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PAMLICO - TAR RIVER FOUNDATION

CITIZEN MONITORING PROGRAM

FINAL TECHNICAL REPORT

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ABSTRACT. The Pamlico-Tar River Foundation (PTRF) designed and implemented a pilot program for water quality monitoring using volunteers in the Tar-Pamlico basin.

In planning the program, PTRF staff solicited input from the Policy, Technical, and Citizen Advisory Committees of the Albemarle-Pamlico Estuarine Study, as well as area agency water quality professionals. To help insure scientific validity, a volunteer support committee of area scientists was consulted. A final facet of the planning was an exhaustive review of existing lay monitoring programs. The Citizen Program for the Chesapeake Bay (CPCB) served to be the best model.

We have equipped and trained sixteen volunteers who began sampling weekly in April, 1988, at nearshore sites in the Tar-Pamlico and some of its tributaries. Water and air temperature are determined using a field thermometer; pH, using a wide-range color comparator kit; dissolved oxygen with a micro-Winkler titration kit; salinity, by means of a specific gravity hydrometer; and a limit of visibility by means of Secchi disk depth. At upstream, fresh water sites salinity is not measured, but nitrate-nitrogen and phosphate are, both by use of color comparator kits. Each monitor follows strict procedures and records his test results on a standardized form. The form is mailed to the project coordinator for verification and entry into a computer file.

Quality assurance began with informed planning and continues through every aspect of the program. Each volunteer was initially trained at a workshop held in late March. Follow-up calls and visits are made to the monitors to answer questions and discuss any problems. In addition, periodic "quality control sessions" are held. The purpose of these sessions is to review procedures and conduct quality control exercises to assess the precision of the data.

The Pamlico-Tar River Foundation (PTRF) was funded by the Albemarle-Pamlico Estuarine Study (APES) in October, 1987 to design and implement a pilot program for water quality monitoring using volunteers on the Tar-Pamlico basin. The goals of the project, as stated in the proposal, were to: (1) Provide general public participation in the estuarine study; and (2) Develop a credible scientific data base to supplement the current monitoring of water quality by government agencies. I'd like to approach this report in terms of these two stated goals.

The idea of a citizens' monitoring program in the Pamlico was met with an enthusiastic response from the start. Finding capable and willing volunteers to carry out the testing procedures has definitely not been a problem. Members of the PTRF as well as many individuals from other regions within the APES area have responded admirably. We were easily able to dispatch all available monitoring kits to capable volunteers. In fact, many potential monitors were turned away without kits, and I continue to hear from individuals and civic groups who want to become involved in the project.

In August 1988, each monitor responded to a questionnaire regarding various aspects of the monitoring program. The results of this questionnaire provided some useful insights into the future handling of volunteers in this and other programs of it's kind. In summary: (1) Most volunteers responded that they found the manual easy to follow and the majority of the tests easy to execute. There were a few who felt the hydrometer used to determine salinity was difficult to read. Those who indicated a "favorite" test chose the test for dissolved oxygen, mostly because they felt it to be very important information and because this test is one of the most accurate of all the procedures; (2) Everyone felt that the initial training session held in March 1988 was informative and gave them a good basis for beginning their monitoring efforts; (3) Almost everyone was willing to continue testing until July 1989 and the majority expressed a willingness to continue testing indefinitely. One or two of the monitors stipulated good application of the data generated as a contingency for continuing the program. One monitor felt she would be more likely to continue if sampling frequency were reduced to once every two weeks rather than weekly; (4) All monitors said they were enjoying the program, siting the feeling of doing something worthwhile as a major motivation. The most common fear expressed was that the data generated might not be taken seriously by the agencies and scientific community and that it may not be put to good use; (5) Lastly, nearly all of the volunteers felt that increased contact of the monitors with the program coordinator, officials of DEM and APES, and the other monitors to be important. Many of these suggestions should be

answered by the expansion of this program with a full-time coordinator. Solicitation of this type of input from the volunteers themselves should continue to be an integral part of this program and any other monitoring effort using volunteers. The suggestions made by the volunteers must be dealt with fairly and given important consideration by those making decisions for the future of such a program.

The effort to develop a credible scientific data has involved many steps. The first of these steps was to seek the advice of a volunteer support committee of area scientists (Dr. Stan Riggs, Dr. Vince Bellis, Dr. Barney Kane, Dr. Graham Davis, Dr. Bob Crounse, and Dr. Jacqueline McGinity). Their input helped us to develop a program of sampling that is scientifically viable and able to supply useful data to supplement and complement existing monitoring efforts. The science committee met initially in August, 1987. It was agreed that obtaining data on some basic parameters such as dissolved oxygen, salinity, temperature and pH on a frequent basis could help to isolate the interactions of these variables that precede fish kills. The science committee discussed several options for the location of sampling stations. Dr. Donald Stanley, a long-time Pamlico River researcher, felt that tributary creeks had been neglected by earlier and current monitoring schemes. The committee concurred that a major focus of the PTRF would be the tributaries. Sampling protocol and potentials for future expansion of monitoring were also reviewed by the committee. This committee will also be able to serve as our panel of experts for advice on the analysis and interpretation of data generated.

Input into the planning of the program was also solicited from the Policy, Technical and Citizens Advisory Committees of the APES, as well as some agency water quality professionals. Representatives from the Washington, NC, regional Division of Environmental Management and the Division of Water Quality Planning were invited to attend and participated in a training workshop held in late March.

A final facet of the planning was an exhaustive review of existing lay monitoring programs. One of the most successful of these programs, and the one we chose as a model for our own is the Citizen Program for the Chesapeake Bay, Inc. (CPCB). The CPCB was started in July of 1985 as a pilot program designed to determine if citizens could collect scientifically valid data from nearshore stations that could be used to help document changes in the main tributary. They also set out to determine the most reliable sampling procedures, reporting formats and data management systems for a volunteer program.

PTRF staff felt that the extensive research done by CPCB in establishing effective sampling and testing protocol and procedures, plus the testimony of their subsequent success, more than justified the adaptation of their program to our own needs without our repeating the preliminary comparative studies.

Based on the CPCB monitoring scheme, we chose the following parameters and methods. Water and air temperature are determined using an armored field thermometer that measures in 0.5 degrees C increments from -5.0 degrees C to 45.0 degrees C. pH is determined using a wide range color comparator kit that measures in 0.5 pH unit increments. Dissolved oxygen concentration is measured in mg/1 using a micro-Winkler titration kit in increments of 0.1 mg/1. A limit of visibility is determined by Secchi disk depth in 0.1 m increments. All of the preceding equipment was purchased from LaMotte Chemical Products, Inc. The salinity is determined in parts per thousand (o/oo) using a specific gravity hydrometer in increments of 0.1 o/oo. The hydrometer is purchased from Fisher Scientific. A 500 ml. polyethylene graduated cylinder serves as an hydrometer jar and is also purchased from Fisher.

Parameters for the upstream fresh-water stations differ slightly. Here we are also determining nitrate-nitrogen and phosphate concentrations. It was the consensus of our science committee that measuring nutrients in the Pamlico was extraneous. There is already over $75 thousand spent annually to measure these elements in the estuary but not in the upper Tar. Secondly, the measuring devices which might be within our budget limitations were wholly inadequate for salt water areas. In the estuary, nutrient levels are so small that only very sophisticated measuring techniques will isolate the fluctuations. On the converse, Dr. Stanley recommended the measurement of nitrogen and phosphorus levels in the upper reaches of the Tar River as worthy of investigation. One reason for this is that nutrient levels in the fresh water Tar River were expected to be higher making the use of color comparator kits acceptable. Another reason is that there is no historical or current data base for nutrients in the Tar River, therefore such monitoring would provide new information. It will need to be evaluated for its significance and a decision made on whether to continue tests in the future.

Both of these nutrient levels are being measured in parts per million (ppm) with color comparator kits purchased from LaMotte Chemical Products, Inc. The remaining parameters and methods of determination are the same as for the estuarine stations.

Before distribution to volunteers the thermometers and hydrometers were calibrated according to calibration protocols discussed in "An Introduction to Water Quality Monitoring Using Volunteers" by Kathleen K. Ellett, CPCB Citizen Monitoring Coordinator. Quality assurance for these test and for the remaining ones - D. O., secchi depth, nitrate and phosphorus - begins by supplying each volunteer with standardized equipment for performing each measurement. Each volunteer is thoroughly trained in the proper protocol and procedures for the tests and is given a manual containing detailed instructions for all procedures. (see attached monitoring manual)

On March 26, 1988, a training workshop for volunteers was held. Presentations were made by Doug Rader, former director of APES, and Laurin Loftin of the Division of Water Quality Planning. Kathy Ellett, coordinator for CPCB, presented a slide show explaining the parameters and the procedures for measuring them. The volunteers were then equipped with materials and kits to measure each of the aforementioned variables. They were carefully trained in the procedures that each must follow. Data collection was begun by the volunteers in early April.

To date, we have equipped and trained sixteen volunteers who are sampling weekly at nearshore sites. The determination of site locations in a program of this type obviously depends largely on where the volunteers are willing to sample. We have, however, tried to cover as many of the tributaries as possible and the upstream areas of the Tar River. We have sites at Louisburg, Tarboro, Greenville, on the Tar between Greenville and Washington and on Chicod Creek and Tranter's Creek (tributaries of the river), as well as in Chocowinity Bay, Broad Creek, Bath Creek, South Creek and the Pungo River and Pungo Creek. At least two of the nearshore stations should provide good points of comparison with regularly monitored state sites at Broad Creek and at Indian Island.

An effort was made to select among the volunteers those who were willing to monitor areas of particular interest to the general public (i.e. - stressed or undegraded areas). However, due to the "relative" nature of water quality, it is sometimes difficult to determine the state of a particular area. Some would agree that the entire Tar-Pamlico system has been stressed, degraded or impacted in some way. Areas such as South Creek, Chicod Creek, Tranter's Creek and the Pungo River would be generally considered undegraded, though South Creek and the Pungo River may be quite stressed agriculturally. The Tar River at Louisburg and Greenville and the Pamlico at Broad Creek are areas of relatively high development. The site at Chocowinity Bay (relatively undegraded at present) should be of great interest in the future as development of the area by Westminster Company begins and progresses (proposed site of high density development).

Hopefully, with future expansion of the project, we will be able to cover the area of the Tar at Rocky Mount, the Highway 17 bridge at Washington (state monitoring site for comparison purposes) and some of the other Pamlico tributaries such as Blounts Creek, Durham Creek, North Creek and Goose Creek.

Each monitor follows strict procedures provided for him in written form and records his results on a standardized form. The form is mailed to the project coordinator for verification and entry into a computer-based storage. We are in the process of setting up computer files using Lotus 1-2-3 software for storage, generation of graphics, and some statistical analysis.

It should be noted that the use of mostly nearshore stations has been called into question by some members of the support committee. The choice was made on the basis of: (1) each access to the sites by the volunteers to encourage consistent year-round sampling (weather is less of a factor); (2) consistency in locating the exact site again and again; and (3) the question of safety and liability in the use of boats. It was the finding of the Implementation Committee Resolution on Citizen Monitoring (for the Chesapeake Bay Program) that "the data obtained so far indicate that the nearshore data provides essentially the same picture of the mainstem of the river as those taken in the mainstem itself." It will be necessary, however, to compare the data generated by the PTRF monitors with those of the state before any conclusions in this regard can be drawn for the Tar-Pamlico data.

PTRF monitors collect their data from surface water samples. It may seem desirable to some to also collect bottom water data. There are several factors to consider here: (1) Taking surface and bottom samples will require considerably more of the volunteers time; (2) the bottom water samplers add substantially to the cost of the kit; and (3) many of the nearshore sites are located in water too shallow to be concerned with stratification events. We have, however, purchased a few bottom water samplers that will be distributed to monitors in areas where stratification is likely to occur so that they can determine salinity, temperature, and DO for bottom samples. This data will then be used to determine whether or not bottom water sampling provides significant information in addition to surface sampling alone.

It was generally agreed upon by the members of the science committee that the measurement of fecal coliform concentrations would provide good information to the agencies and the scientific community as it would fill a gap in the current monitoring schemes. Unfortunately, the fairly complex logistical considerations of coliform monitoring (time limitations, transportation of

samples from distant monitoring sites to a certified lab, etc.) proved to be beyond the scope of this limited pilot effort. I do not feel, though, that the idea should be discounted in the future. I think that it could be handled successfully by a full-time coordinator as a separate project within the monitoring program. To date, the Chesapeake program has not attempted fecal coliform monitoring but are considering it as a future possibility. Other volunteer programs do monitor for fecal coliform quite successfully. The most notable is the "Pond Watchers" program of coastal Rhode Island, coordinated by Virginia Lee of the URI Seagrant Program.

Continued quality assurance is now the major concern of the project coordinator. The first of a series of periodical "retraining" and "quality control" meetings was held in August 1988. The purpose of these sessions is to review all procedures and conduct certain quality control exercises to assess the precision of the data. This will include tests set up to have monitors all test the same water with their equipment in the way they do at home or read and record previously set up laboratory tests similar to a classroom laboratory practical exam. The volunteers' results will be calibrated against results obtained by the coordinator using standard laboratory procedures (such as standard Winkler titration for DO and a laboratory pH meter for pH). These sessions also provide the monitors with the opportunity to share information and insights and to compare results.

Other measures to guarantee continued quality assurance in the program are essential to the acceptance of the data. Many of the QA measures used in this program were taken directly from the "Quality Assurance Project Plan for the Citizens Monitoring Project", Citizen Program for the Chesapeake Bay, Inc. submitted to EPA in November 1987 by the program and project managers (Fran Flanagan and Kathy Ellett). Among these measures are criteria for calibration and its frequency, sampling and analytical procedures, data validation and reporting, internal quality control checks, preventive maintenance, and specific routine procedures for identifying and correcting out-of-control situations. My point here is that good quality assurance is absolutely necessary to the success of this program. Procedures for this have already been established, tried, and approved by EPA on the Chesapeake project. It is my opinion that any citizen program can produce valid data if the criteria and procedures described by Kathy Ellett, et.al. in the QAPP are conscientiously applied and executed. Also, provisions have been made in the establishment of the steering committee for 1988-1989. The committee incudes two members of DEM staff, a streamwatch staff member and members of the scientific community to help insure the future scientific validity of the program.

In an effort to promote the use of a standard protocol for all APES area citizen monitoring, PTRF purchased four additional kits. These kits were distributed to members of the Neuse River Foundation and the Albemarle Environmental Association. Both of these groups are interested in establishing water quality monitoring programs of their own. The recipients of the kits were present at the March workshop and were fully trained in the proper sampling and testing procedures.

Travel funds from the grant were used to finance two trips for David McNaught, executive director of PTRF, and myself. The first was a trip to the Chesapeake in December, 1987. The purpose of the trip was to meet with Kathy Ellett, CPCB Citizen Monitoring Coordinator, and Frances Flanagan, CPCB Program Manager. We were able to discuss with them the various aspects of setting up a citizen monitoring program. We also got a first hand look at the equipment used by CPBC monitors and a thorough lesson in the procedures for sampling and testing.

The second was a trip in May, 1988, to the University of Rhode Island Narragansett Bay campus for a three day national workshop titled "The Role of Citizen Volunteers in Environmental Monitoring." The conference was co-sponsored by the Environmental Protection Agency and the Rhode Island Sea Grant Program. The first day we head a series of presentations from some of the nation's most successful citizen monitoring projects. On each of the following two days, we heard overview presentations on the elements of a successful program, quality control, funding, and handling a volunteer force successfully. The conference broke up into workshops after these talks to discuss the many topics addressed in them. The purpose of the discussion groups was to come up with some guidelines for fledgling programs regarding all of the major topics. Hopefully, we also developed some recommendations for EPA on how they can best facilitate and promote successful citizen monitoring efforts throughout the nation. The proceedings of the workshop will be published and a draft of the conference recommendations to EPA should be available upon request from Virginia Lee, U.R.I. Sea Grant, Coastal Resources Center, University of Rhode Island, Narragansett, RI. 02882.

A large part of the tasks of executing this grant was an investigation of other lay programs. There were a few points that were expressed time and time again by the coordinators and participants from other programs. Some of these key elements to which program success is attributed area as follows. (1) Programs should be designed with specific data needs in mind, so that data obtained will contribute to action or knowledge sought in the correction of an environmental problem. It is important to identify project needs in the beginning. (2) Input from key

volunteers, key experts and key agency people should be sought in the initial design phase of the program. A program must be launched soundly. This means expert advice from the start and thorough initial training of volunteers. (3) Quality control and quality assurance has to be built in the program from the beginning and constantly maintained throughout the life of the project to insure data validity and acceptance by agency and the scientific community. (4) The volunteer is the backbone of every program. They should be selected carefully, properly trained, adequately motivated and always appreciated. The volunteers should be allowed to be involved in the initial planning and subsequent evolution of the program. (5) It is important to build in a pathway for future revisions to a project. If the needs of the project change, the planners should have the ability to modify the project to meet the changing needs. Don't get stuck in an useless or misguided volunteer effort. The main difficulties identified by other programs include obtaining adequate funding and dealing with poor cooperation from state and federal agencies.

In conclusion, I would like to say that so far we have met with few obstacles in setting up this program. There is certainly no lack of support from the public or from most of the agencies and scientific community. Perhaps the major concern we have at this point is that the data generated by our volunteers will not be accepted by state agencies. The volunteers themselves express concern that their work will not be taken seriously or worse, will simply be ignored. We would like to suggest to the APES that they establish some sort of standard procedures for water quality monitoring by volunteers, so that groups wanting to start monitoring programs will be able to turn to a standard protocol that is acceptable to state and federal agencies.

A shortcoming of this pilot program was its failure to establish coordination with DEM for QA checks and the transfer of data. Hopefully steps have already been taken to insure DEM's input into the issue of quality assurance by including DEM staff members on the steering committee for the 1988-1989 grant administration. The data generated by the pilot program has been compiled into useful form and is available to DEM and the APES. I was unable to determine who in DEM was to be responsible for the data generated by volunteer monitors. It is my suggestion that the officials of APES and DEM assign this responsibility to a person or persons to whom the project coordinator can have easy access. This person should have the duty of receiving compiled data from the project coordinator on a regular basis and filing it in the DEM or APES data base for use by any interested parties.