monitoring and fecal coliform data throughout the estuary. In addition, various research facilities have received copies of parts of the data collected by the Citizen Monitoring program for their specific research needs. A new Citizen Monitoring program has been funded for the 1990-1991 AP Study coordinated through the Institute for Coastal Marine Research at East Carolina University.

PROJECT ABSTRACT

An Evaluation of Pollutant Removal by a Demonstration Urban Stormwater Detention Pond

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Urban stormwater pollution control in coastal North Carolina has become an important issue during the past five years, as evidenced by the passage of new regulations for protecting coastal waters that have been called some of the most stringent in the nation. But there have been few studies in the region regarding the effectiveness of various control strategies. In 1989 the Albemarle-Pamlico Estuarine Study awarded a $150,000 demonstration project grant to the City of Greenville, NC to construct a dry detention pond to treat urban runoff from an area in west Greenville near the Tar River. In its proposal to APES, City officials indicated that their primary objective was to construct the detention pond facility. Because of funding constraints, the City will perform only limited chemical analyses on a few samples collected at the pond outlet and inlet. Also, they will not be monitoring the flows into and out of the pond that would be necessary to calculate the pond efficiency in terms of pollutant removals. Instead, they indicated that they would ask the U.S. Geological Survey (USGS) for help with the flow measurements, and East Carolina University (ECU) for assistance with the pollutant analyses, input-output budgeting, and detailed analysis of the drainage area land uses.

This study is intended to address this need to determine the effectiveness of the detention pond. The study will provide information on 1) the chemical characteristics of stormwater from a typical urbanized drainage area in eastern North Carolina, and 2) the effectiveness of a dry detention pond in removing total suspended solids, nitrogen and phosphorus, several heavy metals, BOD and organic carbon, and fecal coliforms from the stormwater. In addition, the study will provide a detailed analysis of land use and other characteristics for the project drainage area that will be useful for comparing the runoff characteristics and pond trapping efficiency with those from other studied areas, and for extrapolating the study results to other areas in the region. Finally, the accumulation of heavy metals at various depths in the pond sediments will be examined; this information can be used in evaluating the ability of the soil to retain sedimented pollutants to prevent contamination of ground water. Overall, the data on project effectiveness -- along with data from the City of Greenville on ease of construction, operation, and maintenance -- will provide resource managers with better information on the merits of dry detention ponds, relative to those of other BMP's, for controlling urban stormwater pollution in eastern North Carolina.

PROJECT ABSTRACT

Toxics Inventory for the Albemarle-Pamlico Estuarine Study

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Although toxic inputs to the Albemarle-Pamlico (A/P) estuarine system are not believed to be high relative to some other estuarine systems, resource managers currently do not have a complete picture of what data are available. The lack of a complete inventory of toxics data remains a critical gap in the A/P study resource data base as without an inventory no accurate assessment of toxic pollution sources to instream water quality problems (including sediment contamination and bioaccumulation by fish and shellfish) can be made. Toxics data for the A/P study area are found in numerous data bases, files, and special reports maintained by State and Federal agencies and educational institutions.

The objectives of this project are to (1) develop an inventory list of sources of toxics data for the A/P study drainage area, including data in existing data bases and data available in hardcopy, (2) conduct a screening analysis of existing computerized data against current State and Federal water quality standards and criteria, (3) summarize data sources reviewed or screened, (4) recommend data needs and monitoring strategies to further evaluate toxic hot spots, and (5) produce maps showing the location of sites having potential toxic problems. The data will also be available in report form.

PROJECT ABSTRACT

Point and Nonpoint Phosphorus and Nitrogen Budgets and Flux Estimates For Major Tributaries in the Albemarle-Pamlico Estuarine Study Area

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Management of nitrogen and phosphorus inputs to the Albemarle-Pamlico system has been recognized as a major goal for resource agencies. However, existing information regarding sources of nitrogen and phosphorus to the system is incomplete, outdated, or derived for slightly different purposes, with different datasets, with different techniques, and/or by different agencies or researchers. Therefore, a need exists for systematic areawide development of nitrogen and phosphorus budget estimates.

The objective of this project will be to develop both point and nonpoint source nutrient budgets for major tributary basins. Recent Landsat land use and land cover data will be used along with a literature search to determine nutrient export to estimate nonpoint source loadings. DEM's Compliance Monitoring system will provide data needed for point source loading estimates. Ambient flow and nutrient monitoring data collected by DEM and USGS will be used to estimate instream nutrient flux.

The products of the project will be (1) a report presenting the methods and results and discussing the management implications; (2) maps presenting nutrient loadings; and (3) a baseline database allowing for ongoing examination of the effect of management efforts on nutrient inputs.

A Management Plan for Currituck Sound
Part II. Model Development

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Abstract

The geographic scope of the current project is defined as the North Landing River watershed area, extending from Lynnhaven Bay through West Neck Creek and North Landing River to Currituck Sound. The intent of the modeling effort is to determine under what conditions significant flows may occur north to south into Currituck Sound from this source. Data stations either exist or will be installed (as a separate but coordinated effort) which will support the modeling study. The results of this study will yield a solid understanding of one of the major watershed areas of the Currituck system. The project will consist of the following tasks: 1) data review, 2) flow and transport model development, 3) model calibration and verification and 4) report preparation.

Data Review: USGS data collected prior to the start of this study will be reviewed. The records as of 8/90 will contain 6 months to a year of data so that seasonal differences in the system will be represented. Extreme events in the record will be identified and analyzed. These will be useful in creating test scenarios for model calibration and verification. In addition, a data collection station consisting of water elevation and salinity will be installed and maintained by the USGS just west of Faraby Island in Currituck Sound. This station will serve as the downstream boundary to the North Landing River system.

Flow and Transport Model Development: WASP4, a US EPA supported hydrodynamic and water quality model will be used to model the system. Two parts of the model will be used, DYNHYD4 and TOXI4. DYNHYD4 solves the one dimensional momentum and continuity equations for a link-node system. The results of the hydrodynamic solution are stored for use by TOXI4 which solves the one dimensional mass balance equation for dissolved constituents. Because of the supporting field data, salinity will be the constituent modeled. However, TOXI4 (and the associated eutrophication model EUTRO4) can handle many more constituents and processes. This should be advantageous as extended work on the Currituck system develops.

Model Calibration and Verification: The model will be calibrated and verified using the USGS data from the three previously defined sites. The data, which will be collected at fifteen minute intervals for the duration of the project, should contain many varied conditions which can be used to test the model. Additional scenarios will be hypothesized and simulated if needed.

Agricultural Runoff into Estuarine Systems

William W. Kirby-Smith (Duke University Marine Laboratory)

A three-year study of the effects in estuaries of pesticide runoff from farms has been completed. The study, funded by EPA, was an interdisciplinary investigation involving physical, chemical, and biological components. It involved the cooperation of three universities (Duke University, the University of Minnesota, and the University of North Carolina), an industry (Open Grounds Farm, Inc.) and a government laboratory (the EPA Gulf Breeze Environmental Research Laboratory).

The studies were done in upper estuaries (nursery areas) near small streams entering the South River estuary, a lateral branch of the Pamlico Sound at the eastern end of the Neuse River estuary. These innumerable small coastal plains estuaries are where impacts of pesticides would be expected to be greatest because they are closest to the sources (farm fields) and are areas of great biological sensitivity (nursery areas). Studies focused upon runoff (rainfall) events following application of chemicals to fields in spring (herbicides) and late summer (pesticides) and upon integrated long-term ecosystem effects on communities of fish and bottom-dwelling organisms.

Physical studies involved development of a shallow water instrumented profiling system which profiles the water column every 20 minutes for temperature, salinity, dissolved oxygen and current speed and direction. Results demonstrated the importance of regional winds in controlling runoff following rainfall. High wind tides can "damn up" runoff for several days until wind velocity changes. Fresh water carrying the pesticides layers out on top of sea water and outflow on the surface increases inflow along the bottom. This upstream circulation is important in transport and mixing. Knowledge the bi-layered flow of waters on time scales of minutes to hours is essential to understanding the chemistry and biology of these nursery areas.

Chemical studies were focused upon the fate of three chemicals, the herbicide alachlor and the pesticides terbufos and permithrin, as they were applied to corn and soybean fields. All three chemicals were transported into the estuaries in runoff following application and rainfall. Concentrations depended upon amount applied, solubility in water and, most importantly, the hydrodynamics of the runoff event and mixing in the estuary. Concentrations peaked a few hours after runoff began and decrease rapidly over a 2 to 4 day period. Mixing with sea water appeared to be the major cause of the decreases.

A number of biological studies have been linked with the physical/ chemical studies. Grass shrimp have been held in cages in estuaries and laboratory studies have been done on larval shrimp using runoff water. Sampling of fish and bottom communities in 6 small estuaries have shown that there has been no measurable impact on these systems. A similar study by the Division of Marine Fisheries 10 years ago found community effects. It appears that the size of the creeks relative to the size of the altered drainage system may explain the different conclusions of the two studies. These results can help plan strategies for regulating storm water runoff to minimize impacts.

Public Participation

PROJECT ABSTRACT

Leadership Development Workshops on Water Quality Impacts of Nonpoint Source Pollution

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Maurice Cook
Simon Garber
Frank Humenik
North Carolina Agricultural Extension Service

Effective control of nonpoint source pollution will require cooperation from farmers, local leaders, and others to install best management practices (BMPs). The goal of this project is to provide local leaders and other interested groups with educational resources and strategies for promoting BMPs. The main products from this project are a series of four leadership development workshops and an educational handbook on nonpoint source pollution.

Four leadership development workshops were held during March of 1990 in the following locations: Washington, New Bern, Edenton, and Nashville. An average of 75 people participated in each workshop. Participants represented a variety of groups from both the public sector (e.g., agencies) and private sector (e.g., landowners). The format for each workshop was the same. Presentations were given by the project team and others about: the A/P study, water quality issues, land use, and educational strategies. Respondents then discussed one specific land use issue in small group formats. The issues addressed included: cropland management, livestock waste, forest land management, urban runoff, septic tanks, shoreline development, recreation, fisheries management, and point source pollution. Groups answered four questions about each of these issues: (1) What obstacles make this problem difficult to solve? (2) What types of education or information do landowners or other groups need? (3) What new types of government programs or policies might be needed to control the problem? and (4) What types of additional research-based information are needed to support local programs for controlling this problem? Each small group presented the results of their discussions. These presentations were tape recorded and transcribed.

The second major product will be a handbook for use by local leaders, resource managers, and interested citizens. It will serve as a tool for planning and implementing educational programs to control nonpoint source pollution. We have completed a draft that is now being edited. This handbook is based, in part, on the results of the four leadership development workshops. This publication covers the following subjects: importance and nature of watershed management; causes and nature of nonpoint source water pollution problems; best management practices for controlling nonpoint source water pollution; barriers to adoption of best management practices; and educational strategies for controlling nonpoint source water pollution.

POSTER SERIES/ BUMPER STICKERS

David McNaught, Executive Director
Pamlico-Tar River Foundation
Washington, NC. 27889

Under funding from the Albemarle-Pamlico Estuarine Study, PTRF developed three different stimulating posters and two bumper stickers to increase public interest in the activities of APES. The project was completed under budget by late February 1990. PTRF developed the concept and content through the various committees of APES and saw the posters and bumper stickers through production. APES staff has been responsible for the distribution of the materials.

Raising Public Awareness and Involvement through Radio Broadcasts

Gayle Rancer and R.V. Fodor

Department of Marine, Earth, and Atmospheric Sciences
North Carolina State University
Raleigh, NC 27695

We have completed three radio programs (18 broadcasts) as mini-documentaries and talk shows that addressed three different environmental topics. Our objective has been to bring various issues to the attention of the public and to encourage public interest and participation in the Albemarle-Pamlico estuarine study. To achieve this, we received air time on five eastern North Carolina radio stations and Raleigh's WRDU to present 30-minute programs on each of the three topics. Typically, each show began with a ten-minute pre-produced introduction, background, and discussion of the particular environmental theme, followed by a phone-in talk show where listeners could talk directly to an expert we scheduled for that particular show and station (where no phone-in facility was available, as at WRDU, the pre-produced segment was followed by a taped interview with one or more experts).

The topics presented and discussed in our three productions were: point source and non-point run-off; the wetlands; and waste treatment. The participating eastern Carolina stations were WELS, WBTB, WJNC, WVOT, and WRRF. Among our radio-station guests were John Dorney, Jim Cummings, Alan Klimek, Bill Mills, Steve Leonard, Bob Rubin, and Frank Humanick.

Our goal is six programs on six different topics. Radio programs 4, 5, and 6 are in various stages of production, ranging from scheduling air-time (e.g., #4 should air mid-October), to script review, to obtaining interviews of experts and scheduling their visits to stations. The topics are: human impact and economics (public attitude survey); public participation; and fisheries and fish diseases. Experts and guests involved in these three programs include Joan Giordano, Mike Orback, Carolyn Hess, Bill Clifford, Tom Hoban, Tim McNaught, and Ed Noga.

Finally, we have arranged for tapes of all six completed programs to be available to other North Carolina and Virginia radio stations. This will bring the total number of stations participating in this public awareness endeavor to at least ten.

ALBEMARLE-PAMLICO ESTUARINE STUDY FINAL REPORT: COMMUNITY EDUCATION OUTREACH GRANT

Pamlico-Tar River Foundation
Thomas M. Stroud III, Principal Investigator

PTRF sought with this grant to continue to promote the awareness and better understanding of estuarine functions and issues in the central Pamlico region. As with the first year of this grant, the primary target groups for this effort were school students of all grade levels and the general lay public at large. A second but equally important function conducted through the grant this year was a series of meetings with local government officials in the Pamlico region. The purpose was to inform officials of the status and goals of the A/P Study, and to establish a liaison through which important information about the Study could be funnelled.

Both the general outreach and the specific effort local government effort were quite successful, and the foundation for continuing both into the next grant year seems strong.

Student-age contact (including youth groups such as church groups and Scouts) resulted in meeting with over 2,600 students during the grant year; that is an increase of more than 1,000 over last year's contact. Students from every grade level, first through 12th (and 3 college classes), were given presentations, with the bulk of the contact going toward lower and middle grades. The content of the programs focussed primarily on the function and concerns of the Tar-Pamlico River and estuarine region. Nearly 100 separate presentations were given at 20 different schools in Beaufort, Pitt, Hyde and Wilson counties.

Contact through civic clubs and other forums resulted in 36 programs (compared to 26 last year) through which approximately 4,700 were reached (compared to c. 3,400 people last year). These included presentations in nearly 20 different municipalities.

Also during the year, I distributed six newsletters to schoolteachers whose classes I have met with during the past two years. The newsletters focussed on estuarine and environmental concerns. It was aimed at students in grades 6-10 (though teachers in higher and lower grades asked to receive it). For grant year 90-91, over 30 teachers are scheduled to receive the newsletter.

The second major outreach effort of the grant during 89-90 was directed at local government officials in the Pamlico region. This involved presentations at regular meetings of county commissions, town boards, etc. The presentation was basically an introduction to the Study and its goals and objectives.

The following local governments were contacted during the year: County Boards -- Beaufort, Carteret, Craven, Hyde, Jones, Martin, Pitt, Tyrrell, and Washington. Town Boards/Councils -- Greenville, Farmville, Tarboro, Washington, New Bern, Havelock, Morehead City, Jamesville, Bath, Belhaven, Oriental, Robersonville, Williamstom, Beaufort, Plymouth and Swansboro.

The boards responded with varying degrees of interest, but virtually all expressed support for the Study and hoped it would produce a usable management plan.

.MPTON ROADS
NING DISTRICT COMMISSION

REBA S. McCLANAN, CHAIRMAN • ROBERT M. MURPHY, VICE CHAIRMAN • ROBERT G. BAGLEY, TREASURER
ARTHUR L. COLLINS, EXECUTIVE DIRECTOR/SECRETARY

CHESAPEAKE
rt G. Bagley, City Councilman
lan Krasnoff, City Councilman
mes W. Rein, City Manager

FRANKLIN
ert E. Harrell, City Councilman
ohn J. Jackson, City Manager

HAMPTON
T. Mamon Butler, Vice Mayor
James L. Eason, Mayor
obert J. O'Neill, Jr., City Manager

ISLE OF WIGHT COUNTY
s E. Standish, County Administrator
ard L. Turner, Board of Supervisors

JAMES CITY COUNTY
th N. Knudson, Board of Supervisors
id B. Norman, County Administrator

NEWPORT NEWS
Joe S. Frank, City Councilman
Vincent T. Joseph, City Councilman
Edgar E. Maloney, City Manager

NORFOLK
son C. Andrews, M.D., City Councilman
Paul D. Fraim, City Councilman
Joseph A. Leafe, Mayor
James B. Oliver, Jr., City Manager
G. Conoly Phillips, City Councilman

POQUOSON
L. Cornell Burcher, Mayor
Robert M. Murphy, City Manager

PORTSMOUTH
L. Louise Lucas, City Councilwoman
V. Wayne Orion, City Manager
Gloria O. Webb, Mayor

SOUTHAMPTON COUNTY
Rowland L. Taylor, County Administrator
C. Harrell Turner, Board of Supervisors

SUFFOLK
S. Chris Jones, Vice Mayor
John L. Rowe, Jr., City Manager

VIRGINIA BEACH
John A. Baum, City Councilman
Robert E. Fentress, Vice Mayor
Harold Heischober, City Councilman
Walter E. Mather, Citizen Appointee
Reba S. McClanan, City Councilwoman
Meyera E. Oberndorf, Mayor
Aubrey V. Watts, Jr., City Manager

WILLIAMSBURG
Frank Force, City Manager

YORK COUNTY
Sandra M. Lubbers, Board of Supervisors
Daniel M. Stuck, County Administrator

CONTINUING PROJECT
INSTITUTIONAL ENHANCEMENT AND PUBLIC INVOLVEMENT PROGRAM FOR SOUTHEASTERN VIRGINIA

The Chowan, Northwest, and North Landing Rivers and Back Bay are major tributaries to Currituck and Albemarle Sounds. They originate in or flow through Southeastern Virginia. Land use and other activities in these Basins affect environmental quality in the Sounds. Concurrently, management programs developed through the Albemarle-Pamlico Estuarine Study are likely to affect future development in these Basins. Through a cooperative program, the HRPDC is facilitating information exchange between North Carolina and Virginia environmental programs and localities.

Three major categories of work - Public Involvement, Information Exchange and Technical Studies - are underway. This program provides for the direct involvement of eight Southeastern Virginia localities in the APES Program. The HRPDC is carrying out the following activities:

Public Participation and Involvement:

- Provide information about APES through HRPDC's regular publications;
- Conduct Seminars for local government officials, business and agricultural interests and the general public;
- Operate a local government advisory committee;
- Represent its member local governments at program meetings; and,
- Maintain a Bi-State Coordination Process.

Information Exchange and Clearinghouse:

- Exchange information between Southeastern Virginia localities and APES Program staff and researchers; and,
- Refine and maintain a formalized, ongoing information and data exchange process.

Technical Studies:

- Prepare River Basin Fact Sheets on Virginia tributaries; and,
- Evaluate proposed Comprehensive Conservation Management Plan strategies as they relate to Virginia localities.

The HRPDC has prepared a Project Summary, documenting project activities and accomplishments during Fiscal Year 1989-90 and will prepare a similar summary for Fiscal Year 1990-91 activities. Recommendations for future activities and coordination will be made.

This project is of direct benefit to the APES Program and Southeastern Virginia localities. It is assisting to foster increased coordination and cooperation among the Bi-State region's localities.

Contact: John M. Carlock, Physical Planner
Hampton Roads Planning District Commission
723 Woodlake Drive
Chesapeake, Virginia 23220
Phone: (804) 420-8300

PUBLIC EDUCATION PROGRAM IN THE ALBEMARLE AREA

Maureen Hazelworth Colwell

Albemarle Environmental Association
Box 5346
Hertford, NC 27944

The Albemarle Environmental Association will continue the educational programming begun last year in the Albemarle area. Nine counties and nine municipalities will be targeted for presentations to local government officials. These include Bertie, Camden, Chowan, Currituck, Dare, Gates, Hertford, Pasquotank and Perquimans, and selected towns within these counties.

Presentations are currently being planned in cooperation with the Pamlico-Tar River Foundation to insure similar approach and content in all eastern counties. Programs will focus on results of research recently completed by the A/P Study, with initial emphasis on the maps and overlays which have been produced by LRIS.

To augment presentations, a series of brief newsnotes featuring updates on the Study will be produced and sent on a regular basis to government officials, community leaders, local libraries and schools. These newsnotes will provide the basis for regular news releases to the local press. It is expected that this combination of public presentation and written follow-up on a regular basis will re-inforce the goals of the Study.

Programming for civic groups and schools, which was begun last year, and which included a slide presentation and hands-on demonstration of citizen monitoring for water quality, will also continue. These programs were well received by the general public, and by teachers and students, and provided a solid introduction for discussions about the water quality of local rivers and the Sound.

A/P STUDY PUBLIC OUTREACH PROGRAM
(WITHIN ESTABLISHED STRUCTURE OF NORTH CAROLINA'S SYNDICATED RADIO PROGRAM, "WEEKDAYS WITH BARBARA KING")

Barbara K. Cleary

Business Forum, Inc.
323 Cliton Street
Greenville, NC 27858

The "portrait" of the Albemarle-Pamlico Estuarine Study Area which is evolving through the research and documentation of A/P Study participants is of a complex system whose Protection and Management involve numerous factors, not the least of which is positive public participation in those "steps" which A/P study participants are determining to be critical in reaching protection and management goals.

The project titled above is a public outreach program directed toward achieving positive public participation related to the A/P Study. Specifically, this project will result in the planning,development and production of eight (8) A/P Study -related radio program series totalling twenty five (25) programs which will air in 1990-1991 on the already established A/P region-wide and state-wide syndicated radio program "Weekdays With Barbara King", which has a daily audience of over 200,000 listeners.

This A/P Study - radio program series will include interviews with A/P Study investigators, other resource managers and A/P Study Area government officials, with the goal of increasing interaction between the A/P Study, local governments and general public, particularly in the study area.

Also planned in this project is the dissemination of the completed radio program series transcripts and cassette dubs to all individual resources featured and to A/P Study officials. Public outreach will be further achieved by airing specific references to sources of additional information related to A/P Study issues. The incorporation of the A/P Study-related program Series within the "Weekdays With Barbara King" radio program is also designed to position A/P Study goals and projects as critical issues and goals which the public and private sectors need to treat as everyday, on-going concerns rather than as isolated regional interests.

The program series will begin airing in October, 1990. The schedule of airing will be published and disseminated to A/P Study Officials and Participants. Data collection and resource identification is already underway for the program series. This data collection and individual resources identification is based on an approved program series outline which includes topics ranging from an historical perspective of the A/P Study area to a projection for the study area's future. Topics to be included parallel high ranking recommendations to date from the A/P Study such as Critical Habitat Protection, Managing Wastewater Treatment and Comprehensive Conservation Management Plan Development.

Some Interviews for the radio program series, and voice "actualities recording have been completed to date on the June, 1990 APES Media Tour and by telephone.

This project is open to recommendations for programs and resources identification from other A/P Study participants.

AWARDS PROGRAM

Tom Burns

Albemarle Resource Conservation and Development Council

The Albemarle-Pamlico Estaurine Study is beginning its fourth year of collecting information through research. Many information and education activities have been initiated to inform the public and involve them in the study process. This proposal will provide a mechanism to further involve citizens and to recognize the involvement of constituent groups who have practicen conservation and water quality protection in the A/P Area.

A "professionally organized" Water Quality Awards Program will create an environmental awareness among the general public by recognizing volunteer environmental/conservation advocates throughout the A/P Study area while increasing A/P visibility and support. The program will cover all counties of the A/P Study.

Nominations will be solicited from County Commissioners, Town Councils, Soil and Water Conservation Districts, Extension Service, Environmental Organizations, and all related natural resource agencies in all 33 counties of the A/P Study Area. Examples of potential nominees would be: farmers who have installed many BMPs on their land, citizens who are involved in the stream monitoring program, groups or individuals who have initiated water quality programs such as recycling days and beach sweeps, as well as individuals who have supported the A/P Study with many hours of

volunteer service. A committee of ten individuals shall be established to generate the rating criteria that will be used by this committee for selecting the award winners. This committee will be comprised of three members to be named by the Albemarle-Pamlico Estaurine Study, with the remaining seven members to be appointed by RC&D with concurrence of the A/P Study. This will provide for a wide variety of expertise that will reflect a balanced representation over the Albemarle-Pamlico Estaurine Study geographic area. A monthly progress report will be furnished to the A/P Study and consultation provided as required. The firm date for the Awards Banquet event will be determined in consultation with the A/P Study Committees. The Committees will provide this information of an acceptable date no later than August 15, 1990. When winners are selected, a video tape will be made showing these winners and their water quality activities to be shown at the banquet when awards are presented.

The Awards Banquet will probably be held in Greenville and plans will be made to accomodate 400 people including award winners, county officials, agency representatives, and legislators. Plaques will be presented to as many as 33 award winners. A notable keynote speaker will be sought to speak to this special group. The Governor's support will be requested for this occasion to provide us an opportunity to blitz the media both well before the event and as the Banquet unfolds.

FACT SHEETS ON THE ALBEMARLE

Grace Gray
Maurice Powers

Albemarle Environmental Association
Box 5346
Hertford, NC 27944

The Albemarle Environmental Association will produce a series of five fact sheets about the waters of the Albemarle. Topics will include the Roanoke, Chowan, Perquimans, and Pasquotank Rivers and the Albemarle Sound.

Biological, ecological, and geological data will be blended with cultural and historical information to help people understand the paramount role these waters have played in shaping history and daily life. How activities on land affect the health of the waters, and how people can be stewards of their natural heritage will also be emphasized.

Specific topics that will be considered for inclusion in each fact sheet are. . .Indian occupation and colonial settlement. . . later history. . .fisheries: seasonal rhythms, recent problems and their possible causes. . .shipping, transportation, and recreation. . .ecosystems. . .the people of the rivers. . .sources of pollution. . .citizen monitoring. . .state programs. . .goals of the A/P Study and latest research findings.

Research sources will include local libraries, newspaper archives, scientific studies, and the local people themselves. As the project progresses, requests for reminiscences from the general public, for possible inclusion in the publication, will be made through the news media.

Contests, also publicized in the news media, will be held in appropriate local high schools to seek illustrations for the Fact Sheets. Rough drafts of the manuscripts will be given to art teachers, along with guidelines for the type of reproducible artwork needed, and winners will have their work published.

The Fact Sheets will be distributed to schools, libraries and the general public.

Willard
PRODUCTIONS

"YES, IN YOUR BACKYARD"
TELEVISION PUBLIC SERVICE CAMPAIGN,
AND CONCURRENT TIP SHEET

Lisabeth A. Willard

Willard Productions
P.O. Box 33425
Raleigh, North Carolina 27636

The "Yes, In Your Backyard" television campaign is a series of 9 public service announcements targeted at specific audiences in North Carolina. Spots will be produced in categories including- "Citizen", "Farmer", "Children", "Recreational Boater", "Fisherman", "Small Businesman". The spots will offer a free tip sheet suggesting additional information when the viewer sends a self-addressed stamped envelope to the A P Study.

The spots will be distributed to every television market in North Carolina. The marketing strategy will include personal delivery of the spots, with the opportunity for stations to offer the tip sheet through a spot presented by one of their on-air talents, thus tying them into the campaign. 2,000 tip sheets will be printed.

Work is now beginning on the series. On-location shooting is scheduled for November; for post-production completion in December 1990; for distribution-January 1991. We believe this is an opportune time for delivery. The political season has ended. The Christmas season has ended. Television stations have more available time, and the viewer is particularly receptive to free offers after the holidays.

Please address comments and suggestions now to Lib Willard. 919-851-0017.

In a public opinion survey, "Public Attitudes Toward Water Quality and Management Alternatives in the AP Estuarine System" by Drs. Tom Hoban & William Clifford, Department of Sociology, North Carolina State University, 37.7 % of those polled had heard of The Albemarle-Pamlico Estuarine Study, and an overwhelming 91.5 % said they got some or a lot of of their information about water pollution from television. We look forward to this activist campaign moving forward the goal of clean water for the Albemarle and Pamlico Sounds.

P.O. BOX 33425 • RALEIGH, NC 27636 • 919/851/0017

NORTH CAROLINA COASTAL FEDERATION

Hadnot Creek Farm • 3223-4 Highway 58 • Swansboro, North Carolina 28584 • (919) 393-8185

PUBLIC EDUCATION AND INVOLVEMENT IN THE ALBEMARLE-PAMLICO ESTUARINE STUDY

October 1, 1990 to September 31, 1991

Frank Tursi
Principal Investigator

The activities that the Coastal Federation will assist the staff and CACs to organize and conduct include:

(1) Annual CAC Meeting: The Coastal Federation will assist the CACs in planning and conducting their annual meeting. The Federation will provide a wide range of services to the CACs to help them plan the agenda, as well as publicize and conduct their annual meeting.

(2) *Citizens Guide To Coastal Water Resource Management*: A second edition of this extremely popular publication (no copies remain to be distributed) that was first published by the Federation with funding from the Albemarle-Pamlico Estuarine Study will be published. New information about the government agencies will be included in this edition. Twenty-five hundred copies will be printed.

(3) Fact Sheets that Translate Funded Studies to English: The ten most significant studies funded (to be determined by the CACs and staff) will each be boiled down to a three- or four-paragraph synopsis that explains the study's purpose and its conclusions. These can be published in the quarterly newsletter, sent out as fact or "tip" sheets, and distributed free through the Aquariums, street festivals, and other public events.

A PUBLIC FORUM ON MANAGEMENT NEEDS FOR PROTECTING ESTUARINE RESOURCES IN THE ALBEMARLE-PAMLICO SYSTEM

Richard E. Shaw

Division of Coastal Management, DEHNR
P.O. Box 27687
Raleigh, NC 27611

The Coastal Resources Advisory Council (CRAC), the 47-member advisory board to the Coastal Resources Commission (CRC), will sponsor a public forum entitled "Managing Estuarine Water Quality and Natural Resources in the Albemarle-Pamlico Region." During a series of meetings at two central locations, interested citizens will have the opportunity to express their views and increase their understanding of specific problems related to managing estuarine resources and make recommendations for action by government agencies and other organizations.

A series of three meetings will be held in both Plymouth and New Bern from October 1989 to January 1990. At the first meeting citizens will be allowed to voice their concerns on estuarine resource degradation with regard to (a) sewage disposal and (b) monitoring & enforcement of existing environmental regulations. Citizens will be asked such questions as "Who is responsible for the current state of the A/P resources?" and "How effective are the current programs at protecting the A/P estuary?" In addition to recording oral comments, the project will utilize a professionally-developed survey to solicit citizens' perceptions of the sewage disposal and enforcement problems. The findings will be presented at a second meeting to public officials, resource managers, researchers and environmental groups to give them a feel for the public's perception of the issues. The results of the survey will be presented to the public at the third meeting, after which the resource managers will be given an opportunity to respond to the survey and discuss the problems with the public. Finally, given all that they have heard, citizens will be asked to make recommendations dealing with regulations, enforcement, monitoring, land use planning, public education, and citizen action. The recommendations will be organized in a final report and distributed to the Coastal Resources Commission, Environmental Management Commission (EMC), local governments and interested organizations with the expectation that the report will provide a framework for action on the selected problem areas.

The project will identify citizen attitudes on resource management, evaluate current and potential land use management efforts, and produce recommended alternatives for coordinating government and citizen management activities. In addition, the forum will offer interested citizens the opportunity to express their views on estuarine management problems, learn more about those problems, and to take part in the actual process of policy making for improved estuarine resource protection.

TEACHER TRAINING WORKSHOP
"Coastal Ecology and Water Quality"

Melva Okun, Education Specialist
UNC-CH Environmental Resource Project
315 Pittsboro St., C.B. #7410
Chapel Hill, North Carolina 27599-7410
919 966-3332

With funding from the Albemarle Pamlico Estuarine Study, a two-week teacher training workshop was conducted during the summer of 1990. Fifteen teachers from eastern North Carolina gathered at East Carolina University. The days were divided between classroom instruction, lab work, and daily field trips. The workshop was coordinated by Melva Okun of the UNC-CH Environmental Resource Project. The primary instructor was Dr. Mark Brinson with the ECU Biology Department. Information was presented on such topics as: the water cycle, ground water hydrology, the relationship between ground water and surface water, evolution of stream channels and floodplain features, topography map reading skills, water quality testing, impact of nonpoint sources (such as from farming) of nutrients, natural features of the coastal plain, human impacts on coastal resources, and how humans can make a difference in improving the coastal resource. Besides instruction provided by ECU faculty, presentations were made by Dr. Doug Rader of the NC Environmental Defense Fund, George Norris with the state's StreamWatch Program, Tom Stroud of the Pamlico-Tar River Association, Lena Ritter of the NC Coastal Federation, representatives from Weyerhaeuser, and Jess Hawkins and Pattie Fowler with the NC Division of Marine Fisheries. Field trips were made to the Greenville water and wastewater treatment plants, streams and rivers throughout the area, a salt marsh, swamps, the sound and the ocean. Water quality tests were performed and analyzed. Measurements were made of submersed aquatic vascular plants. The teachers were given materials for the classroom. Water quality testing kits are available for classroom usage.

A follow-up weekend with the teachers will take place in Morehead City on October 5-7th. Teachers will learn more about salt marshes and mudflats and the critters that reside there. They will examine night zooplankton and trawl and dredge the Newport River Estuary. Additional funds were made available by an Eisenhower Grant from the UNC Math Science Education Network.

October 2, 1990

ELIZABETH CITY-PASQUOTANK SCHOOL SYSTEM

Development of a Model Estuarine/Environmental
Health Education Center

ENVIRONMENTAL PROBLEM: There currently exits in our society a lack of understanding and appreciation for the impact estuaries have on our quality of life. The effect of uniformed decisions and irresponsive behavior on this delicate system is little understood and must be addressed from an educational standpoint, in an effort to preserve our estuaries for future generations.

EXPECTED RESULTS: The Elizabeth City-Pasquotank School System is using wetlands on school properties as learning laboratories to develop a "hands-on" model modular estuarine curriculum for grades K-6. One hundred fifty teachers will be trained and 3900 elementary students impacted by the project. The students will be given the opportunity to share their knowledge with the community by: a) conducting informational tours at the wetlands; b) implementation of a Kids Speaker Bureau; and, c) holding an exhibit at the mall.

Presentations will be made and/or information disseminated at the state science and health conferences and the regional science fair. Linkages will be established with the Northeastern Regional Education Center and the State Department of Public Instruction for the purposes of visibility and replication.

STATUS: Two hundred fourteen educators have been trained - 162 teachers, forty eight teacher assistants, and four supervisors - in using the Project WILD curriculum. This training has impacted upon 3340 students using the environment as a learning laboratory. Microprojectors (bioscopes) are being used to observe microscopic creatures that live in the estuaries. Terrariums are placed in each elementary school to teach the significance of plants to the natural world. Three elementary schools are currently developing their existing wetlands areas into learning laboratories. The development of estuarine environmental/health teaching modules will focus on four areas: 1) Water, 2) Wildlife, 3) Conservation, and 4) Recycling. The modules will integrate all subjects and will include "hands-on" activities.

For Additional Information Contact:
Superintendent - Dr. Travis Twiford
Project Director - Dr. Shirley Turnage
Project Coordinator - Ms. Dianne Maiggs
(919) 335-2981

Project Summary: Public Participation
"Precious Waters: North Carolina's Coastal Sounds"
An Exhibit at the North Carolina Aquarium at Pine Knoll Shores
Proposal Presented By: North Carolina Aquarium Society

The North Carolina Aquarium Society is sponsoring an exhibit entitled "Precious Waters: North Carolina's Coastal Sounds" with funding from the Albemarle-Pamlico Estuarine Study. This exhibit, scheduled to open in the fall of 1991, will be in the main exhibit hall at the North Carolina Aquarium at Pine Knoll Shores. The Aquarium's focus is on public education, promoting an awareness and appreciation of our state's fragile coastal environment. With an annual visitation of almost 600,000, the Aquarium is well suited to reach a wide range of visitors with information about the Albemarle-Pamlico region, its problems, and its management.

The exhibit will consist of a variety of components, including Aquarium displays featuring some of the animals of the region, graphic panels that tell the story with words and pictures, a large interactive map that teaches various features of the sounds, and video displays that provide an in-depth perspective on key issues. The Aquarium's education staff will create numerous programs that will complement the exhibit's message.

The precious waters exhibit will occupy about 900 square feet and will be on display for approximately 3 years. Additional funding will be sought in the coming months for construction. Most of the research, writing, editing, design and fabrication will be done in-house by the Aquarium staff.

During the summer of 1990, Aquarium Society intern Laura Wilkerson produced a survey to solicit background information for the exhibit. Out of the 100 surveys that were mailed, 35 were returned, and results of that survey are available from the Aquarium. This background information will assist the staff in determining what the most important messages are to be relayed in the exhibit.

For more information about the "Precious Waters" exhibit, contact Neal Conoley, Executive Director, North Carolina Aquarium Society, 919 733-2290, or Jay Barnes, Director, North Carolina Aquarium at Pine Knoll Shores, Atlantic Beach, NC 28512-0580, 919 247-4004.