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Measuring Progress of Estuary Programs

A MANUAL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 17 1995

THE ADMINISTRATOR

Dear Colleagues:

Estuaries -- the coastal areas where fresh water from rivers and streams mixes with salt water from the ocean -- are a major national resource and economic asset in this country. The protection of the 100 estuaries in the U.S. is a vital national concern.

Through the National Estuary Program (NEP), the U.S. Environmental Protection Agency brings together citizens, business representatives, scientists, state and local officials, and environmental organizations to arrive at common-sense plans for protecting 21 of these vital coastal areas. These plans, called Comprehensive Conservation and Management Plans, recommend actions to achieve specific goals.

This manual is intended to help managers in the National Estuary Program to assess environmental progress and communicate to citizens about efforts undertaken and successes achieved. An informed and involved citizenry is essential to the success of environmental protection.

Protecting estuaries means controlling pollution from a great variety of sources -- in the air, in the water, and on land. For this reason, the National Estuary Program provides an important model as our nation moves beyond piecemeal, pollutant-by-pollutant regulation to more a comprehensive "ecosystem" approach to environmental protection.

The procedures presented in this manual for assessing environmental trends and communicating with the public have been developed and field-tested by the Urban Institute of Washington, D.C. We expect they will be useful both within the National Estuary Program and for managers of watershed protection and other environmental efforts outside the NEP.

Sincerely,

Carol M. Browner

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Estuary

An *Estuary* is a coastal area where fresh water from rivers and streams mixes with salt water from the ocean. Many bays, sounds, and lagoons along the coasts are estuaries. Portions of rivers and streams connected to estuaries are also considered part of the estuary. The land area from which fresh water drains into the estuary is its watershed and affects the health of the estuary.

Outcome

An *Outcome* is an action or occurrence that happens outside the estuary protection program but that is likely to have occurred at least in part because of an estuary protection activity.

Indicator

An *Indicator* is a particular characteristic or reference marker used to measure whether an outcome is being achieved.

Acknowledgments

The procedures described in this manual were developed under Cooperative Agreement #CX819149-02-3 with the Urban Institute, Washington, D.C. We wish to thank Harry Hatry, Blaine Liner, and Shelli Rossman of the Urban Institute for bringing their expertise and knowledge in the field of program evaluation to the National Estuary Program (NEP). The Urban Institute worked with the Buzzards Bay and Tampa Bay National Estuary Programs to pilot test these procedures. For their help in ensuring the procedures will be most relevant to other estuary programs special thanks is extended to Dr. Joseph Costa, Director of the Buzzards Bay NEP and Richard Eckenrod, Director of the Tampa Bay NEP. At each pilot location, local advisory groups of NEP staff and advisory committee members assisted in the development and testing of the procedures. All together, probably well over 100 persons were involved in the preparation of this manual. While space does not permit listing all of them, their important roles are acknowledged, with our thanks. In addition, a national steering committee representing state and local agencies, academia, industry, and public interest organizations, helped guide the development of the procedures and reviewed the draft manual. Following is a list of the members of our steering committee whom we thank for their guidance:

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Finally, we extend our gratitude to the Richard King Mellon Foundation of Pittsburgh, Pennsylvania, and to the Mary Flagler Cary Charitable Trust, for their generous support of the Agency's efforts to help its estuary programs evaluate their progress.

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Summary

Estuaries are a major national resource and economic asset over and beyond their importance as food sources and recreational areas. The United States has approximately 100 estuaries. Protecting them is a vital concern to the nation. Organizations in many of these estuaries have established programs aimed at their protection. The U.S. Environmental Protection Agency's (EPA) National Estuary Program (NEP) currently has 21 participating estuaries.

This manual provides a series of suggestions on how estuary programs, localities, states, and the federal government (each of which have major interests in estuary protection) can regularly track the progress that estuary protection programs are making. The focus is on identifying the outcomes and results of estuary protection efforts that can be useful to estuary managers and other officials. This manual is not addressed to the technical community; it does not cover procedures directly related to the highly technical details involved in environmental monitoring.

By participating in the NEP, estuaries have agreed to organize their efforts around the development and implementation of a Comprehensive Conservation and Management Plan (CCMP). This agreement spells out the threats to the estuary and the plan for improving the protection of the estuary and its waters. The outcome monitoring procedures outlined in this manual should be useful in the development of CCMPs as well as in their implementation.

The material presented is based to a considerable extent on pilot efforts undertaken by the NEPs in Buzzards Bay (Massachusetts) and Tampa Bay (Florida) over an 18-month period in 1992 and 1993. The Buzzards Bay Project had completed its CCMP and was in the implementation phase during the pilot effort. The Tampa Bay NEP was developing its CCMP during the pilot period.

This manual first discusses the basic features of an outcome measurement system and the outcome indicators that appear relevant for estuary programs. An illustrative set of indicators is included. A major characteristic of many of the suggested indicators is that they identify indicators that should be considered "intermediate" outcomes. These intermediate indicators typically indicate some action or behavior undertaken by persons or organizations that can affect bay quality but do not measure the end results (such as the condition of living resources in the bay).

Procedures are described for tracking progress from estuary protection actions undertaken by: (a) governments; (b) businesses (such as those using hazardous materials); (c) households; and (d) boaters. Procedures are also presented for translating information on actual bay quality into "Bay Quality Indices" (BQI) developed from such information as available environmental monitoring data and data on beach closures to shellfishing and swimming.

Each of these procedures enables estuary officials not only to obtain the aggregate data for each outcome indicator, but also to break out the outcome data by various key characteristics. For example, changes in estuary protection activities of businesses can be broken out by type of business and by the type and amount of training and technical assistance the business received. Changes in behavior of households can be identified by county or town and household composition. Changes in the BQI can be broken out, for example, by segment of the bay.

The manual discusses for each procedure, and for the procedures as a whole, their limitations and cost implications. Finally, it presents suggestions on how the information from the various procedures might be analyzed and presented to estuary officials and the public in the most useful way.

SECTION 1

Introduction

This manual identifies outcome indicators and describes procedures that individual estuary protection programs can use to track progress in protecting their estuaries. The focus of the procedures is on obtaining regular information on the *outcomes* of estuary protection activities. The word "outcome" is used throughout this manual to refer to an action or occurrence that happens *outside* the estuary protection program but that is likely to have occurred at least in part because of an estuary protection activity. Outcomes do not include measures of the quantity of program work activity. The definition of outcome used in this manual intentionally does not include the requirement that the outcomes measured are the result of estuary protection activity. As discussed later, such causality is usually difficult to determine because of the many other factors that can contribute to outcomes.

The 1990s have become the decade of "accountability," "managing-by-results," and "customer satisfaction." Federal and state governments have been required by legislation (such as the Government Performance and Results Act of 1993) and by

the National Performance Review and Total Quality Management systems now in place, to monitor and report on program outcomes or results.[1]

The widely disseminated publications of authors such as Thomas Peters and Robert Waterman, W. Edwards Deming, David Osborne and Ted Gaebler, and Peter Drucker have argued for what seems to be pure common sense: publicly supported programs should regularly, or at least annually, track the *results* and outcomes of their efforts.

What does this mean for estuary protection programs? Common sense dictates that estuary protection programs should regularly track the outcomes of their efforts at improving and maintaining the quality of estuary waters. Estuary protection officials should use this information to help them determine where improvements are needed and, later, whether improvement efforts have led to targeted or desired results.

Monitoring the status of an estuary is a complex undertaking. Measuring water and living resource quality at all times, in all locations, and at all depths would be prohibitively expensive. No estuary would attempt that, even if it could afford to do so. But estuary programs need a process that provides adequate and appropriate information so that judgments can be made about the estuary's health.

Estuary managers and the public need meaningful information in order to judge progress in protecting and regenerating the nation's estuaries. The objective of an outcome monitoring system is to provide information that can help managers measure both progress in estuary protection and significant changes to an estuary over time. Such information can also set the stage for relating observed changes to their possible causes. To do this, estuary officials need to track progress in actions taken by governments, industries, and households, and to track environmental indicators of water quality and the health of estuary living resources.

For estuaries participating in the NEP, the required Comprehensive Conservation and Management Plan (CCMP) defines the purpose of the estuary protection program and a planned monitoring process. Other estuaries likely have, or will have, a management plan to which the outcome tracking system described in this manual can be related.

Some estuary programs may be in the process of developing an estuary protection plan such as a CCMP. If they are already undertaking estuary protection projects (such as providing encouragement to citizens to take steps to reduce polluting-related behavior), they probably can use at least some of the procedures in this manual to track the outcomes of their efforts. Even estuary programs not yet undertaking any "action" projects can review these procedures to glean suggestions for progress tracking procedures and to develop baseline data against which to compare later progress.

The outcome monitoring procedures described here were developed with the participation of two estuaries that are part of the NEP: the Buzzards Bay Project in Massachusetts and the Tampa Bay NEP in Florida.[2]

Both programs established project advisory committees to provide guidance to their work. These committees comprised representatives from local governments, citizen groups, and the technical community. In addition, local NEP staff used special advisory groups for some of the new monitoring procedures, such as the development of a Government Action Checklist and a Bay Quality Index, both of which are described below.

This manual also benefited from a national advisory group that provided early guidance on the elements the project team should examine and on the draft final report.

An important consideration for outcome monitoring procedures is that they be affordable. We have incorporated many components where data are likely to be already available or new low-cost procedures, such as use of volunteers to help with surveys, are likely to be readily achievable.

This manual presents an illustrative set of outcome indicators that estuary programs can consider for their own use. We describe in detail four data collection procedures that can provide data on a number of these outcome indicators and that are not commonly applied to estuary programs. Each of these procedures can generate outcome information on a regular basis. These procedures include:

1. Use of a Government Action Checklist to track progress in local public agency actions (a similar type of checklist is needed covering state and federal activities);
2. Surveys of business and industry to track their behavior in environmental protection, such as hazardous waste reduction;
3. Surveys of households and boaters to track their behavior with respect to wastes; and
4. Development of a Bay Quality Index to track overall water quality and health of the bay's living resources.

PURPOSE OF REGULAR OUTCOME MEASUREMENT

Regularly monitoring the outcomes of estuary protection efforts has the following basic purposes:

- To help estuary program officials and managers plan, manage, and improve estuary protection programs. Outcome information obtained by tracking the extent of progress being made should help them improve program activities, identify new activities that are needed, and set priorities by identifying where existing activities are achieving or not achieving desired results, and by identifying problem areas;
- To increase accountability of estuary protection programs to elected officials and the public, so they can assess the extent to which desired results were achieved after resources were applied;
- To help develop and justify budget requests, especially when outcome information is linked to proposed resources and activities;
- To communicate to citizens and the media the progress being made.

Other more specific estuary program uses include the following:

- If an estuary program sets targets for itself each year, the outcome assessments can be used to track progress in meeting these targets.
- The information from the process can be used to provide baseline information for estuary programs that engage in long-range/strategic planning.
- For programs that incorporate a "total quality management" (TQM) approach, the outcome information should provide an important part of TQM's measurement requirements.
- The outcome information can help identify activities that need more in-depth evaluation, such as activities that are not generating the outcomes expected. The availability of past outcome information should also enable in-depth studies, such as evaluations of particular estuary protection activities, to be conducted more efficiently and expeditiously by providing relevant data for these studies.
- The procedures should be useful to estuary officials during the early years of an estuary protection program, such as during the period leading up to final Comprehensive Conservation and Management Plan approval:
    - During the CCMP preparation period, estuary programs undertake numerous activities intended to help protect the estuary even though the CCMP has not been completed. For example, estuary programs carry out various efforts to alert their citizens to estuary protection needs and undertake demonstration projects. Outcome monitoring

procedures such as those described here can help the estuary protection program track the achievements of those efforts.

- For estuary programs preparing strategic plans such as CCMPs, the outcome monitoring process can also help form the basis for the estuary program's CCMP monitoring plan, as required under CWA Section 320(b)(6).
- The Government Action Checklist process (described in Section 4) can be used, as in the Tampa Bay NEP, to help identify the specific steps needed to protect the estuary over the long run—steps that should be included in the CCMP.
- As noted earlier, the initial data collected by the procedures will provide the baseline against which progress can be measured.

❑ At any stage, whether pre- or post-CCMP, the outcome indicators can be used to help track progress on major special projects and activities. This can be done if the relevant outcome indicators are broken out to relate to the project, for instance, by breaking out the outcome data by the specific geographical areas or types of households or businesses targeted by the project. If, for example, an estuary program has a special project to provide on-site technical assistance to businesses in a particular industry for hazardous waste reduction, the program can obtain separate tabulations of indicators of changes in industry behavior for the particular businesses directly assisted. The program could also compare the outcome data for assisted businesses to those for businesses that did not receive such assistance.

❑ The "ordering" of the indicators into sequential stages (as described in Section 2) can be used to help estuary officials and the public understand the time and steps necessary for achieving environmental results. This can lead to more realistic expectations and greater public support over the long run.

The information generated by outcome monitoring is also intended to help federal and state officials in their accountability and program improvement tasks. For example, the federal government can use the information provided by individual estuary programs to help prepare reports to Congress on the progress and achievements that have occurred. The federal government can also use the information from many locations to identify what performance areas have been weakest and need technical assistance or other help. Since each estuary program will likely have somewhat different outcome indicators and measurement procedures, the quantitative values will usually not be additive. Other aggregated forms of the outcome information, however, can be used.

The procedures in this manual are *not* aimed at tracking internal activities, such as the number of committee meetings held or other "activity" measures, though such information may be desirable for a variety of estuary internal management purposes.

For national purposes, to the extent that many estuary programs use similar procedures, such information can be accumulated and reported to provide a *national* perspective on progress in estuary protection. With over 100 estuaries around the nation, estuary protection is a major resource concern to the country as a whole.

COVERAGE AND SCOPE

This manual presents an illustrative set of basic indicators of estuary protection outcomes and describes procedures that can be used by estuary protection programs to obtain regular (quarterly or annual) data on these indicators. The manual also includes illustrative data collection instruments such as questionnaires that can be adapted for use by individual estuary programs. Estimates are provided of costs and the extent to which an estuary program is likely to need special resources to utilize these procedures.

The manual also suggests the steps that estuary programs can take to develop *their own version* of the outcome indicators and data collection procedures.

The procedures described in this manual track progress in the following categories of estuary protection activities:

- Progress of individual *governments* in implementing estuary protection actions and activities;
- Progress in encouraging key *industries* to alter their practices and to reduce their release of polluting substances;
- Progress in encouraging *households and boaters* to undertake actions that reduce potential estuary pollution and damage;
- Finally, and ultimately the most important, progress in achieving overall improved water quality, improved condition of living resources, and increased ability of the estuary to support desired public and business uses of the estuary waters.

This manual does not describe technical procedures for obtaining detailed environmental monitoring data or for obtaining more commonly collected information needed for outcome measurement, such as effluent data and extent of

shellfish closures. As indicated later, such procedures are needed for a comprehensive outcome monitoring process but are likely to be already familiar to estuary programs.

BASIS FOR THESE PROCEDURES

The Urban Institute examined numerous materials relating to performance indicators and held numerous interviews with EPA and estuary protection personnel. Two estuary programs participated as pilots and helped develop and test these outcome monitoring procedures: the Buzzards Bay Project in Massachusetts, which had recently completed development of its CCMP, and the Tampa Bay NEP in Florida, which was just beginning its program and has not yet completed its CCMP. NEP personnel from each of these two estuaries, together with the Urban Institute team, worked over 14 months to identify appropriate indicators of estuary protection outcomes and low-cost data collection procedures.

The procedures reported here have been tested by one, and sometimes both, estuary programs, or are in the final stages of testing as of this writing.

The principal tests conducted include the following:

- Both estuary programs are undertaking tests or have completed pilot tests of the "Government Action Checklist" procedures. The joint estuary program-Urban Institute team worked with public officials, citizen groups, and other professionals in each estuary to develop a checklist of government actions that the officials believe are important for governments to implement. Procedures for assessing the extent to which each item on the checklist has been achieved by each local community were developed. (In the Buzzards Bay Project, the progress ratings are being assessed by an existing citizen group, the Coalition for the Buzzards Bay Project. In the Tampa Bay NEP, the assessments are being conducted by the Regional Planning Council). Repeating this process annually will provide officials and the public with an indication of progress over time. The information generated is also expected to be used by the individual communities to help them identify gaps that need to be filled.

- The Tampa Bay NEP conducted a test of a random sample of households throughout the area and, separately, a survey of households in two neighborhoods whose residents were given special guidance in ways households can protect estuary waters. In both surveys, the purpose was to assess the level of current household estuary or environmental protection behavior and the extent to which activities being conducted by

the estuary program have achieved results, and to provide baselines for measuring progress in future years when the surveys are repeated.

- The Buzzards Bay Project tested a survey of boaters to identify the extent to which boaters are properly handling wastes. Periodic surveys will indicate progress achieved after efforts have been made to inform boaters on recommended waste-handling procedures.
- The Buzzards Bay Project undertook an initial test of a survey of industries that use or generate hazardous/toxic waste. The purpose is to provide a baseline for future periodic surveys, to help ascertain technical assistance needed by participating businesses, and to help identify whether and to what extent programs to reduce hazardous waste (and to improve waste handling) are achieving desired results.
- Both sites developed and tested procedures to develop Bay Quality Indices. The indices combine key available indicators of water quality, condition of living resources such as fish and shellfish, and the ability of the waters to support public and business uses such as shellfishing and swimming. These indices can also be broken out by major sections of the estuary. Such indices are based on available data and do not necessarily represent the ideal composition of such indices, but do reflect the practical cost limitations on data collection. A key feature is that the indices are understandable to public officials and the public.

DEVELOPING ESTUARY PROTECTION OUTCOME MONITORING PROCEDURES

The outcome indicators and data collection procedures presented in this manual are intended to illustrate what individual estuary programs can do in their own outcome monitoring efforts. The indicators and procedures are not intended to be copied verbatim. Each estuary program will want to develop its own version of such procedures, though some basic elements are likely to be common to most, if not all, estuaries. The outcome indicators and data collection procedures identified here can also be used as starting points for estuaries that are not already monitoring the outcomes of their estuary protection programs. Estuaries with existing outcome monitoring procedures may find some suggestions contained here useful for improving their efforts.

We recommend that estuary programs use these outcome indicators and data collection procedures as a starting point to identify which indicators and procedures are appropriate for their own estuary. For example, what items should be

included in your own Government Action Checklist? Which topics should be covered by your own household and industry survey instruments? Which elements are practical for inclusion in your own Bay Quality Index?

The process for developing outcome monitoring procedures should involve existing local policy, management, and citizen advisory committees to help identify the overall set of outcome indicators and the various data collection procedures. The sections of this manual that describe each procedure also describe a process that a local estuary program can use to develop its own version of those procedures.

LIMITATIONS OF OUTCOME MONITORING

Outcome information tells public officials the status of each outcome indicator, but does not tell what caused the outcomes. This limitation should be recognized by all those using outcome information. We also emphasize, however, that having regular information on outcomes is a basic first step toward directing attention to aspects of environmental protection that need attention—and later indicating whether past activities have led to desired outcomes. In some instances, the estuary program will be able to identify *likely* linkages between actions taken and outcomes, such as when special effort has been applied to particularly problems at particular locations *and* improvements in those problems subsequently occur at those locations.

A useful analogy is that of sports activities. A baseball or football score is needed to tell whether the team is winning or losing but does not tell why. Outcome information provides a scorecard for estuary protection program information vitally important for managing and overseeing activities, but does not tell the reasons for good or bad outcomes. More information is needed, perhaps a special study, to indicate why.

External factors can, and often do, play a major role in determining outcomes. For example, unusual amounts of rain, or start up of new businesses, can have considerable effect on water quality. Sometimes we simply don't know on a scientific basis whether action "A" led to outcome "A." A new waste treatment plant coming on line just prior to observed improvements in the nitrate levels in an estuary may have had little or no causal relationship to the improved nitrate levels. Declining nitrate levels might be the result of improved farm management practices or a reduction in the size of farms, rather than the result of a new treatment plant.

Nor will outcome information by itself identify *what should be done* to correct problems indicated by the outcome information. Nor will these procedures by themselves provide estimates of the *efficiency* with which program resources are being used. However, when combined with other information such as program

costs these procedures will support estimates of the cost-effectiveness of program activities. Lag times between cause and effect often can obscure the linkage or may lead observers to the wrong conclusions. Linkages, attribution, lag times, and many other considerations may be involved in judging performance of any one set of actors or actions in the improvement or decline in the state of an estuary. (These problems apply less to the "intermediate" outcome indicators suggested throughout this manual; the activities of estuary programs can much more directly affect intermediate outcomes—see discussion in the next section.)

Thus, users of outcome information such as that described in this manual should not rely solely on the outcome data for drawing conclusions about the reasons and causes for the observed outcomes. Expectations must be tempered with a realistic understanding of the complexities of cause and effect.

THE NEED FOR COST AND STAFF EFFORT TO BE KEPT LOW

Some of the data needed for outcome monitoring should already be readily available in many, if not most estuaries (such as estimates of effluents, beach closures to shellfishing, and some environmental monitoring data). In such cases, little or no added cost is likely to be required to use that data for tracking outcomes. The new procedures described in this manual, however, each require additional staff time and cost. Formal estuary protection programs such as the NEP are seldom, if ever, the sole data collection organization for an estuary. The outcome measurement work should be coordinated with, and use relevant data from, other federal, state, local, and private organizations.

To reduce costs, surveys of households or organizations can use mail survey procedures if ample follow-ups of non-respondents are used to obtain reasonably credible response rates. Random samples can also be used to reduce collection costs, rather than attempting to survey all households or all organizations. Mailing costs are likely to be small, but the administration of surveys requires staff time to process the mailings, do the tabulations, and prepare the reports. Clerical staff and, perhaps, volunteers can be used on these activities, making such surveys feasible, even for small estuary protection programs.

The cost of regular Bay Quality Index preparation depends on how much data collection is done regularly on the various components of the Bay Quality Index. An ideal Bay Quality Index would likely require major resources for regular collection of a large number of often complex water quality and living resource condition measurements. The use of volunteers to collect and compile some data

elements (as is done by the Buzzards Bay Project and other estuary programs) will increase the feasibility of obtaining data on some index components for those estuary programs with limited resources. Because estuary programs need to collect data on environmental indicators, most of the cost of the collection will need to be incurred whether or not the estuary implements an outcome monitoring process. Thus, the principal added costs of calculating Bay Quality Indices should be small.

Cost issues are discussed in more detail in each of the chapters that describe the data collection procedures.

ORGANIZATION OF THIS MANUAL

This manual has eight sections. In Section 2 we suggest how to identify useful outcome indicators, grouping estuary indicators into four "orders" that fit well with the monitoring format used in the Comprehensive Conservation and Management Plans for NEPs. In Section 3 we identify an *illustrative set of performance indicators* based on those generated by the Buzzards Bay Project, the Tampa Bay NEP, and Urban Institute personnel after extensive discussions with local experts and officials. Hundreds of indicators were suggested in first-round discussions. The resulting list was whittled down from that initial master list.

In Section 4 we present the process for tracking the *actions of governments*—the local Government Action Checklists used by both pilot estuaries. We include recommendations on how to present this information to the public and to local officials.

Section 5 contains recommendations on obtaining information on *protection practices of the business sector*, including use of surveys of businesses on hazardous and toxic waste reduction based on work conducted by the Buzzards Bay Project. We present the rationale for these surveys, the procedures used, and the questionnaire.

In Section 6 we describe procedures for obtaining information about *protection practices of households and boaters*. Using the household surveys conducted in the Tampa Bay NEP and the boaters survey conducted in the Buzzards Bay Project, we present the rationales, procedures, and simple data collection instruments.

In Section 7 we present recommendations for *Bay Quality Indices* based on those being used in both pilot estuaries. We highlight the use of citizen volunteers and the existence of measurement problems.

In Section 8 we suggest *ways to analyze and report the outcome information* gathered from the various data collection procedures in order to provide useful and useable information for estuary program officials.

Notes, Section 1

1. The Office of Water is in the process of identifying environmental indicators, in order to track progress and report results to the public in meeting Agency goals. See appendix 5 for recommended indicators.

2. The CBP has developed a similar approach to measuring progress. Appendix 6 provides a brief description of their efforts.

SECTION 2

Identifying Useful Outcome Indicators and Implementing an Outcome Monitoring System

In this section we examine how to categorize outcome indicators and outline the basic steps in implementing an outcome monitoring system.

CATEGORIZING OUTCOME INDICATORS

The first step in categorizing outcome indicators is to *distinguish indicators of outcomes from those that measure the quantity of work activity done.* Counting the number of meetings held by estuary program staff or the number of water quality readings taken are indicators of work activity. These numbers are important to estuary managers, but say nothing about the *results* of those activities.

Here we define an outcome indicator as an indicator that measures responses that have occurred *outside* the program, such as changes in the estuary protection behavior of the public or businesses, reduction in the amount of pollutants released into the bay, changes in the condition of life in the bay, and so on.

The next step is to distinguish *"end outcome" indicators from "intermediate outcome" indicators.* Estuary protection programs generally aim to affect the behavior of governments, businesses, households, and boaters. Improved environmental behavior actions by these groups are important outcomes, but are not the ultimate ends being sought. Instead, they represent "intermediate outcomes." Examples of "end outcome" indicators are improved bay quality and health of living resources in the estuary.

Intermediate outcomes can be expected to occur relatively early, in contrast to some end outcomes, which may take years to show up. Monitoring progress on these earlier outcomes are thus important for managing estuary protection efforts. In fact, estuary protection activities often set in motion a series of sequential outcomes, indicating that a multiple categorization of outcomes is helpful.

Four categories of outcome indicators appear especially relevant to estuary protection activities.[1] Each is described below. The first three categories are intermediate outcomes.

- ***First-Order Outcomes (Behavioral Change): These indicators assess the extent to which desirable estuary protection actions have been adequately implemented by governments, businesses, or households.*** These indicators do not provide information or whether water quality or the condition of living resources has changed, which are third- and fourth-order outcomes). The Government Action Checklist and the business, household, and boater survey procedures focus primarily on first-order outcomes. For example, the Government Action Checklist procedure (see Section 4) measures and tracks the extent to which local governments have implemented actions aimed at estuary protection. However, having implemented such actions does not tell whether there are improvements in the amount or quality of effluent, in water quality, or in the condition of living resources in the estuary. Similarly, the outcome indicators used

to track protection actions taken by households and boaters (see Section 6) and by businesses (see Section 5) also represent first-order effects. These actions are important first steps but do not indicate how successful the actions were in reducing pollutants, improving water quality, or improving the condition of the estuary's living resources. Other indicators are needed to track progress on these latter elements.

Many if not all first-order outcomes will likely be closely associated with implementation actions proposed by an estuary program's long-range plan such as its CCMP. Thus, measuring these outcomes will be a major way to track progress in implementing these plans.

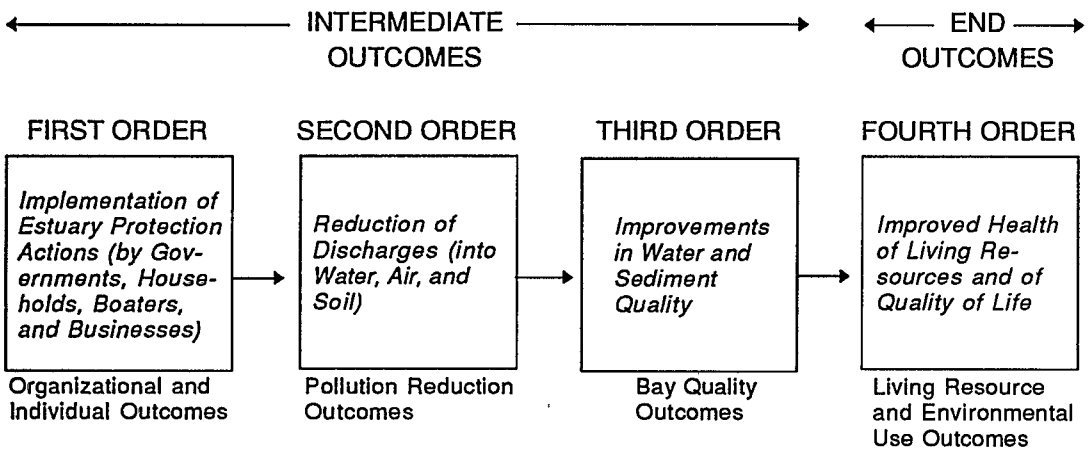
- ***Second-Order Outcomes (Pollution Reduction): These indicators provide information on the extent to which actions have led to reductions in pollutant discharges.*** Amounts of various pollutants or other hazardous substances discharged into the water or air from various businesses are examples of this category of outcome indicator. Because considerable effort to monitor discharges is already underway across the country, this manual does not describe data collection procedures for measuring amounts of pollutant discharges. The business, household, and boater survey procedures, however, provide information on whether businesses, households, and boaters report having reduced their discharges. But these surveys are not likely to be a reliable source for learning the actual amount of such reduction.

- ***Third-Order Outcomes (Water Quality): Such indicators provide information on the extent to which water or sediment quality has changed.*** These include such frequently used indicators as BOD, amounts of potentially hazardous chemicals in the water, and amounts of pathogens and fecal concentrations. This manual does not describe the detailed data collection procedures for obtaining values of each potential component of these indices. That information is highly technical, and well beyond the scope of the effort reported here.[2] However, in Section 7 we discuss how technical data on water quality can be combined with indicators of fourth-order effects to produce a comprehensive Bay Quality Index.

- ***Fourth-Order Outcomes (Living Resources): Indicators of fourth-order outcomes provide information on the extent to which the health of fin fish, shellfish, other wildlife, habitat and vegetation, and the region's economy has changed.*** This category also includes indicators of the extent to which an estuary can support individual uses such as swimming and shellfishing.

In Exhibit 2.1 we summarize these four categories of outcomes in a "chain-of-events" diagram. In Exhibit 2.2 we illustrate this progression of outcomes for a

EXHIBIT 2.1 *Estuary Protection Chain of Events*



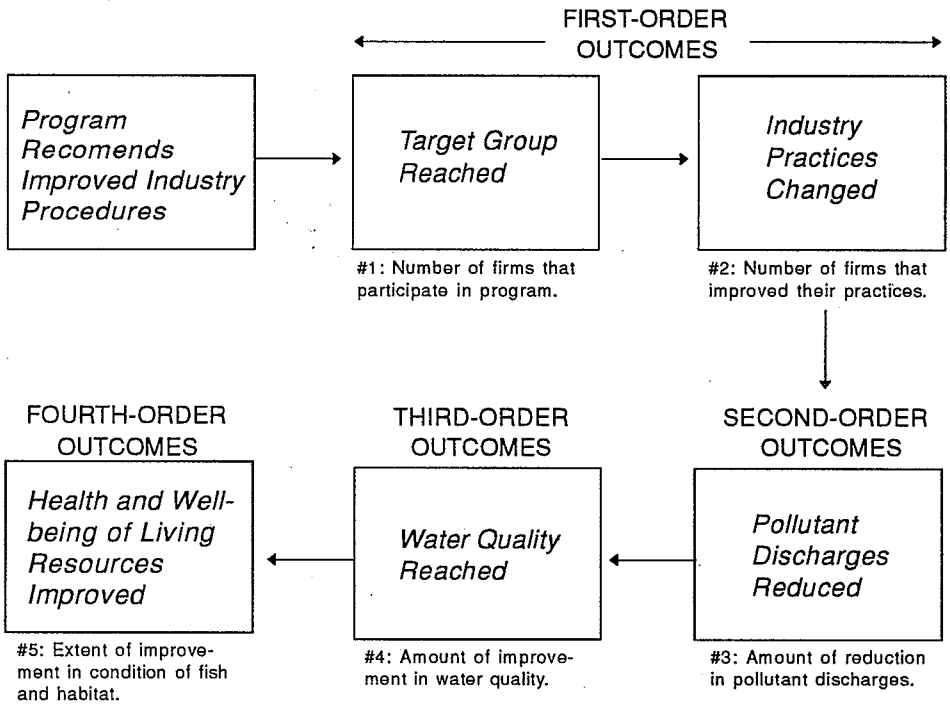
specific estuary protection activity: an effort to encourage industrial firms to reduce the amount of hazardous waste generated. Getting firms to seek training and technical assistance in hazardous waste reduction is a first positive step and is shown as outcome indicator #1 in Exhibit 2.2 . (Note that measurements such as the *number of events* held by the estuary program are not outcomes but rather measure the amount of program *work activity*.) It is even more useful to measure the number of businesses that made constructive changes in their use and handling of hazardous materials/waste (outcome indicator #2). Both of these indicators measure first-order outcomes. Reductions in the amount of hazardous waste generated and amount of individual pollutants discharged by these businesses (outcome indicator #3) are second-order outcomes. Even better outcomes are improvements in the quality of receiving waters (outcome indicator #4), a third-order outcome. Ultimately, the results desired are improvements in the condition of the estuary's fish, other wildlife, vegetation, and in the ability of citizens and businesses to use the estuary's waters (outcome indicator #5), which are fourth-order outcomes.

In Exhibit 2.3 we present another example of this outcome progression using local ordinances as a starting point.

Categorizing outcome indicators is important in providing a clear perspective to officials and the public on the ultimate importance of individual indicators. It should also enable users of the outcome information to keep in perspective which results are relevant to the ends ultimately sought by estuary protection activities.

Note that although these four orders form a cause-effect chain, estuary actions do not necessarily have to start at the beginning of the chain. For example, some

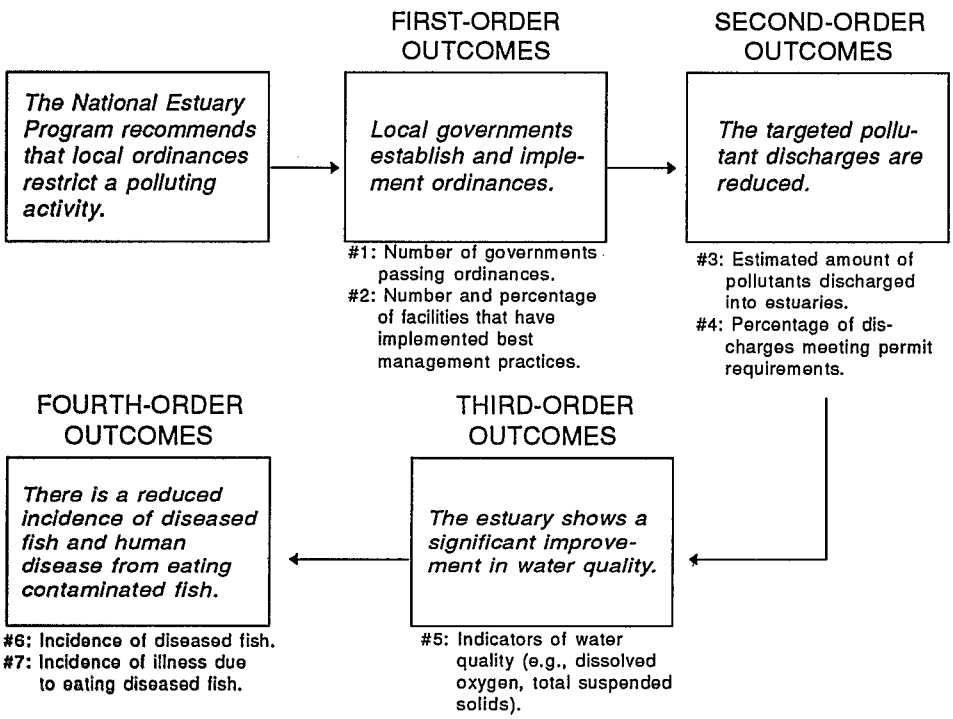
EXHIBIT 2.2 *Ordering of Estuary Protection Outcomes: Effects of Hazardous Waste Reduction*



water clean-up activities (e.g., of PCBs) might not affect first- or second-order indicators but would directly impact water quality and subsequently the health of living resources, which are third- and fourth-order impacts.

Monitoring outcome indicators that measure first- and second-order outcomes has the advantage of enabling users to track estuary protection progress in a more timely fashion. First- and second-order outcomes generally occur relatively soon after program activities, while third- and fourth-order outcomes often occur later. Fourth-order outcomes—changes to living resources—sometimes may not occur until many years after corrective actions have been taken. The purpose of outcome monitoring information is to provide *timely* information that public and private officials can use to help them make program decisions. Decisions often cannot wait; officials need information to help them make decisions even if the information available is far from ideal and represents only intermediate outcomes. Thus, first- and second-order outcomes provide early indications and can be considered proxy indicators of end outcomes.

EXHIBIT 2.3 *Ordering of Estuary Protection Outcomes: Effects of Local Ordinances*



IMPLEMENTING AN OUTCOME MONITORING SYSTEM

Below are recommendations for estuary programs to consider in implementing their own outcome monitoring systems.

1. *Derive the outcome indicators from mission statements after considering the perspectives of the various "customer" groups.* Use such sources as:
   - Legislation;
   - A strategic plan such as a CCMP if it already exists;
   - Interviews with federal, state, and local government officials, key area businesses, local environmental protection organizations, boating groups, and households (this approach was heavily used for the outcome indicators presented in this manual);

- Focus groups with representatives from the above groups;
- Data elements already available in the community; and
- Work done in other estuary programs (including the indicators illustrated throughout this manual).

2. *Seek information on multiple outcome indicators of estuary protection performance.* Estuary protection involves multiple aspects. For example, estuary programs are likely to want to track progress in encouraging local governments, businesses, and citizens to implement problem-reduction activities, as well as to track the "end" outcomes such as improvements in the health of living estuary resources. Each of these requires separate outcome indicators. In Section 3 we present an illustrative set of outcome indicators.

3. *Break out selected outcome indicators by key characteristics that are expected to be of importance to program officials and managers.* This will make the outcome information much more useful to program officials. Desirable breakouts are likely to include geographical characteristics (such as breakouts of the Bay Quality Indices by political boundaries or segments of the estuary waters); type of industry (such as breakouts of the extent to which businesses in particular industries have improved their hazardous material handling); source of impairment; type of recreational activity; and type of household (such as indicators of household estuary protection behavior by size of household, income, and whether the homes are owner-occupied or rentals).

4. *Provide outcome information to officials on a regularly scheduled and timely basis.* Outcome reports should be provided at least quarterly to reflect seasonal considerations. However, data on some outcome indicators will need to be collected more frequently, while it will not be feasible to obtain data on other indicators as often. For some indicators, annual data collection or less frequent collection will be appropriate. However, the reports should include all outcome measurements, noting that some have not been remeasured during the previous quarter.

5. *Compose outcome reports that are understandable and useful to nontechnical audiences such as policy officials and the public.* The outcome reports described in this volume are not intended as technical reports for the scientific community. These outcome reports should be clear, concise, and readable by a nonscientific, nontechnical audience. This does not mean that the indicators should not be technically sound, but they should be presented in a way comprehensible to most readers. Outcome reports should show relevant comparisons by presenting data from previous reports and showing progress against outcome indicator targets established for the period. Though data for many of the outcome indicators may only be "roughly right," that

is, not precise in a technical sense, such information should be much more useful to officials who need to make program and policy choices than no outcome information at all.

6. *Avoid frequent changes to the outcome indicators.* The set of indicators should be reasonably *stable over time* so that progress and trends can be identified. A relatively fixed set of outcome indicators should be used. Of course, improvements in measurement will occur, and the appearance of new estuary problems or the emergence of improved measurement techniques may require revisions to the set of indicators. When modifications are made to existing indicators, provide estimates of the effects.

7. *Limit the number of performance indicators to avoid overwhelming users, but have back-up detail available.* Some outcome indicators will need to be composite measures, that is, indicators representing aggregations of two or more component indicators. For example, the Government Action Checklist procedure (see Section 4) involves identifying the progress made by each local government in implementing individual estuary protection actions. Outcome reports for public officials should contain summary indicators, with the information on each specific action available as back-up information when needed. Similarly, the Bay Quality Index (see Section 7) is a composite of a number of individual measurements. Information on each component indicator should be readily available to those who want more detail.

8. *Provide relevant explanatory information in each outcome report along with the outcome data.* Many external and internal factors can affect outcomes. Such information should be included, particularly when the outcome values deviate substantially from expected values. For example, natural elements such as major rainfalls or hurricanes can have major effects on some outcome values. If these events affect the outcome data significantly, their occurrence should be flagged in the outcome reports. Explanatory information might include quantitative data such as major population changes, amount of precipitation, and temperature data or qualitative information such as reports on the number of major businesses that entered or left the area, or that a fish disease not believed to have been caused by human activity appeared. Explanatory information should, when possible, indicate the likely effects on the outcome indicators and identify when any planned corrective actions are likely to show up in the outcome indicator values. Explanatory information provides program managers with the opportunity to give their views publicly on why progress was not as great as expected and to identify planned actions to correct observed problems, thereby reducing the likelihood that elected officials and media will unfairly place blame on program officials for not achieving desired results.

9. *Consider setting annual and long-range targets for the values for each outcome indicator*. The program can subsequently track progress relative to the targets. Such targets should be set only after considering the resources (dollars and personnel) that the estuary program expects to be available and any external factors likely to aid or hinder progress. This target setting probably should be part of the development of the estuary program's annual action plan and CCMP or other goal-setting mechanism.

COST AND EFFORT REQUIRED FOR OUTCOME MONITORING

What will these procedures cost? The outcome monitoring process should, of course, be one that the estuary can feasibly implement with as low a cost in dollars and staff time as possible. Environmental monitoring data will be the basis for most third- and fourth-order performance indicators (such as for the Bay Quality Indices described in Section 7). Data collection for environmental monitoring will usually be the most expensive data to obtain. Estuary programs need to make tough decisions about which items to measure, how frequently to measure them, how large a sample to use, and which geographical segments of the estuary to cover. Estuary programs already make similar choices as they collect environmental monitoring data for scientific purposes. For outcome monitoring systems, which involve frequent (quarterly) reporting, estuary programs need to give consideration to:

- ❑ Frequency of environmental data collection;
- ❑ Timing of collection;
- ❑ Which geographical segments need separate measurements; and
- ❑ How much data precision is needed.

Each of these factors has substantial influence on data costs.

Estimates of approximate cost and personnel time needed for the other data collection procedures are discussed in the relevant sections of this manual. Each procedure requires time, effort, and some added dollar costs for personnel time, mailings, and so on. The added dollar costs of each of these procedures appear likely to be small, but finding staff time for administration will be an added burden, especially for already busy program staff. To the extent that volunteers can be used to help with these activities, both dollar costs and staff burden can be reduced. In many cases, the monitoring data may already be available from other sources at little or no cost.[3] The start-up effort required to develop the procedures and to pilot

them will be the most burdensome problem. However, once the procedures have been established, data collection in subsequent years should be considerably less burdensome.

FINAL COMMENTS ON OVERALL PROCEDURES

Each estuary program will need outcome indicators that measure progress in addressing the particular environmental problems and priorities of that estuary. Each locality will need to choose data collection procedures based on local needs and available measurement resources. The basic principle is to use measurement and reporting procedures that provide reasonably valid and useful information for assessing estuary protection outcomes. The estuary program should regularly report on each indicator until the indicator becomes obsolete or until it clearly is no longer worth collecting and reporting.

Perfect measurement is not possible. Many measurement problems exist and will continue to exist. The measurement procedures should be the best ones currently available to the program within its resources. The procedures should make as much use as possible of the latest scientific and technical knowledge and should be sufficiently precise to help program officials make decisions that help them improve estuary protection. Standardized data collection protocols should be used throughout the estuary to the extent feasible. However, a desire for perfection and scientific precision should not deter the use of outcome indicators and data collection procedures that do not meet rigorous standards. *It is better to be roughly right than to have no information at all.*

Notes, Section 2

1. In effect, this is a four-level version of the six-level categorization currently being used by the Chesapeake Bay Program and EPA's Office of Water. Their levels 1 and 2 ("Actions by EPA/State Regulatory Agencies" and "Response of the Regulated Communities") are both included as "first-order effects." Level 3 corresponds with our "second-order effects." Levels 4 and 5 ("Changes in Ambient Conditions" and "Changes in Uptake and/or Assimilation" correspond with our "third-order effects." Level 6 corresponds with our "fourth-order effects."

2. See, for example, American Society for Testing and Materials, 1993, "Compilation of Scopes of ASTM Standards Relating to Environmental Monitoring." Philadelphia, Pa.

3. An excellent discussion of volunteer monitoring relating to environmental condition indicators is contained in: *Volunteer Estuary Monitoring: A Methods Manual*, EPA 842-8-93-004, December 1993; and *Volunteer Water Monitoring: A Guide for State Managers*, EPA 440/4-90-010, August 1990; both from U.S. Environmental Protection Agency Office of Water, Washington, D.C.

SECTION 3

Illustrative Outcome Indicators

In this section we present an illustrative set of outcome indicators that estuary protection programs can use as a starting point for their selection of outcome indicators. We also briefly address the *process* of indicator selection and the characteristics that individual and sets of indicators should have.

SELECTING OUTCOME INDICATORS

Outcome indicators are the backbone of any outcome monitoring process. The values that are regularly obtained for each indicator provide the basis on which estuary program officials determine progress in bay protection. These values also help officials allocate scarce resources based on where outcomes seem to be achieving desired results and where they are not.

It is vital that outcome indicators be selected to:

- ❑ Cover the major measurable outcomes for the estuary;
- ❑ Represent a reasonable consensus among key estuary program officials;
- ❑ Provide reasonably valid data that can be obtained for each indicator; and
- ❑ Supply data that can be obtained within available budget and personnel resources (including voluntary assistance).

We suggest the following basic steps for selecting outcome indicators:

1. The estuary program leadership forms a special working group to draft the set of indicators. For estuary programs with formal policy, management, technical, and/or citizen committees, representatives from each of these should be represented in the working group.
2. The working group examines available mission statements and identifies currently available data related to outcomes, identifying what is being collected, when, how often, and by whom.
3. Working group members meet individually with represen tatives from interest groups, including environmental groups, industry, citizen groups, local and state governmental officials and staff, boaters, commercial fishermen, the scientific community, and so on. These representatives are asked what outcomes they believe to be important and what results they would like from estuary protection activities.
4. The working group synthesizes the many outcome indicators identified from the previous steps, examines them for overlap and relevance, and combines the remaining "candidate" outcome indicators into a central list. The list may still be too large for practical coverage. The working group members should discuss the individual candidate outcome indicators, rate each on criteria such as those shown in Exhibit 3.1, and rate importance of each indicator. For example, to reduce the

EXHIBIT 3.1 ***Criteria for Evaluating Each Candidate Outcome Indicator***

1. Does it measure something of importance?
2. Are the effects it measures significant to the geographical area that impacts the estuary?
3. Does it measure something not adequately covered by another outcome indicator?
4. Can the indicator be measured in a reasonably valid way? Even if measurements are not currently available, can a reasonably practical and valid data collection procedure be developed?
5. What is the likely cost of regular data collection?

list to a more manageable size, each working group member might give each indicator a low, medium, or high importance rating. This procedure was used effectively in both the Buzzards Bay Project and the Tampa Bay NEP.

5. The working group prepares the specifications for each selected outcome indicator including its rationale, data source, and limitations. Exhibit 3.2 is a sample outcome indicator specifications sheet that might be used for this purpose.

EXHIBIT 3.2 ***Outcome Indicator Specification Sheet***

Program: _____ **Date:** _____

1. Outcome Indicator.
2. Rationale (what does it measure and why?).
3. Data Collection Procedure/Source.
4. Frequency and Timing of (a) Collection, (b) Reporting.
5. Definitions of any Unclear Terms.
6. What Disaggregations of the Outcome Indicator Are Needed?
7. Who Is Responsible for Data Collection and Quality?
8. Limitations of the Indicator (e.g., limited geographical coverage, precision limitations, etc.).

EXAMPLES OF OUTCOME INDICATORS

Exhibit 3.3 presents an illustrative set of outcome indicators that might result from a process such as that described above. This set is based on indicators prepared by the Buzzards Bay Project office. Both the Buzzards Bay Project and the Tampa Bay NEP believe that the indicators should be grouped by subject. The Buzzards Bay Project grouped its indicators into the following categories, based on those it had used in its completed CCMP:

- Reducing toxic pollution,
- Preventing and managing oil spills,
- Managing sewage and septage,

EXHIBIT 3.3 *Illustrative Outcome Indicators*[a]

INDICATOR	UNIT OF MEASURE	ORDER[b]	SOURCE
Overall Summary Outcome Indicators			
Governments scoring 75% success on the "Government Action Checklist"	Number of Governments	1	Government Action (GAC) Survey
Households with at least one problem behavior	Percent of Respondents	1	Household Survey
Boaters with at least one problem behavior	Percent of Respondents	1	Boater Survey
Businesses reporting reduction in hazardous waste discharged	Number	2	Business Survey
Amounts of pollutants discharged	Various Units	2	Agency Report
Overall water quality	Water Quality Index	3	Combination of Water Quality Factors
Overall bay quality	Bay Quality Index	4	Combination of Living Resource Factors
Reducing Toxic Indicators			
Household hazardous waste collection	Number of Towns, Number of Events, and Amount Collected	1	GAC Survey
Oil recycling programs	Number of Towns	1	GAC Survey
Integrated pest management programs	Number of Farms, Number of Acres	1	GAC Survey
Businesses participating in pollution prevention activities	Number, Percentage	1	Business Survey, Local Agency Records
Businesses Reporting Reducing their Generation of Hazardous Waste	Number, Percentage	1/2	Business Survey
Outfalls with toxics exceeding NPDES permit	Number, Percentage	2	Federal Data

Toxics substituted or eliminated	Pounds	2	State Data
Fishing closures due to toxics	Acres	4	State Data
PCB concentrations in sampled fish	Percent with Excess Concentrations	4	State Data
Preventing and Managing Oil Spills			
Municipalities with oil spill coordinators with defined responsibilities, job descriptions, and requisite training	Number, Percentage	1	GAC Survey
Municipalities with developed protocols in place (e.g., mutual aid pacts) that are compatible with Coast Guard regional plan	Number, Percentage	1	GAC Survey
Municipalities with appropriate equipment	Number, Percentage	1	GAC Survey
Mutual aid pact among towns	Number of Towns Covered	1	GAC Surveys
Boatyards/marinas with oil containment and cleanup equipment on site and with an active response plan	Number, Percentage	1	Boatyards and Marinas, GAC Survey
Regulations in place for appropriate fueling of vessels; enforcement of regulations	Number	1	GAC Survey
Oil spills	Number, Size	2/3	Local, State, and Federal Records
Oil spills that are responded to effectively by following response plan (overall assessment of event by spill coordinator, harbormaster, state, or local programs)	Number, Size	2/3	Expert Judgments from State and/or Federal Government
Managing Sewage and Septage			
Nitrogen-loading limits added to NPDES permits	Number of Towns	1	GAC Survey
Businesses adopting pre-treatment and pollution prevention programs	Number of Businesses	1	Business Survey

(continued)

Exhibit 3.3 *(continued)*

INDICATOR	UNIT OF MEASURE	ORDER[b]	SOURCE
Towns with program for licensing septage haulers	Number of Towns	1	GAC Survey
Days businesses did not meet NPDES limits and were in substantial non-compliance	Number of Days, Number of Businesses	2	Federal Data
Untreated sewage discharged directly into bay	Gallons	2	State Data
Managing Stormwater and Agricultural Runoff			
Remedial stormwater BMPS in place	Number of Volumes	1	GAC Survey
Educational measures for farmers developed to control agricultural runoff	Number of Towns	1	GAC Survey
Bylaw changes for new developments (subdivision regulations)	Number of Towns	1	Planning Boards
Remediation of illegal septic tie-ins	Number of Towns	1	GAC Survey
Sewer overflows	Number, Volume	1/2	Local Agency Records
Managing Boat-related Wastes			
Identification of no-discharge areas	Number of Towns	1	GAC Survey
Availability of pump-out facilities[c]	Number of Towns	1	GAC Survey
Usage rate of pump-outs	Number of Boats Using Them	1/2	Local Agency Records
Boaters who report using pump-outs regularly	Percentage	1	Boater Survey
Regulation of MSD chemical additives	Number of Towns	1	GAC Survey
Enforcement actions taken for illegal discharges	Number of Towns	1	GAC Survey
Implementation of education program for boaters	Number of Towns	1	GAC Survey

Nitrogen-loading standards adopted by towns	Number of Towns	1	GAC Survey
Use of BMPs by farmers	Number of Farms	1	GAC Survey
Embayments exceeding nitrogen-loading standards	Number	3	Environmental Monitoring
Excessive amounts of nitrogen	Number of Embayments with Excessive Readings	3	Environmental Monitoring
Amount of seagrass	Acreage	4	State Data
Managing On-Site Septic Systems			
Septic system regulations requiring inspection and upgrade prior to title transfer	Number of Towns	1	GAC Survey
Noncomplying systems identified and remediated	Number of Towns	1	GAC Survey
Innovative/alternative systems installed	Number of Such Systems	1	Local Agency Records
Septic systems "x" ft. from coastal area	Number of Systems	1	Local Agency Records
Incidence of identified overflows	Number of Systems with Overflows	2	Local Agency Records
Assessing Shellfish/Finfish Resources			
Shellfishing areas closed .	Acres	4	Environmental Monitoring
Shellfish/finfish kills	Number, Size	4	State and Local Agency Records
Incidence of Diseased Shellfish/Finfish	Percentage of Species, Number of Occurences	4	State Data

a. This exhibit is a modified version of tables developed by the Buzzards Bay Project (Massachusetts).
b. "Order" refers to the four orders. Order 1 = indicator of behavior; 2 = indicator of amount of pollutants discharged into the bay; 3 = indicator of bay water quality; 4 = indicator of the health of bay living resources.
c. Item included in Government Action Checklist.

- Managing storm water and agricultural run-off,
- Protecting wetland and coastal habitat,
- Managing boat-related waste,
- Managing nitrogen,
- Managing on-site septic systems,
- Managing shellfish/finfish resources.

The Tampa Bay NEP sorted its indicators into the following categories:

- Septic systems,
- Municipal waste,
- Hazardous waste and materials,
- Storm water,
- Dredge and fill,
- Oil pollution and emergency response,
- Boat use and boater discharges,
- Agriculture and industry,
- Shellfish closures,
- Land use,
- Public information and technical assistance,
- Miscellaneous.

The estuary program's outcome monitoring working group should select categories that best represent the long-term concerns of its particular estuary program.

To these categories, we have added the category "Overall Summary Outcome Indicators," shown on the first page of Exhibit 3.3. This group of indicators is intended to contain a small number of indicators that provide a more comprehensive picture of overall bay quality and of the outcomes of the major activities undertaken by the local estuary program. The summary indicators in Exhibit 3.3 include an overall Bay Quality Index (see Section 7) and indicators that summarize the outcomes of activities aimed at affecting environmental protection behavior by local governments, households, boaters, and businesses. Estuary program officials should select those summary indicators that they believe can best provide a comprehensive picture of overall estuary protection progress.

Once the outcome indicators have been chosen by estuary program officials, estuary program staff can prepare a "specification sheet" on each individual outcome indicator, such as that shown in Exhibit 3.2. These specifications identify the rationale for the indicator, the data collection procedure or source, frequency of collections and reporting, and who (what organization) is responsible for data collection and data quality. As discussed in Section 2, the specifications also should identify what, if any, breakouts should be made of the indicator data, such as geographical breakouts for bay quality indicators, or breakouts showing environmental behavior of particular types of households.

REPORTING OUTCOME INDICATOR VALUES

The set of outcome indicators forms the basis for an estuary program's regular outcome monitoring efforts. An estuary program should obtain and report data on a regular (e.g., annual) basis for each indicator. Some examples of report formats are presented in Sections 6, 7, and 8 of this manual.

The estuary program should also examine the data on each outcome indicator, including subsets of data, in order to help estuary program officials determine where progress is occurring, where it is not, and where additional effort and resources are likely to be needed. For example, data on the indicator "Governments That Have Met at Least 75 Percent of the Items on the Government Action Checklist" (see Exhibit 3.3) should be examined to identify which checklist items and which governments have not yet achieved the targeted results. This information will indicate where estuary program personnel might provide technical assistance.

SECTION 4

Tracking the Progress of Local Government Estuary Protection Efforts: The Government Action Checklist

PURPOSE OF THE GOVERNMENT ACTION CHECKLIST

At all levels of government—federal, state, and local—regulatory actions, resource allocation such as for public health agents to monitor shellfish bed openings and closures, and other activities such as technical assistance or public information campaigns have major implications for estuary protection. We suggest identifying major activities of relevant governments that have ramifications for the estuarine environment and placing them on a "Government Action Checklist" (GAC). Each year, the extent of achievement of the items on the checklist can then be assessed to track progress.

In this section we present a framework for tracking the progress of estuary protection activities undertaken by local governments in the estuary area. In the future, it is likely to be useful for estuaries to develop parallel GACs that relate to state and federal activities.

The GAC procedure provides a vehicle for annually monitoring the overall progress that local governments are making in their efforts to protect an estuary. The assessments of progress made by each government in implementing bay protection activities should also provide each area government with a "scorecard" for its own actions, as well as permitting each local entity to compare its progress to that being made by other governments in the area. The GAC assessments also will enable private organizations and the public to keep track of this progress.

The Tampa Bay NEP, in its pre-CCMP period, is using the GAC process as a step in developing an action schedule for its CCMP. The Buzzards Bay Project, having completed its CCMP, which provided a major portion of its checklist items, is using the GAC process to help it measure progress in meeting the goals of the CCMP.

In general, the GAC procedure should increase awareness of the relationship between governmental activities and environmental consequences. This should encourage environmental planning by each community and focus attention on issues that the community needs to address. *The procedures described here do not attempt to assess the effectiveness of these government actions, only to document that the actions have taken place.* Other outcome monitoring and evaluation procedures are needed to assess the effects of these actions.

The material in this chapter is based largely on the efforts of the Buzzards Bay Project and the Tampa Bay NEP. In the Buzzards Bay Project, a citizens' group called The Coalition for the Buzzards Bay Project had already been using an "Environmental Report Card" for a few years to assess the efforts of 12 watershed

communities surrounding the bay in protecting groundwater and coastal water. Their approach served as a catalyst for developing the GAC model presented here.

Below we describe the major characteristics of the GAC approach, the process for developing a GAC, the steps in formulating a checklist, analysis and reporting of GAC information, and the effort and costs involved.

MAJOR CHARACTERISTICS OF THE GAC APPROACH

1. A checklist should cover key government activities affecting the estuarine environment, including:
   - Ordinances,
   - Planning activities and documents (e.g., soil conservation plans),
   - Compliance and enforcement activities,
   - Best Management Practices (BMPs) programs promulgated in specific areas of concern or for selected audiences (e.g., sectors of agriculture or industry),
   - Public information and technical assistance efforts.
2. The GAC should be administered on a regular schedule, probably annually, to permit estuary managers, local governments, and the public to monitor progress on a relatively frequent and timely basis.
3. The GAC process should cover all government entities that have a significant role in protecting the estuary. The checklist items used in this manual are limited to local governments. It also is desirable to monitor items that relate to state (or even federal) government activities, although separate checklists are needed for such purposes.
4. The number of items in the checklist should be limited to between 50 and 75 items. The focus of the GAC should cover primary issues and actions identified by the CCMP, if a CCMP has been prepared.
5. Individual checklist items should apply to most, if not all, of the governments included in the monitoring activity. If an item does not apply to a specific community, this should be clearly delineated (e.g., items that apply to septic systems might be designated "inapplicable" for a town that does not have such systems).
6. The checklist coverage should be determined with the participation of the local governments. The involved governments, as well as other interested

organizations, should be given ample opportunity to express their views on which items should be included in the GAC.

7. The items on the GAC should be carefully defined and specified so that those undertaking the status assessments in future years will be able to reliably determine whether or not the government has fully undertaken the actions specified by the items. Prepare a "rating scale" for each item on the GAC to enable those conducting the assessments each year to make reliable, useful ratings.

8. An objective, respected organization should implement the annual GAC assessments.

9. A summary assessment of each government's progress should be prepared and disseminated to estuary protection organizations and the public. Although an overall grade could be assigned to each government based on the ratings (as is currently being done in the Buzzards Bay Project by the Coalition), there are less controversial ways to summarize the findings for each government and for the area as a whole.

10. The method for reporting the information should be carefully considered and structured so that it is as helpful and constructive as possible. Governments should be given the opportunity to review the ratings and provide explanatory information prior to any public dissemination of the findings.

THE PROCESS FOR DEVELOPING A GAC

The estuary program should establish a GAC working group comprising representatives of each of the estuary program's primary committees (e.g., technical advisory committee, citizens' advisory committee, policy committee, management committee), local scientific experts, representatives of each local government likely to be assessed using the GAC process, and pragmatists with a sense of what is needed by management, policy-making officials, and the public. Including a broad segment of the community will both improve the quality of the procedure and help gain support for subsequent effective implementation.

The group should expect to complete its work within 12 months, during which time members will shape the GAC process, select the checklist items, oversee the conduct of the pilot test, and formulate reporting requirements and formats. Although the development process could be speeded up, it is not advisable to do so because a shorter timetable decreases the likelihood of obtaining the input desired from many groups in the affected area.

The working group should:

- ❑ Identify users for the information that the process is intended to generate, define the desired system characteristics and the advantages and disadvantages of such outcome assessments, and discuss the steps needed to obtain baywide support for the checklist process;
- ❑ Identify and discuss the desired performance characteristics to be tracked, including how the items would be assessed;
- ❑ Determine data collection procedures, including identification of organizations or groups that are candidates to undertake the annual data collection;
- ❑ Determine how the information will be scored and presented to the local government and the public.

The working group will need to spend several months examining the relevance, likely validity, and usefulness of individual indicators, and revising the checklist and procedures accordingly. Once the group has achieved consensus that the GAC is nearing completion, it should solicit input from a wider range of local government representatives.

One way to accomplish this is by having working group members circulate the draft to members of the affected agencies in their respective governments. These other agencies can be asked to make additions, recommend items that should be deleted, and prioritize those items that should be considered for inclusion (in the event that the listing needs to be streamlined). Reviewers should be provided with criteria they can use in making their recommendations. For example:

- ❑ Does the item describe an action/activity that is of significant importance to bay protection?
- ❑ Is the wording of the item specific and accurate?
- ❑ Does the item cover an important activity not otherwise captured?

After the review cycle has been completed and a reasonably complete version of the GAC generated, the working group should define the selected items, finalize an appropriate rating scheme, and conduct pilot testing of the draft instrument. Once the pilot test has been completed, the working group should reconvene to:

- ❑ Review the pilot test results,
- ❑ Consider difficulties that arose and identify what steps need to be taken to eliminate such problems in the future,
- ❑ Use the pilot test results to test the utility of the planned reporting formats,

- ❑ Estimate the costs of the ongoing process, and
- ❑ Formulate recommendations on the future implementation of the GAC.

FORMULATING A GAC PROCESS

The basic steps in formulating a GAC process are listed in Exhibit 4.1. Each of these steps is discussed in the following sections.

STEP #1: Select the Items to Be Included in the Checklist

The first step is to identify the relevant activities that governments should undertake to protect the estuarine environment. This entails identifying a comprehensive list of potential items, then reviewing the list to ensure that key issues have been adequately covered and that redundant items and those of marginal importance have been removed. The group formulating the checklist and other reviewers of draft GAC materials should seek to limit the length to a reasonable number of high-priority items, probably 75 or less.

Several sources can yield possible items. These include:

- ❑ Local government staffs and other experts,
- ❑ CCMPs or other official estuary goal/action statements,
- ❑ Local ordinances that detail actions that governments have taken,

EXHIBIT 4.1 *Formulating a GAC Process*

1. Select the items to be assessed, i.e., the set of activities that governments should undertake to maintain and improve the estuarine environment. Group the items by useful categories of protection (such as toxic waste reduction, managing stormwater and agricultural runoff, and so on).
2. Determine which communities will be included in the regular GAC assessments, that is, which local governments and at what level (e.g., city, county).
3. Operationally define checklist items for assessment purposes, and develop a rating scale for each item that captures whether local governments have achieved the intended activity/action (e.g., achieved fully, partially, or not at all).
4. Select the organization that will administer the ratings and develop the summary reports.
5. Pilot test the assessment procedures.
6. Determine the data analysis process and reporting formats.

- Model ordinances that identify future activities that might be desirable to undertake,
- State comprehensive plans,
- Regional policy plans,
- City and county comprehensive plans,
- Land development regulations (LDRs), and
- Emergency response plans such as those pertaining to oil spills.

The set of potential items should be grouped into categories that highlight key topic areas of concern to estuary managers. Exhibit 4.2 presents the categories used in developing the GACs for the Buzzard Bay Project and the Tampa Bay NEP. Since the Buzzards Bay Project had completed its CCMP development process, it drew heavily from the CCMP in deriving both the categorization scheme and the selection of specific items. The Tampa Bay NEP, on the other hand, had not yet completed its CCMP. Therefore, in formulating its GAC structure, the Tampa Bay NEP chose topics that were central issues guiding its CCMP development process, including only those items on which there was a clear sense of agreement among participants.

Several criteria should be considered in evaluating candidate indicators, as well as during the final selection of checklist items:

- *Their usefulness in encouraging government action.* Items should be useful for local government planning purposes.
- *The extent to which there is evidence that the item is important to estuary protection.* Some items may be controversial or the "jury may still be out" on them from a technical perspective. Such items probably should be excluded from the GAC.
- *The extent to which the indicators can be affected by local government.* For example, activities and actions regulated by state or federal governments, over which local governments have little authority, should generally be excluded. However, where actions are covered by federal or state laws, GAC items can be included, if expressed in terms of whether the local government is in compliance with the existing federal or state law. Actions beyond the statutory authority of the area governments should not be retained in the final GAC. (Note: Some governments may not be responsible for some items in the checklist. For example, counties, as opposed to towns or cities, may be responsible for some items. If so, the items would be rated for counties, but not for cities or towns.)

EXHIBIT 4.2 *Sample Categorizations of GAC Indicators*

Buzzards Bay Categories

- Nitrogen Action Plan,
- Protecting and Enhancing Shellfish Resources,
- Controlling Stormwater Runoff,
- Managing Sewage From Boats,
- Managing On-Site Wastewater Disposal Systems,
- Preventing Oil Pollution,
- Protecting Wetlands and Coastal Habitat,
- Planning for a Shifting Shoreline,
- Managing Sewage Treatment Facilities,
- Reducing Toxic Pollution,
- Conducting Pollution Remediation Projects in New Bedford.

Tampa Bay Categories

- Water Quality,
- Land Use,
- Septic Systems,
- Municipal Waste,
- Hazardous Materials and Hazardous Wastes,
- Stormwater,
- Conservation Measures,
- Boater Use and Boater Discharges,
- Oil Pollution and Emergency Response,
- Agricultural Industry,
- Other Industry,
- Shellfishing,
- Public Information/Technical Assistance,
- Intergovernmental Coordination,
- Miscellaneous.

- ☐ *Overlap with other items.* Items that overlap in a substantial way with other items should be revised or deleted.
- ☐ *Measurability.* For some items under consideration, it could be quite difficult to make a reasonably reliable assessment of progress by juris-

dictions. If ability to make a reliable assessment is questionable, the item probably should not be included in the checklist.

After the initial draft list has been prepared, the GAC working group and the local government experts in each area should review the GAC section by section to determine which items should be retained and what additional items should be considered for inclusion. This may involve several review cycles to achieve consensus on the set of final checklist items. In the Buzzards Bay Project and the Tampa Bay NEP, four cycles were needed to finalize the indicators. Both estuary programs had the working group members rate each candidate item as to its importance, e.g., high, medium, or low, to help determine the final set. Exhibit 4.3 presents the

EXHIBIT 4.3 *Guidance for Reviewing Draft GAC Items*

TO: *Reviewers of the Draft Tampa Bay "Government Action Checklist"*

The Tampa Bay National Estuary Program (TBNEP) as one of its primary objectives will be preparing a set of action recommendations to help protect Tampa Bay. One set of actions TBNEP expects to recommend relates to actions that the various local units of government in the Tampa Bay area can take.

Also as part of our obligations, the TBNEP needs to develop a procedure for regularly (e.g., annually) tracking progress toward these actions. As a first step, we are preparing what we are tentatively calling a "Government Action Checklist" (GAC). The GAC is intended to identify the *major* actions that are desirable for local governments to undertake. We expect that in its final form, each of the items on the Checklist would be rated for each government as "Fully Accomplished," "Partially Accomplished," or "Not At All Accomplished."

The attached draft GAC has been prepared as an initial list for your review. It has been based on items included in the various county, city, and regional comprehensive plans (as noted at the back of the GAC). We request that you and/or your staff (who are expert in the various environmental areas) review the list carefully and provide your suggestions as to: (1) desirable *rewording* for any of the items; and (2) items that you believe should be *added*.

After indicating any rewording you believe is desirable for any of the items, rate each item as to whether it should be considered:

- High priority for inclusion on the Checklist (H);
- Medium priority (M);
- Low priority (L);
- Dropped (D); or
- You have no opinion on the item and leave it to others to rate its priority.

instructions provided to individuals who served as reviewers for the Tampa Bay GAC.

Once a final set of items has been determined, these should be sequenced within categories for substantive clarity and temporal and logical consistency.

STEP #2: Determine Which Governments Will Be Included

The GAC working group needs to consider whether the GAC monitoring should apply to all communities that feed into the watershed, only the local governments participating in the estuary program, only the larger entities such as cities and counties but not the smaller municipalities, or some other configuration.

For example: The Tampa Bay NEP decided to start with three major counties and three large cities. Some counties included as many as 22 municipalities—a number thought to be unwieldy for individual assessment in the GAC process. Moreover, many of the municipalities were thought to have small impacts on bay quality. A number of the items on the Tampa Bay GAC refer to county-level activities that are not applicable to the towns.

In contrast, the Buzzards Bay Project has targeted GAC monitoring for each of the communities that were signatories to the CCMP. The procedure currently covers 12 local governments. The Buzzards Bay Project developed three versions of the GAC: one for coastal towns, one for inland towns, and a separate checklist for New Bedford—the only large city in the local area and the area's industrial manufacturing hub.

In estuaries with local government units numbering in the hundreds, the working group will likely want to focus on governments believed to have the greatest influence on bay quality or, alternatively, to rotate the GAC coverage, monitoring the smaller, less influential communities, say, every three years.

STEP #3: Operationally Define Each GAC Item for Assessment Purposes and Develop a Rating System

This step raises two primary measurement issues:

- How to locate the source of the information for each item and how the information is to be collected, and
- How to rate achievement of each item.

The measurement scheme should define items as clearly and specifically as possible so that they can be objectively rated.

The more specific the item wording, the easier it will be to obtain relevant information and conduct the rating. The item definitions should enable those doing

the assessments to reliably determine whether or not the government has fully undertaken the action intended by the item. Thus, an early effort should be to ask the local experts to be as precise as possible in defining each item on the checklist.

For example: In the Tampa Bay NEP, the item, "The local government promotes the use of innovative and alternative wastewater systems (such as batch treatment processes) at appropriate commercial, industrial, and large residential land use sites" was operationally defined as:

- ❑ Identifies appropriate potential users and disseminates information to them,
- ❑ Provides incentives for use,
- ❑ Mandates the use of innovative and alternative wastewater systems by appropriate users.

Similarly, in the Buzzards Bay Project, the item, "Has the town developed . . . embayment or harbor management . . . for their entire coastline to guide the use and protection of sensitive areas?" was defined as:

- ❑ Conducts townwide assessment of coastal natural resources (i.e., eelgrass beds, shellfish beds, fringing marshes, and so on),
- ❑ Designates dock- and mooring-free zones based on sensitive natural resources,
- ❑ Establishes boat exclusion zones and boat speed limits to minimize adverse effects on natural resources,
- ❑ Defines where dredging is permitted and where it is not,
- ❑ Specifies times of the year when construction or dredging are permitted in order to minimize ecosystem impacts.

In defining each item, rely on user-friendly terminology. The phrase "home septic system," for example, is more easily understood by both potential government respondents and GAC raters than "on-site disposal system."

A rating scale needs to be prepared for each item on the checklist to enable those doing the assessments each year to make reliable, useful ratings. If the rating scale gets too long or involved, those doing the ratings may be unable to make such fine distinctions, and the process may become excessively complicated and time-consuming.

A two-level scale ("yes" or "no," has or has not been achieved) is probably too simplistic for most items. A three-level scale such as "fully accomplished," "partially accomplished," or "not accomplished at all" will probably be adequate for most items. If an item does not apply to a specific jurisdiction, it should be marked

"not applicable." For example, using the Tampa Bay NEP wastewater item referenced above, a local government would receive a rating of:

- ☐ "Fully accomplished" if it has identified appropriate potential users and disseminated information about innovative and alternative wastewater systems to them; provided incentives for use; and mandated the use of innovative and alternative wastewater systems by appropriate users. (Note that this particular item does not cover having an active monitoring and enforcement program relating to the mandate. The checklist also should contain such an item.)
- ☐ "Partially accomplished" if it has implemented some, but not all, of the three identified sub-issues.
- ☐ "Not accomplished" if none of the sub-issues had been achieved.

The quality and effectiveness of the government's activity is *not* relevant in this process and should not be considered when making ratings. The rating is based on whether the activity/action identified in the wording of the checklist item has been undertaken. Therefore, the rating should focus on actions governments have already taken, not on those intended in the future. For example, the existence of a plan to carry out some action should not be viewed as the equivalent of having accomplished the action. However, as noted in the Tampa Bay NEP, some plans (e.g., city and county comprehensive plans) implicitly carry a binding obligation to act, and therefore estuary managers may decide that local governments should be given credit for partial accomplishment if they have a specific schedule for carrying out a recommended action.

The rating categories and their definitions should be detailed in an annotated version of the GAC.

Appendix 1 presents sample checklists developed by the Buzzards Bay Project; Appendix 2 contains the Tampa Bay NEP checklist.

STEP #4: Select the Organizations that Will Administer the Rating Process for Subsequent Implementation of the GAC

The organization that ultimately conducts the assessment should be one that is perceived as being reasonably objective by the governments being rated and by the public. It is probably preferable to accomplish this by relying on a regional organization such as a Council of Governments, a regional planning association, or a university.

Selecting another organization to administer the ratings has an additional benefit to the estuary program. The program is thereby removed from having to judge organizations with which it must retain an ongoing working relationship.

The program is thus better able to support those organizations as they address any deficiencies noted by the rating entity.

Training sessions should be held for those persons who will do the ratings and should be held each time the assessments are made. This is important to facilitate inter-rater reliability and consistency across raters within the same timeframe or from one year to the next.

The organizations should preferably have:

- ❑ In-house staff expertise on pertinent environmental issues and local government procedures,
- ❑ On-line capacity to access relevant data, and
- ❑ A reputation for credibility and objectivity.

Another option is to use a citizens' group such as a bay watch group or the League of Women Voters. If it becomes necessary to use citizen volunteers to conduct GAC assessments, estuary managers should exercise considerable care in their selection and training. These efforts may have to be supplemented by local experts on GAC items that require some technical knowledge. When this is the case, it may be advisable to split the instrument into sections and have the more technical items handled by individuals with expertise on those items. If volunteers are used, it is particularly important to provide substantive rater training sessions to ensure the quality of the work.

The Tampa Bay NEP has contracted with its the Tampa Bay NEP Regional Planning Council to undertake the first GAC effort. The Buzzards Bay Project has chosen to contract with a local citizens' group—the Coalition for the Buzzards Bay Project. The Coalition uses some paid staff and some volunteers.

STEP #5: Pilot Test the Assessment Procedures

Once the working group has settled on a final draft version of the checklist and has completed definitional guidelines for the ratings, the GAC should be field-tested to identify difficulties with the items, their wording, or the assessment procedures. The location selected for the pilot test should resemble the local government areas that will receive the final version of the GAC in order to be a fair test of potential usefulness. Rarely will the first version of the GAC survive unmodified as it undergoes a pilot test among selected local communities.

For example: For the pilot test of the Buzzards Bay Checklist, one town (Fairhaven, Mass.) was selected for a trial run of in-person interviews with agency personnel. Coalition staff arranged meetings in Fairhaven with appropriate town officials to complete the checklist. Several improvements were suggested, and the checklist is undergoing appropriate revision.

The distribution of any materials being circulated externally should be handled carefully and with sufficient information to allay participants' concerns. Even though representatives of local government agencies will have been involved in developing the checklist, some individuals who receive the materials during the pilot test (or during subsequent administrations of the annual GAC) may not have first hand familiarity with the GAC or with their agency's prior participation. Unless adequate information is expressly communicated to them at the time they receive the checklist, such persons may be hostile or suspicious and may not cooperate with the information-gathering effort needed to make the ratings.

To facilitate each local government's understanding of the GAC and encourage it to cooperate, representatives from relevant local agencies should be briefed prior to distribution of the checklist. Such briefings should include in-person meetings as well as clearly written instructions. Discussions between estuary staff and local agency personnel should minimally cover the following points:

- ❑ Background concerning the Government Action Checklist and its role in estuary management, with appropriate reference to the CCMP or other goals/objectives adopted for the estuary;
- ❑ How the checklist was generated, including explanations of why items have been grouped or categorized as shown in the draft version of the checklist;
- ❑ Acknowledgment of all local participants in the GAC development process;
- ❑ Timetables for the pilot test and the sequence of events and anticipated timing for reporting results, including announcement of any decisions made concerning frequency of the exercise;
- ❑ Schedule and method for revising the GAC based on pilot test results, and local agency participation in this process if desired;
- ❑ Illustrations of sample reporting formats;
- ❑ Steps to alleviate local agency fears of unfair ratings, including giving agencies the opportunity to provide explanations for their actions or failure to act, as well as permitting agency review of ratings prior to dissemination of GAC findings.

Limitations of the checklist or the ratings procedures also should be identified and discussed. These include items such as:

- ❑ Reminders that the quality of the activities is not measured by the GAC process;

- Recognition of the difficulties inherent in dealing with an unweighted set of checklist items, that is, the fact that various actions are unequal in terms of their contribution to estuarine protection. For example, a local law requiring owners to clean up animal wastes, while desirable, is not likely to have the same potential effects as implementing advanced water treatment.

- Acknowledgment of the fact that lag times, cause-and-effect linkages, and externalities prevent generalized assumptions about the relationship between checklist items and bay quality.

The discussion also should focus on the specific activities that must be undertaken to ensure satisfactory and timely completion of the GAC assessments. These include considerations such as:

- *How the rating process will be implemented, including who will compile the information used to make the rating, what local government agencies should* be involved in providing relevant information to the raters, what information they will need, suggested sources of relevant information, and the appropriate level of detail required.

- *How the ratings will be reported and how local government personnel can indicate the context or reasons for failure to achieve the highest GAC ratings.* The GAC working group should be particularly sensitive to local governments' concerns about ratings that could lead to public criticism of their performance.

For example: The Coalition for the Buzzards Bay Project for several years used a "report card" format with grades (A through F) assigned to town performance. Because local governments were graded so specifically, they developed a higher level of anxiety than would have arisen had they been simply rated as falling along the continuum from full to non-accomplishment of selected items. The comparisons, however, had the benefit of creating competition among the towns and generating interest by the press that translated into citizen interest.

- Even where report card-type grading is not part of the assessment process, comparisons will be made of government performance across locales and over time within each local area. Therefore, GAC procedures should allow for governments to provide explanatory narratives addressing special circumstances or conditions that might have mitigated against accomplishment of specific GAC goals.

- *The need to designate a single individual to represent each participating government.* The raters will need to obtain information from many agencies in a government in order to complete the ratings.

For both the pilot test and subsequent use of the GAC, it is important to identify how to collect the information needed for the ratings. Several options exist. One possibility is to mail the checklist to local governments, asking them to indicate by mail what they have done with respect to each item on the GAC. Another option is to mail the checklist to each local government in advance, then hold in-person discussions between the raters and designated local government representatives to document current status. A third option is for the raters to track the information themselves with a minimum of input from the government staff. This last method is a good option if the raters are technical experts who are familiar with each government's status on the subject matter.

In the Buzzards Bay Project, for example, a Coalition staff member distributes the GAC to a single point of contact in each local government. The latter individual is then responsible for distributing the GAC to the appropriate local boards for completion. The evaluator then follows-up in a face-to-face format with representatives of the boards to clarify and expand the information needed to make a rating.

The Tampa Bay NEP, on the other hand, is mailing out the checklist to designated government representatives after an initial kick-off meeting that addresses procedural and information requirements. Local government representatives will mail their responses, together with supporting documentation, to the Regional Planning Council responsible for completing the ratings.

Regardless of which approach is used, the GAC project staff should designate a GAC contact to respond to local government questions or concerns about GAC items or procedures.

For the pilot test and subsequent ratings, schedule about a four-week period for the rates to obtain the information needed for their ratings, including distribution and return of completed checklists from the local governments. Remind local governments of the due dates midway through the scheduled period, by phone or mail. Avoid allocating too little time for completion (resulting in respondent frustration and inability to complete the task within the desired time) or too much time (causing respondents to view the exercise as low priority, since there is no immediate need to respond).

STEP #6: Determine the Analysis Process and Reporting Formats

Analyzing and reporting the findings is a critical step in the process. Central to the design of reporting formats is that the data be meaningfully aggregated, clear and accessible to a range of users, and of practical use for estuary management purposes.

ANALYZING AND REPORTING GOVERNMENT ACTION CHECKLIST INFORMATION

The following are likely to be the key analytic and reporting elements for tracking government agency estuary protection progress:

1. Calculate and report *for each category of government action* (such as toxins reduction, storm water and agricultural runoff management) the number and percentage of GAC items that all communities together have achieved. Also calculate these figures for each community. This will provide information on which categories of environmental protection appear to be doing well and which are not—so that encouragement and technical assistance can be provided to those communities needing assistance.

2. Calculate and report the number and percentage of assessed *communities that showed improvement* on one or more checklist items from the previous assessment. Some estuary protection programs may want to use a more stringent criterion such as the number and percentage of communities that improved on, say, three or more of the checklist items. This information indicates where progress has been made. Together the outcome information here and in #1 identify the latest level of achievement and progress made over the past year — giving a more complete and fairer picture of each community's estuary protection status.

3. Calculate and report the number and percentage of *checklist items that each community, or the estuary program itself, had previously identified as priority* and for which the assessment showed an improved level of achievement since the previous checklist assessment. This type of reporting is probably attractive to local governments. Local governments would be asked, during each GAC reporting cycle, to specify their own priorities for the coming year.

For example: The Buzzards Bay Project local government representatives requested the opportunity to identify at the beginning of each year those checklist items that were of priority for their towns. Each town would subsequently be assessed on achievement of its priority items. The government representatives felt that these steps would be useful for their own planning effort. This procedure complemented, rather than replaced, an analysis of all checklist items.

Special attention could be paid to reporting the extent to which each government had achieved its stated objectives. This information should be particularly useful to individual communities on the progress that each had hoped to make, providing a comparison of actual versus targeted achievement.

Similarly, estuary programs may elect to set targets or prioritize GAC items into high, medium, and low objectives. The Tampa Bay NEP, for example, is considering setting targets two years in advance so that local governments would know what short-term standards of accountability they will be measured against. Once targets are set, the number and percentage of local governments that have achieved stated priorities can be reported.

4. Calculate and report the number and percentage of *all checklist items that each assessed community has achieved.* (This is the grand total of #1 for each community, across all categories of government action.) This information provides a summary indicator of accomplishment for each community. Estuary program officials may choose to use such a report to compare achievement among its communities (as has been done in the Buzzards Bay Project). This is a useful strategy if done constructively and can provide encouragement to move forward on estuary protection. However, if, because of adverse media or inter-community relations, an antagonistic atmosphere exists, the comparative checklist information may aggravate those problems. In such cases, estuary program officials may want to play down the "report card" aspects of the presentation.

5. Tabulate and report (but probably to a more limited audience) the *number and percentage of communities that have achieved each item on the checklist.* This information is more detailed than will be wanted by most outside organizations and the public. However, such tabulations permit estuary program officials to focus on *specific* protection activities that warrant special attention, helping identify needed encouragement and technical assistance efforts.

A *"Summary of Survey Findings,"* as illustrated farther below in Exhibit 6.6 (on the findings of household surveys), should be prepared. The analysts should identify selected key findings from the latest survey findings. Significant progress made over previous checklist assessments should be highlighted—progress made both by individual communities and by the estuary program as a whole.

In addition to these analyses, outcome information should be accompanied by selective explanatory information. This information should focus on checklist items that the assessments indicate have significant problems or have been significantly improved. The personnel in each local government responsible for the items should be encouraged to provide explanatory information on significant findings, and should be given the opportunity to do so *before* the report is disseminated externally. This will allow government personnel to present their reasons and identify any actions they are taking to correct problems or, if they choose, to dispute the assessments. The opportunity to provide explanatory information is needed for the sake of fairness, to help interpret major findings, and to make the outcome moni-

toring process less threatening—since the public and officials know they will have the opportunity to provide their side of the story.

Clarity of format is of special importance. The art of presenting complex data is often overlooked by agency personnel. Estuary program staff should carefully consider design alternatives before finalizing their reporting format. Draft reporting formats should be examined not only by estuary management staff, but also by local government representatives to ascertain that the data are meaningfully displayed. Information sorted by unclear or inaccurate headings may cast doubt on the validity of the data and the process.

Technical jargon and extensive use of acronyms should be avoided. Formats should be designed so that past measurements (from previous years) appear alongside current data for ease in identifying progress. Trends are often very useful, sometimes even more useful than current measurements. The use of grading systems is effective for many purposes and acceptable in many locales, but normally detracts from the main purpose of performance measurement—to provide managers with indications of where modifications might improve outcomes.

The GAC should be useful for local government planning purposes and for estuary management. For this reason, we recommend:

- ❑ Highlighting in each community's report progress on the items that the community had identified as priorities for the past year;
- ❑ Giving assessed governments the opportunity to provide explanatory information on their ratings. These explanations should be included in the annual monitoring report prior to its official release. Inclusion of this feature will reduce the threatening aspects of the GAC and provide users with relevant supplementary information.
- ❑ Asking the administering organization to estimate whether the cost of meeting each shortfall is negligible, small, or high (e.g., requires construction).

The purpose of these added steps is to assist individual communities in better planning and to provide information that enables the communities, together with regional organizations, to undertake joint planning.

Each estuary program needs to ensure constancy over time once it establishes a format for its GAC. Revisions to the format in the early years should be avoided if possible, since one purpose of the GAC is to identify both positive and negative changes over time. Although there has to be some flexibility to modify items so that the GAC continues to be relevant in future periods, it is important to design a stable core set of checklist items that will permit assessment of trends.

Finally, schedule a public event to announce the annual GAC results. For example, the Tampa Bay NEP plans to design an event during which results of the pilot can be disclosed and discussed. Feedback from this meeting will provide information about changes needed or important additions. Such a meeting can bring together representatives of several local governments, thereby enhancing communication, networking, and technology transfer within and across various agencies and areas.

EFFORT AND COST

The GAC working group members require roughly 12 months to develop and pilot test the process. Once the process has been developed, the ratings constitute the major ongoing activity. For example, the Buzzards Bay Project estimates that the annual rating process takes approximately three calendar months.

The time and cost required to do the ratings will depend on the number of items in the checklist, their complexity, and the number of local governments covered. The Buzzards Bay Project and the Tampa Bay NEP each allocated approximately $13,000 for the process to be conducted by an outside organization. Each process involved less than 15 local governments.

SECTION 5

Tracking the Outcomes of Business-Related Estuary Protection Activities

Businesses and industries, including agriculture, are often major contributors of pollutants to an estuary. Thus, they provide major opportunities for pollutant reduction. Progress in encouraging business and industry to adjust their operations in order to produce less hazardous polluting materials should be tracked, as should the actual magnitude of pollutants emitted. Obtaining such

information can be used to identify where estuary protection activity is needed and the extent to which past activity has been successful.

National Pollution Discharge Elimination System (NPDES) permits can be examined for direct dischargers, and the permitting and monitoring programs accompanying these permits can provide significant information. However, the accumulation of discharges from the hundreds of businesses and industries around an estuary into a publicly owned water treatment system is often an even greater problem. By-products of businesses ranging from small paint and body shops to mortuaries and electroplating industries often discharge hazardous wastes, many of which are difficult to eliminate by standard public treatment systems before discharge into the estuary or stream. The public treatment system itself is occasionally, and sometimes chronically, hampered or damaged by these discharges.

Public and private agencies can have a variety of waste reduction and pollution elimination programs for businesses and industries. Educational and technical assistance programs can be provided to businesses and industries to disseminate or attract attention to best management practices for specific sectors of commercial operations. Regular inspections can be conducted to develop information as part of the permitting program.

PROCEDURES FOR TRACKING OUTCOMES

Three primary data collection procedures are discussed here for tracking the outcomes of business-related estuary protection activities:

1. The primary way to track progress in reducing hazardous waste is to monitor the data on pollutant loadings, such as the data obtained from the tests required by permitted businesses from tests performed by the Publicly Owned Treatment Works (POTW, which also operate under an NPDES permit). These data include discharges to the air as well as to the water. Thus, indicators of loadings should normally be included as part of an outcome monitoring system and measure "second-order" effects.

   Some effluent data are collected at the end of pipes that accumulate pollutants from many sources. Such data provide an aggregate outcome indicator, but do not necessarily show the outcomes for efforts directed at specific businesses or industries, especially the many small businesses that can discharge pollutants. The next procedure can help here.

2. The second procedure involves tracking the extent of actions taken by businesses to reduce their hazardous waste. The primary method for doing

this is to administer periodic (annual) surveys of businesses to ask them about their activities relating to hazardous waste reduction. This is an excellent way to track the effects of training and technical assistance efforts provided to businesses, and is the central subject of the remaining parts of this section.

3. Finally, as the list of outcome indicators presented in Section 3 (Exhibit 3.3) suggests, progress by individual local governments can be tracked by looking at the extent to which they, for instance, urge use of alternatives to hazardous materials used by businesses, sponsor industrial pre-treatment programs, and implement agriculture pesticide/fertilizer best management practice programs.

   Progress by local governments can be measured using the Government Action Checklist procedure described in Section 4.

   For example, the Buzzards Bay Project focused on reduction of toxic materials discharged by local businesses in the New Bedford, Massachusetts area.[1] New Bedford is the largest city adjacent to the estuary and historically has been a center for the manufacture of textiles, advanced electronics, seafood, jewelry, and other products whose manufacture produces high volumes of hazardous or toxic materials. The Acushnet River, forming a spine of industrial development and draining into the estuary through the central city, has been contaminated with PCBs to the degree that the river has been designated as one of the nation's two underwater Superfund sites.

   The Buzzards Bay Comprehensive Conservation and Management Plan included a pollution prevention program for toxic waste generators as one of its eleven action plans.[2] The goal was to help reduce hazardous waste generation by half by 1997 (the Commonwealth of Massachusetts 1990 Toxins Use Reduction Act has a goal of reducing 1987 levels by half by 1997). The program included components such as technical assistance, audits, and workshops.

QUESTIONNAIRE CONTENT

The survey of businesses should cover both reduction of hazardous materials use and reduction of hazardous wastes in discharges (into the air, the solid waste stream, or water). When asking about reductions in the amount of hazardous materials and wastes, the questionnaire needs to focus primarily on changes due

to preventive actions as distinct from those due to reduced (or increased) product sales. That is, the focus should be on the amount of hazardous wastes *per unit of product.*

The questionnaire is probably not the place to ask direct questions about the *amounts* of hazardous materials used and wastes generated. It is better to rely on data from other sources for that information. The questionnaire will also probably need to avoid sensitive questions such as those relating to whether the business is conforming to a legal requirement. (Note that the responses should be confidential but not anonymous. In order to follow up on businesses that have not returned questionnaires, the survey process will need to identify which questionnaires have been returned.)

SURVEY ISSUES THAT NEED TO BE RESOLVED BY THE ESTUARY PROGRAM

1. *Which businesses should be included?* Both direct and indirect dischargers? Only those covered under permits or also smaller non-permitted businesses such as car washes, photo finishers, auto body shops, and funeral parlors that collectively may present a significant hazardous materials/waste problem? The Buzzards Bay Project included only indirect dischargers in its pilot test. Lists of targeted businesses are likely to be readily available. The yellow pages of local telephone books can also be used, if necessary, to draw samples and obtain addresses (though without zip codes) to which questionnaires should be sent.

2. *Which geographic areas should be covered?* The Buzzards Bay Project had to decide whether to cover only the New Bedford area or to include the three nearby towns of Acushnet, Fairhaven, and Dartmouth, all of which had numerous at-risk industries and small businesses.

3. *What topics should the periodic surveys cover?* How should the questions be worded? These issues and examples are addressed farther below.

4. *Should the businesses themselves or local business groups be asked to help shape the questionnaire?* This would likely help gain businesses' future cooperation in responding to the survey but can be time-consuming. A local Chamber of Commerce and relevant trade associations might be used as the focal point for such participation. Their support for the survey should help the survey team get a respectable response rate. The survey team might even ask the local trade association(s) to cosponsor the survey. The experience in Buz-

zards Bay indicates that this step is likely to be highly desirable for gaining business cooperation in responding to the survey.

5. *Should the survey use one questionnaire applicable to all types of businesses or different questionnaires for different types of businesses?* The latter would permit asking firms about specific hazardous waste prevention practices relevant to specific industries. One questionnaire would be much simpler to develop, administer, and analyze. Here again, the advice of the business community could be quite helpful. Clearly, agricultural businesses that present hazardous waste risks for the estuary should be monitored by issuing them a separate questionnaire on use of pesticides and fertilizers.

6. *How should the survey questionnaire be administered—in person, by telephone, by mail, or a combination of these?* Who should administer it? In-person surveys require the most time and effort because of the travel time involved. Mailing is the least expensive. However, mailing produces the lowest rate of returns. Using a mailed questionnaire, the Buzzards Bay Project achieved only an 11 percent response rate (14 of 125 recipients completed questionnaires), even after a postcard follow up and telephone reminder. However, later conversations with businesses revealed that company officers had three reasons for not responding: a) they did not know how to answer the questions; b) they were confused by the questions or their possible responses; c) they did not know what the Buzzards Bay Project was or anything about this survey.

   Some of these problems are correctable. Much higher response rates should be expected if the participation of business associations is obtained, if the questionnaire is first pilot tested with a small number of businesses (maybe six), and if the questionnaire is cosponsored by one or more business associations. The use of reminder cards, second mailings, and telephone reminders should produce response rates of 50 percent or higher.

7. *How many businesses should be surveyed?* Estuary protection programs in areas with small numbers of targeted businesses (100 to 200) should be able to survey all of them, especially if the questionnaire is mailed. Much above that number may require taking random samples of subsets of businesses, for instance, 50 of each major type of business. Note that the many agricultural establishments and farmers in a rural area should be covered, perhaps by sampling if the number is very large.

8. *What other steps should be taken to help ensure a high survey response rate from businesses?* Responding to the survey will be voluntary. The questionnaire should be pre-tested with a small sample of businesses (5 to 10) to assure that the wording is clear and appropriate and the questionnaire is not overly long. A short, friendly cover letter should accompany the questionnaire. It

is preferable that the person signing the letter be someone known and respected by the community. The letter might be signed by both an estuary program official and the president of a local business organization. Offering to send a copy of the survey report to those responding will also help to increase mail survey response rates. Exhibit 6.4 in Section 6 provides further suggestions.

9. *Should only assisted businesses be surveyed or all potentially polluting businesses?* All businesses or at least representative samples of all businesses should be surveyed. This provides a much more complete picture of what is happening in an area and also provides a comparison group of non-assisted businesses (so that actions of assisted businesses can be compared to those of non-assisted businesses).

   For initial surveys conducted *before* an assistance program begins, the estuary program will need to survey all businesses (or a sample thereof) in order to obtain baseline information from which changes can be measured. If the estuary program chooses to survey only assisted businesses, it should do so before assistance is given and every one or two years thereafter. Higher response rates can be expected from businesses that have been assisted. The number of assisted businesses is likely to be small enough to undertake a 100 percent sample without being overly costly.

THE QUESTIONNAIRE

A sample questionnaire is presented in Exhibit 5.1. A different questionnaire would need to be developed for some types of businesses such as agriculture. The questionnaire in the exhibit is adapted from one prepared by the Buzzards Bay Project/Urban Institute team after extensive field interviews with EPA national staff, reviews of EPA documents, and interviews with town and environmental officials and with selected representatives of larger industries. The questionnaire probably should cover such topics as:

(a) Particular hazardous waste-reduction activities that a potential polluting business has underway such as a waste reduction plan and reduction targets, training sessions, and in-plant waste reduction assessments;

(b) The extent of use by the business of local hazardous waste-reduction training and technical assistance programs;

(c) Evaluations by respondents of any assistance received;

EXHIBIT 5.1 ***Illustrative Industry Questionnaire***
(Based on one tested in New Bedford, Mass.)

1. Does your firm have a current toxic material/ waste reduction plan?	❑ Yes	❑ No
2. Does your firm have specific toxic material/ waste reduction targets?	❑ Yes	❑ No
3. Do you believe that you and your firm have sufficient and clear information about the following:		
a. Toxic waste requirements?	❑ Yes	❑ No
b. Technical information on the toxic materials that your firm uses?	❑ Yes	❑ No
If yes to either (a) or (b), what information do you need? _____		
4. In the past 12 months have you done any of the following:		
a. Sent personnel to workshops or training sessions that contained a significant toxins reduction component?	❑ Yes	❑ No
If yes, approximately how many employee-days were spent? _____		
b. Organized employee teams to work on toxins/ hazardous waste reduction?	❑ Yes	❑ No
c. Conducted an in-plant audit or assessment that contained a significant toxins reduction component?	❑ Yes	❑ No
If yes, who did the audit/assessment (check all that apply):		
❑ Your own staff		
❑ A consultant paid by your company		
❑ State personnel		
❑ Others (please specify) _____		
_____		
d. Initiated a recovery and reuse program for any item containing toxic/hazardous material?	❑ Yes	❑ No

(continued)

EXHIBIT 5.1 *(continued)*		
If yes, what toxic/hazardous material? _____		
e. Eliminated or replaced the use of any item that contained toxic/hazardous material?	❑ Yes	❑ No
f. Changed the way you handle toxic hazardous wastes (such as by a pre-treatment or disposal method) so as to reduce the amount of waste discharged into the water and air?	❑ Yes	❑ No
5. Overall, have any of the above activities, or similar ones that you have used, actually enabled you over the past 12 months to actively reduce your company's:		
a. Use of toxic/hazardous materials?	❑ Yes	❑ No
b. Amount of toxic/hazardous materials discharged into the water and air?	❑ Yes	❑ No
6. How have these toxic/hazardous waste reduction strategies over the past 12 months affected your company's overall costs per unit of product (considering both operating and capital cost)? Please check one: ❑ Increased overall cost per unit of product produced ❑ Decreased overall cost per unit of product produced ❑ Neither ❑ Don't know		
7. What training and technical assistance, if any, would you like for your firm? _____		

(d) Whether the business has modified any of its materials or processes to reduce hazardous wastes (but these surveys are *not* likely to be an appropriate source for data on the actual magnitude of effluent volume changes);

(e) Whether the magnitude or type of hazardous waste has actually been reduced; and

(f) Information or technical assistance the business believes it needs and would like to have.

The questions for potential polluters were prepared based on discussions with or materials provided by the U.S. EPA Pretreatment and Multi-Media Branch and the Massachusetts Executive Office of Environmental Affairs' Office of Technical Assistance (based on the latter's prior work with the electroplating, metal working, and auto body shop industries). In Buzzards Bay, the Project staff developed a list of 125 firms in New Bedford to be surveyed. A questionnaire and cover letter were developed, and the first mailing was sent in July 1993. The completed questionnaire was intended to provide baseline data for toxic reduction activity as well as data on what assistance the businesses would like.

The questionnaire should be short, preferably no more than two sides of one sheet of paper. A short letter introducing the purpose of the survey should be included. An illustrative cover letter is shown in Exhibit 5.2. Naturally, each estuary protection program will need to tailor the cover letter to its own circumstances.

EXHIBIT 5.2 ***Sample Letter to Accompany Hazardous Waste Reduction Questionnaire***

Date

Dear:

The [*Name of Community*] Estuary Protection Program needs help to improve the program's services to reduce hazardous wastes. We ask for a few minutes of your time to complete the enclosed questionnaire. This questionnaire is being sent to a large number of businesses in [*Name of Community*].

We have provided a stamped self-addressed envelope for your convenience in returning the completed questionnaire. Your responses will be treated as confidential; they will be used only to prepare summary findings from all respondents.

Please return the completed questionnaire to us by [*Date*].

Thank you!

Sincerely,

Questions such as those in Exhibit 5.1 should not be unduly complex or intrusive. The low response rates that initially occurred in Buzzards Bay indicate the need for the survey to be preceded by a substantial educational effort. As noted earlier, this might include having industry representatives assist in preparing the

questions, having local business associations cosponsor the survey, holding workshops, attracting media attention, and having businesses determine who from the companies would be responsible for completing the questionnaire. It would be appropriate to provide a hotline telephone number to assist in clarifying questions.

The information obtained from the survey can be used to judge progress in future years when the survey is repeated. In the short term it can be used to help structure technical assistance.

ANALYZING AND REPORTING THE SURVEY RESULTS

Below we suggest how to report the results of business surveys in ways that will be most useful to estuary program officials.

1. Tabulate and report for each question the percentage of respondents that provided a response. Then calculate and report the number and percentage for each category of business. Businesses might be categorized by such characteristics as size (perhaps using two to five size categories), type of business (farms, food service, small paint and body shops, mortuaries, electroplating industries, or groupings of businesses), and location (city, county, or town). These data (along with other information such as estimates of the amounts of hazardous or toxic wastes disposed of by various categories of businesses) will provide information to estuary program officials to help determine where future estuary protection efforts should be targeted. The format used in Exhibit 6.5 for household surveys can also be used for tabulating data on the questions included in the survey of businesses.

2. After repeat surveys have been conducted, identify time trends and where improvements have occurred. This information will be particularly useful for identifying the results of estuary program efforts to encourage or assist certain categories of businesses. It will provide estuary program officials with evidence on whether their efforts have led to desired outcomes. The evidence will be stronger if changes in outcomes for assisted businesses are compared to those of unassisted businesses.

3. Provide explanatory information along with numerical data where relevant. For example, if business activity had significantly increased or decreased during the year, or if the estuary protection program had assisted a particular industry (perhaps in a specific section of the estuary) to improve handling of toxic or hazardous materials and waste, this might explain findings of

such improvement. Such information will provide estuary program officials with a better perspective on why the outcomes occurred.

4. Prepare a "Summary of Survey Findings" like that shown in Exhibit 6.6. This information will help public and private officials understand the major findings from each business survey without having to wade through extensive tables.

EFFORT AND COST

Because data on actual effluent pollutant levels presumably will be obtained from already existing sources, the cost of collecting them is likely to be negligible for the estuary protection program.

The survey of businesses, however, will require extra effort and a small amount of cost, especially the first time the survey is done. Initial development of the process to be used for obtaining feedback from businesses, including development of the questionnaire, will likely require considerable time on the part of estuary program staff and business representatives. However, once the process has been developed and tested, regular surveys of samples of businesses are likely to be inexpensive. Administration would normally be by mail, with perhaps two mailings and a reminder card. Some telephone follow up and interviews will likely be needed to encourage non-respondents to complete the questionnaire. Drawing the sample of businesses, preparing addresses, doing the mailing, and keeping track of returns all require clerical time. Entering the data and getting tabulations will also require clerical and a small amount of analysts' time.

Notes, Section 5

1. *Toxic wastes* are normally those wastes that are found to contain high concentrations of heavy metals or specific pesticides. *Hazardous wastes* include toxins but are more broadly defined to include any wastes that could cause injury, death, or may damage or pollute natural resources. Many hazardous wastes are listed in the RCRA regulations. Other hazardous wastes are identified by characteristics such as ignitability (solvents), corrosiveness (acid), or reactivity (bleach). In 1986, the Massachusetts Department of Environmental Management estimated that 194,163 tons of hazardous and toxic wastes were generated and handled in that state.

2. See *A Toxic Waste Source Reduction Program for Buzzards Bay*, prepared by the Buzzards Bay Project, June 1992.

SECTION 6

Measuring Outcomes of Household and Boater Estuary Protection Activities

Households and boaters play major roles in estuary protection. Their actions can hurt or help the estuary's condition. Households affect estuary quality by their use of fertilizers and pesticides, disposal of contaminants (such as paint and cleaning materials), and upkeep of private septic systems. Boaters affect

estuary quality by dumping waste, mishandling fuel, and damaging submerged aquatic vegetation with their propellers.

Most if not all estuary programs provide information and assistance to households and boaters aimed at encouraging them to act in ways beneficial to estuary protection. A key issue is the extent to which the behavior of households and boaters is changing as a result of protection programs designed especially for them. Tracking such outcomes is likely to be an important element of an estuary program's outcome monitoring effort.

An estuary program may also want to assess periodically the outcomes of *specific* outreach activities. Information on current behaviors provides estuary officials with "needs assessment" information to help them allocate their limited resources. For example, surveys can measure the extent to which estuary publications have reached targeted groups and whether the public is familiar with estuary protection resources available in the local area.

The major way to assess the status of, and changes in, household and boater estuary protection behavior is to survey them periodically about their environmental protection-related activities. Theoretically, another option is to observe this behavior. However, observation procedures would likely require an expensive, labor intensive effort and are unlikely to reveal a complete picture of a household's or boater's behavior.

Estuary programs have the option of tracking the extent of illegal boater behavior by examining the number of boater violations reported. This measurement source, however, has severe drawbacks. Unreported violations will probably be much larger than the number of reported incidents, and many adverse behaviors are not illegal. Therefore, boater surveys would likely be needed to provide more complete information.

The outcomes obtained through such surveys of household and boater behavior are first-order outcomes. Improvements in behavior can be expected to lead to reduced amounts of contaminants discharged into the waters of the estuary, and subsequently to improved water quality and life conditions for animals and vegetation.

Below we discuss: questionnaire design, how the questionnaire should be administered, how to select the survey sample, and how to report the findings. Exhibit 6.1 summarizes the major steps needed to undertake household surveys.

This material draws heavily from the experiences of the Tampa Bay NEP in its survey of households across the Tampa Bay area and its specialized survey of households located in Tampa Bay's "Florida Neighborhood Program." It also draws on the Buzzards Bay experience with its boaters' survey.

EXHIBIT 6.1 *Steps for Environmental Protection Household Surveys*

1. Prepare questionnaire to be administered to households.
2. Identify appropriate listings of the household population and draw a random sample of households (or if the whole population to be covered by the survey is small, obtain the full list of that population).
3. Administer questionnaire by mail or telephone. Preferably, precede this by a letter or postcard to those in the sample notifying them that they will be contacted shortly and asking for their help.
4. Track returns; undertake a second mailing (or additional telephone calls) to non-respondents approximately three weeks after the first mailing.
5. Carry out telephone reminders or telephone interviews to non-respondents in order to achieve the targeted response rate (at least 50 percent).
6. Tabulate responses.
7. Prepare report on the findings. Include both the numerical results and a summary of the main findings, including a narrative explanation. For both the numerical findings and narratives include comparisons with previous administrations of the survey, focusing on changes that have occurred over time.

When examining changes in household and boater behavior from year to year, small observed differences are not likely to be as important as large differences to estuary program officials. This means that large household and boater samples yielding a high degree of precision are not likely to be needed.

QUESTIONNAIRE DESIGN

Issues to Be Covered by the Questionnaire

The topics chosen for the questionnaire and the specific wording of individual questions have a major effect on the survey's ultimate usefulness.

The first step is to identify potential problem areas relating to household estuary protection behavior. These problem areas can become the subjects for the individual questions.

Exhibit 6.2 is an illustrative list of potential household behavior areas likely to be of concern to estuary programs. An estuary program can start with this list as a way to begin its own identification of which potential problem areas are important to include in its own household and boater questionnaires.

EXHIBIT 6.2 ***Illustrative List of Potential Household Behavior Problems to Be Covered in Surveys***

- Handling of fertilizers;
- Handling of pesticides and herbicides;
- Handling of used oil, paint, and household chemicals;
- Lawn-watering;
- Handling of waste while boating;
- Handling of pet wastes;
- Type of mulch used;
- Cleaning of on-site septic systems;
- Stormwater runoff control;
- Water use.

The selection of the questions to be covered by the questionnaire can be made through a process involving a working group of both technical personnel familiar with potentially "dangerous" household and boater activities and household and boater representatives. Recruiting household representatives should not be a problem because at least some of the technical representatives are also likely to be residents of the estuary region, thus acting as both technical and household representatives. The working group should identify potential problems relating to the estuary's quality (such as those listed in Exhibit 6.2) and break them into specific behavioral issues, about which specific questions should be framed for the questionnaire.

In Tampa Bay, the team developing the household questionnaire had the advantage of a recently prepared publication that identified the types of actions that households could take to help improve the quality of the bay (*Tampa Bay Repair Kit: R_x for a Healthy Bay*, Tampa Bay NEP, St. Petersburg, Fla., 1993.) The team preparing the questionnaire used problem areas identified in the pamphlet. It also used the household actions suggested in the pamphlet for selecting some of the response categories for questions included in the survey. Other estuary programs can draw from this and similar types of publications in developing their own questionnaires.

The working group should identify both problem areas and household characteristics that are likely to affect or be related to household and boater behavior. This background information should be collected from each responding household. When cross-tabulated to household (or boater) behavior findings, such information enables the estuary program to relate the findings on behavior to household characteristics. For example, in its household questionnaire Tampa Bay sought descriptive information such as:

- Household composition (size and presence of children);
- Whether respondents owned or rented their homes;
- County of residence (the Tampa Bay Estuary affects three major counties; the questionnaire asked for county of residence as a way to identify whether the programs appear to be more effective in some counties than others and which ones might need more intense assistance);
- Whether the respondent lived in an apartment, condominium, or mobile home as distinct from a house (in order to exclude that group for questions relating to methods of lawn fertilization, pesticides, materials used for walk areas, and so on).

Obtaining such information enables estuary program officials to break out the outcome program indicator values for each category. This will help identify whether a problem primarily occurs with households of one particular type or in one particular county. Estuary program officials can subsequently direct resources to those particular households.

Question Wording

A major step in developing the questionnaire is to develop the specific wording of each question, including the appropriate response categories for each question. For an environmental protection survey, this task requires special attention.

The specific wording and order of the questions should be prepared with extensive input from people knowledgeable in questionnaire design. Assistance can be obtained from local universities. It is easy to frame questions in a biased manner that does not appear biased to persons inexperienced in questionnaire design. The wording, of course, has to be put into terms that will be readily understood by respondents. This is particularly so if the questionnaire is to be administered by mail, where the respondent has little or no opportunity to clarify the meaning of a word or phrase. For example, in Tampa Bay, a question originally contained the word "xeriscape." This was changed to "drought tolerant plants" to be clearer to respondents. In fact, even the phrase "drought tolerant plants" may not be sufficiently clear and should be simplified further, perhaps to something like "plants that need little, if any, water."

Response categories should cover all possible responses and be worded in specific terms so that *desirable* environmental protection responses can be distinguished from those that are *undesirable*. For example, some types of mulch may be undesirable. For the questionnaire findings to be useful, the estuary program will want to obtain tabulations of the number and percentage of households that report positive as distinct from negative activities. The information can then be used to help the estuary program direct its attention to those areas where there appears to

be a significant amount of negative environmental behavior. The estuary program can plan or expand activities aimed at assisting households to improve those estuary protection behaviors.

The working group should carefully review the initial versions of the questionnaire, even if prepared with the assistance of a survey expert, to assure that the questions and their wording capture the information wanted.

The questionnaire should then *be pre-tested.* That is, it should be tried on a small number of households or boaters representing a cross-section of households to whom the questionnaire will be administered. A pre-test does not mean merely giving the questionnaire to respondents to see if they answer all the questions. It also means that pre-test respondents should be asked whether they had any problems in understanding questions. On question wording that the working group itself found to be problematic, respondents should be asked to give their understanding of what those words or terms meant to them. Based on the findings from the initial pre-test, the questionnaire should be revised. If the problems are substantial and require significant questionnaire modifications, the questionnaire should be again pre-tested.

To our knowledge, there is no scientific way to determine how many persons should be included in a pre-test. The estuary program should probably include about a dozen households in its pre-test. If these households have problems with the questionnaire, the working group should add additional households to the pre-test until it feels confident the questionnaire is reasonable.

Because of the likely variety of households in any estuary, the questionnaire will need to include some skip patterns so that households with certain characteristics skip over some questions. For example, households that live in apartments should not be asked questions about lawn fertilizers because they are unlikely to be sufficiently informed about the maintenance of grass areas outside their apartment units. Similarly, boaters without marine sanitation devices do not need to be asked about their use of pump-out facilities.

Appendix 3 presents a modified version of the household questionnaire used by the Tampa Bay NEP. Some of its questions are unique to that region of the country and will not likely be applicable to other estuaries. Appendix 4 presents a modified version of the boaters' questionnaire used by the Buzzards Bay Project, which focused on waste disposition given the local area's recent enactment of a "No Discharge Zone." In contrast, a boaters' survey for the Tampa Bay NEP would likely reflect that area's concern for protection of seagrass.

Finally, in areas with significant numbers of non-English-speaking residents, the estuary program may need to provide different language versions of the questionnaire.

The survey questionnaire can be administered to households and boaters by mail, by phone, in person at their home or dock, or by a combination of the above.

Mailing the questionnaire is likely to be the most feasible method for most estuary programs. It is usually the least expensive approach. Its major drawback is that unless the process is handled properly, response rates may be so low that the results will not have sufficient validity and credibility.

Administration by *telephone* is the survey technique most favored by survey organizations. However, it is a more labor-intensive effort since it requires time to train interviewers, locate and reach potential respondents, and complete and document the interview. Completion rates, however, are likely to be substantially higher than for mail surveys if the phone interviewers repeatedly call back numbers until contacting the respondent.

In-person household interviews are not likely to be feasible for most estuary programs given the considerable amount of interviewer time required for travel to respondents' homes. These days, interviewers are also reluctant to go into certain areas of their communities, particularly in the evenings when people are most often available for interviews.

Some exceptions exist. For example, Tampa Bay's Florida Neighborhood Program had personnel that provided direct assistance and information about environmental protection to a small number of households within pre-selected neighborhood areas. In such situations, program staff are in a position to deliver the questionnaires to homes and then return to pick them up or to offer to complete an interview at the person's home or elsewhere in the neighborhood. This procedure should be able to produce a high completion rate at very low cost, but adds extra work for program personnel.

One option for administering boaters' surveys is to access a sample of boaters at their docks when they return from trips. This approach is likely to become feasible if the estuary program can assign volunteers or staff to primary docking locations around the estuary at various times of the day, days of the week, and seasons. In Buzzards Bay, the boating season lasts from April until mid-September.

The most satisfactory approach for estuaries is likely to be a *combination of mail and telephone* administration in order to bring the response rate up to reasonable levels at a reasonable cost. We suggest that estuary programs seek a 50 percent rate of return, excluding questionnaires that were returned because the family had moved or otherwise were ineligible for the survey. The estuary program will need to undertake a second and perhaps third mailing to non-respondents to increase

the response rate. After the second mailing the program should follow up non-respondents by phone to remind them to complete and return the questionnaire, or if preferred, to complete the interview by phone.

The first mailing should request the completion and return of the questionnaire by approximately the third week after the date the questionnaire is mailed. An example of a mail questionnaire cover letter is shown in Exhibit 6.3. In addition to the information shown here, the cover letter should also indicate that the information provided will be confidential and it should identify who can be contacted for more information on the survey. The second mailing, with a new updated cover letter and another copy of the questionnaire, should be sent shortly after the first is due. This requires the survey team to identify households that have already returned the questionnaire. The second mailing should give a new date for returning the questionnaire, about two weeks after the follow up is mailed.

EXHIBIT 6.3 ***Example of a Household Survey Cover Letter***

Dear Neighbor:

Tampa Bay needs your help!

To help develop a pollution prevention strategy, the Tampa Bay National Estuary Program is randomly surveying households in the Tampa Bay region to learn more about residents' level of awareness of environmental issues and practices in and around the home to minimize pollution. You can help by taking a few minutes to fill out the enclosed survey and returning it to us in the enclosed self-addressed, stamped envelope by January 15, 1993.

To thank you for your assistance, we will send you a *Tampa Bay Repair Kit*—an easy to use handbook on actions homeowners can take to reduce pollution, conserve water, and protect the natural resources of the bay.

Your assistance is very much appreciated.

Sincerely,

Richard M. Eckenrod

Usually it will be desirable to code each questionnaire to identify which households have returned the questionnaires and which have not. It is quite appropriate to guarantee in the cover letter that the responses will be confidential and that only aggregate data will be reported. However, it is not necessary to guarantee complete anonymity, at least not from the program personnel administering the survey.

The cover letter can give households the option of contacting the survey team to be interviewed by telephone rather than completing the questionnaire in writing. This option is not likely to be used by many households, but some might have literacy problems, feel uncomfortable with a written questionnaire, or otherwise feel more comfortable talking to someone at the survey office.

Improving Response Rates

Exhibit 6.4 presents suggestions to increase the likelihood that households will complete and return mail questionnaires.

The questionnaire and the cover letter should indicate the date by which the questionnaire should be returned. Judgments differ on how much time should be allowed. Allowing a period of about two to three weeks from the date that the questionnaire is expected to be mailed is probably appropriate. The due date should not be so far out in the future that people will put if off and lose the questionnaire. On the other hand, the time allotted should be long enough to allow for mail delivery and for respondent's possible absence or other commitments.

For boater surveys, endorsement and even cosponsorship of the survey by local boater associations would likely be very helpful. In such cases, it is preferable that the cover letter be signed by the association president as well as an estuary protection program official, to encourage boaters to respond to the survey.

SELECTING THE HOUSEHOLDS AND BOATERS TO BE SURVEYED

The survey team will need to determine the listing of households and boaters to be used to draw the sample, the sample size, and the procedure used to select the sample from the list.

Sample Source

If the survey is *by telephone,* the survey team could draw from recent telephone directories to obtain its sample, assuming that the number of households without telephones and with unlisted numbers is not expected to be large enough to significantly affect the findings. A more sophisticated approach that takes care of the unlisted phone problem is to use "random digit dialing," a procedure that should probably be used with the help of an expert in random digit dialing (again, contact a local university). An easier option is to draw a sample from the phone

EXHIBIT 6.4 *Suggestions for Increasing Mail Survey Completion Rates*

1. Keep the questionnaire as short as possible. A mail questionnaire should be no longer than four pages and preferably shorter. Telephone questionnaires can be longer. Interviews of 15 to 20 minutes are not likely to be overly troublesome for most respondents.

2. Print the questionnaire on attractive paper and in an attractive format so that it does not look oppressive and is easy to complete, say, within 15 minutes. A questionnaire development expert would be very helpful in designing the questionnaire format (the questionnaire also needs to be easy to tabulate).

3. Send a postcard or letter in advance to each household in the sample telling them that the questionnaire will be forthcoming and asking them for their cooperation and help.

4. Include a short, simple cover letter with the questionnaire asking for the respondent's help. Have it signed, preferably by someone likely to be known by households and with favorable name recognition. Assure confidentiality and provide a phone number for households with questions about the survey (see Exhibit 6.3).

5. Personalize the cover letter if at all possible; this is most feasible if reasonably current word processing hardware and software are available.

6. Use second and perhaps third mailings (including another copy of the questionnaire) to non-respondents.

7. When feasible, offer an incentive for completing and returning the questionnaire. The estuary program might offer to send a particularly attractive publication to persons responding. In Tampa Bay returners were offered a copy of the *Tampa Bay Repair Kit*, an attractive document that provided suggestions to households about environmental bay protection. Some government tourist offices put the names of households that return completed questionnaires into a lottery, for say, a $100 savings bond.

8. Use telephone reminders to households that have not returned their questionnaires. Offer to complete the questionnaire over the phone if the respondent prefers.

directory and then increase each drawn phone number by one. This makes the telephone numbers random and will, thus, cover listed as well as unlisted numbers.

If the questionnaire is to be administered *by mail*, addresses can be obtained from telephone directories. But in addition to the problems mentioned above,

telephone directories used for mailing purposes do not provide ZIP codes. Therefore, someone will probably need to identify the ZIP codes for each address. Telephone directories are usually reasonably up-to-date (persons who have resided in the community for less than a year probably should not be surveyed).

However, use of phone directories can present problems if the directory boundaries do not match those of the target area for the estuary. The Tampa Bay NEP survey initially used the telephone directories for each of three counties. This procedure yielded problems because a number of households were found to reside in communities outside the survey region to be surveyed (phones listed as being in one town were sometimes found later to be located in another, out-of-the-area location).

The Tampa Bay NEP found a more efficient device—the use of "reverse directories," directories arranged by street address that provided addresses, zip codes, and in most cases phone numbers (that can be used for telephone reminders or phone interviews). These directories, prepared by business firms, may also contain additional useful information such as apartment numbers. (If the estuary program wants to exclude households that are in apartments, the reverse directory will enable this to be readily done.) Unfortunately, reverse directories are usually prepared only for high-population areas. Reverse directories can be used for both mail and telephone surveys.

In some small communities it might be feasible to use real estate rolls, utility billing addresses, or other government lists. In doing so, the survey team needs to carefully determine whether some types of households they want to include have been excluded, or that some they would like to exclude are included. For example, real estate rolls would exclude renters. Utility bills would include some renters including apartment dwellers.

No list is likely to be perfect. But as long as the survey team uses comparable lists each time it conducts the survey and is able to obtain reasonable response rates, comparisons across time should be reasonably valid.

For boater surveys not administered at the dock, the survey team might use available listings of registered boaters or of local boating clubs. This would not cover visiting boaters, but their behavior is less likely to be influenced by estuary protection activities. However, questionnaire administration at the dock can cover visitors if they are felt to be a major offender group and if the estuary program believes it can take actions that would have a tangible effect on visiting boaters' behavior.

Sample Size

For surveys where the total target population is small (under 500), the questionnaire can normally be administered to 100 percent of households. Tampa Bay's Florida

Neighborhood Program administered questionnaires covering all of the few hundred households included in the program.

For area-wide household surveys such as the Tampa Bay household survey, administering questionnaires to all households clearly is infeasible. Even the larger estuary programs are unlikely to be able to survey more than 1,000 households. Smaller estuary programs should be able to handle mail surveys of about 300 to 500 households without much trouble. Note that statistically it is better to get a higher completion rate from a smaller sample than a much lower response rate from a larger number of households. For example, it is usually much better to receive 100 completed questionnaires from 150 households (a 67 percent response rate) than to receive 1,000 completed questionnaires from 150,000 households (a 10 percent response rate). The 10 percent response rate raises a significant possibility of non-response bias (i.e., that non-respondents differ from respondents in significant ways in their responses).

A complicating factor is that the estuary program is likely to want information on various sub-groups of the full sample. This increases the sample size needed. For example, if an estuary program wants to obtain reasonably statistically valid information for each of three counties, it is likely to want to seek a sample return of at least 300 questionnaires—about 100 from each county. If it expects a 50 percent response rate, a mailing of 600 will be needed.

When compiling addresses (or telephone numbers if the survey is by phone) for the sample, the survey team also needs to consider the number of households on the list that are likely to be *ineligible* for the survey. Some households may be found to have moved or to live outside of the eligible area. For example, if about 20 percent of households in the listing are expected to be ineligible, the number of households that should be drawn initially—assuming a 50 percent response rate is sought—is 375 if the number of completed questionnaires sought is 150, 750 if 300 completions are sought, and 1,250 if 500 completions are sought.

Sample Drawing Method

After determining the size of the sample and the sources from which it will be drawn, the next step is to draw the sample from the list.

The survey team needs to estimate the total number of households in the list from which the sample is to be drawn. That number should be divided by the sample size to give the approximate sampling interval. For example, if the listing contains 100,000 households (a community of between 250,000 and 300,000 population) and the survey team wants a sample of 750, the team needs to choose one out of every 133 listings. Such a selection can be done in a number of ways. One

relatively simple procedure is to randomly select a starting point in the directory and then choose every 133rd listing.

Counting the number of listings in each directory and selecting every 133rd listing need not be done exactly, but should be "roughly right." The principle here is to draw the sample in a way that reduces potential biases. The persons drawing the sample should look out for listings that are not relevant or not eligible to be sent a questionnaire such as a business or government office or, if the survey is not intended to include them, households living in apartments, trailers, and condominiums. If the questionnaire is not intended to target certain groups of households such as renters, the questionnaire itself should include a question to screen out renters.

ANALYZING AND REPORTING THE SURVEY RESULTS

Typically, agencies put too little time into considering how the information should be reported. Below we discuss both the analysis of findings and their presentation.

Analyzing the Information

When questionnaires are returned, each should be reviewed to ensure that the responses given are clear and fit into the appropriate response categories. This is particularly important in mail surveys because respondents sometimes make errors such as missing skip patterns. For example, in Tampa Bay respondents living in an apartment, mobile home, or condominium were instructed to skip over questions about maintenance of lawns and septic systems. On occasion, some respondents provided responses to questions they were asked to skip. The questionnaire editor should correct those entries by marking and tabulating those answers as "non-applicables."

If a respondent provides an ambiguous response by, say, putting a check mark half-way between response categories, the editor will have to treat the responses as if the respondent had not answered them. However, if these questions are felt to be of major importance to the study, the survey team might go back by phone to that respondent to clarify the responses. But this is seldom likely to be needed or appropriate.

The numerical tabulations should be done by computer. Many software packages are available that permit the ready entry and tabulation of questionnaire data.

Standard software programs such as SPSS and SAS do have such tabulation capability, but their use requires individuals knowledgeable of the software.

Though we do not recommend it, if necessary the tabulation work can be done by hand using a spreadsheet approach by listing each respondent in a row and using each column to enter the responses to a different question. Manual tabulations are feasible if the number of households in the sample is relatively small, say up to about 300, and if the survey team does not need to make many cross-tabulations.

Manual tabulations can readily provide one or two sets of cross-tabulations such as findings broken down by county or by whether respondents own or rent their homes. Different spreadsheet pages would be used for each category. The findings can then be tabulated for each page and totaled. If, however, the survey team wants to tabulate a number of such cross-tabulations, the manual work quickly becomes difficult to handle—and is subject to substantial potential tabulation errors.

Presenting the Findings

Findings should generally be presented in at least two different types of formats. The first format presents the *numerical results*. These can be presented in tables and charts by reporting the percentage of respondents that gave each response for each question, perhaps entered on a copy of the questionnaire. Another way to present numerical results is by providing tables for each question (see Exhibit 6.5 for example). Note that the principal numbers used in the presentation are percentages—the percentage of the total sample that responded in each way to each question. The number of households that responded to the question is also included to give users a perspective on sample size. The format shown in Exhibit 6.5 also allows users to see readily whether substantial differences in responses occurred for different categories of households.

The data should be analyzed for each environmental problem behavior. These data should also be examined to determine whether specific categories of households (e.g., those living in particular jurisdictions, those with a certain household composition, or renters or owners) presented problems. For example, the hypothetical data shown in Exhibit 6.5 indicate that proper disposal of oil, paint, and other chemicals is particularly a problem in County C and with renters, a large proportion of whom dispose of these items into sewer or storm drains.

Estuary programs are also likely to find it useful to calculate an overall outcome indicator such as the "percentage of households with one or more environmental problems." This overall outcome indicator should also be broken out by household category.

EXHIBIT 6.5 *Illustrative Report Format for Household Survey Responses (Hypothetical Data)*

Percentage of respondents that reported disposal, in the past 12 months, of motor oil, paints, or chemicals at (a) county collection sites; (b) local service stations; (c) into sewer or storm drains.

	Number of Respondents	DISPOSITION		
		County Collection Sites	Local Service Stations	Sewer or Storm Drains
Total Number of Respondents	200	90	70	40
Percentage of Respondents	—	45%	35%	20%
County A	60	67%	25%	8%
County B	75	27%	53%	20%
County C	65	31%	38%	31%
One-Person Household	35	43%	43%	14%
Two-Person Household	65	38%	39%	23%
Three-Person Household	100	50%	30%	20%
Owners	120	67%	25%	8%
Renters	80	13%	50%	37%

When tracked over time, these measures provide an overall snapshot of progress in improving household environmental protection behavior. They indicate the extent to which efforts to provide information to households can help improve bay quality. For example, if a large percentage of households or only certain categories of households report problem behavior, estuary program officials may want to allocate significant resources to targeting those types of households with education or technical assistance.

The summary report should also provide users with a brief description of key features of the survey: whether it was administered by mail, phone, or a combination of the two, the response rates obtained, and the dates when the survey was conducted. This information enables readers to be better able to interpret the precision and timing of the survey.

Findings should also be summarized in a short, clear *narrative form* that highlights the findings. This "Summary of Survey Findings" should identify major problems needing attention. After the survey has been undertaken more than once, the summary should identify where significant improvements or backsliding have occurred relative to previous survey findings.

Exhibit 6.6 presents an excerpt from a summary of the Tampa Bay 1993 household survey. Because this was the first time the survey was conducted, the findings do not present information on time trends. The Tampa Bay survey findings indicate how survey information might be used by estuary protection programs. For example, a substantial percentage of households (25 percent) that disposed of oil, paint, or chemicals in the past 12 months reported that they had disposed of them into their sewers or outside storm drains. This indicates a problem that the environmental protection program should address in its future activities.

EXHIBIT 6.6 ***Highlights of Survey Findings: Tampa Bay Household Environment Survey, 1992/1993***

- Forty-two percent either do not have or do not know if they have water flow saving devices.
- Forty-five percent do not have a displacement device in their toilet; another 11 percent do not know if they do or not.
- Twenty-five percent of those surveyed who had disposed of oil, paint, or chemicals in the past 12 months reported disposing of them in their sewer or outside storm drain.
- Seventy-two percent are separating their trash for recycling; 25 percent are not.
- Twenty-four percent of dog owners never pick up their animal wastes; 14 percent do it "sometimes."
- While only 9 percent do not use slow-release fertilizers, 30 percent do not know if they do or not.
- Forty-eight percent use pesticides to control yard pests; 50 percent use pruning.
- Seventy-three percent have mostly, or some, native or drought resistant plants and trees; 17 percent are not sure if they do or not.
- Regarding new foliage planted, 21 percent said they are not drought resistant varieties; another 29 percent said they didn't know if they were or not.
- Twenty-six percent said they do not group plants according to fertilizer/watering needs; another 31 percent did not know if they did or not.
- Although only 7 percent have septic systems, of these, 67 percent pump out residues later than the recommended 3 to 5 years. Additionally, 67 percent use cleaning compounds and 34 percent use a garbage disposal.

Such information is the major purpose of household and boater surveys. It is used to identify whether past activities have had targeted outcomes and to help identify future actions that should be taken to improve household and boater estuary protection activities.

LIMITATIONS OF HOUSEHOLD AND BOATER SURVEYS

The information collected in these surveys should be considered "roughly right." Because of major resource limitations that most estuary programs will have in undertaking such surveys, a great deal of precision is unlikely to be feasible. But it is not likely that questions in these surveys will need more precision than within five to seven percentage points.

In addition, the accuracy of household and boater responses will always be subject to some question. Respondents' possible reluctance to indicate negative environmental protection behaviors and their incomplete understanding of some environmental issues (such as the impact of boater discharges on estuary water) may affect the accuracy of their responses. Non-responses from some individuals in the sample also negatively affect the accuracy of the survey findings.

Finally, as noted earlier, household and boater surveys provide information only on first-order effects. Whether improvements in these behaviors will lead to major, significant changes in the water quality and the condition of estuary living resources is subject to some uncertainty.

EFFECT AND COST

The cost of estuary program activities that encourage households and boaters to improve environmental protection behavior and the cost of the household surveys that assess the outcomes of these activities are usually relatively small, at least compared to other types of activities.

Probably a major barrier to undertaking household and boater surveys is that estuary program personnel are not experts in survey work and do not have staff with sufficient time to do the work themselves. The major time and cost requirement for household and boater surveys is likely to be spent on initial development of the questionnaire. Once this has been developed, the administration of future surveys should require much less cost and time.

Nevertheless, estuary protection programs should consider hiring a local survey organization to administer the questionnaire. The estuary program should still use a working group to help develop the questionnaire and to address basic issues such as which categories of households should be included and excluded. However, estuary program officials will find it less troublesome if they have an experienced survey organization to take care of the details including sampling, administering the survey, conducting the tabulations, and preparing the initial summary reports. Estuary program officials should, however, remain responsible for reviewing the survey findings and preparing their own summary of findings, perhaps with recommendations for future estuary program activities based on those findings.

If the survey is conducted by mail, it should generally cost no more than $5.00 per completed questionnaire, once the questionnaire has been developed. If the survey is conducted by telephone (the preferred mode of most survey organizations), the estuary program will find the cost higher, perhaps $15.00 to $20.00 per completed interview. Thus, for 500 completed interviews, the contract cost should range from $2,500 for mail surveys to $10,000 for telephone surveys.

Because of the numerous details and problems involved with undertaking a survey, we recommend that, if feasible, an estuary program contract out the survey.

SUMMARY

A random sample of households in the estuary protection area is the primary way to obtain periodic information on the estuary protection behavior of households. Conducting such surveys periodically enables the estuary protection program to track the extent to which activities aimed at improving estuary protection behavior are achieving desired results. The surveys also provide important needs assessment information by indicating what types of behaviors (by which categories of households) are present that seem likely to cause bay protection problems. The information obtained can then be used to help estuary program officials identify where they need to apply their future effort and resources.

SECTION 7

Obtaining Information on Bay Quality: The Bay Quality Index

The end result sought by estuary protection programs is an estuary that is healthy and fully supports use by fish, wildlife, vegetation, and humans. The only practical way to assure that progress is being made toward this end is by defining a comprehensive set of measures, or environmental indicators, that can reveal progress over time. However, as Robertson and Davis point out:

> Water quality is an abstract concept used to denote an overall evaluation of the condition or environmental health

> of a water body or resource.... A complete assessment would entail measurement of all the environmental properties of an area. This is obviously not possible as the number of physical, chemical, geological, and biological properties that can be measured in an area are immense. Instead, a relatively few properties that can provide general indications of environmental condition must be selected for measurement.[1]

How can outcome monitoring provide data useful to officials and the public without burdening them with an excess of esoteric information? We recommend summarizing environmental monitoring data into a "Bay Quality Index" (BQI).

The intent of a BQI is to provide a sound, reliable composite indicator of an estuary's overall quality and major components. The index is intended to capture the major bay quality features of the estuary in a straightforward and simple way. The index should be clear, understandable, and useful to public and private officials and to the public at large. It should permit the monitoring of trends in estuary quality over time and help identify key aspects of bay quality that need extra attention. It should also enhance the ability of estuary protection officials to communicate needs and progress to citizens and the media.

The index should be scientifically sound, while recognizing that it is impossible to capture all relevant estuary characteristics in one index; resources for environmental monitoring are limited; and the index is not likely to be fully satisfying to the scientific community (or any segment of the community). However, the index should provide a reasonable and comprehensive picture of the status of the estuary at particular points in time. The index should use already available environmental monitoring data to the extent possible.[2]

Federal and state governments are already using a variety of environmental indices. For example, the State of Ohio has developed an "Index of Biotic Integrity." This uses data on the number of different types of species and the total number of species to produce an overall biological assessment of the quality of streams.

The Hillsborough County Environmental Protection Commission in Tampa, Florida, has been annually updating a "Water Quality Index" generated in 1984. This index serves as a model for some of the procedures discussed here.

MAJOR FEATURES OF A BQI

1. The index should indicate:

- ❑ The condition of living resources including fish, vegetation (e.g., seagrasses), and other wildlife—and incidence of human illnesses due to poor estuary quality;

- ❑ The extent of support for desired uses of the bay, including swimming and commercial seafood collection;
- ❑ Water quality; and
- ❑ Other key aspects of habitat quality.

The BQI might also include perceptions of bay attractiveness, perhaps based on feedback from representative samples of citizens. It might also include economic indicators closely related to bay conditions. Those who prepare the index should identify major gaps in the index attributable to currently unavailable data.

2. The overall index can be an aggregation of a number of sub-indices, such as indices for each of the categories listed in #1 above. We recommend that estuary programs maintain separate indices of *water quality,* which is basically a third-order indicator, and of *condition of living resources,* a fourth-order indicator. Some estuary programs might want to combine both as is done by the Buzzards Bay Project and the Tampa Bay NEP.
3. The procedure should provide sub-indices for key geographical segments of the estuary, for instance, for particular embayments within the estuary and for key tributary and tidal streams and creeks.
4. The index should be calculated on a regular schedule so that estuary protection officials can have timely information on which to allocate their scarce resources. The information should be made available on a timely basis, at least annually and preferably seasonally. This does not require that all index components be updated frequently; some components will likely be collected less often, both because of resource constraints and because they are not expected to change frequently.
5. The values of individual index components should be readily available in back-up materials so that users can, if they wish, examine them for themselves. Data on individual index components can, of course, be quite valuable for helping to pinpoint problems.
6. Index values should be divided into ranges (e.g., excellent, good, fair, or poor) so that users will know which values fall into each of a small number of important and understandable categories of bay quality.
7. Staff and consultants should probably prepare the first version of the index, but it should be subject to full discussion, review, and debate by interested persons in the estuary area, including the technical community and government, environmental, and user groups. The intent is to achieve a reasonable degree of consensus on the index's coverage.

Below we discuss principal issues in the development and use of Bay Quality Indices, drawing on the experiences of the Tampa Bay NEP and the Buzzards Bay Project.

DEVELOPING A BQI

The following four steps are needed to develop a BQI:

- ❑ Select the components to include in the index;
- ❑ Determine the way in which these components are to be combined into the index;
- ❑ Identify those values of the index that represent the various levels of bay quality such as excellent, good, fair, or poor;
- ❑ Select the sub-indices likely to be useful.

The BQI is likely to receive special attention from the media because of its apparent simplicity, just as overall air pollution indices in cities have achieved considerable acceptance by the media, the public, and even the technical community.

As suggested farther below, each report containing updated BQI data should also provide explanatory information that assists readers to understand why the values of the index have improved, worsened, or remained the same. Such explanations might also include actions being undertaken or planned to improve the values. The explanations should also estimate the likely effects and timetable of such actions; some index components may require many years of effort before improvement is seen. Such information should be included with the index data in reports made to public officials, the media, and the public in order to reduce misunderstandings about the implications of the BQI data.

STEP #1: Select BQI Components

This is the first step needed in developing a BQI. Inevitably, any estuary program will be faced with limited resources for data collection. This limits the ability to collect all the information needed, as frequently as it is needed, from samples as large as needed, and in as many locations as needed. The objective is to provide data on a regular seasonal or, at least, annual basis.

This means that for outcome monitoring, estuaries will need to be content with an index that covers a smaller number of environmental components and uses

smaller samples collected at fewer locations and less frequently than they would like.

Examples of components for a BQI focusing on condition of living resources—a fourth-order outcome—are presented in Exhibit 7.1. Each estuary needs to identify those components most relevant to its own situation. Index components should be selected by using the following criteria :

EXHIBIT 7.1 ***Examples of Components for a Bay Quality Index Focused on Condition of Living Resources (Fourth-Order Outcomes)***

- Extent of shellfish bed closures or restricted use/consumption advisories;
- Extent of beaches closed to bathing or having other restrictions due to unnatural causes;
- Acreage of seagrasses;
- Number of fish kills;
- Fish populations;
- Populations of selected mammals and birds;
- Extent of algae blooms;
- Extent of offensive noxious odors;
- Prevalence of fish abnormalities due to unnatural causes, based on tissue samples;
- Number of cases of human illness due to consumption of contaminated seafood;
- Citizen ratings of estuary attractiveness.

- ❑ *The component gives important, reasonably valid information about bay quality,* particularly the elements listed earlier under "Major Features of a BQI": condition of living resources and the extent to which the bay supports designated uses.
- ❑ *The information provided does not overlap substantially with the information provided by one of the other candidate components.*
- ❑ *The component is related in a substantial way to protection of the estuary.* For example, a component that primarily affects land or water areas outside the bay would not likely warrant inclusion in the BQI. An air pollution problem that did not have a significant impact on the waters should not be represented in the index. A fish species that spent most of its time

outside the estuary and was not significantly affected by it, even though considered of prime importance throughout the state, should not be included.

- ☐ *Collectively, the components selected provide a sufficiently comprehensive picture of the estuary's "health."*
- ☐ *Relevant data are available for the component* or, if they are not, reasonably valid data are likely to be obtainable in a practical way in the future.
- ☐ *The cost of regular or periodic collection of any additional data is reasonably manageable.*

One sticky issue is what to do about components that are not currently an estuary problem but could at some point flair up and become a major concern. Should these be included in the index? For example, certain toxins may not currently be a concern. Should such components be included in the index? Inclusion would give the estuary credit for controlling an important potential pollutant. In general, it is probably desirable to include such components. The major hurdle here is the added cost to collecting that information. However, the estuary program could collect data on such components less frequently, reducing data collection costs significantly. It is likely to be good practice for an estuary to check such components at least every few years.

In many cases, estuary programs rely on the federal government for some measurements. Unfortunately, federal collection efforts often do not provide the geographical coverage and frequency that most estuary programs need. Until the estuary program finds the funds to make such regular measurements, it will likely need to rely on the limited federal data available.[3]

Inevitably, the various components of the index will be collected at different times, with different frequencies, from different sample sizes, and possibly from different locations, depending on the nature of the component and the resources available for data collection. Thus, different component values will have different degrees of precision and validity.

It will sometimes be necessary to use proxies for the ideal measurements. Differences of opinion will exist among technical personnel on the accuracy and validity of various measurements. For example, one controversial area has been measurement of fecal coliform as an indicator of the extent to which pathogens are present in water. Another example is the use of Secchi Disk Depth readings rather than more accurate PAR (Photosynthetically Active Radiation) procedures; the former is less costly and can readily be collected by volunteers but is not likely to be as accurate as the latter.

As indicated earlier, this manual takes the position that it is better to be roughly right than completely ignorant. Thus, we recommend that the estuary use the best,

most recently available data, even though some may be old or less than ideal. When the technical community believes that the data for a component have become obsolete or otherwise invalid, the component should be dropped from the index until new information is obtained.

Some real-life examples of indices are the following:

- Since 1984 the Hillsborough County Environmental Protection Commission (HCEPC) has calculated a Water Quality Index for Tampa Bay and its major sections. This index has been used as a starting point for both the Buzzards Bay Project and the Tampa Bay NEP to develop their BQIs. The Hillsborough index includes the parameters shown in Exhibit 7.2.

EXHIBIT 7.2 *Example of BQI Components and Their Weights*

PARAMETER	WEIGHT
Percentage of Saturation Dissolved Oxygen	.212
Chlorophyll "a"	.167
Total Coliform	.167
Effective Light Penetration	.111
Total Phosphorus	.111
Total Kjeldahl Nitrogen	.111
Biochemical Oxygen Demand	.111
Sum of Parameter Weights	1.000

Source: Richard Boler, ed. 1992. "Surface Water Quality, Hillsborough County Florida, 1990-1991. Tampa, Fla.: Hillsborough County Environmental Protection Commission (September), p. A-2.

- The Tampa Bay National Estuary Program is building on the HCEPC Water Quality Index. It is adding fourth-order indicators such as the condition of living resources and the extent to which the bay supports desired uses (the Hillsborough Index, as the HCEPC has pointed out, focuses solely on water quality parameters). The Tampa Bay NEP, as of this writing, is selecting the components for the index. It is considering inclusion of: (a) acreage of "functionally healthy" vegetative habitat such as seagrasses, salt marshes, and mangroves (these would be obtained from periodic assessments by the Southwest Florida Water Management District); (b) fish population data, including specified juvenile fish, recreational fish, and selected mammals (collected by the Florida Department of Environmental Protection); and (c) measurements of "impaired" uses such as extent of shellfish bed closures, red tide counts, number of fish kills, and extent of blue-green algae blooms.[4] Commercial shellfishing has been

closed in most of Tampa Bay for many years. This has not been a visible issue there because no commercial shellfishing industry has been present to act as an advocacy group for opening the beds.

- The Buzzards Bay Project has adapted the HCEPC index. The Buzzards Bay Project index uses five components: early summer morning dissolved oxygen concentrations (as a percentage of saturation); Secchi disk depth; chlorophyll; total organic nitrogen; and dissolved inorganic nitrogen—to evaluate water quality degradation caused by nitrogen loading (coastal eutrophication). The index also will include the extent of shellfish resource closures—a major issue in the Buzzards Bay estuary. The Buzzards Bay Project would also like to evaluate PCB concentrations in edible tissues of flounder and lobster as a way to evaluate Superfund Cleanup success. However, the Buzzards Bay Project does not yet have adequate resources for implementing such monitoring. Similarly, while the program would like to include an indicator of living resources such as habitat, bay officials feel that the high cost of such monitoring is prohibitive. They are considering monitoring the extent of eelgrass beds, but only every five years or so. These latter items are not included in the current version of the BQI.

Each estuary program needs to identify the components of its index that can best reflect bay quality. For example, neither the Buzzards Bay Project nor the Tampa Bay NEP has felt it necessary to include an indicator of salinity in their indices. However, an estuary program in which saltwater intrusion has become a major threat to wildlife would likely want to include a salinity measure in its index.

The above indices combine third- and fourth-order outcomes in the same index. Though this is certainly an option, we recommend that these be kept as separate indices.

A discussion of technical data collection methods for the various environmental monitoring parameters is beyond the scope of this report. Estuary programs, however, should recognize that alternative data collection methods often exist for individual parameters. Different sample collection methods can result in different findings. Estuary programs will, of course, need quality control steps, particularly when using volunteer monitoring procedures.

The federal government has been sponsoring substantial research into environmental parameters and data collection methods, with the long-range intent of obtaining some degree of standardization of procedures.[5] However, in the foreseeable future estuary programs will likely face major uncertainties and various options in determining what to collect and how.

STEP #2: Combining Individual Parameters into an Index

Once an estuary program has identified the components for the index, the next problem, a difficult one, is to combine the values of the components into an overall index.

This requires two important steps. The first is to transform the values for each component—each of which is expressed in different measurement units—into a common unit of measurement. That is, each value needs to be "normalized." The second step is to combine those normalized values into an overall index value.

A basic procedure for transforming each parameter into a common metric is to map possible values for each parameter onto a 0 to 100 scale with 100 representing "highest" quality. Develop a relationship line, perhaps on a logarithmic scale, that relates the potential values for the parameter to the associated value on the 0 to 100 scale. This line, based on technical judgment, establishes the relationship among all possible component values and environmental quality. Examples of such transformation scales are shown (for chlorophyll, coliform, and light penetration) in Exhibits 7.3, 7.4, and 7.5.[6]

The next step is to apply "weighting factors" that reflect each parameter's importance as an indicator of the health of the bay. Most commonly, analysts apply weights to each parameter that add up to "one." For example, the weights used in the Hillsborough County Index are shown in Exhibit 7.2.

The respective weights can then be multiplied by each of the "normalized" values of the individual BQI components and added together to produce the latest value of the BQI.

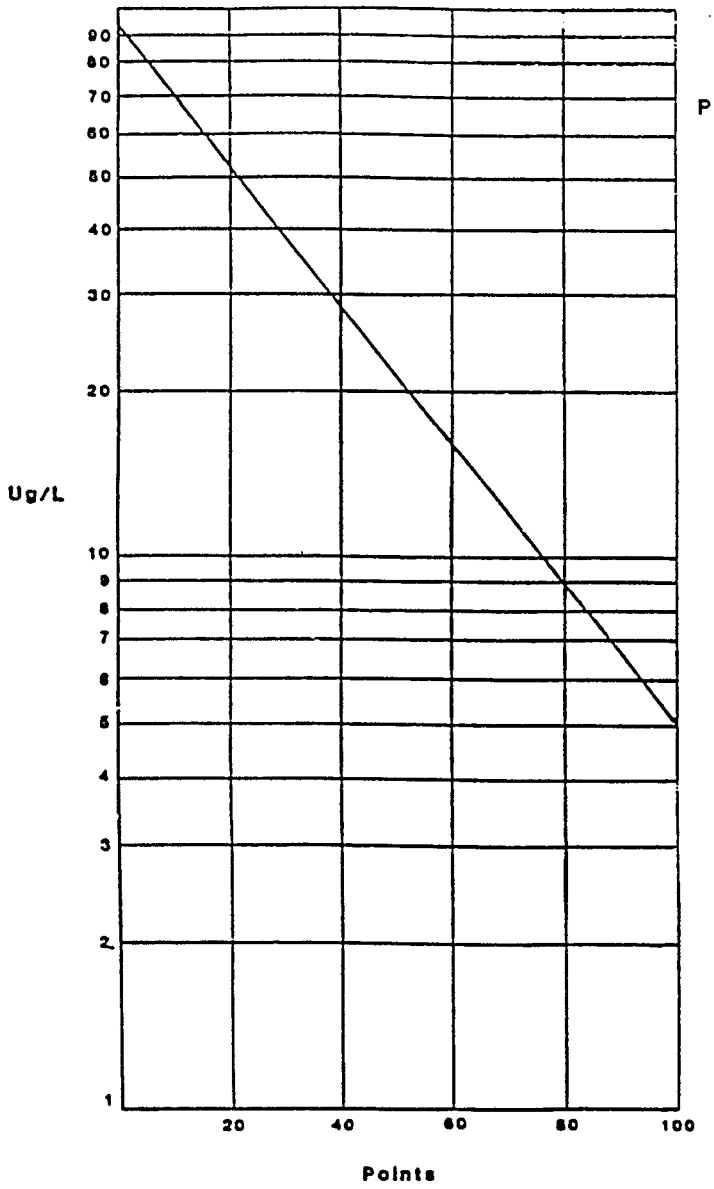
STEP #3: Identify BQI Values That Represent Various Levels of Overall Quality

Bay Quality Indices based on the above types of procedures will generate an index typically varying from 0 to 100, perhaps with 100 meaning very good and 0 being terrible.

These numbers will be very helpful in tracking the extent of progress from one year to the next. However, many users of the information will also need data that permit them to interpret which of these values are "good" and which are "not good." Thus, an estuary will also need a procedure that translates values of the BQI (0-100) into categories such as excellent, good, fair, or poor. The estuary will need to select a range of BQI values for each such category.[7]

This process is not as easy as it may sound. The determination of which values for the BQI should be categorized as excellent, good, fair, or poor will be based to a large extent on judgment. The "judges" that determine the category ranges will

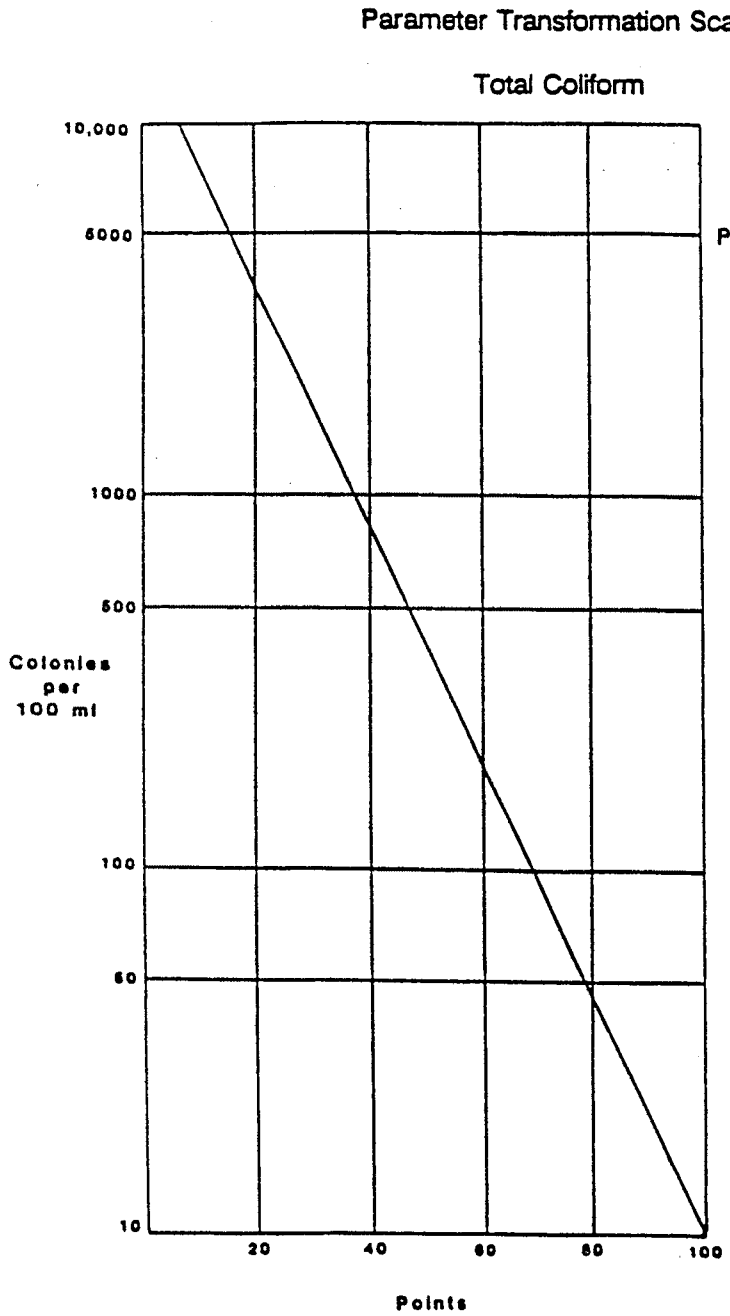
EXHIBIT 7.3 *Example of a Transformation Scale: Chlorophyll "a"*



$$PTP = \frac{\ln(\text{Chl "a"}) - 4.540316}{-.02928074}$$

PTP	Chl "a"
0	93.7
20	52.2
40	29.0
60	16.2
80	9.0
100	5.0

EXHIBIT 7.4 *Example of a Transformation Scale: "Total Coliform"*



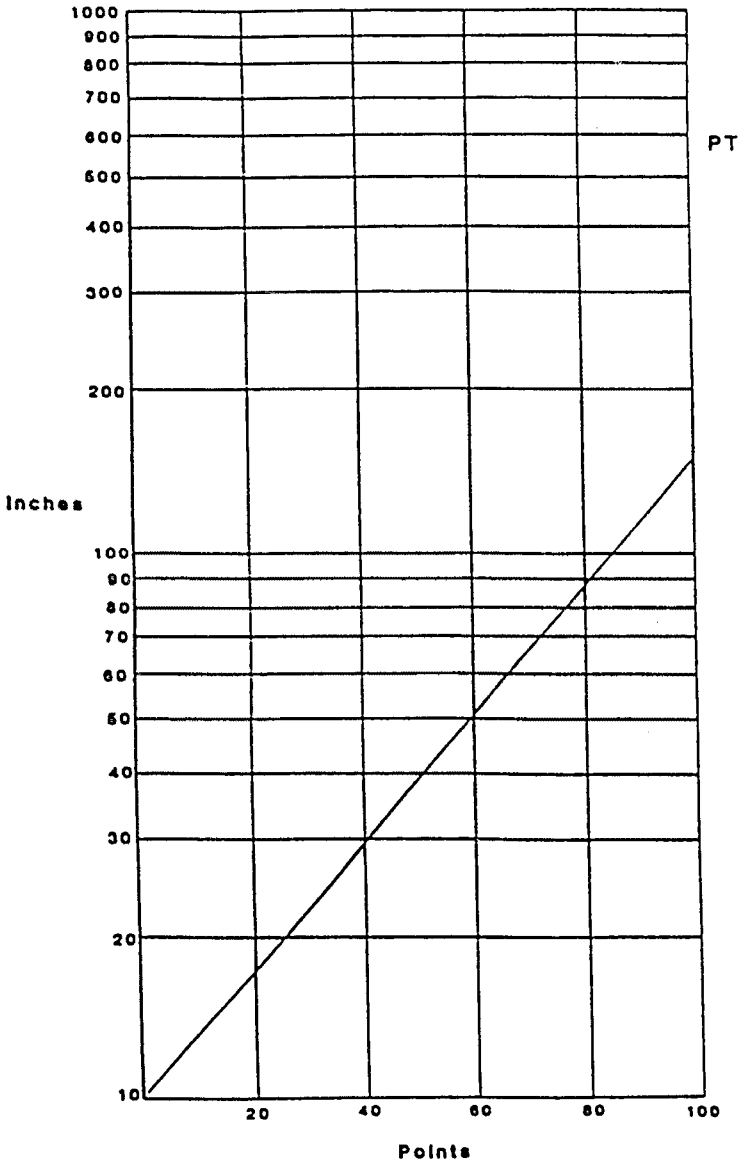
$$PTP = \frac{\ln(E.Coli) - 9.946062}{-.07676813}$$

PTP	E. Coli
0	20,850
20	4491
40	968
60	208
80	45
100	10

EXHIBIT 7.5 *Example of a Transformation Scale: "Effective Light Penetration"*

Parameter Transformation Scale

Effective Light Penetration



$$PTP = \frac{\ln(Secchi) - 2.329764}{.02680789}$$

PTP	Secchi
0	10
20	18
40	30
60	50
80	90
100	150

need to examine numerous sample index values and their components to facilitate their determinations.

The HCEPC separated the 0 to 100 range of possible values for its Water Quality Index into five categories: excellent, good, fair, poor, and undesirable (i.e., very poor). HCEPC derived ranges by having experts review various BQI values and by observing the relation to various negative occurrences such as fish kills, excessive algae, low (anoxic) levels of dissolved oxygen, and significant numbers of complaints (e.g., offensive odors).[8]

> **Caution:** Traditional weighting systems such as those described in Step 2 can sometimes overstate the quality of the estuary. Certain values for some important index components may be so bad that, regardless of the readings for other components, the overall BQI *should* fall into the "poor" category. To counteract this, consider attaching an algorithmic procedure, that is, a rule that if the value of particular components exceeds particular distress levels, the overall BQI will fall into the "poor" category. The need for such a procedure becomes larger as the number of components used in the BQI increases, since the weight of any one component is likely to go down. Thus, very poor values of an important parameter may not have enough weight in the traditional weighting approach to push the index into the "poor" category.

STEP #4: Select Sub-Indices

Most estuary programs will want more detail on outcomes than is yielded by an overall, estuary-wide BQI. Two major types of sub-indices should be considered:

- ❑ Sub-indices for various geographic segments of the estuary; and
- ❑ Sub-indices for various groups of components such as living resources, support of desired uses of the bay, and water quality.

Such breakouts of the overall BQI provide estuary program public officials with much greater ability to identify where problems are occurring. They therefore enable officials to allocate scarce resources more efficiently. As officials track the BQI values over time, they can identify where conditions are improving or worsening. This provides a much better picture of what is happening, where it is happening, how successful programs have been, and where further activity is needed.

❑ GEOGRAPHIC SUB-INDICES

Calculating and reporting the BQI for each segment of the bay is likely to be very useful to estuary program officials and the public. The Buzzards Bay Project is breaking out its BQI for each of its more than 30 major embayments. Water quality and fecal coliform measurements are being made for each embayment to help answer embayment-specific questions. However, the more areas covered by sub-indices, the more data (and sample points) are needed, thus raising the costs of data collection.

The HCEPC annually prepares maps that show Water Quality Index categories for each part of Tampa Bay. The 1991 map is shown in Exhibit 7.6. HCEPC's annual reports include maps for both the latest year and the prior year (HCEPC has been calculating its index since 1985). The Tampa Bay NEP plans to calculate its BQI for approximately seven major sections of the bay.

❑ TYPE OF COMPONENT

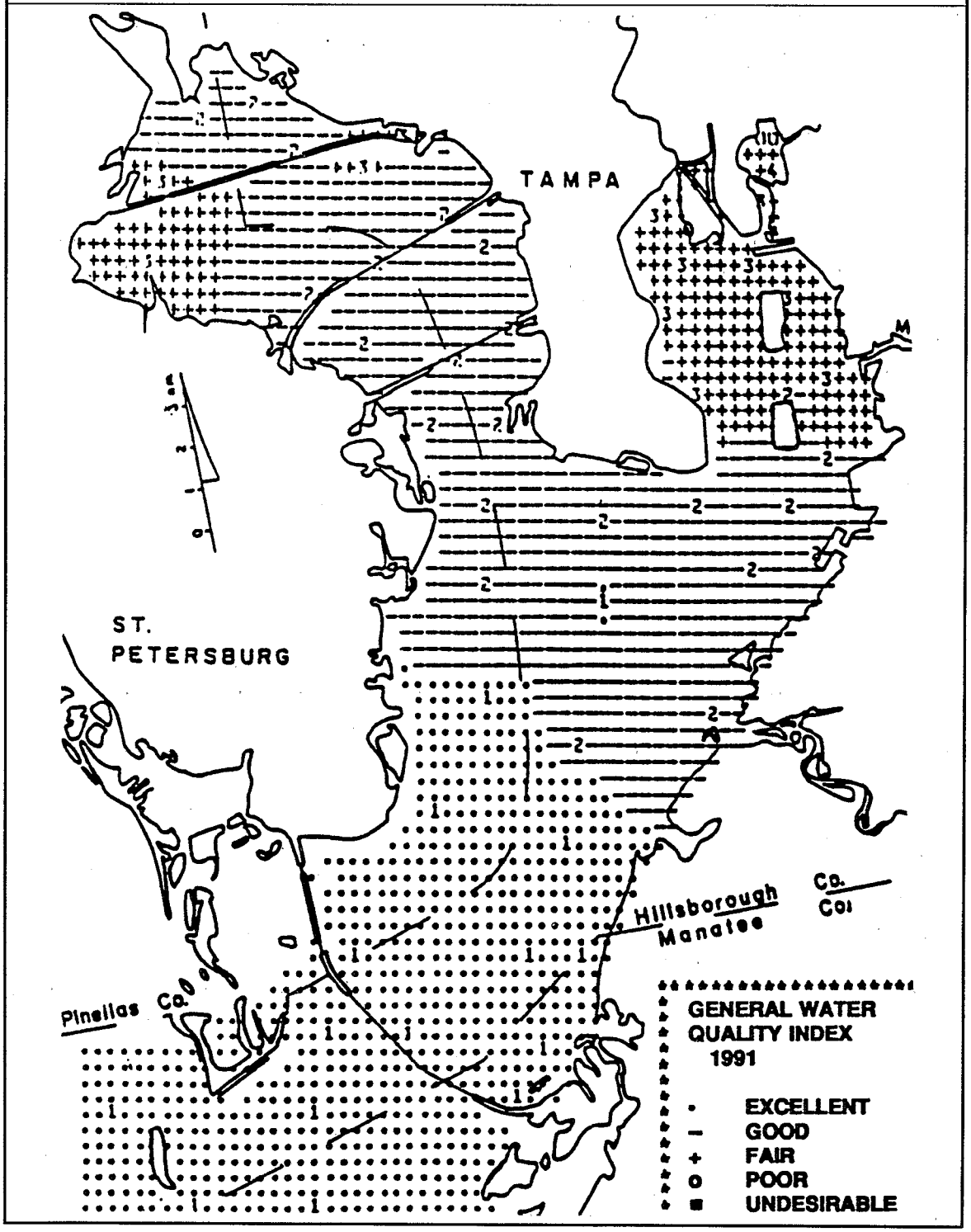
Some estuary protection programs will find it useful to have sub-indices based on particular categories of components such as the condition of living resources, the extent of support for desired uses, and water quality. A sub-index could be prepared for each category. The Buzzards Bay Project, for example, is currently calculating data on "water quality" separately from its "supporting-uses" category, with the latter based on shellfishing closures.

ESTABLISHING A BQI

Most estuary programs are likely to find it useful to establish a working group to develop the BQI. This could be a subcommittee of an existing technical committee. This subcommittee, however, should also include substantial representation from management and policy personnel, because the BQI is not intended as a scientific tool but as a management and policymaking tool. It also should contain broad community representation, because the BQI focuses on elements of direct concern to users such as shellfish and swimming closures, and illnesses due to consumption of contaminated seafood. Citizens are likely to want to know if they can eat the fish, swim in the water, and walk along the beach without getting into tar, oil slicks, and unpleasant odors.

One intriguing way to identify needed outcome indicators is to interview local people in a series of "oral histories" about what the estuary used to be like. This provides a baseline of past conditions and suggests conditions that should be tracked and perhaps included as long-range objectives.

EXHIBIT 7.6 *Bay Quality Index by Section of Tampa Bay*



The subcommittee should be responsible for undertaking the steps discussed above. It should also have responsibility for monitoring the index for at least two to three years to ascertain that it is providing sensible findings.

Subsequently, the estuary program should provide for a periodic review of the index to determine whether changes are needed because of new environmental monitoring technology or newly emerging bay quality problems.

A major use of the index is to monitor trends over time. If the index is significantly changed, this can substantially degrade the ability to monitor trends. Changing the method of measurement of any components or adding or dropping components can substantially alter the time series. The estuary program subcommittee should then attempt adjustments to overlap the old and new time series. This might be done, for example, by continuing the old series for an additional year or two so that it overlaps with the new index, in order to permit reasonable insights into the overall time trend.

ANALYZING AND REPORTING BQI INFORMATION

Step 4, Selecting Sub-Indices, has already identified how the BQI can be designed to be of most utility to users of the information. Reporting an overall index for the whole estuary is likely to be of interest to elected officials and the public, but is not nearly as operationally useful to program personnel in government or the private sector as data on the sub-indices and the individual environmental indicators.

Exhibit 7.6 illustrates an attractive form of reporting geographical information. Such a map could also include data on sub-indices such as the condition of fish and support for desired uses.

Section 8 below provides additional suggestions on analyzing and reporting BQI data.

LIMITATIONS OF THE BQI

The BQI will not be able to cover all the environmental concerns that would ideally be included in the index. Furthermore, formulating the index will require extensive judgments based on sometimes arguable scientific information that is limited by our current technical abilities to monitor the environment. As stated earlier, the intent is to provide as good an indicator of overall bay quality as is currently financially and technically feasible for estuary programs.

As emphasized elsewhere in this report, BQI values also provide an indication of whether overall conditions are improving or worsening and to what extent, but the data will not indicate *what has caused these changes,* nor what should be done to improve them. However, using the geographical or other sub-indices, the estuary program can attempt to link environmental outcomes to specific projects aimed at particular geographical areas of the bay or at particular sub-indices. In general, however, an estuary program will be undertaking many activities at one time which, taken together, affect overall bay quality. Extracting the effects of any one project is likely to require special in-depth evaluations.

To alleviate this problem, personnel involved with the estuary program should provide, with each BQI report, the best information at their disposal that can help users of the report understand why the BQI values were at the calculated levels. Such explanatory information will aid users to better interpret the information, and will give estuary protection personnel the opportunity to discuss issues, activities, and problems that exist.

OUTCOME MONITORING TIME AND COSTS

Environmental monitoring can be very expensive for a local program. Costs are affected by the number of parameters to be measured, the number of locations at which parameters are to be measured, frequency of sampling, and amount of precision sought (which can greatly affect the sample size needed). Estuary programs will need to concentrate scarce resources on those index components, locations, and times that represent key "pressure points" for the estuary.

Environmental monitoring is undertaken even in the absence of a BQI requirement or regular outcome monitoring, sometimes by the federal government or others in the scientific community. However, in general, federal monitoring does not provide the number of samples in the desired locations nor the frequencies likely to be needed in order to be useful to an estuary program for regular monitoring.

Some BQI data components such as counts of the extent of shellfish closures may require only a small amount of additional resources. Other data collection efforts, such as annual estimates of acreage of seagrasses, can require substantial additional resources and effort if not already being done on a regular basis.

To reduce cost, the estuary program can adjust data collection frequencies to reflect relative risk, stability, and importance of individual BQI components. For example, some components might be less frequently sampled in areas of the bay that have had few problems in recent years. Components that do not change rapidly

can be measured less frequently than those that do. A useful BQI might contain data for some components that are older than ideally desirable. However, as long as environmental experts consider that data are reasonably appropriate, this should not prevent the use of those values in the BQI.

The process of developing the BQI is likely to be labor intensive because it relies on local technical experts to help develop the index and make the various judgments required. This effort will not necessarily require much additional out-of-pocket expenses unless, as done in Tampa Bay, the estuary program prefers to contract out parts of the BQI development. After the index has been developed, the time and resources required to transform the readings for each component into an overall BQI and sub-indices should be small—especially if the procedure has been partly computerized. This applies even if the BQI is updated periodically throughout the year.

The ultimate test for determining the worth of the time and cost required is whether estuary protection personnel are able to *use* the information to help them more effectively allocate resources for estuary protection and to communicate bay quality progress to the estuary's citizens.

Notes, Section 7

1. Andrew Robertson (NOAA) and Wayne Davis (EPA), 1993. "The Selection and Use of Water Quality Indicators." Working Paper for Proceedings of Water Environment Federation Conference, Santa Clara, Ca., August.

2. Environmental monitoring data suggestions are provided in: "Monitoring Guidance for the National Estuary Program," EPA 842-B-92-004, Washington, D.C.: Environmental Protection Agency (September 1992); "Guidelines for the Preparation of the 1992 State Water Quality Assessments 305(b) Reports," Washington, D.C.: Office of Water, USEPA (August 1991); and "Strategic Assessment of Florida's Environment: Final Review Indicator Manual," Tallahassee, Fla.: Florida Dept. of Environmental Protection (March 1993).

3. For a description of the regional coverage, frequency, and environmental indicator coverage of this major federal data collection program, see "EMAP Project Descriptions," Environmental Protection Agency Office of Research and Development, Washington, D.C., EPA 620/R-93/009, September 1993.

4. For further information on the Tampa Bay BQI, see "Development of a Conceptual Design for Bay Quality Index for Tampa Bay, Florida," St. Petersburg, Fla.: Coastal Environmental Incorporated, and the Tampa Bay National Estuary Program (December 1993).

5. For example, see "Compilation of Scopes of ASTM Standards Relating to Environmental Monitoring," Philadelphia, Pa.: American Society for Testing and Materials (November 1993).

6. For other transformation scales developed by the Hillsborough County Environmental Protection Commission, see its report on "Surface Water Quality," cited in Exhibit 7.2. See Appendix A of that report for details on the procedure for transforming individual parameters into common units.

7. Ample precedence exists in the practice of establishing commonly understood categories to map technical numerical values. For example, the Environmental Protection Agency categorizes local air quality healthiness into the categories: hazardous, very unhealthful, unhealthful, moderate, and good. The categorization is based on levels of a number of pollutants that have been converted into a Pollutant Standard Index (PSI).

8. Florida's Department of Environmental Regulation has used a scale of good ("meets use"), fair ("partially meets use"), and poor ("does not meet use") for assessing the quality of state waters. See Florida Department of Environmental Protection, "1992 Florida Water Quality Assessment, 305(b) Main Report," June 1992.

SECTION 8

Analyzing and Reporting Outcome Monitoring Information

The information obtained from outcome monitoring procedures can be used by estuary program officials for many important purposes. Such information should help estuary program public and private officials:

- ❑ Identify where problems exist so that attention and resources can be directed to those areas;
- ❑ Identify the extent to which improved estuary outcomes have occurred after actions were undertaken by the estuary program;

- Provide information to organizations funding the estuary protection efforts, such as federal and state governments and local taxpayers, to identify the outcomes of those expenditures;
- Provide evidence for applying resources to activities where outcome information indicates that needs exist, and identify candidates for cutting back activities where desired outcomes have been completed and where activities have not achieved the intended results.
- Provide a baseline for long-range planning, against which future estuary protection progress can be assessed, and identify specific goals that should be included in the plan.

In the previous sections of this manual we provided suggestions on how to analyze and report the information obtained from each data-gathering procedure. Here we summarize, for each type of information, the major types of analysis and reporting likely to be most useful to local estuary program officials and provide suggestions on how to combine that information into a summary report. We also identify the limitations of the procedures described in this manual.

GOVERNMENT ACTION CHECKLIST OUTCOMES *(See Section 4)*

Below are suggestions for analyzing and reporting data that track government agency estuary protection progress.

1. For each category of government action (such as toxics reduction, storm water and agricultural runoff management) calculate and report the number and percentage of GAC items that all communities together have achieved, and that each community has achieved on its own. This will provide information on which categories of environmental protection appear to be doing well and which are not. This will allow encouragement and technical assistance to be provided to communities in categories of estuary protection activities for which assistance seems needed.
2. For each community, and for all assessed communities in aggregate, calculate and report the number and percentage of the checklist items that showed improvement from the previous assessment. Some estuary protection programs may also want to calculate the number and percentage of communities that improved on a certain number of the checklist items (such as three). This information indicates where progress has been made. The outcome information here and in #1 above identifies the latest level of achievement

and progress made over the past year—giving a more complete and fairer picture of each community's estuary protection status.

3. Calculate and report the number and percentage of those checklist items that each community and the estuary program itself had previously targeted for improvement and that showed improvement over the previous checklist assessment. This information should help communities measure the progress they themselves hoped to make.

4. Calculate and report the number and percentage of all checklist items that each assessed community has achieved (this is the total of #1 for each community, obtained by combining all categories of government action). Doing so provides an overall summary indicator of accomplishment for each community. Estuary program officials may choose to use such information to compare achievement among its communities, as has been done in Buzzards Bay. This is a useful strategy, if done constructively, and provides encouragement to communities to enhance their estuary protection. However, if, because of adverse media or inter-community relations, an antagonistic atmosphere exists, this comparative checklist information may aggravate those problems. In such cases, estuary program officials may find it better to play down the "report card" aspects of the presentation.

5. Tabulate and report (probably to a more limited audience) the number and percentage of communities that have achieved each item on the checklist. This information is more detailed than will be wanted by most outside organizations and the public. However, it permits estuary program officials to focus on specific protection activities that warrant special attention.

6. Provide explanatory information along with the outcome data. This information should focus on those checklist items that the assessments indicate are particularly problematic or have shown significant improvements. Local government personnel responsible for the various checklist items should be encouraged to provide explanatory information on significant problems or improvements, and should be given the opportunity to do so *before* the report is disseminated externally. This will allow them to identify reasons and any actions they are taking to correct problems. This process is necessary for fairness and makes the outcome monitoring process less threatening, since local officials know they will have the opportunity to provide their side of the story. It also helps others interpret the major findings more easily.

7. Prepare a "Summary of Survey Findings," as illustrated in Exhibit 6.6. Analysts should highlight significant progress made over previous checklist assessments—progress made both by individual communities and by the estuary program as a whole.

BUSINESS ENVIRONMENTAL PROTECTION BEHAVIOR OUTCOMES *(See Section 5)*

Below are suggestions for analyzing and reporting data on businesses that estuary program officials are likely to find most useful.

1. For each estuary protection question in the survey, tabulate and report the percentage of businesses that provided a response in each category. Also calculate and report the number and percentage for each category of business. As indicated in Section 5, businesses might be categorized by size, type, and location. These data will provide information to estuary program officials to help determine where future estuary protection efforts should be targeted. The format used in Exhibit 6.5 for household surveys can also be used for tabulating data on questions included in the survey of businesses.
2. After repeat surveys have been conducted, calculate and report comparisons over time. The findings will indicate time trends and where improvements have occurred. This information will be particularly useful to assess the results of estuary program efforts to encourage or assist certain categories of businesses. It will provide estuary program officials with evidence on whether their efforts have led to desired outcomes. The evidence will be stronger if changes in outcomes for assisted businesses are compared to those for unassisted businesses, as suggested in Section 5.
3. Provide explanatory information along with the numerical data where relevant. Such information will provide estuary program officials with a better perspective on why the outcomes observed occurred. For example, if business activity significantly increased or decreased during the year, or the estuary protection program had assisted a particular industry to improve handling of toxic or hazardous materials and waste, this might explain improvement findings.
4. Prepare a "Summary of Survey Findings" as shown in Exhibit 6.6. This information will be useful to public and private officials by enabling them to glean the major findings from each such survey of businesses without having to wade through extensive tables.

HOUSEHOLD AND BOATER ENVIRONMENTAL PROTECTION BEHAVIOR OUTCOMES *(See Section 6)*

Below are suggestions for analyzing and reporting data on the estuary protection behavior of households and boaters.

1. For each estuary protection question in the survey, tabulate and report the percentage of respondents that provided a response in each category. These data should also be broken out by household (or boater) characteristics of importance, to help interpret the information and determine where future estuary protection efforts should be directed. For example, the data on each question might be tabulated for each community, by household size and composition, and by whether the households are renters or owners. For boater surveys, the docking location and type of boat would also likely be relevant. Exhibit 6.5 illustrates one format for presenting the data on each survey question. Such reporting will identify the extent to which potential environmental problems are indeed problems and for which types of households. Such information will help determine what estuary protection efforts are most needed and how these efforts should be targeted.

2. Calculate and report the overall percentage of households that indicate having, say, two or more environmental problems. This is a summary indicator that should also be broken out by the household characteristics discussed directly above in item #1. This will help target types of households that have multiple estuary protection problem behaviors.

3. Calculate and report comparisons of findings from one year to the next. Findings from any one survey will be helpful in determining the current need and level of household (or boater) estuary protection behavior. But for tracking progress, repetitions of the same survey (with the same questions) are needed. As multiple surveys are undertaken, time trends will become evident. Changes in the findings from one year to the next should be of particular interest to estuary programs that have been conducting major activity aimed at increasing household or boater estuary protection behavior. If activities in the past year have focused on particular household or boater behaviors, the report should highlight findings related to the targeted behaviors.

4. Provide relevant explanatory information to give a more in-depth perspective on the findings from the household or boater survey. For example, analysts may be aware that a particular community has undertaken a neighborhood assistance program. This might explain significant improvements in the household estuary protection behavior of households in that community.

5. Prepare a "Summary of Survey Findings," as illustrated in Exhibit 6.6. Analysts should identify the key findings from the latest survey, including trend information. They should, as appropriate, single out where particular types of households were especially deficient or had made substantial improvements in estuary protection behavior from previous surveys. This

provides busy estuary program and community officials with a quick summary without having to pour through extensive tables.

BAY QUALITY INDEX *(See Section 7)*

In Section 7 we described how to transform potentially overwhelming amounts of environmental monitoring data into more manageable and useful form by creating a BQI. Below we summarize ways to analyze and report BQI information.

1. Calculate and report the BQI for various portions of the estuary as well as for the estuary as a whole. The BQI lends itself to breakouts by geographical section of the estuary. This permits tabular presentations by estuary section as well as visual displays, as illustrated in Exhibit 7.6. "Mapping" displays can be particularly informative to officials and the public if the indices are transformed into easy-to-understand bay quality categories such as excellent, good, fair, or poor, as described in Section 7. This summary information enables readers to obtain a comprehensive picture of bay quality. It can help trigger, and gain support for, improvement efforts in parts of the bay found to be of low quality.
2. Break the overall index into sub-indices for various types of components including water quality, health of living resources, and the extent of bay support for desired uses such as swimming and commercial seafood collection.
3. Calculate and report comparisons of BQI findings from the current year to previous years. This will indicate both short- and long-term trends.
4. Provide back-up information that helps explain significant changes in the BQI from one period to another, or for any given period. This can be done by analyzing the quantitative data on the particular components of the index. For example, if nitrogen loadings or dissolved oxygen readings are the main cause for the index's improvement or worsening, this should be reported. The BQI is intended to be a summary measure that gives a comprehensive picture of bay quality. However, the back-up data on individual environmental indicators need to be examined for their effects on the index values and to help guide future estuary protection actions.
5. Provide qualitative explanatory information with the BQI report. Likely sources of problems reflected by the index will be of major interest to users of the index information. For example, external events such as an unusual amount of rain or the start up of new industries should be identified along with the BQI data.

OVERALL SUMMARY OF ESTUARY PROTECTION OUTCOMES

In the preceding sections we have suggested ways to analyze the findings from individual data collection procedures. The estuary protection program will also likely want an overall summary, combining the information obtained from these procedures by:

- *Using a format such as that shown in Exhibit 8.1.* Exhibit 8.1 identifies each key outcome indicator, its order (whether it is a first-, second-, third-, or fourth-order effect), and provides the latest and previous year's data for each indicator. Each estuary program needs to develop its own set of indicators as described in Section 3 and illustrated in Exhibit 3.3. In that exhibit we presented a summary set of outcome indicators for each category of estuary protection activity, preceded by a very short list of overall outcome indicators that can provide a summary. Exhibit 8.1 includes only the very short list. Such aggregated data, however, do not themselves provide information on where problems exist. To do that, estuary program officials will need to examine the more detailed information described earlier in this section.

- *Comparing the findings from the various outcome indicators against the goals identified in the estuary's long-range plan* (e.g., CCMP). Summarize the extent of progress that has been made toward these goals. Outcome monitoring information can be used to help track progress toward long-range goals. Indicate whether the goals, or the planned time schedule for achieving them, needs to be revised.

- *Preparing a "Summary of Survey Findings" that identifies for estuary program officials significant improvements or problems indicated by the latest data.* Exhibit 6.6 illustrates such a report (in this case, based solely on household survey information). Explanatory information should be included for unusually high or low values.

  This summary should be drawn from the individual "Summary of Survey Findings" developed for each of the data collection procedures described in Sections 4 through 7. The highlights should also include summary outcome data such as illustrated in Exhibit 8.1, and relevant explanatory information, as discussed earlier. The highlights should both:

  - Summarize the extent to which targets set by the estuary program have been achieved during the current reporting period; and

EXHIBIT 8.1 *Illustrative Outcome Indicators: Overall Summary Outcome Indicators*

INDICATOR	UNIT OF MEASURE	ORDER	PREVIOUS PERIOD'S VALUE	LATEST PERIOD'S VALUE	TARGET FOR PERIOD
Governments that Have Met at Least 75% of the Items on the "Government Action Checklist"	Number of Governments	1			
Households with at Least One Problem Behavior	Percent of Respondents	1			
Boaters with at Least One Problem Behavior	Percent of Respondents	1			
Businesses Reporting Reduction in Hazardous Waste Discharged	Number	2			
Amounts of Various Pollutants Discharged into the Bay	Various Units	2			
Overall Water Quality	Water Quality Index	3			
Overall Bay Quality	Bay Quality Index	4			
Comments/Explanatory Information:					

- Compare the outcome information for the current reporting period to that for the previous period(s).

Thus, estuary program and community officials will likely find the outcome information considerably more useful if the monitoring process provides the following information:

- ❑ A "Summary of Survey Findings" developed by staff based on their best judgment of the most important findings for the reported period;
- ❑ Explanatory information to supplement the outcome data, for the purpose of identifying factors believed to have contributed significantly to the main findings;
- ❑ Comparison of current reporting-period outcomes to those of previous reporting periods;
- ❑ Comparison of actual outcomes to the targets set by estuary programs at the beginning of the year, such as those set by individual communities as part of the Government Action Checklist procedures.

OVERALL CONSTRAINTS ON OUTCOME MONITORING

There are several limitations to the outcome monitoring process outlined in this manual. We discuss them in turn below.

❑ LACK OF CAUSAL INFORMATION

The data collection procedures described in this manual, like most data collected by estuary programs, do *not* tell what caused these outcomes. For example, the presence of improvement from one year to the next in the environmental protection behavior of assisted businesses does not prove that it was the program activities that caused those outcomes. Other factors could have brought about the observed improvements in outcomes.

Outcome data provide a "scorecard" but do not generally provide a sound basis for praising or blaming estuary protection activities. Outcome information *is* vital for understanding what has been happening and what progress is being made, and for helping to identify where future attention and resources are needed.

To obtain information on *why* the outcomes are as they are, or why changes over the last reporting period have occurred, estuary program personnel will need to conduct more in-depth examinations. These might be done by staff, but estuary

program officials will usually need to rely on local experts and evaluations by local colleges or universities to identify causes for outcomes.

The estuary program might also undertake in-depth program evaluations that use a variety of statistical and analytical methods to attempt to identify the extent to which specific activities have caused measured outcomes. These studies, however, can be expensive, and are unlikely to be feasible unless state or federal resources are provided. If an estuary program has an outcome monitoring program, in-depth studies are easier and less expensive to do, because more of the data on outcomes will already have been collected.

❑ THE NEED FOR PERIODIC OUTCOME INFORMATION

The first run of the outcome monitoring procedures will provide data for one point in time that will also serve as baseline data for comparisons for future years. One year of information, however, will be of somewhat limited value in identifying trends, unless the estuary program has been fortunate enough to have prior-year data on the outcome indicators.

❑ THE DELAYED EFFECTS OF PROGRAM ACTIONS

Some estuary protection actions cannot be expected to lead to quick, substantive changes in some desired outcomes. For example, major problems in the presence of toxins or excessive nitrogen may take years to correct, because a new sewage treatment plant may take many years before it can correct a major source of the pollution. The ability to clean up PCBs in the bay may also take years. Nevertheless, early outcome information is needed to alert estuary program officials and the public to the presence of problems so that protection actions can begin.

❑ THE NEED FOR QUALITY CONTROL

This manual has not discussed quality control procedures for the outcome monitoring process. Clearly, each of the data collection procedures should be re-examined periodically (at least once every year or two) to ensure that the procedures are being conducted properly and provide reasonably accurate data.

❑ COST AND EFFORT

Establishing an outcome monitoring process can take considerable start-up effort. It requires estuary program staff time, time on the part of personnel from the various government agencies involved (to help select the items to include in the Government Action Checklist), and time on the part of many advisory groups representing citizens, technical experts, and special interests in the community.

Once established, the regular ongoing data collection can also require considerable effort. This will vary widely, depending on the various factors discussed in previous sections of this manual. Once the procedures "become routine," the effort required should be reduced considerably.

FINAL COMMENT

We hope that this manual is helpful to estuary programs throughout the country in designing their own outcome monitoring processes and in making the findings useful to estuary program officials for improving bay quality. We recognize that this manual does not cover all the many outcome indicators that are likely to be relevant to some estuaries. We know that implementing such a process is hard work and is not something that an estuary program can do overnight. It will minimally take a year to establish an outcome monitoring process, and probably two to three years before the process can be fully implemented. The procedures first need to be pilot tested. Therefore, time-trend data are not likely to be available until two or three years after the process has begun. Estuary protection, however, is a long-run proposition. To do it well requires continuous, long-term attention.

Ultimately, an outcome monitoring process needs to stand the test of cost-effectiveness. If the information is not used to help estuary program officials improve their work, or if it does not provide funders or the public with relevant information that they can understand and utilize, the results will not be worth the costs.

Nevertheless, estuary program officials vitally need scorecard information that tells them the progress they are making in protecting the bay and where deficiencies lie. Estuary protection programs should make a full-scale effort to develop an outcome monitoring process that will be useful to public and private officials.

APPENDIX 1

Buzzards Bay Government Action Checklists

New Bedford
Coastal Towns
Inland Towns

CONTACT
The Coalition for Buzzards Bay
P.O. Box 268
Buzzards Bay, MA 02532
508-759-1441

The Coalition for Buzzards Bay

1993 Buzzards Bay Environmental Report Card

(Evaluating CCMP Implementation)

* NEW BEDFORD *

Managing Sewage Treatment Facilities (BBCCMP, Pg. 115)

1. Has the city developed and implemented strategies to reduce influent volume at the wastewater treatment facility -- including plans to reduce groundwater infiltration and stormwater inputs, as well as promoting water conservation by individuals and businesses? How much of a reduction in influent have you experienced over the course of the last year? (Informational) Mayor's Office, DPW

2. Is the city in compliance with deadlines to upgrade the sewage treatment plant? Please explain. Mayor's Office

3. Were there any upgrades this year of Combined Sewer Overflows(CSOs)? How many CSOs continue to discharge untreated waste in dry conditions? DPW, Board of Health, Mayor's Office

Preventing Oil Pollution (BBCCMP, Pg. 87)

1. Does the city have an Oil Spill Coordinator and a Contingency Plan responsible for overseeing the maintenance and deployment of equipment and for directing response activities? Has the city signed on to the Buzzards Bay Mutual Aid Agreement to coordinate spill response? Mayor's Office

2. Does the city have regulations that (a) require all boatyards and marinas to maintain oil containment and cleanup equipment on site; and (b) manage the appropriate fueling of vessels? Oil Spill Coordinator, Mayor's Office

3. Oil spill response training. Oil Spill Coordinator, Mayor's Office

a. Has the city implemented oil spill response training and drills? Date of last drill. Number of participants.

b. Does the city Oil Spill Coordinator attend yearly training sessions and periodically update the local information needed for the Oil Spill Contingency Plan as recommended by the US Coast Guard? Date of last session attended.

c. Has the city agreed to participate in free OSHA/EPA training through the Oil Spill Mutual Aid Agreement ?

4. How does the city handle operational fuel oil spills on the commercial waterfront? How often are spills reported to the Oil Spill Coordinator? Oil Spill Coordinator

5. Does the city have a waste oil recycling program for residents? For commercial fishermen? Board of Health

Reducing Toxic Pollution (BBCCMP, Pg. 121)

1. Has a program been developed and implemented concerning industrial pretreatment and industrial waste reduction for industries that discharge directly into receiving waters or sewage treatment facilities? Board of Health, DPW

1a. What are the city's plans in the course of the next year to implement this program?

2. Did the city hold a household hazardous waste collection? When? What were the costs? How successful? Has the city been able to locate and employ innovative strategies in the collection of HHW to reduce costs? Board of Health

Protecting and Enhancing Shellfish Resources (BBCCMP, Pg.55)

1. Has the city designated an individual with public health jurisdiction to assist the Division of Marine Fisheries (DMF) in shorewalks and surveys? Who? When was your last update of the sanitary survey? Mayor's Office, Board of Health, Shellfish Warden

2. How successful have you been in the remediation of identified sources of coliforms and pathogens (ie. individual septic systems, storm drain discharges, and other "potential pollution sources" as listed in the DMF sanitary report) entering rivers and estuaries through investigation and enforcement? Board of Health, Shellfish Warden

3. Have any acres of shellfish beds been closed this year due to pollution? Have any shellfish beds been opened this year due to pollution mitigation efforts? (For informational purposes) Board of Health, Shellfish Warden

Controlling Stormwater Runoff (BBCCMP, Pg. 65)

1. Do the city's subdivision regulations and site plan review ordinance require Best Management Practices (BMPs) for stormwater runoff (ie. detention/retention ponds and leaching catch basins with runoff retention times long enough to allow for pollution treatment) in residential subdivisions and commercial and industrial developments to reduce non point source pollution on site? List technical highlights of regulation. Planning Board

2a. Does the city have a map of all stormdrain discharges to surface waters showing the road area of flow contribution? Board of Health, DPW

2b. Does the city have a mechanism for the prioritization of stormdrain discharge repairs? Explain.

2c. How many stormwater discharges were remediated this year? (For informational purposes, What are the locations of the city's top three priority stormwater discharges?)

3. What actions has the city taken through preventive maintenance programs such as cleaning of catch basins to reduce the impacts of stormwater pollution? DPW, Mayor's Office

4. Does the city have a policy that results in the installation of stormwater Best Management Practices such as leaching catch basins when major road repairs are performed in an area? DPW, Mayor's Office

5. Does the city require oil and grease removing catch basins in new subdivisions? Is there a maintenance program associated with these basins? How often is maintenance required? Planning Board, Conservation Commission, DPW

6. Does the city make efforts to limit impervious surfaces in new development in order to reduce and treat runoff on site and allow for groundwater recharge? Planning Board

Protecting Wetlands and Coastal Habitat (BBCCMP, Pg. 95)

1. Do Conservation Commission members receive periodic training in permitting under the Wetlands Protection Act and wetland delineation to improve their ability to protect these resources? Date of last training? Conservation Commission, Mayor's Office

2. What criteria does the city use in the appointment of Conservation Commission members? Mayor's Office

3. Does the city employ a Conservation Agent to guide and facilitate Conservation Commission actions? Conservation Commission

4. Has the city adopted a wetlands protection bylaw to strengthen protection of city resource areas? What does it require above the provisions of the Wetlands Protection Act (Please list highlights) Conservation Commission

5. Does the Planning Board require that wetland, streams, and surface waters are shown on plans and comment made by the Conservation Commission prior to subdivision approval? Planning Board, Conservation Commission

6. Are minimum lot sizes for new development calculated using only the upland portion of the lot or set a maximum percentage of lot area that can be wetlands to limit encroachment on resource areas? Planning Board

7. Does the city utilize nonregulatory wetlands/habitat protection techniques such as open space land acquisitions and conservation easements? Did the city acquire any new open space this year? Conservation Commission

8. Has the city developed an embayment or harbor management plan for their entire coastline to guide the use and protection of sensitive areas? (Please list environmental highlights) Planning Board, Conservation Commission, Mayor's Office, Harbormaster

Managing Sewage From Boats (BBCCMP, Pg. 75)

1. Does the city provide mobile or land-based boat pumpout facilities? How many? Where? How many private pumpouts exist in town? How many boats utilized the pumpout each day? Board of Health, Harbormaster

2. Does the city have a management plan, regulation, or incentive program (including Public education) to enforce the use of these facilities (ie. tank dyes, locked heads, etc.)? Explain. Board of Health, Harbormaster

3. Has the city established or initiated the nomination of EPA designated no-discharge areas? Does the city take enforcement actions for illegal discharges? Board of Health, Harbormaster

Managing On-Site Wastewater Disposal Systems (BBCCMp, Pg. 81)

1. Does the city have an inspection and maintenance program to identify and remediate septic systems not meeting Title 5 requirements? Please describe. (For informational purposes, What percentage of the city is served by private on-site wastewater disposal systems? have there been any sewer extensions and tie-ins this year?) Board of Health

2. Does the city have septic system regulations that require inspection and upgrade -
   a. prior to title transfer
   b. prior to conversion from summer to year round use
   c. during significant renovations or additions? Explain. Board of Health

3. Do the city's septic system regulations establish a setback distance between septic systems and surface waters and wetlands or require adjustments to the system design and application rate to ensure viral removal in environmentally sensitive areas? Board of Health, Conservation Commission

Planning For A Shifting Shoreline (BBCCMP, Pg. 109)

1. Does the city regulate construction activities and establish coastal construction setbacks more stringently for areas predicted to be subject to sea-level rise, erosion, or flooding? Planning Board, Conservation Commission

Issues of Baywide Concern

1. How is the city leading others in developing regional solutions to environmental management issues?

2. Who is the city's Buzzards Bay Action Committee (BBAC) representative? How was their attendance at BBAC meetings over the course of the past year? Did they relay all information concerning technical and financial assistance to city boards?

3. What methods does the city employ to train new board members?

4. Does the city have formal procedures for coordinating actions and fostering communication among boards to achieve environmental goals?

5. Does the city have a recycling program? Curbside or drop-off? How successful has the town been in developing citywide compliance through education?

6. Has the city identified and removed any residential underground storage tanks this year? Does the city prohibit the installation of USTs?

7. What is the status of the city landfill? When is it scheduled to close? What plan has the city developed to deal with solid waste following the closing of the landfill?

8. Please fill out this matrix. Conservation, Planning Board, Board of Health

	Conservation	Health	Planning
# meetings held in 1993			
% of Board members present			
Approximate # of on-sites by board			
Approximate # of on-sites by agent			
# of training courses attended by board			

Additional Comments

This space is for city boards to comment on what they feel their greatest accomplishments were this past year in protecting the local environment and Buzzards Bay. In addition, please comment on any of the issues addressed in this evaluation which you would like to learn more about. Both Coalition and Buzzards Bay Project staff are available to assist you in developing or improving local bylaws and zoning.

(Continue on additional sheets if necessary)

The Coalition for Buzzards Bay

1993 Buzzards Bay Environmental Report Card

(Evaluating CCMP Implementation)

* COASTAL TOWNS *

Managing Nitrogen-Sensitive Embayments (BBCCMP, Pg. 41)

1. Has the town taken any steps in the investigation and management of nitrogen sensitive embayments as listed in the Buzzards Bay CCMP? Explain. (Please check off actions taken) Planning Board, Board of Health, Conservation Commission

___ Delineate and calculate embayment critical nitrogen-loading limits
___ Calculate nitrogen inputs from existing and grandfathered parcels
___ Determine acceptable future nitrogen loads
___ Adjust future nitrogen loading inputs so that the total nitrogen additions at build-out do not exceed the nitrogen-loading limits

(Buzzards Bay Project technical assistance is available for performing Nitrogen-loading studies and developing necessary land use planning)

2a. Does the town zoning bylaw, subdivision regulations, or Board of Health regulations address appropriate minimum lot sizes and specify allowable future land uses based on nitrogen loading limits? Explain.

Mailing Address: P.O. Box 268, Buzzards Bay, Massachusetts 02532 • Office: 3rd Company Dormitory • Massachusetts Maritime Academy • Phone: (508) 759-1440

2b. Has the town addressed all of its coastal embayments?

Buzzards Bay embayments requiring Growth Management & Remediation

Westport: Westport River, East & West Branch
Dartmouth: Slocums River
Apponagansett Bay, inner
New Bedford: Acushnet River
Fairhaven: Acushnet River, Inner Nasketucket
Mattapoisett: Mattapoisett Harbor, upper & lower
Wareham: Wareham River
Weweantic River
Onset Bay
Buttermilk Bay
Bourne: Buttermilk Bay
Hen Cove
Pocasset River

Controlling Stormwater Runoff (BBCCMP, Pg. 65)

1. Do the town's subdivision regulations and site plan review bylaw require Best Management Practices (BMPs) for stormwater runoff (ie. detention/retention ponds and leaching catch basins with runoff retention times long enough to allow for pollution treatment) in residential subdivisions and commercial and industrial developments to reduce non point source pollution on site? List technical highlights of regulation. Planning Board

2a. Does the town have a map of all stormdrain discharges to surface waters showing the road area of flow contribution? Board of Health, DPW

2b. Does the town have a mechanism for the prioritization of stormdrain discharge repairs? Explain.

2c. How many stormwater discharges were remediated this year? (For informational purposes, What are the locations of the towns top three priority stormwater discharges?)

3. What actions has the town taken through preventive maintenance programs such as cleaning of catch basins to reduce the impacts of stormwater pollution? DPW, Board of Selectmen

4. Does the town have a policy that results in the installation of stormwater Best Management Practices such as leaching catch basins when major road repairs are performed in an area? Board of Selectmen, DPW

5. Does the town require oil and grease removing catch basins in new subdivisions? Is there a maintenance program associated with these basins? How often is maintenance required? Planning Board, Conservation Commission, DPW

6. Does the town make efforts to limit impervious surfaces in new development in order to reduce and treat runoff on site and allow for groundwater recharge? Planning Board

7. What actions has the town taken to control domestic, waterfowl, or agricultural animal waste entering surface waters? Board of Health

Managing On-Site Wastewater Disposal Systems (BBCCMp, Pg. 81)

1. Does the town have an inspection and maintenance program to identify and remediate septic systems not meeting Title 5 requirements? Please describe. (For informational purposes, What percentage of the town is served by private on-site wastewater disposal systems? Have there been any sewer extensions and tie-ins this year?) Board of Health

2. Does the town have septic system regulations that require inspection and upgrade -

   a. prior to title transfer
   b. prior to conversion from summer to year round use
   c. during significant renovations or additions? Explain. Board of Health

3. Do the town's septic system regulations establish a setback distance between septic systems and surface waters and wetlands or require adjustments to the system design and application rate to ensure viral removal in environmentally sensitive areas? Board of Health, Conservation Commission

Controlling Growth and Protecting Open Space

1. Has the town developed a Growth Management or Open Space Plan to control future development and provide protection for environmentally sensitive areas, wildlife habitat, and coastal and fresh water quality? Planning Board, Conservation Commission

2. Does the town employ a Town Planner or hire consultants to assist in the further development of zoning measures and the regulation of land use? Planning Board, Board of Selectmen

3. Does the town actively pursue land acquisitions and conservation easements to protect open space and meet the goals set in the Growth Management/Open Space Plan? Did the town acquire any new open space this year? Planning Board, Conservation Commission

4. Did the town utilize innovative land use planning techniques such as cluster/density averaging or Transfer of Development Rights (TDR) or work to preserve farmland through the APR or Chapter 61 programs? Planning Board, Conservation Commission

Protecting Wetlands and Coastal Habitat (BBCCMP, Pg. 95)

1. Do Conservation Commission members receive periodic training in permitting under the Wetlands Protection Act and wetland delineation to improve their ability to protect these resources? Date of last training? How many members attended? Conservation Commission, Board of Selectmen

2. What criteria does the town use in the appointment of Conservation Commissioners? Is appointment dependant on attendance at wetlands training? Board of Selectmen

3. Does the town employ a Conservation Agent to guide and facilitate Conservation Commission actions? Conservation Commission

4. Has the town adopted a wetlands protection bylaw to strengthen protection of town resource areas? What does it require above the provisions of the Wetlands Protection Act (Please list highlights) Conservation Commission

5. Are minimum lot sizes for new development calculated using only the upland portion of the lot or set a maximum percentage of lot area that can be wetlands to limit encroachment on resource areas? Planning Board

6. Does the Planning Board require that wetlands, streams, and surface waters are shown on plans and comment made by the Conservation Commission prior to subdivision approval? Planning Board, Conservation Commission

7. Has the town developed an embayment or harbor management plan for their entire coastline to guide the use and protection of sensitive areas? (Please check off issues addressed) Planning Board, Conservation Commission, Board of Selectmen, Harbormaster

___ Townwide assessment of coastal natural resources (ie. eelgrass beds, shellfish beds, fringing marshes, etc.)
___ Designates dock- and mooring-free zones based on sensitive natural resources
___ Establishes boat exclusion zones and boat speed limits to minimize adverse effects on natural resources
___ Defines where dredging is permitted and where it is not.
___ Specifies times of the year when construction or dredging are permitted so as to minimize ecosystem impacts.
___ Other. Please elaborate.

b. Does the town have a policy, bylaw, or regulation to regulate the number and placement of docks and piers? Does the town encourage shared docks?

Managing Sewage From Boats (BBCCMP, Pg. 75)

1. Does the town provide mobile or land-based boat pumpout facilities? How many? Where? How many private pumpouts exist in town? (For informational purposes, How many boats participated in the utilization of the pumpout each day?) Board of Health, Harbormaster

1a. Is the town actively pursuing Clean Vessel Act funds for additional pumpouts facilities?

2. Does the town have a management plan, regulation, or incentive program (including public education) to enforce and enhance the use of these facilities (ie. tank dyes, locked heads, etc.)? Explain. Board of Health, Harbormaster

3. Has the town established or initiated the nomination of EPA designated no-discharge areas? Does the town take enforcement actions for illegal discharges? Board of Health, Harbormaster

Protecting and Enhancing Shellfish Resources (BBCCMP, Pg.55)

1. Has the town designated an individual with public health jurisdiction to assist the Division of Marine Fisheries (DMF) in shorewalks and surveys? Who? When was your last update of the sanitary survey? Board of Selectmen, Board of Health, Shellfish Warden

2. How successful have you been in the remediation of identified sources of coliforms and pathogens (ie. individual septic systems, stormwater drain discharge, animal waste, and other "potential pollution sources" as listed in the DMF sanitary report) entering rivers and estuaries through investigation and enforcement? Board of Health, Shellfish Warden

3. Have any acres of shellfish beds been closed this year due to pollution? Have any shellfish beds been opened this year due to pollution mitigation efforts? (For informational purposes)

Preventing Oil Pollution (BBCCMP, Pg. 87)

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2. Does the town have regulations that (a) require all boatyards and marinas to maintain oil containment and cleanup equipment on site; and (b) manage the appropriate fueling of vessels? Oil Spill Coordinator, Board of Selectmen

3.Oil spill response training. Oil Spill Coordinator, Board of Selectmen

a. Has the town implemented oil spill response training and drills? Date of last drill. Number of participants.

b. Does the town Oil Spill Coordinator attend yearly training sessions and periodically update the local information needed for the Oil Spill Contingency Plan as recommended by the US Coast Guard? Date of last session attended.

c. Has the town agreed to participate in free OSHA/EPA training through the Oil Spill Mutual Aid Agreement?

4. Does the town have a waste oil recycling program? Describe. Board of Health

Managing Sewage Treatment Facilities (BBCCMP, Pg. 115)

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Reducing Toxic Pollution (BBCCMP, Pg. 121)

1. Did the town hold a household hazardous waste collection? When? What were the costs? How successful? (For informational purposes, Has the town been able to locate and employ innovative strategies in the collection of HHW to reduce costs? Board of Health

2. Has the town developed and implemented a program of industrial pretreatment and industrial waste reduction for industries that discharge directly into receiving waters or sewage treatment facilities? Board of Health, DPW

Planning For A Shifting Shoreline (BBCCMP, Pg. 109)

1. Has the town mapped critical areas that are subject to sea-level rise, erosion, or flooding to investigate increased setbacks for septic systems and coastal construction in these areas? Planning Board, Conservation Commission, Board of Health

Issues of Baywide Concern

1. How is the town leading others in developing regional solutions to environmental management issues?

2. Who is the town's Buzzards Bay Action Committee (BBAC) representative? How was their attendance at BBAC meetings over the course of the past year? Do they relay all information concerning technical and financial assistance to town boards?

3. Has the town applied for assistance or funding from the Buzzards Bay Project this year? What issues?

4. What methods does the town employ to train new board members?

5. Does the town have formal procedures for coordinating actions and fostering communication among boards to achieve environmental goals?

6. Does the town have a recycling program? Curbside or drop-off? How successful has the town been in developing townwide compliance through education?

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8. What articles of environmental concern were proposed at town meeting? How were they received by the town?

9. What is the status of the town landfill? When is it scheduled to close? What plan has the town developed to deal with solid waste following the closing of the landfill?

10. Please fill out this matrix. Conservation, Planning Board, Board of Health

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# meetings held in 1993			
% of Board members present			
Approximate # of on-sites by board			
Approximate # of on-sites by agent			
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The Coalition for Buzzards Bay

1993 Buzzards Bay Environmental Report Card

(Evaluating CCMP Implementation)

* INLAND TOWNS *

Controlling Growth and Protecting Open Space

1. Has the town developed a Growth Management or Open Space Plan to control future development and provide protection for environmentally sensitive areas, wildlife habitat, and coastal and fresh water quality? Planning Board, Conservation Commission

2. Does the town actively pursue land acquisitions and conservation easements to protect open space and meet the goals set in the Growth Management/Open Space Plan? Did the town acquire any new open space this year? Planning Board, Conservation Commission

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3. Does the town employ a Town Planner or hire consultants to assist in further development of zoning measures and the regulation of land use? Planning Board, Board of Selectmen

4. Did the town utilize innovative land use planning techniques such as cluster/density averaging or Transfer of Development Rights (TDR) or work to preserve farmland through the APR or Chapter 61 programs? Planning Board, Conservation Commission

Managing On-Site Wastewater Disposal Systems (BBCCMP, Pg. 81)

1. Does the town have an inspection and maintenance program to identify and remediate septic systems not meeting Title 5 requirements? Please describe.(For informational purposes, What percentage of the town is served by private on-site wastewater disposal systems? Have there been any sewer extensions and tie-ins this year?) Board of Health

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2. What criteria does the town use in the appointment of Conservation Commissioners? Is appointment dependant on attendance at wetlands training? Board of Selectmen

3. Does the town employ a Conservation Agent to guide and facilitate Conservation Commission actions? Conservation Commission

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5. Does the Planning Board require that wetlands, streams, and ponds are shown on plans and comment made by the Conservation Commission prior to subdivision approval? Planning Board, Conservation Commission

6. Are minimum lot sizes for new development calculated using only the upland portion of the lot or set a maximum percentage of lot area that can be wetlands to limit encroachment on resource areas? Planning Board

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2a. Does the town have a map of all stormdrain discharges to surface waters showing the road area of flow contribution? Board of Health, DPW

2b. Does the town have a mechanism for the prioritization of stormdrain discharge repairs? Explain.

2c. How many stormwater discharges were remediated this year? (For informational purposes, What are the locations of the towns top three priority stormwater discharges?)

3. What actions has the town taken through preventive maintenance programs such as street cleaning and cleaning of catch basins to reduce the impacts of stormwater pollution? DPW, Board of Selectmen

4. Does the town have a policy that results in the installation of stormwater Best Management Practices such as leaching catch basins when major road repairs are performed in an area? Board of Selectmen, DPW

5. Does the town require oil and grease removing catch basins in new subdivisions? Is there a maintenance program associated with these basins? How often is maintenance required? Planning Board, Conservation Commission, DPW

6. Does the town make efforts to limit impervious surfaces in new development in order to reduce and treat runoff on site and allow for groundwater recharge? Planning Board

7. What actions has the town taken to control domestic, waterfowl, or agricultural animal waste entering surface waters? Board of Health

Preventing Oil Pollution (BBCCMP, Pg. 87)

1. Does the town have an Oil Spill Coordinator and a Contingency Plan responsible for overseeing the maintenance and deployment of equipment and for directing response activities? Has the town signed on to the Buzzards Bay Mutual Aid Agreement to coordinate spill response? Board of Selectmen

2. Oil spill response training. Oil Spill Coordinator, Board of Selectmen

2a. Has the town implemented oil spill response training and drills? Date of last drill. Number of participants.

2b. Does the town Oil Spill Coordinator attend yearly training sessions and periodically update the local information needed for the Oil Spill Contingency Plan?

2c. Has the town agreed to participate in free OSHA/EPA training through the Oil Spill Mutual Aid Agreement?

3. Does the town have a waste oil recycling program? Describe. Board of Health

Reducing Toxic Pollution (BBCCMP, Pg. 121)

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Issues of Baywide Concern

1. How is the town leading others in developing regional solutions to environmental management issues?

2. Who is the town's Buzzards Bay Action Committee(BBAC) representative? How was their attendance at BBAC meetings over the course of the past year? Do they relay all information concerning technical and financial assistance to town boards?

3. Has the town applied for assistance or funding from the Buzzards Bay Project this year? What Issues?

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6. Does the town have a recycling program? Curbside or drop-off? How successful has the town been in developing townwide compliance through education?

7. Does the town have an aquifer protection bylaw to protect groundwater resources?
Has the town identified and removed any residential underground metal fuel storage tanks this year? Does the town prohibit the installation of such devices?

8. What articles of environmental concern were proposed at town meeting? How were they received by the town?

9. Please fill out this matrix. Conservation, Planning Board, Board of Health

	Conservation	Health	Planning
# meetings held in 1993			
% of Board members present			
Approximate # of on-sites by board			
Approximate # of on-sites by agent			
# of training courses attended by board			

Additional Comments

This space is for town boards to comment on what they feel their greatest accomplishments were this past year in protecting the local environment.
In addition, please comment on any of the issues addressed in this evaluation which you would like to learn more about. Both Coalition and Buzzards Bay Project staff are available to assist you in developing or improving local bylaws and zoning.

APPENDIX 2

Tampa Bay Government Action Checklist

CONTACT

The Tampa Bay Estuary Project
111 Seventh Avenue South
St. Petersburg, FL 33701
813-893-2765

October 7, 1993

TAMPA BAY: MEASUREMENT COMPONENTS FOR RATING GOVERNMENT ACTION CHECKLIST (GAC)

Note:

1. Items entered in **bold type** are additions suggested during September 27-28 discussions on measurement and rating issues.

2. * Denotes items that TBNEP believes no local government has yet accomplished either partially or fully.

3. √ Denotes items that need to be checked -- Connie is looking into these.

Considerations for pilot, and subsequent administrations, of the checklist:

1. A cover letter should accompany the checklist, (i) explaining its evolution and purpose and (ii) providing clear instructions for completion, as well as noting who local governments should contact in the event of questions/problems. Among the instructions, should be:

   - Awareness that although local governments may wish to solicit input from several cognizant individuals/agencies:

     - Each local government should have only one responsible party who coordinates the various pieces and provides the government's single official response.

     - The official government respondent should be identified, and may choose to identify other individuals to contact for selected topics.

   - Some indication of whether, and in what way, the governments will be debriefed; TBNEP and RPC should consider whether they will provide summary feedback on each government's response, or item-by-item responses; also whether they will facilitate inter-governmental communication (and technology transfer) by providing the names of contact people within each jurisdiction.

2. The checklist needs to be formatted with sufficient space to permit respondents to enter explanatory information.

3. Since the TBNEP and RPC plan to use the initial administration of the checklist as a baseline inventory, rather than as a rating system, each item might have at least 3 possible categorical responses: yes, no, not applicable.

TAMPA BAY: DRAFT MEASUREMENT COMPONENTS FOR RATING GOVERNMENT ACTION CHECKLIST (GAC)

Intergovernmental Coordination

The local government:

1. Coordinates watershed planning along and/or adjacent to common watershed boundaries.

   - Has developed specific watershed management plans.
   - Participates in **Tampa Bay Regional Data Coordinating Council.**

2.* Actively participates in NEP process, and implements strategies for a coordinated approach to achieving goals of the NEP.

   - Attends coordination meetings.
   - Incorporates CCMP into local comprehensive plans.[1]
   - Implements plans as designated in the CCMP.[1]
   - Integrates common goals for the Bay into NPDES permits.
   - Participates in **Tampa Bay Regional Data Coordinating Council.**

3.√ Has delegation of authority from state agencies for environmental resource permits, and has adopted state criteria (or criteria that exceed state requirements).

   - Is seeking or has sought delegation of authority from state agencies for:
     - Stormwater.
     - Dredge and fill.
     - Mangrove trimming.
     - Management and storage of surface water.
     - Wetlands.
     - Other; specify: _____
   - Holds delegated authority for:
     - Stormwater.

---

[1] These criteria will be included in the GAC assessments after the CCMP has been prepared and approved.

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

- Dredge and fill.
- Mangrove trimming.
- Management and storage of surface water.
- Wetlands.
- Other; specify: _____

4. Has other innovative intergovernmental coordination practices that benefit the estuarine environment; please describe briefly:

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Septic Systems

The local government:

5. Has identified locations of septic tanks.

   - Has inventoried location of septic tanks.
   - Has identified them by some kind of locator (e.g., address and longitude/latitude).
   - Has developed a database for use in other activities that deal with septic systems.

6. Has a **health or environmental management** program that requires and enforces periodic inspection of septic systems, and requires homeowners to have tanks pumped, if necessary.

   - Routinely inspects septic systems.
   - Requires homeowners to certify that a maintenance firm has performed an inspection.
   - Has assessed fines for non-compliance or has issued legal orders for violators to take corrective action.

   - **If YES, specify program/governmental entity:**_____

*7. **Has a health or environmental management program that** requires pre-sale inspections or certification that the septic system is functioning properly.

8. Has an ordinance that controls septic system factors not regulated by federal/state entities.

   - Considers potential impacts of nutrients on water quality and aquatic resources as part of the permitting process criteria for septic tanks and their drain fields.
   - Restricts system density.
   - Restricts type of facility.
   - Has setback requirements.
   - Has other controls.

9. Has an education program for residential and non-residential septic users that stresses proper septic system operation and maintenance procedures, as well as actions to avoid (such as discarding toxic organic chemicals into the system and use of certain cleaners/cosmetics).

   - Has information available on request.

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

- Proactively disseminates information to septic system users.

10. Promotes the use of innovative and alternative wastewater systems, such as batch treatment process, at appropriate commercial, industrial, and large residential land use sites.

    - Identifies appropriate potential users, and disseminates information to them.
    - Provides incentives for use.
    - Mandates the use of innovative and alternative wastewater systems by appropriate users.

11. Has ordinance or policy that requires hookup of septic tanks to existing sanitary sewer systems, and does not permit new septic tanks after such service is available.

    - Has policy incorporated in the comprehensive plan.
    - Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
    - Has informal operating procedures.
    - Has implemented the policy.

12. Has other innovative septic system programs or practices that benefit the estuarine environment; please describe briefly:

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Public Information/Technical Assistance

The local government:

13. Has a public information program on such topics as (i) how they can contribute to controlling non-point source pollution; (ii) the importance of not over-applying fertilizers and pesticides; (iii) alternatives to and proper handling, storage, and disposition of household hazardous materials; and (iv) maintenance of native vegetation and shoreline features.

    - Has print information or speakers available on request.
    - Conducts a public information campaign that proactively sends education notices to homes, businesses, industries, etc.
    - Conduct other public outreach activities, such as media campaigns or speakers bureaus that target specific audiences.

14. Provides for public input (including from public interest organizations) on public decisions relating to Bay protection, beyond making required notice of public hearings by the governing board.

    - Has a citizens group/board that serves only in an advisory capacity .
    - Has a formal environmental issues committee/board that carries official sanction.

15. Has an active program to provide technical assistance to households about household activities relating to Bay protection (e.g., neighborhood assistance program on vegetation, use of pesticides and fertilizers, and disposal of hazardous wastes).

    - Has technical advisors and information available on request.
    - Proactively identifies target households/neighborhoods to offer technical assistance.

16. Has other innovative public information/technical assistance programs or practices that benefit the estuarine environment; please describe briefly:

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Municipal Waste and Wastewater

The local government:

17. Actively investigates and prosecutes illegal dumping, including illegal excavation activities related to illegal dumping.

- Has its own proactive monitoring program to detect illegal dumping.
- Proactively solicits reports of illegal dumping through hotlines and other public outreach activities.
- Has investigative response to report of illegal activities:

If YES: please specify:

(1) Number of investigations: _____
(2) Number of warnings/citations: _____
(3) Number of prosecutions: _____

18. Has state-approved recycling program, e.g., drop-off centers, curbside programs, etc.

- Has voluntary recycling program.
- Has mandatory recycling program.
- Has, and enforces, penalties for non-compliance where recycling is mandatory.
- Offers incentives for recycling (e.g., exempts approved charitable organizations that operate successful recycling programs from disposal charges).

19. Has active programs for the use of reclaimed water by public, residential, commercial, and industrial users of potable water and nonpotable substitution.[2]

- Has an active program for reclaiming wastewater.

If YES: please specify:

(1) Design capacity of the government's reclaimed water system: _____

(2) Number of gallons of reclaimed wastewater during distributed past 12 months (or latest 12 months for which data are available):_____

---

[2] Reclaimed water is defined as: treated wastewater used in place of potable or raw groundwater.

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

(3) **Percentage of total treated wastewater that is reclaimed: _____**

(4) **Procedure used to estimate the demand for reclaimed water: _____**

- **Provides advanced waste treatment for reclaimed water.**[3]
- Has assessed the demand for reclaimed water, using a reasonably reliable procedure; specify procedure used to estimate demand:

20. Sewage treatment plants have requirements for industrial on-site pre-treatment of wastes that exceed EPA program requirements.

- Monitors pre-treatment actions of privately owned plants or franchises.

21. Monitors landfill leachate.

- Monitors reports by agency or haulers that certain quantities have been withdrawn at specified times.
- Uses readings from wells to detect changes over time.
- Monitors groundwater conditions.

22. **Has other innovative municipal waste and wastewater programs or practices that benefit the estuarine environment; please describe briefly:**

[3] AWT is defined as: 5 mg/liter BOD; 5 mg/liter TSS; 3 mg/liter total nitrogen; and 1 mg/liter total phosphorus.

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Hazardous Materials and Hazardous Wastes

The local government:

23.√ **Has an underground storage tank program.**

- Monitors leaking underground storage tanks.
- **Has overseen replacement of tanks; specify number of tanks: _____**

_____

24. Actively enforces existing regulations, including non-compliant small quantity generators (SQGs) and non-notifiers.

25. Has an active hazardous **wastes** program targeting households and non-residential generators.

- Provides, and publicizes, regular household hazardous waste materials collection; specify how often these are scheduled: _____
- Holds drop-off or amnesty days to reduce improper disposal of wastes; specify how often these are scheduled: _____

26. Has an active information and technical assistance program to encourage participation in hazardous material use and waste minimization; pre-treatment prior to disposal (whether into the sewer system, incinerator, or whatever); reuse or recycling of hazardous waste; and facilitation of waste exchanges.

- Has information, available on request, on minimization of use, handling, and proper disposal.
- Proactively targets specific audiences to receive information or technical assistance on minimization of use, handling, and proper disposal.

27. Has an oil recycling program.

28. Regulates the proper storage and disposal of oil of commercial firms.

29. Identifies deficiencies in hazardous waste compliance and enforcement programs regardless of which agency is responsible, and attempts to work out solutions.

30. **Has proactively addressed oil spill emergency responses.**

- **Has contingency plans for releases from government facilities.**

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

- Has an individual responsible for **cooperating** with the Coast Guard in the event of an oil spill.
- **Participates in the area response committee.**
- **Has received training, including OSHA training.**
- **Has containment equipment.**

31. **Has hazardous materials response plans for local government facilities that have hazardous substances on site.**

32. **Has other innovative hazardous materials and hazardous wastes programs or practices that benefit the estuarine environment; please describe briefly:**

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Stormwater

The local government:

33. Has regulations that address stormwater quality and quantity concerns, including flooding and erosion problems, and requires development and redevelopment projects to reduce/control pollutants in stormwater runoff.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which:
- Has informal operating procedures.
- Has implemented the policy.

If YES: please specify:

(1) Number of projects using BMPs/stormwater treatment: _____

(2) Percent of projects using BMPs/stormwater treatment: _____

34. Has a stormwater utility system that relies on dedicated funding sources other than tax revenues for funding.

35. Has a stormwater management ordinance that requires discharges to the local government municipal separate stormwater system be treated through BMPs before the stormwater is added to the system.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

36. Encourages practices that include the following stormwater pollution preventive actions:

- Use of pervious pavement for roadways and parking areas.
- Planted and landscaped retention or wet detention areas that utilize native vegetation.
- Natural wetlands.
- Other vegetative BMPs, such as filter strips, urban forestry, etc.

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

- Other practices; specify: _____

37. Uses street cleaning machinery capable of collecting fine particles.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

38. Has a program for household fertilizer application control to reduce **nutrient runoff**.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

39. **In addition to ambient water quality monitoring, identifies** specific pollutant **problems and sources** that impact local area.

- **Responds to** citizen complaints **or requests for inspection.**
- Monitors point-source stormwater discharge.
- Conducts site-specific water quality monitoring.

40. Requires that development not be allowed to shed more stormwater onto adjacent property than was discharged from the site in its natural, unimproved state.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

41. Has a program implementing stormwater rehabilitation projects in priority watersheds (e.g., it has upgraded or retrofitted drainage systems in urbanized areas in priority watersheds to improve stormwater treatment) by:

- Providing land for the projects.
- Contributing a cash match or in-kind services
- Overseeing perpetual maintenance of the local government project.

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

- Ensures that permitted detention/retention systems are designed and maintained in accordance with development requirements.

42. Monitors publicly maintained stormwater treatment systems (and where appropriate, major privately maintained systems) to ensure proper functioning.

43. Requires as-built certification or inspection of publicly maintained stormwater treatment systems (and where appropriate, major privately maintained systems).

44. Encourages or requires catch basin BMPs for removal of oil and grease.

45. Has other innovative stormwater programs or practices that benefit the estuarine environment; please describe briefly:

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Dredge and Fill

The local government:

46. Restricts dredge and fill operations within the coastal areas to activities that facilitate the continued use of existing channels, activities associated with appropriate water-dependent uses, activities that correct environmental problems, and other **activities determined to be** overriding public interest.[4]

- Has a policy that restricts such operations

  If YES, specify:

  (1) Ordinance or rule under which reviews take place: _____
  (2) Number of applications received **per year:** _____
  (3) Number of resubmissions received **per year:** _____
  (4) Number of permits denied **per year:** _____
  (5) Number of permits withdrawn per year: _____

- Has permitting authority; **specify source of authority:** _____
- **Requires as-built certifications or inspections for mitigation projects.**
- **Tracks the cumulative (total) number of acres affected.**
- **Tracks the cumulative (total) number of acres mitigated.**

47. Prohibits the dredging or **filling** of bay bottom containing significant seagrass habitat, except in cases of overriding public interest.

48. Implements erosion control regulations that control turbidity and sedimentation from construction projects.

- Requires turbidity curtains **or other turbidity control measures (e.g., hay bales)** as a standard condition for permit approval.
- Monitors turbidity curtains around dredges.
- **Requires removal of turbidity curtains after construction.**

49. Has other innovative dredge and fill programs or practices that benefit the estuarine

---

[4] See DEP definition of "public interest".

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

environment; please describe briefly:

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Water Conservation Measures

The local government:

50. Has implemented a residential indoor and outdoor water conservation program to encourage reduced average-day and maximum-day water demands.

- Has policies incorporated in local plans or LDRs.
- Encourages use of:
  - Water-conserving toilets, showerheads, and faucet aerators.
  - Water-conserving landscape (xeriscape).
  - Recycled household laundry water.
  - Reclaimed water for outdoor non-potable purposes.
- **Promotes practical, economically feasible, and efficient designs and products (e.g., ultra-low volume plumbing fixtures, rain shut-off devices, and irrigation restrictions) for new residential systems.**
- **Promotes the replacement or improvement of older, less efficient systems.**
- Provides free water-saving devices or other incentives to use such devices; specify what: _____
- Has water-conserving rate structure (e.g., increasing water fees during dry months or inverting water fee structures).
- Has water conservation public information programs.
- Has innovative or demonstration projects on water conservation; specify: _____ _____

51. Has **implemented a non-residential** conservation program for agricultural, commercial, and industrial uses.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which:_____
- Has informal operating procedures.
- Has implemented the policy.
- **Promotes practical, economically feasible, and efficient designs and products (e.g., ultra-low volume plumbing fixtures, rain shut-off devices, and irrigation restrictions) for new non-residential systems.**
- **Promotes the replacement or improvement of older, less efficient systems.**
- **Encourages use of irrigation using detained or retained stormwater.**
- Provides water conservation utility rates or other incentives that encourage adequate treatment, utilization, or reuse of water resources; specify incentives

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

used: _____

52. Has other innovative water conservation programs or practices that benefit the estuarine environment; please describe briefly:

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Boat Use and Boater Discharges

The local government:

53. Requires marinas to have sewage pump-out facilities.

- Has local ordinance; specify any limitations: _____

54. Has an active program to encourage boaters not to discharge on-board waste to surface waters.

- Has boater information available on request.
- Proactively disseminates information to boaters.
- Provides incentives; specify what: _____

55.√ [5]Requires all marinas and boatyards to have adequate oil containment and cleanup equipment on site.

56. Requires all marinas and boatyards with fuel facilities to **operate** the appropriate fueling of vessels.

57. Regulates dock and marina siting in environmentally sensitive areas, and discourages non-water dependent use of jurisdiction's waters

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.
- Does not permit **elevated** decks, gazebos, screened rooms, or walled structures on docks.

58. Uses waterfront buffers (e.g., native vegetation or setbacks) to minimize shoreline impacts due to boating activities.

---

[5] This item has been questioned by reviewers as to whether local governments have any responsibility, rather than the Coast guard. Hillsborough rates this item as high priority; it might be worthwhile to check it with Hillsborough.

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

59. Regulates and enforces boat speeds to promote protection of wildlife and public safety, and to minimize erosion (e.g., has seagrass protection ordinance and appropriate signage).

- Has a policy that regulates boat speed.
- Distributes information to boaters explaining regulations, signs, and covering other water pollution dangers, such as boat wastes.
- Has marine enforcement program; i.e., an on-the-water presence such as marine patrol.
- Issues **warnings and** citations for violations.

60. **Has other innovative boater programs or practices that benefit the estuarine environment; please describe briefly:**

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Agriculture and Industry

The local government:

61. **Has** nutrient monitoring and control program **within the Tampa Bay watershed.**

- **Has interlocal agreements for nutrient monitoring.**
- **Has demonstration programs or pilot projects.**

62. **Has agricultural and industrial** BMP requirements for controlling nutrient **and hazardous/toxic materials** loadings, including retrofitting if needed.

63. Requires BMPs for controlling fertilizer/phosphorus industry activities:

- Materials handling protocols.
- Record keeping and reporting of spillage requirements.
- Operator training certificates.
- Recycling water.
- Runoff protection from conveyor belts.
- Overflow warning devices with a quick response time.
- Tank and berm containers.
- Double lining for pipe over water.

64. Regulates port actions for reducing solid and liquid spillage during on- and off-loading of cargo.

65. Has other innovative agriculture and industry programs or practices that benefit the estuarine environment; please describe briefly:

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Shellfish Beds Reopening

The local government:

66. Has an active program promoting the opening of shellfish beds.

*
- Monitors presence of coliform/pathogens in shellfish beds.
- Assesses the sources of contamination of shellfish **beds.**
- **Has a** plan of corrective action.

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Land Use

The local government:

67. Has **or participates in** a program to acquire open space **or environmentally sensitive land** for aquifer recharge, stormwater filtration/percolation, wellfield protection, and habitat **and wildlife protection.**

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

68. Encourages site design using joint or shared use of parking areas or access roads, or clustering of uses to maximize the preservation of vegetated open space.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

69. Has incentives (e.g., reduced tax rates, **transfer of development rights, density/intensity transfers,** or others) to preserve environmentally sensitive property.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

70. Has local permitting requirements that protect wetlands and upland buffer zones.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

71. Requires landscaping practices and landscape maintenance beneficial for estuary

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

protection (e.g., preserving existing native vegetation on a building site; maximizing use of low ground cover in place of turf grass; where turf grass is used, selecting varieties with minimum requirements for irrigation, fertilizers, pesticides, and mowing; mulching around shrubs).

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

72. Requires that a particular percent of all post-development vegetation be indigenous to the region.

- Has policy incorporated in the comprehensive plan.
- Has policy incorporated in land development regulations (LDRs), or other ordinances or codes; specify which: _____
- Has informal operating procedures.
- Has implemented the policy.

73. **Has other innovative land use programs or practices that benefit the estuarine environment; please describe briefly:**

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

Miscellaneous

The local government:

74. Provides support for habitat restoration **or enhancement** projects.

- Has policy incorporated in the comprehensive plan.
- Provides land for habitat restoration.
- Provides financial or in-kind services.

75. Has an active program, **or participates in a program,** to protect and restore existing marine resources, such as fisheries, shellfish harvesting areas, and seagrass beds.

76. Protects manatees.

- Designates idle speed zones for marinas and multi-family docking facilities.
- Designates slow speed zones for all access channels to marinas and multi-family docking facilities, and in areas of known manatee habitat or congregation sites.
- Posts and maintains educational displays and regulatory signs at marina-type uses and access channels.
- Keeps new boat ramps away from high manatee concentrations.
- Limits density of multi-family docking facilities and single-family docks.

77. Dedicates fines collected from polluters to environmental protection or mitigation.

- Has an environmental fund or pollution recovery fund.

78. Has other innovative programs or practices, not previously described in this survey, that benefit the estuarine environment; please describe briefly:

Note: Please indicate if responsibility has been delegated to another governmental unit (and to whom) for any of the above items.

APPENDIX 3

Tampa Bay Household Questionnaire

CONTACT
The Tampa Bay Estuary Project
111 Seventh Avenue South
St. Petersburg, FL 33701
813-893-2765

TAMPA BAY HOUSEHOLD ENVIRONMENTAL SURVEY

Please complete this questionnaire. It should only take about 10 minutes of your time. Please mail it back in the enclosed stamped addressed envelope.

1. In the past 12 months, have you checked your home for water leaks (e.g., checked toilets, or looked for changes in water-meter readings during periods when water was not in use)?

___ No ___ Yes

2. Do your faucets or showerheads have water flow savings devices?

___ Yes, faucets only
___ Yes, showerheads only
___ Both
___ Neither
___ Don't know

3. Do you turn the water off while brushing your teeth or shaving?

___ Always
___ Almost always
___ Sometimes
___ Never

4. Do your toilets have either a displacement device (e.g., toilet dam) or a water-saver toilet?

___ No
___ Yes, all toilets set up to save water
___ Yes, some toilets set up to save water
___ Don't know

5. a. In the past 12 months, did you dispose of any used motor oil, paints, or chemicals?

___ No ___ Yes

b. *If YES:*

Where did you dispose of them? *(check all that apply)*

___ Sewer
___ At county collection sites
___ Local service station
___ Poured into outside storm drain or gutter
___ Other; Specify: _____
_____

6. Are you a sail or power boat owner?

___ No ___ Yes, sail boat
___ Yes, power boat
___ Yes, power & sail boat

b. *If YES:*

(1) In the past 12 months, when you removed trash from the boat, where did you dispose of it?

___ Put trash in shore receptacles
___ Put non-plastics into the water, and plastics into shore receptacles
___ Put trash into the water

(2) In the past 12 months, how have you disposed of used oil or fuel?

___ Brought to marina or service station recycling facility
___ Dumped overboard
___ Other; Specify: _____
_____

(3) What type of head do you have on the boat?

___ Bucket or Porta-Potty
___ A marine sanitation device with a holding tank
___ A marine sanitation device without a holding tank

(4) What do you use to wash your boat?

___ Phosphate-free soap
___ Regular soap
___ No soap; brush only

7. Do you normally separate any of your trash for recycling?

___ No ___ Yes

b. *If YES: (check all that apply)*

(1)
___ Cans (aluminum items)
___ Paper
___ Glass
___ Plastics

(2) Where do you put these items:

___ At curb for pickup
___ Take to a recycling collections center

8. a. Do you own a dog?

___ No ___ Yes

b. *If YES:*

Within the past 6 months, did you pick up your animal's wastes from lawns, sidewalks, and curbs:

___ Usually ___ Sometimes
___ Never

NOTE: If you live in an apartment, condominium, or mobile home, skip to question 26.

9. a. Have you fertilized your lawn within the past 6 months?

___ No ___ Yes

If YES:

b. The last time you fertilized, did you use "slow release" forms of fertilizers?

___ No
___ Yes
___ Don't know

10. What methods have you used to control pests for your yard over the past 12 months?

___ Pesticides
___ Pruning
___ Hand picking
___ Other; Specify: _____
_____

11. What materials make up your walk areas (e.g., sidewalks, driveways, patios)?

___ Asphalt
___ Concrete

___ Flagstone
___ Brick
___ Sand or gravel

12. a. In the past 12 months, have you paved any surface outside your home?

___ No ___ Yes

b. *If YES:*

What material did you use?

___ Asphalt
___ Concrete
___ Flagstone
___ Brick
___ Sand or gravel

13. Does your landscape include any swales (low areas) and berms (elevated areas)?

___ No ___ Yes

14. Where do your gutters drain?

___ Onto concrete or asphalt surfaces
___ Into grassy areas
___ Other; Specify:_____
_____

15. Do you have native, drought resistant plants and trees in your yard?

___ Mostly
___ Some
___ None
___ Not sure

16. a. During the past 12 months, did you plant any shrubs, bushes, trees, etc.?

___ No ___ Yes

b. *If YES:*

Were any of these drought resistant?

___ No ___ Yes
___ Don't know

17. Do you group plants according to similar watering and fertilizing needs?

___ No ___ Yes
___ Don't know

18. a. Do you use mulching at all?
___ No ___ Yes

b. *If YES:*
What type of mulch is used?

___ Cypress
___ Pine needles
___ Composted materials
___ Other: Specify: _____
_____

19. What percentage of your landscape is lawn (turf grass)?

___ 0 - 25%
___ 26 - 50%
___ 51 - 75%
___ 76 - 100%

20. What height do you set your lawnmower blade? _____

___ High (3" or less of blade is out)
___ Medium
___ Low

21. How have you usually disposed of

your grass clippings?

___ Leave on lawn
___ Use as mulch
___ Compost
___ Bag and discard in trash

22. Do you typically water your lawn:

___ Before 9:00 am
___ Midday
___ After 6:00 pm

23. When watering your lawn, do you do any of the following:

	NO	YES	
(a)	___	___	Use a garden hose shut off device
(b)	___	___	Use a drip system
(c)	___	___	Use a micro-irrigation system
(d)	___	___	Hand water
(e)	___	___	Water only when grass wilts
(f)		___	Other; Specify: _____ _____

24. a. In the past 12 months, have you contacted any government agency for information about water saving or xeriscaping techniques?

___ No ___ Yes

b. *If YES:*

Who did you contact? _____ _____

25. a. Do you have a septic system?

___ No ___ Yes

b. *If YES:*

(1) When was the last time you had it pumped out?

_____(Month & Year)

(2) About how often have you been doing this?

___ Every year
___ Every 2 years
___ Every 3 years
___ Every 4 or more years

(3) Have you used any septic cleaning compounds in the past 12 months?

___ No ___ Yes

(4) Do you use a garbage disposal?

___ No ___ Yes

Demographics

26. Type of property:

___ Single-family home
___ Multi-unit home (e.g., duplex)
___ Condominium or apartment complex
___ Mobile home

27. Do you rent or own your own home?

___ Rent ___ Own

28. What is your household composition?

___ # of Adults
___ # of children living at home

29. What county do you live in?

_____

THANK YOU FOR YOUR COOPERATION!

Please return to:

Tampa Bay National Estuary Program
111 7th Avenue South
St. Petersburg, Florida 33701

APPENDIX 4

Buzzards Bay Boaters' Questionnaire

CONTACT

Buzzards Bay Advisory Committee
2 Spring Street
Marion, MA 02738
508-748-3600

(This questionnaire focuses on boat discharges, not on other boater behavior such as harming seagrass.)

Pilot Test of Boater Survey

For the pilot test, we need to administer the questionnaire in three locations, to six people in each location. Three of the six in each location should fill out the questionnaire themselves and three should be filled in by Page Minshew for the respondent. This will help us decide on how we will conduct the survey.

If the person is reluctant to be interviewed, attempt tactfully and pleasantly to encourage them to be interviewed. For example, point out that their answers will help local officials to make improvements.

At the end of the interview, offer copies of the pamphlets to the respondent. In fact, if the person refuses to be interviewed, we might offer the pamphlets to the person. This also might encourage the person to be interviewed.

Introductory Material

I am _____ from the Buzzards Bay Project. We would like to ask you a few questions relating to the protection of Buzzards Bay. It will take only a few minutes. This is a test of our survey form and questions, so at the end I'll ask you to comment on the questionnaire--questions that weren't clear, or optional answers that were missing or not appropriate.

Your answers will be kept confidential. We don't even need your name. The information we obtain from you will be combined with information we obtain from other respondents before it is reported.

The information will be used to help improve our programs to protect the Bay.

First, we have a few questions about your boat.

Interviewer fills this in for all six respondents in all three locations.

****

a) Date_____ b) Time of day_____ c) Location_____

d) Type of boat: Power___ Sail____ e) Length_____

f) Recreational___ Commercial___ g) Interviewer_____

****

September 23, 1994

Buzzards Bay Boaters' Questionnaire

1. a) What is your home port?_____

   b) In what town/city is your full-time home?_____

2. About how many hours/days were you out on the boat this time?_____

3. How many persons were with you? _____

4. Did anyone use the boat's head during the time you were out? No___ Yes ___

5. What type of head do you have on the boat?

   (a) Bucket or Porta-Potty ___ } Go to Q6-8

   Read definitions of Types I, II, III below, if needed

   (b) Type I Marine Sanitation Device _____ }
   (c) Type II Marine Sanitation Device ____ } Go to Q9
   (d) Doesn't know if Type I or II _____ }

   (e) Type III Marine Sanitation Device ___ } Go to Q10

For Porta-Potty or bucket

6. Have you treated the waste with chemicals? No ___ Yes ___

7. What did you treat it with? Chemical name _____
   Brand name _____

8. Have you disposed of the waste?
   Yes ___ How? _____
   No ___ What are you going to do with it?_____

****

Definitions of Marine Sanitation Devices Types I, II, III

Type I:	***Chops up and disinfects waste with chemicals to a level of 1000 fecal coliform bacteria per 100 milliliters of water (about three ounces).***
Type II:	***Does same as Type I, but reduces fecal coliform bacteria to 200 per three ounces of water.***
Type III:	***Holding tank equipped with piping to discharge waste when over three miles from shore or, better yet, into fixed or floating pump-out facility.***

For Type I or II Marine Sanitation Device [If someone used the head...]

9. Have you disposed of the waste?

A. Yes __ (a) **Used a pump-out** facility. Which one? _____

(b) Were you charged for the pump-out? No__ Yes__ How much? _____

(c) How satisfied were you with the service at the pump-out facility:

(1) Excellent___ (2) Good___
(3) Fair___ (4) Poor___

[If Fair or Poor] Why do you say that?

_____

_____

B. Yes __ (d) **But, did not use pump-out** facility because [check all that apply.]

(e) ___Takes too much time.

(f) ___It's not near enough.

(g) ___Doesn't seem important to do; doesn't hurt the bay.

(h) ___It costs too much.

(i) ___Other ?

C. Yes __ **Discharged it**

D. Yes __ **Did something else**? Explain:

E. No ___ What are you going to do with it?

For Type III Marine Sanitation Device [If someone used the head...]

10. Have you disposed of the waste?

A. Yes __ (a) **Used a pump-out** facility. Which one? _____

(b) Were you charged for the pump-out? No__ Yes__ How much? _____

(c) How satisfied were you with the service at the pump-out facility:

(1) Excellent___ (2) Good___
(3) Fair___ (4) Poor___

[If Fair or Poor] Why do you say that?

_____

_____

B. Yes __ (d) **But, did not use pump-out** facility because [check all that apply.]

(e) ___Takes too much time.

(f) ___It's not near enough.

(g) ___Doesn't seem important to do; doesn't hurt the bay.

(h) ___It costs too much.

(i) ___Other ?

C. Yes __ **Discharged it**

D. Yes __ **Did something else**? Explain:

E. No ___ **Still in the holding tank**, which is not full.

F. No ___ What are you going to do with it?

11. Do you know if there are any officially designated "no discharge" areas in Buzzards Bay?

No ___

Yes ___ If yes, can you name them?

_____

_____

_____

12. Have you seen either of these two pamphlets [SHOW THEM] Yes__ No__

[If Yes] Did you find it/them useful to you? Yes __ No __

[If Yes] In what ways? _____

[Yes or No] How could the pamphlet/s be made more useful to you, for example, what other material would you like to see covered?

13. Are there any suggestions or comments you would like to make about the disposition of wastes from a boat?

14. Since this is a test of the questionnaire, could you please tell us your reaction to the questions?

THANK YOU VERY MUCH FOR YOUR HELP!
WOULD YOU LIKE COPIES OF EITHER OF THE TWO PAMPHLETS?

APPENDIX 5

Environmental Indicators in the Office of Water

CONTACT

Elizabeth Jester-Fellows
U.S. Environmental Protection Agency
202-260-7062

Environmental Indicators in the Office of Water

The Office of Water (OW) is choosing environmental indicators that will accomplish several purposes:

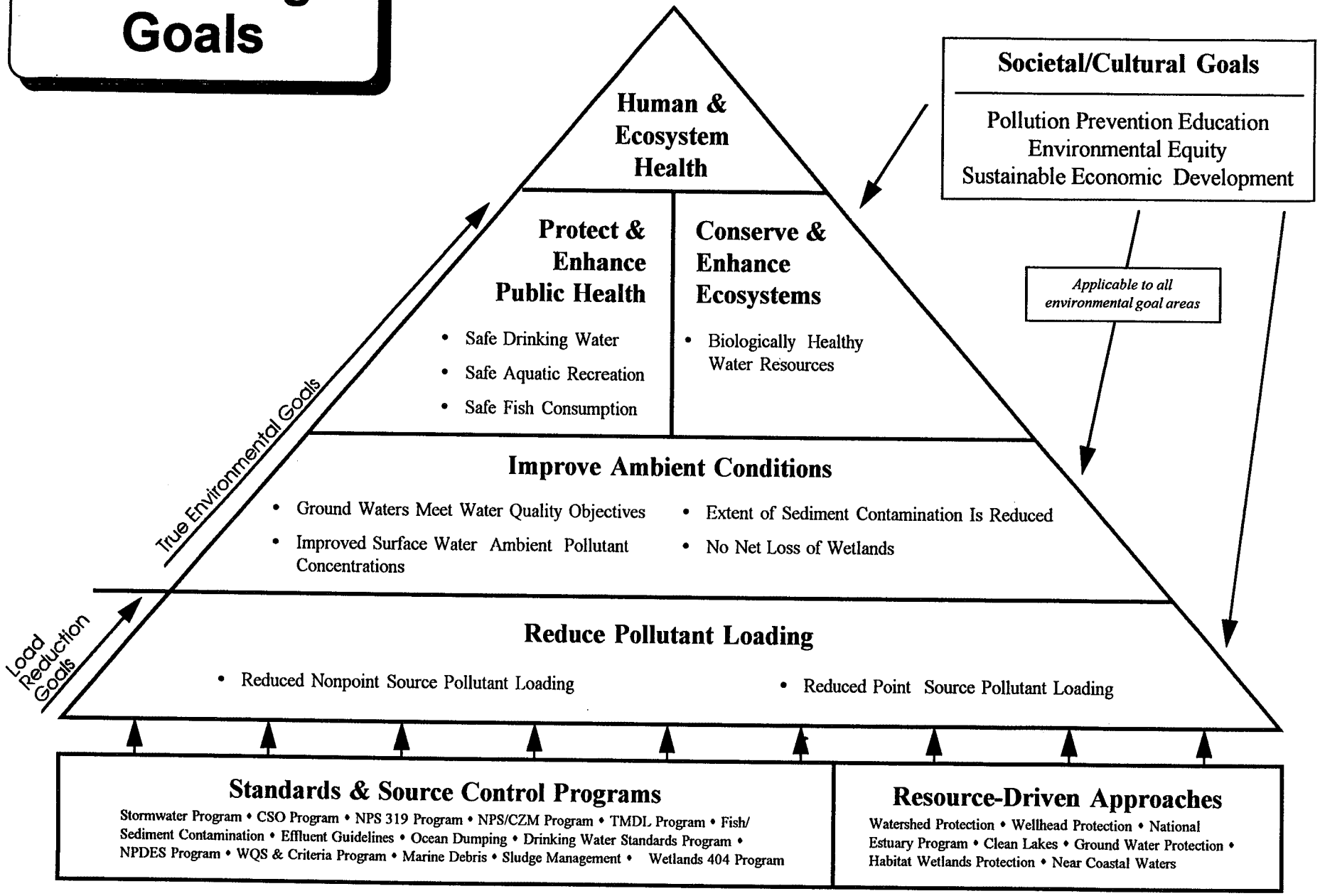
- Measure our progress towards specific environmental goals
- Measure if the waters are supporting the uses we wish to make of them as expressed through State water quality standards
- Communicate to the public in simple terms
- Use good science and be supported with more technical documents
- Engage partners nationally to help provide data to measure the indicators

- **The Office of Water is considering 21 indicators in total that measure four overall goals, and that will be reported to the public in three stages:**
  - **8 indicators in an April 1995 Earth Day report**
  - **8 additional indicators (for a total of 16) in a more detailed Office of Water indicators report in Fiscal Year 1995**
  - **5 additional indicators to be added for the long term.**
- **The Office of Water is also working with 8 States on pilot programs to test the indicators. The States are Arizona, Delaware, Georgia/North Carolina, Maine, Maryland, Ohio, and Wisconsin.**

The four goals that the Office of Water will measure with indicators may be seen in a hierarchical structure -- to reach the top goals of human and ecosystem health one must improve ambient conditions, and to improve ambient conditions, one must reduce or prevent pollutant loadings. Public and private prevention and remediation programs most directly affect pollutant loadings.

The following pages show the OW strategic goals, their related subgoals, additional societal and cultural goals that are measured in terms other than environmental condition, and the indicators to measure the goals.

OW Strategic Goals



GOAL	SUBGOAL	INDICATOR
Protect and Enhance Public Health	**Safe Drinking Water**	* 1. Source water protection * 2. Drinking water standards violations * 3. Contaminants causing drinking water standards violations 4. Blood lead levels in children 5. Waterborne disease outbreaks from public water supplies
	Safe Aquatic Recreation	6. ***Disease outbreaks from swimming***
	Safe Fish & Shellfish Consumption	7. Fish consumption advisories 8. Shellfish bed closures 9. ***Disease outbreaks from fish and shellfish consumption***
	(all three subgoals)	* 10. Waters meeting drinking water supply, swimming and secondary contact, & fish and shellfish designated uses
Conserve and Enhance Ecosystems	**Biologically Healthy Water Resources**	10. Waters meeting aquatic life designated use 11. Species at risk * 12. Biological integrity of the water 13. ***Habitat quality***
Improve Ambient Conditions	**Ground Waters Meet Water Quality Objectives**	* 14. Ambient ground water quality
	Improved Surface Water Ambient Pollutant Concentrations	* 15. Selected toxic & conventional water quality parameters 16. ***Water quality standards attainment***
	Extent of Contaminated Sediments is Reduced	17. Contaminated sediments
	No Net Loss of Wetlands	* 18. Loss or gain of wetland acreage
Reduce Pollutant Loadings	**Reduced Nonpoint Source Pollutant Loadings**	19. Loadings of toxic & conventional pollutants from point sources to surface & ground water
	Reduced Point Source Pollutant Loadings	20. Loadings of toxic & conventional pollutants from nonpoint sources to surface & ground water
		21. ***Marine debris***

Note: Indicators in bold italics are proposed for long-term development

*** Indicators included in the National Goals Report**

HIERARCHY	INDICATOR	DATA SOURCE	OW OFFICE
2	1. Source water protection	EPA: FRDS (soon SDWIS)	OGWDW
1	2. Drinking water standards violations	EPA: FRDS (soon SDWIS)	OGWDW
1	3. Contaminants causing drinking water standards violations	EPA: FRDS (soon SDWIS)	OGWDW
6	4. Blood lead levels in children	CDC: NHANES	OGWDW
6	5. Waterborne disease outbreaks from public water supplies	CDC: Morbidity/Mortality Report	OGWDW
6	6. Disease outbreaks from swimming	CDC:	OWOW
6	7. Fish consumption advisories	EPA: State Reporting	OST
6	8. Shellfish bed closures	NOAA: Shellfish Register	OWOW
6	9. Disease outbreaks from fish and shellfish consumption	CDC	OWOW
4	10. Waters meeting designated uses	EPA: State Reporting	OWOW
6	11. Species at risk	Nature Conservancy: Heritage Database	OWOW
6	12. Biological integrity of the water	EPA: State Reporting	OWOW
6	13. Habitat quality	TBD	OWOW
4	14. Ambient ground water quality	EPA: FRDS (soon SDWIS)	OGWDW
4	15. Selected toxic & conventional water quality parameters	EPA: STORET; USGS: NAWQA	OWOW
4	16. Water quality standards attainment	EPA: Regulatory CWA Requirements	OWOW
4	17. Contaminated sediments	EPA: National Sediment Inventory	OST
6	18. Loss or gain of wetland acreage	USFWS: National Wetland Inventory	OWOW
3	19. Loadings of pollutants from point sources to water	EPA: PCS	OWM
3	20. Loadings of pollutants from nonpoint sources to water	TBD	OWOW
3	21. Marine debris	EPA:	OWOW

Hierarchy

1. Actions by EPA/ State Regulatory Agencies	2. Responses of the Regulated Community	3. Changes in Discharge/ Emission Quantities	4. Changes in Ambient Conditions	5. Changes in Uptake and/or Assimilation	6. Changes in Health, Ecology, or Other Effects

Office of Water
Environmental Indicators

Acronym List

AWWA	American Water Works Association
BEST	Biomonitoring and Environmental Status and Trends, USFWS (Update of NCBP)
BIOS	Biological System Component of STORET, OWOW/OW
CDC	Center for Disease Control
CSGWPP	Comprehensive State Ground Water Protection Programs
CSSI	Contaminated Sediment Sites Inventory
ELMR	Estuarine Living Marine Resource, NOAA
EMAP	Environmental Monitoring and Assessment Program, ORD
ERAMS	Environmental Radiation Ambient Monitoring System, Office of Radiation Programs
FAD	Fish Advisory Data Base, OST/OW
FRDS	Federal Reporting System, OGWDW/OW
FSP	Fisheries Statistics Program, NOAA
HWIW	Hazardous Waste Injection Well Database, OGWDW/OW
IBI	Index of Biological Integrity
ITFM	Intergovernmental Task Force of Monitoring Water Quality
LMR	Living Marine Resource, NOAA
MMS	Minerals Management Service
NAWQA	National Water Quality Assessment Program, USGS
NASQAN	National Stream Quality Accounting Network, USGS
NCBP	National Contaminant Biomonitoring Program, USGS
NCPDI	National Coastal Pollutant Discharge Inventory, NOAA
NCWI	National Coastal Wetlands Inventory, NOAA
NEP	National Estuary Program, OWOW
NFTD	National Fish Tissue Data Base, OST (does not yet exist)
NPDES	National Pollutant Discharge Elimination System, OWEC
NPSurvey	National Pesticide Survey, OPP
NRDC	National Resources Defense Council
NRI	National Resources Inventory, SCS/USDA
NSR	National Shellfish Register, NOAA
NS&T	National Status & Trends, NOAA
NWI	National Wetlands Inventory, USFWS
ODES	Ocean Data Evaluation System
PCS	Permit Compliance System, OWEC
PGWDB	Pesticides in Ground Water Data Base, OPP
PWSS	Public Water Supply Systems
RBP	Rapid Bioassessment Protocols, OWOW
STORET	STOrage and RETrieval System, OWOW
TRI	Toxic Chemical Release Inventory System, Office of Toxic Substances
WBS	Waterbody System (for 305(b) Reports), OWOW
WIDB	Water Industry Data Base, AWWA

APPENDIX 6

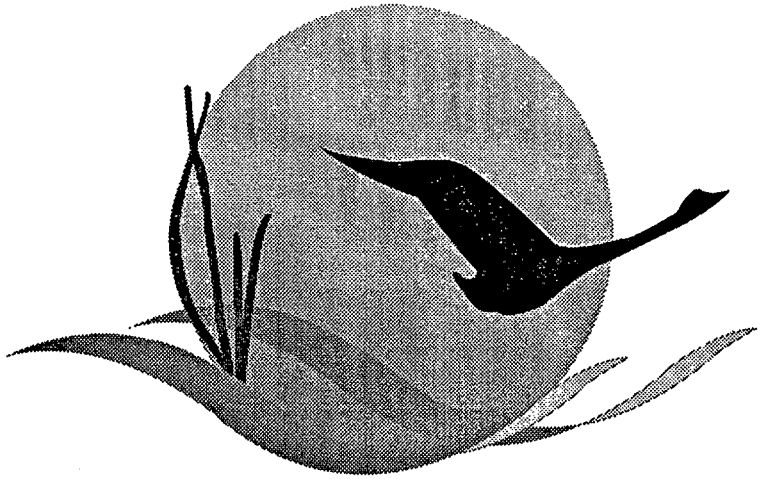
Environmental Indicators: Measuring Our Progress

Chesapeake Bay Program

CONTACT

Kent Mountford
U.S. Environmental Protection Agency
1-800-968-7229

Environmental Indicators: Measuring Our Progress



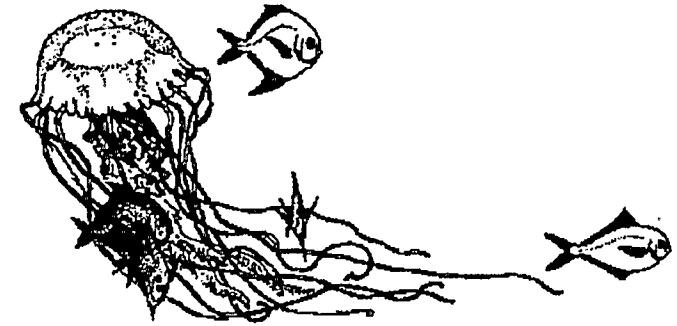
Chesapeake Bay Program

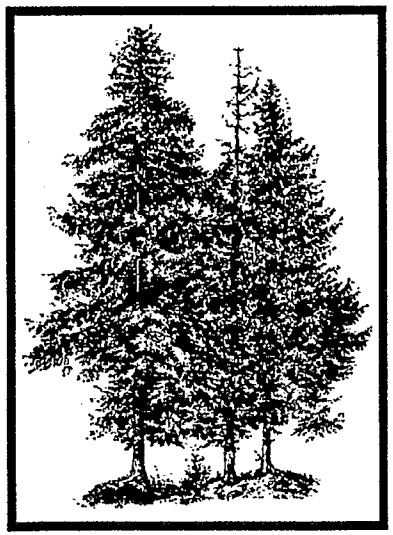
October 1994

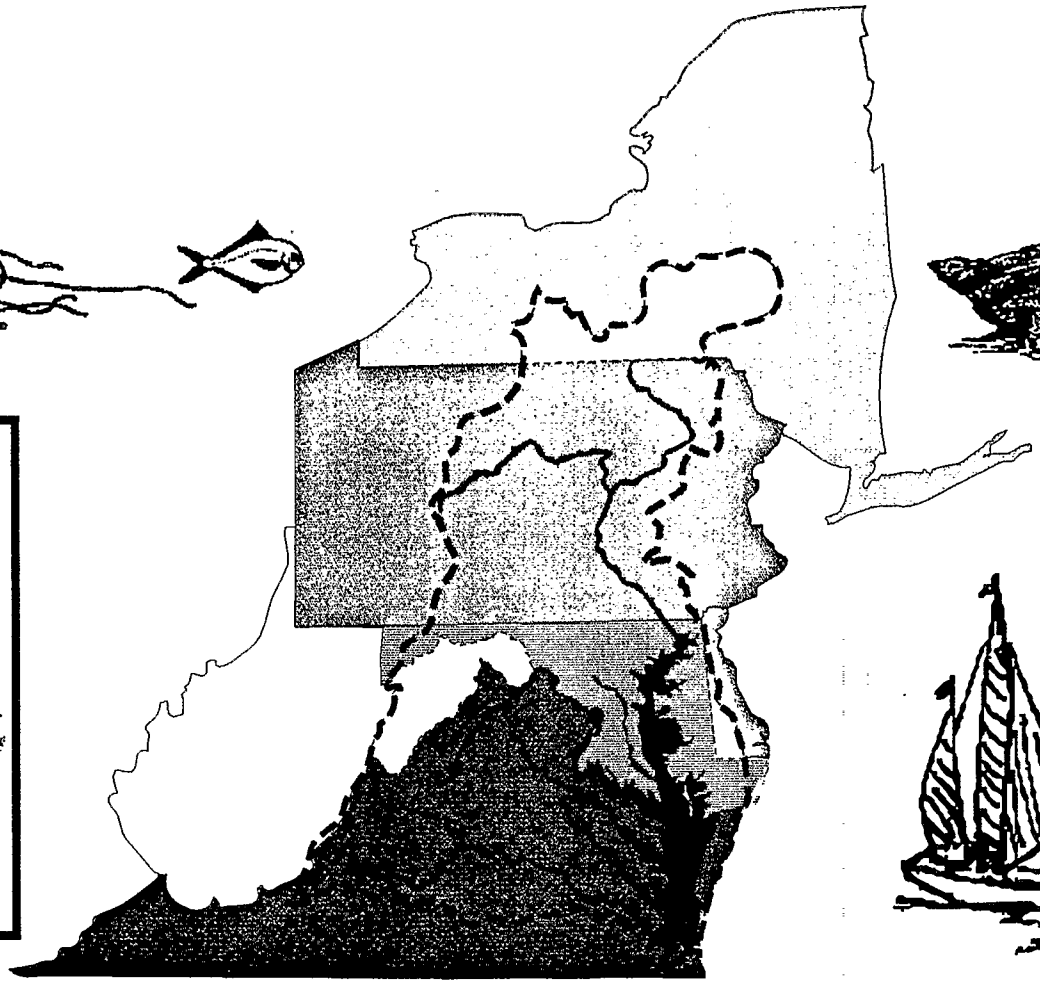
Statement of Purpose

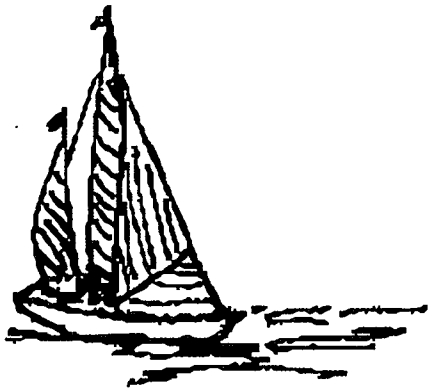
- To provide a brief overview of tracking mechanisms under development
- To evaluate progress in the Chesapeake Bay restoration effort
- To make detailed information and reference data for these indicators available upon request
- To inform and involve the public in achieving the restoration goals.

The Chesapeake Drainage Basin

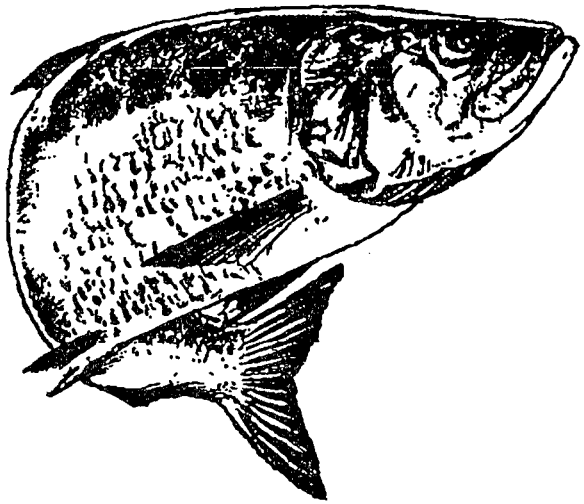








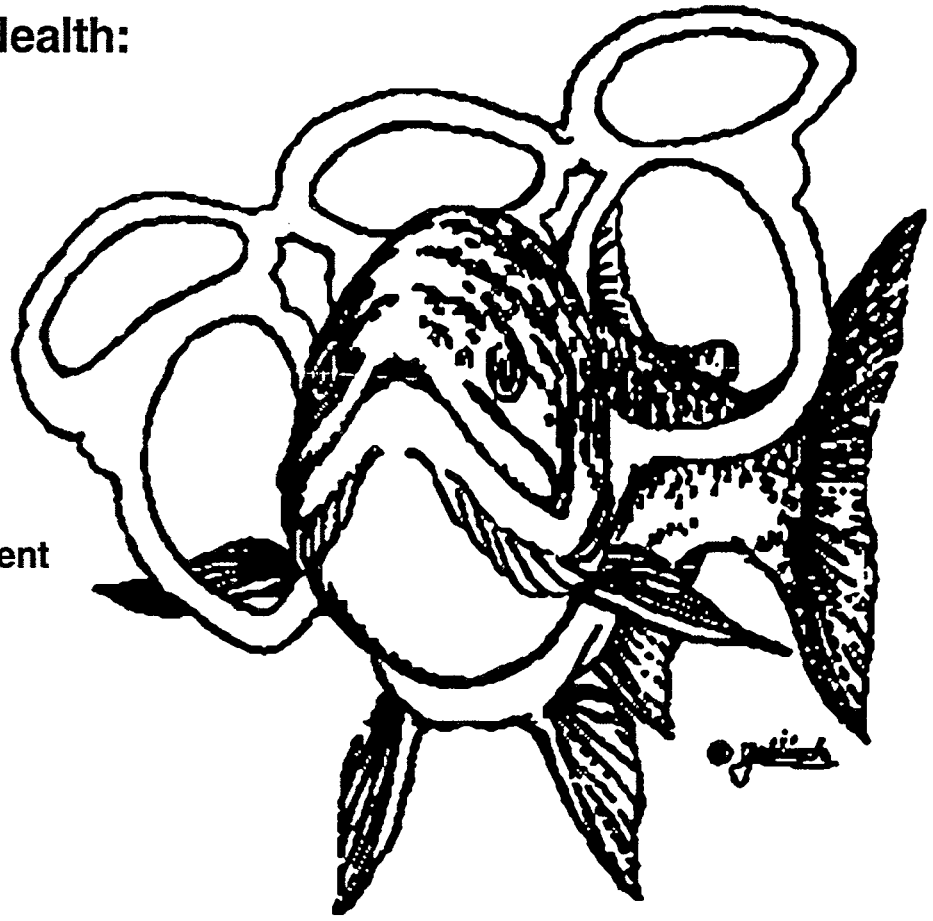
The Bay and its Rivers



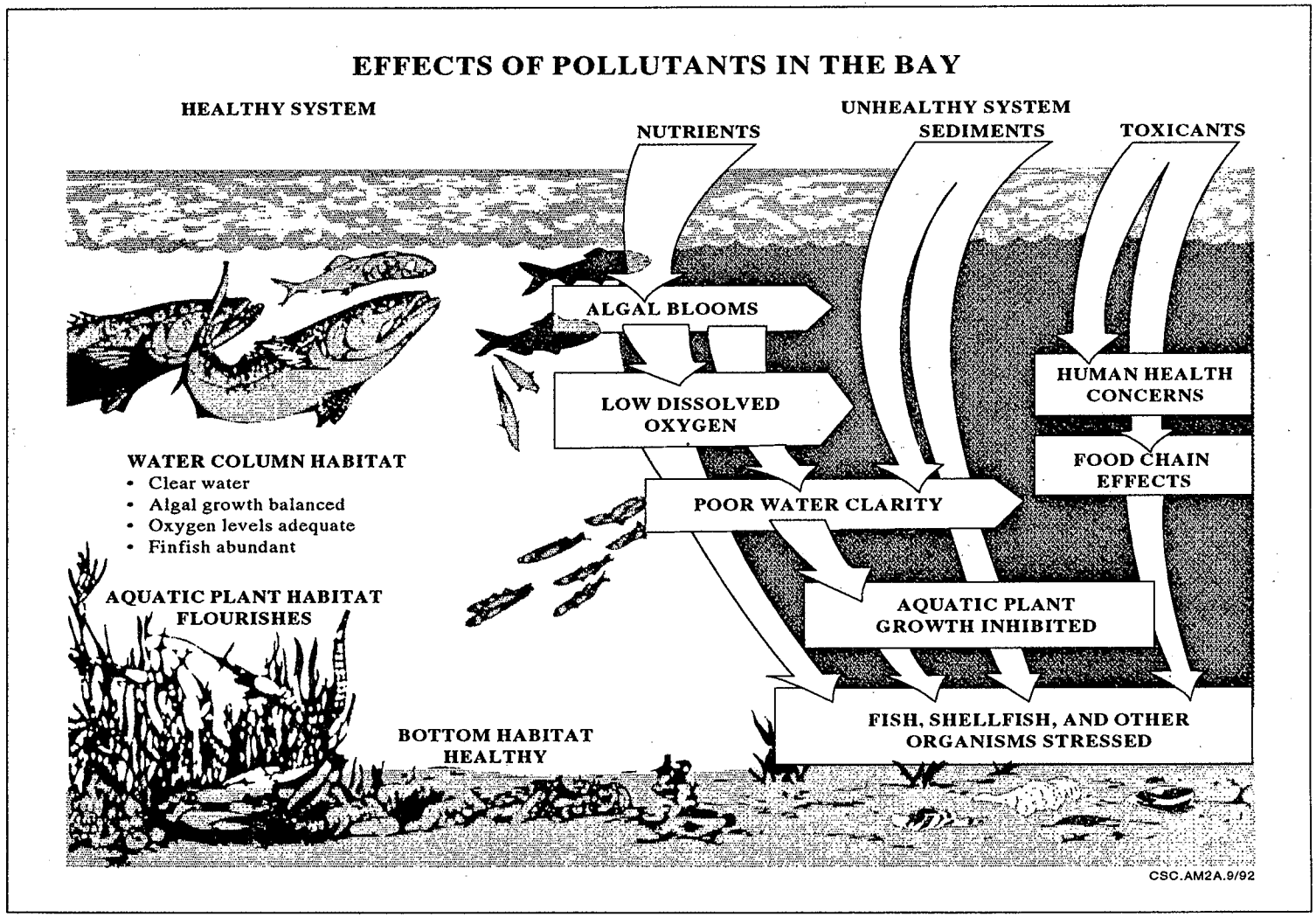
Problems in the Bay

Causes of Decline in the Bay's Health:

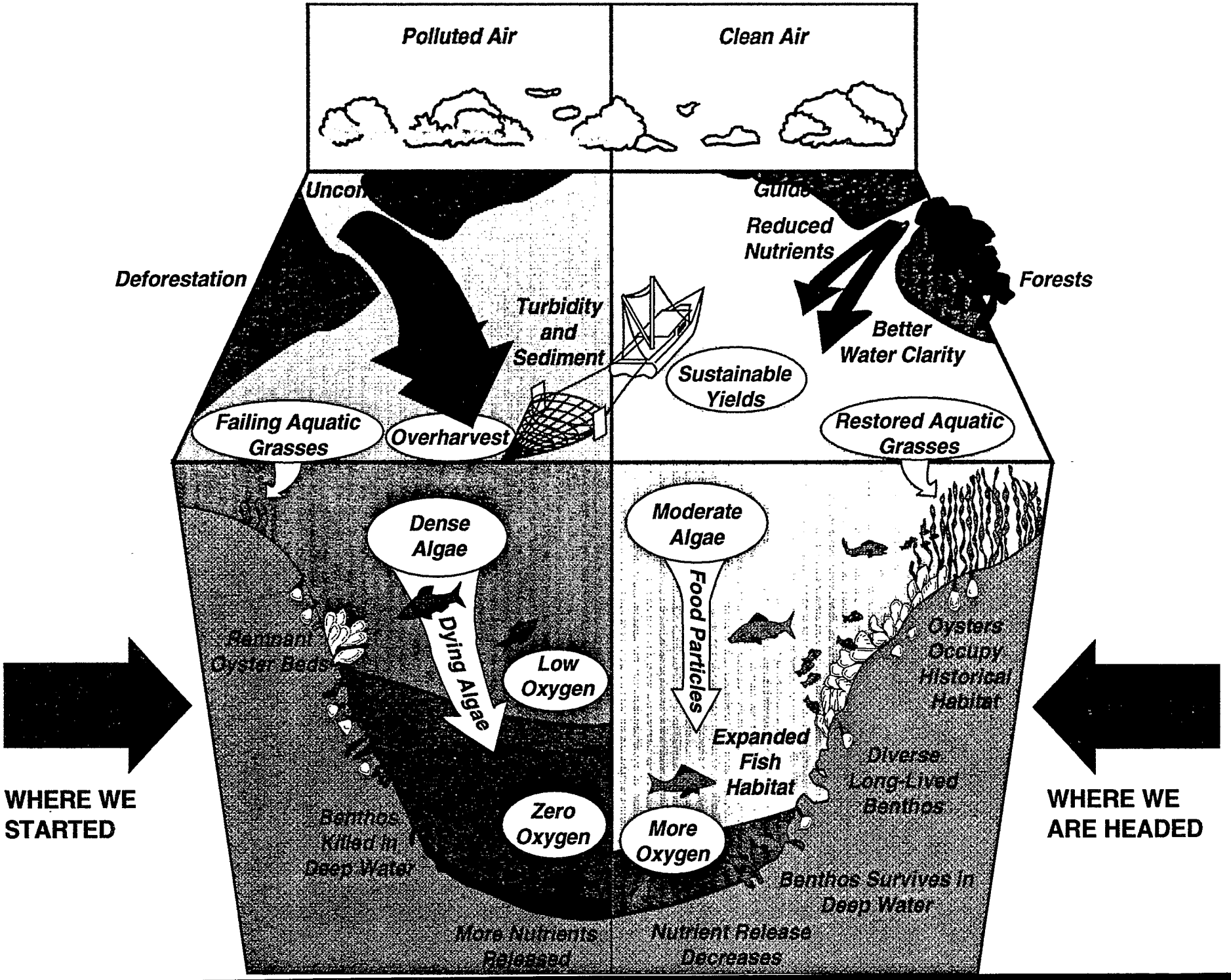
- Air pollution
- Algae Blooms
- Deforestation
- Disease
- Excessive Nutrients
- Lack of Public Education and Involvement
- Loss of SAV
- Overharvesting
- Poor Use of Water Resources
- Toxics
- Uncontrolled development



Effects of Pollutants on the Bay



Source: original artwork provided by Maryland Department of the Environment; recreated by CBPO for Progress Report of the Baywide Nutrient Reduction Reevaluation.


Polluted Air
Clean Air
Deforestation
Turbidity and Sediment
Reduced Nutrients
Forests
Better Water Clarity
Sustainable Yields
Failing Aquatic Grasses
Overharvest
Restored Aquatic Grasses
Dense Algae
Dying Algae
Remnant Oyster Beds
Low Oxygen
Zero Oxygen
Benthos Killed in Deep Water
More Nutrients Released
Moderate Algae
Food Particles
Oysters Occupy Historical Habitat
Expanded Fish Habitat
Diverse Long-Lived Benthos
More Oxygen
Benthos Survives in Deep Water
Nutrient Release Decreases
WHERE WE STARTED
WHERE WE ARE HEADED

Chesapeake Bay Program Approach Overview

- **Extensive monitoring program since 1984, including:**
  - Water quality
  - Air deposition
  - Living resources
  - Land use

- **Data collected are used to:**
  - Assess environmental conditions and trends
  - Develop environmental indicators

- **Environmental Indicators are:**
  - Key measures of progress
  - Facts to support goal-setting and program management
  - Targets and endpoints for the restoration effort

Distinctive Aspects of the Chesapeake Bay Program Approach

- **The focus is on three restoration objectives:**
  - Reduction of nutrient enrichment effects (TRACK 1)
  - Protection and enhancement of living resources (TRACK 2)
  - Reduction of adverse toxics impacts (TRACK 3)
  - Indicators with multiple impacts are included as cross-cutting (TRACK 4)
- **Progress can be measured, gauging the effectiveness of program activities**
- **Regular progress reports are distributed to the public**

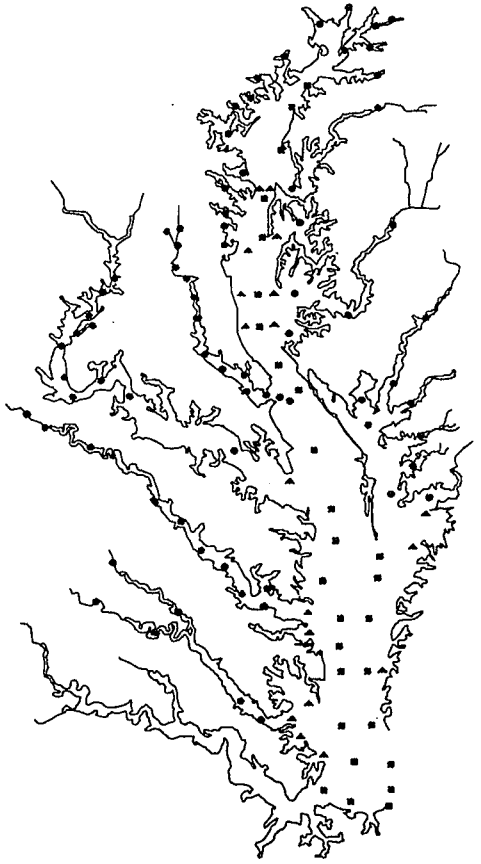
Water Quality Monitoring Program Highlights

➤ Objectives:

- Characterize existing conditions
- Detect changes or trends in water quality
- Understand processes and linkages between water quality and living resources

➤ Applications:

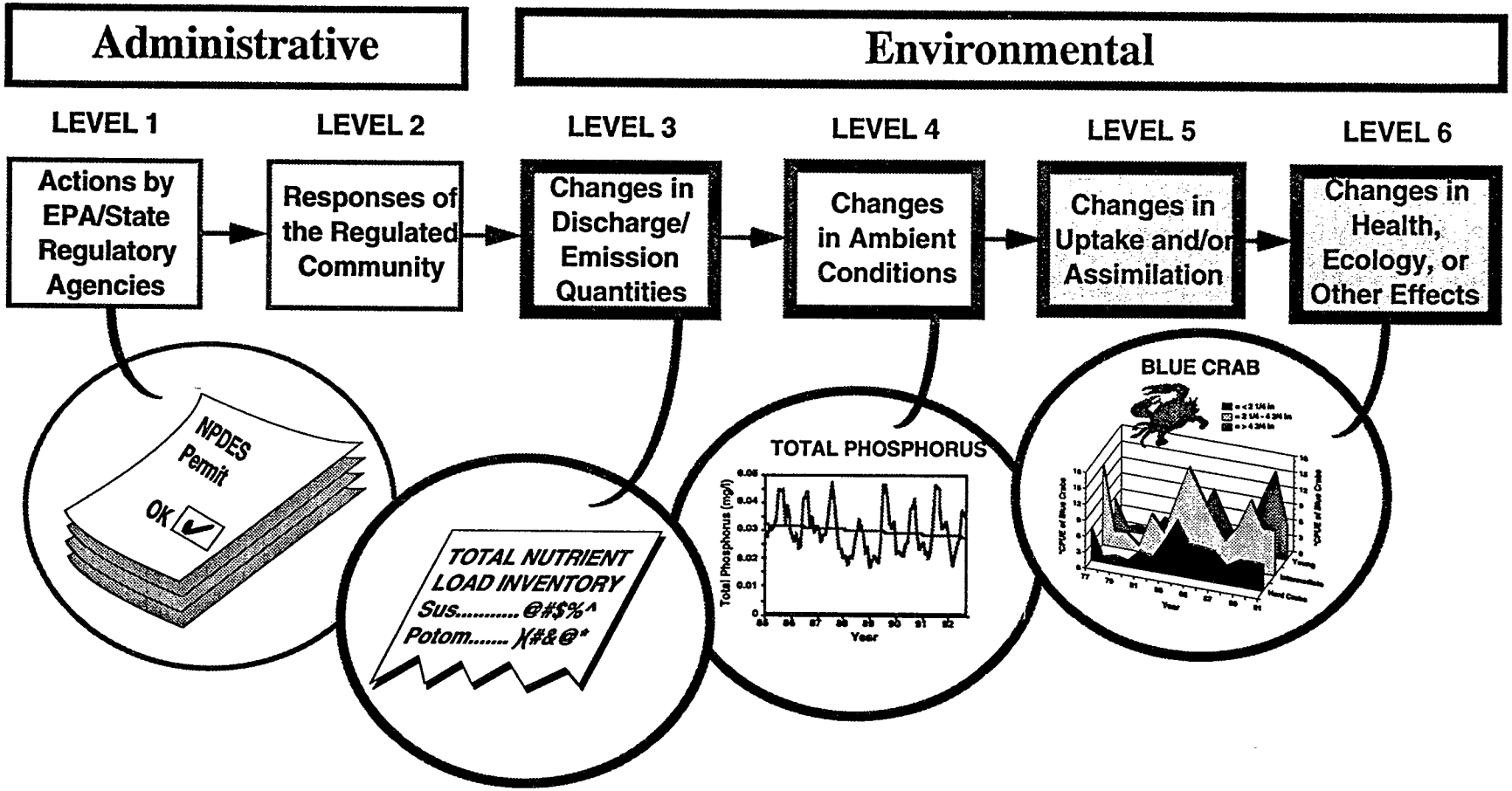
- Evaluate water quality management programs
- Calibrate and verify water quality models
- Characterize SAV habitat requirements
- Support development of living resource habitat goals
- Establish a baseline for environmental assessments
- Stimulate research projects on hypoxia, phytoplankton, and fish recruitment



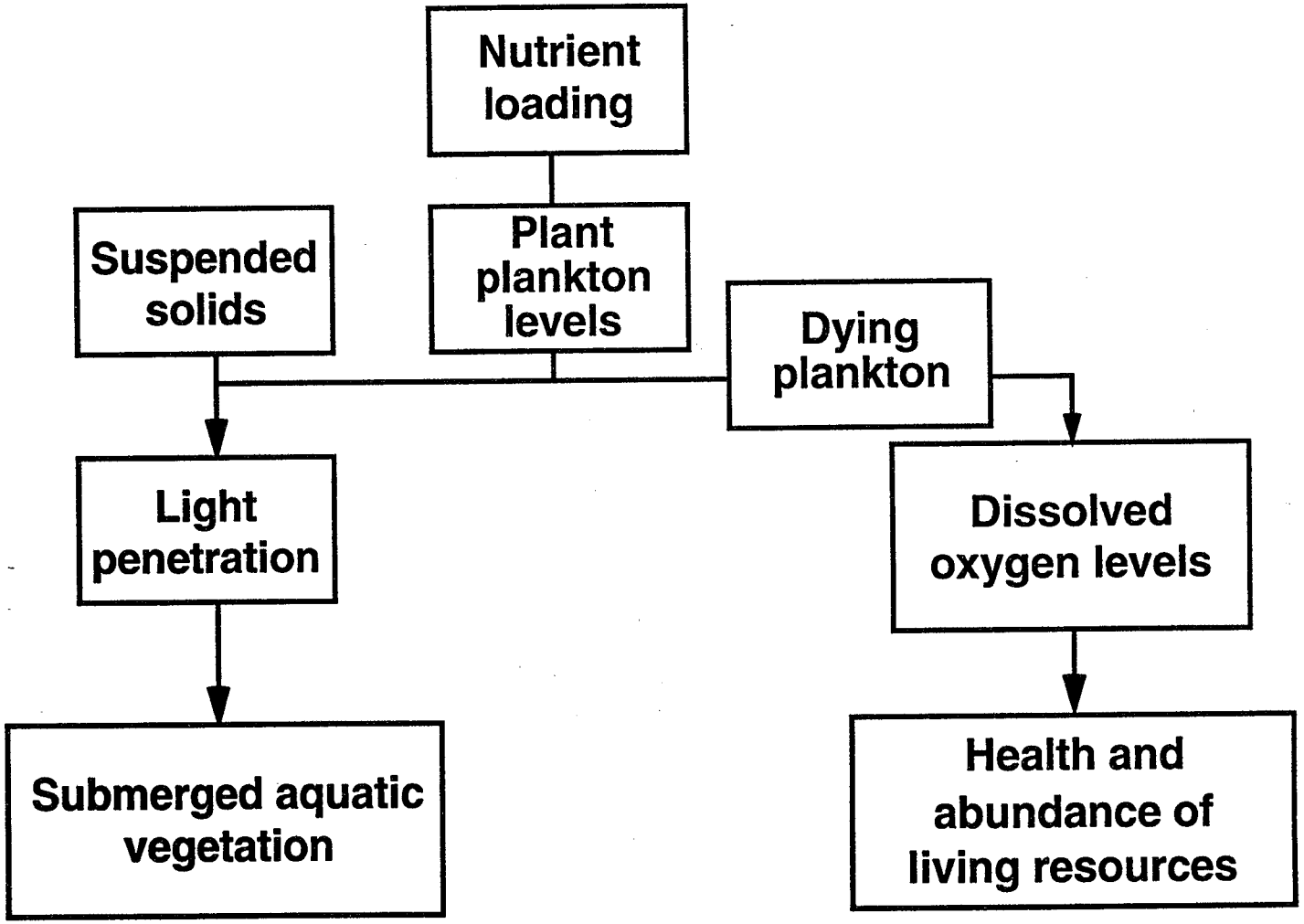
Chesapeake Bay Monitoring Stations

Hierarchy of Indicators

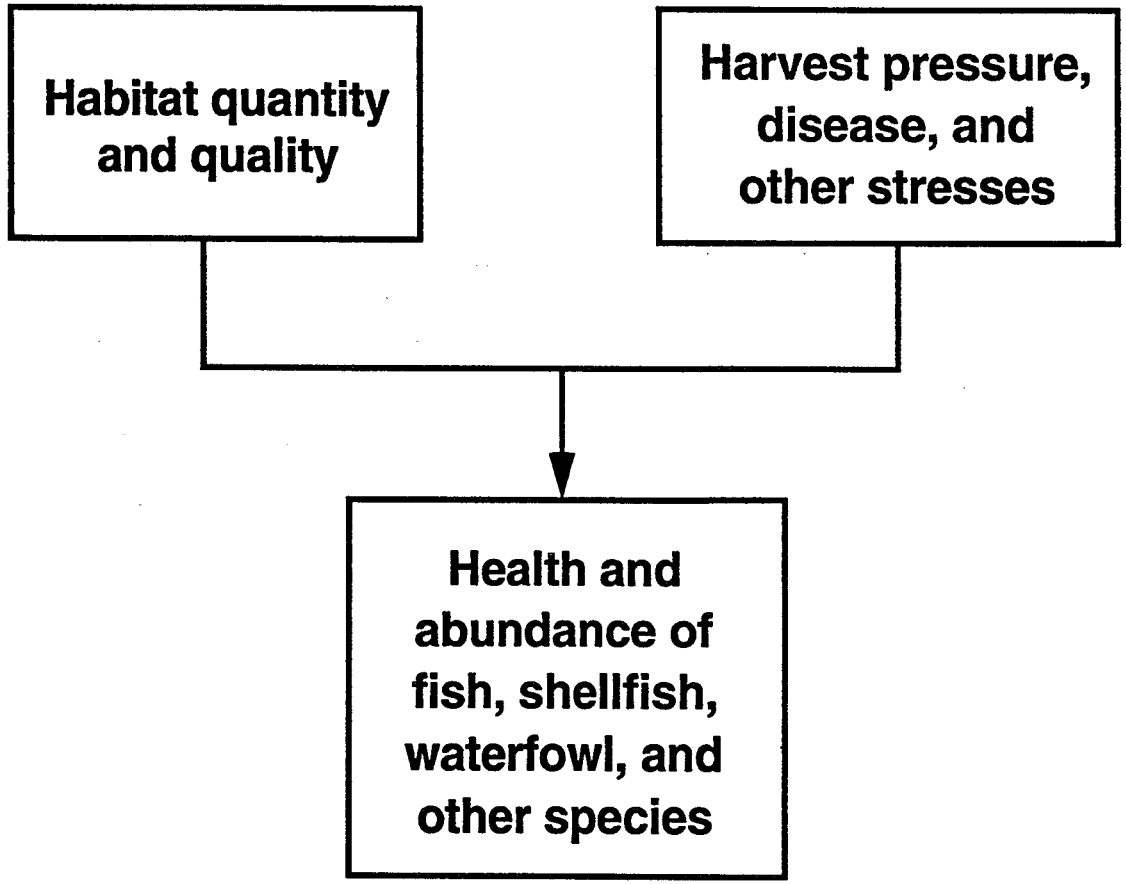
This is how we measure environmental change



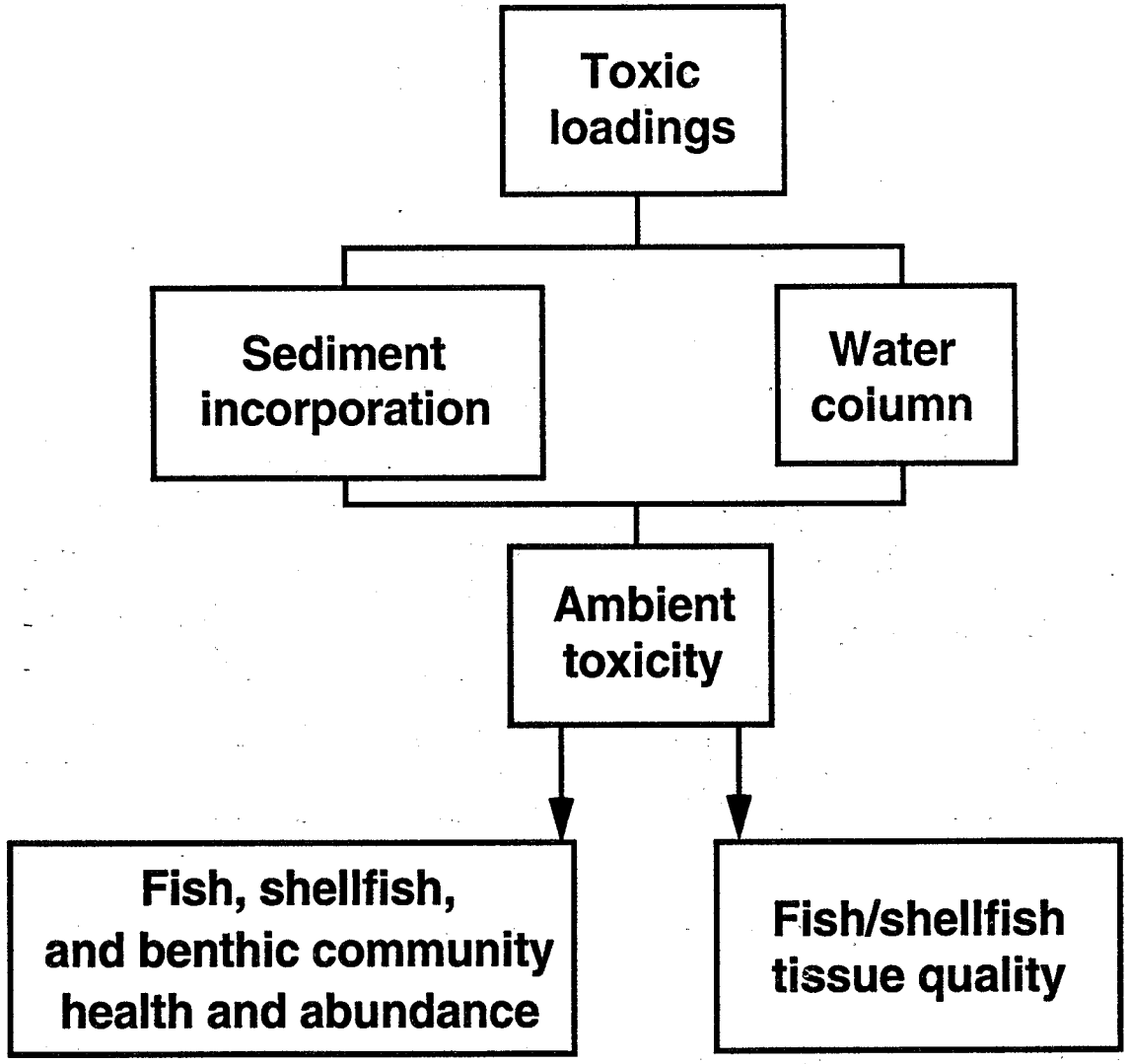
Track 1: Nutrient Enrichment Indicators



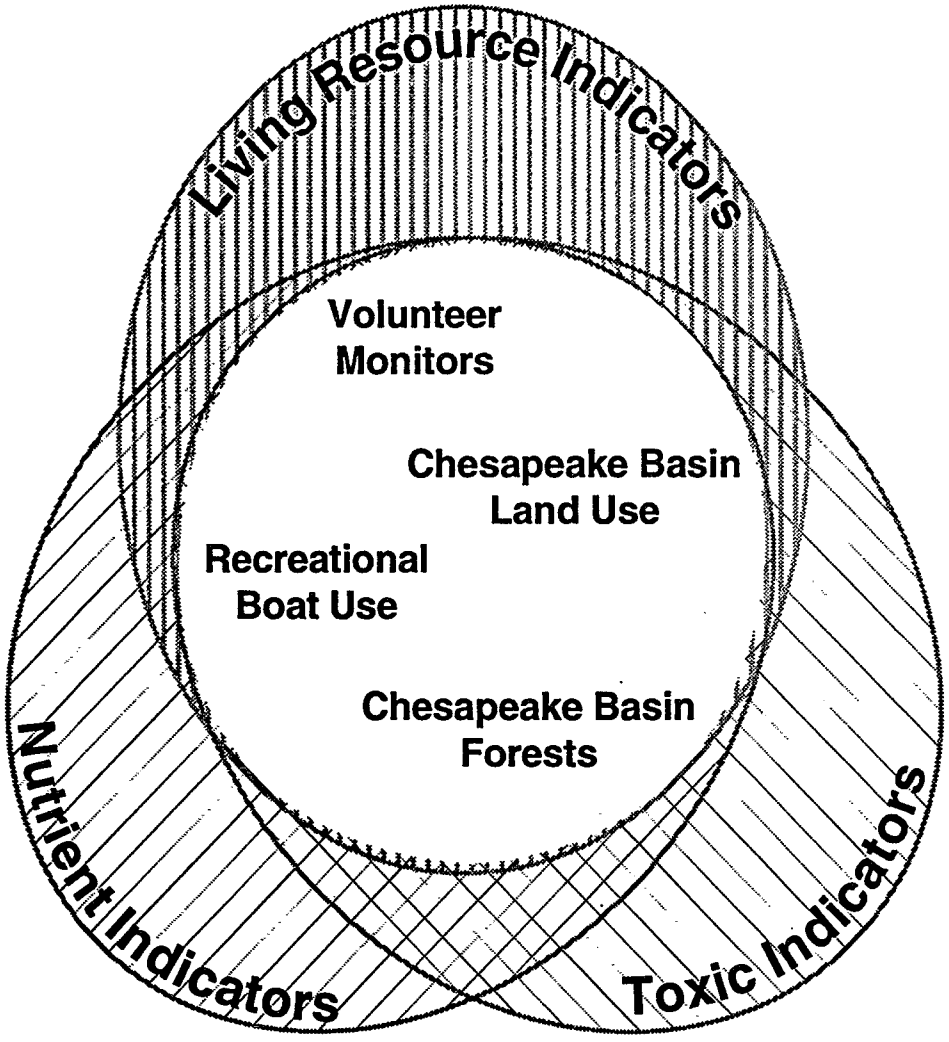
Track 2: Living Resource Indicators



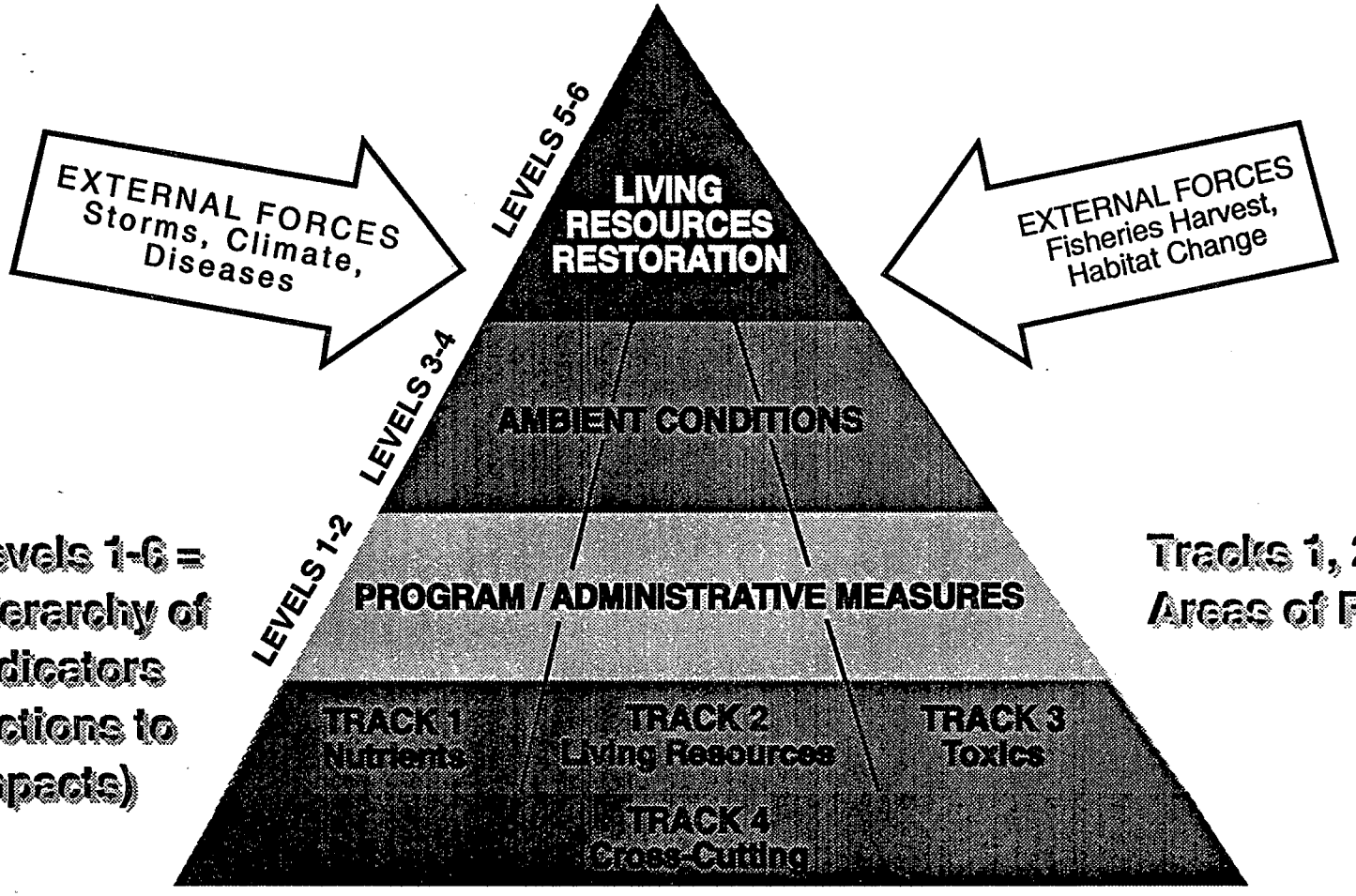
Track 3: Toxic Indicators



Track 4: Cross-Cutting Indicators



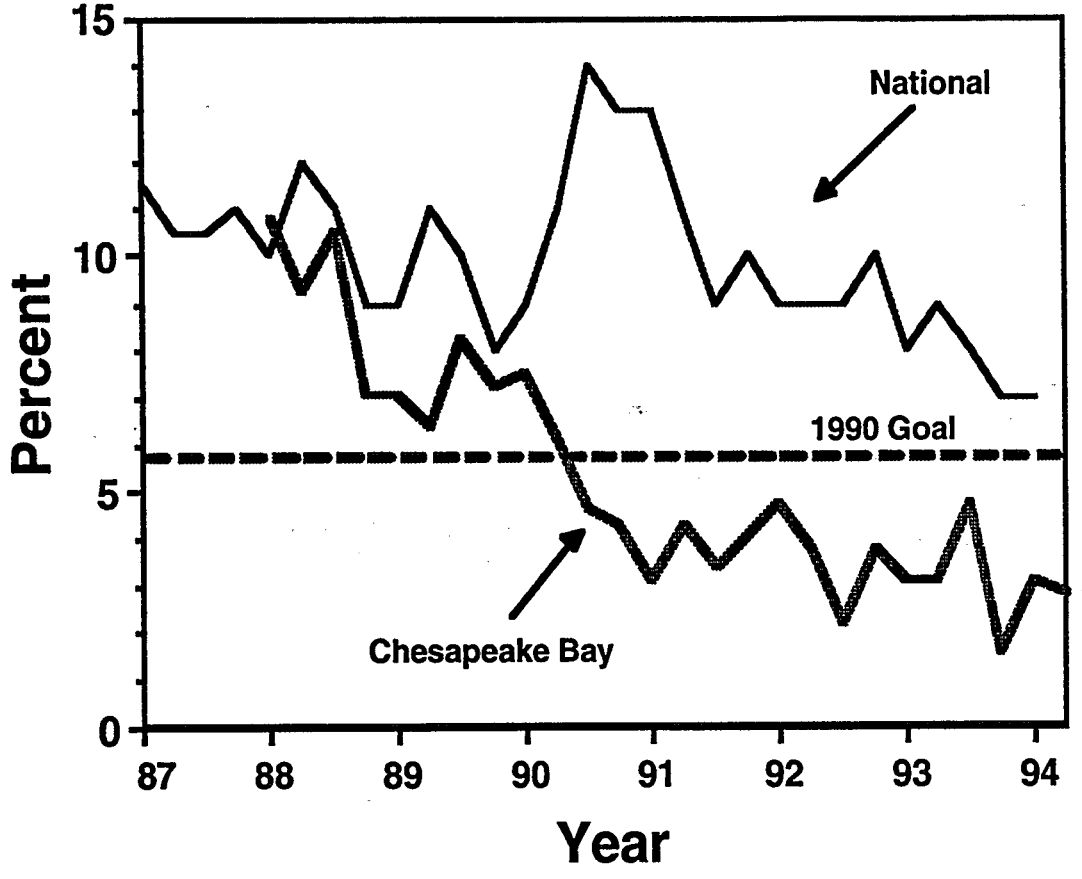
How the Hierarchy and Tracks Work Together



Levels 1-6 = Hierarchy of Indicators (actions to impacts)

Tracks 1, 2, & 3 = Areas of Focus

Dischargers in Significant Noncompliance (SNC)



Data points reflect March numbers.
Source: #2 Chesapeake Bay Quarterly Noncompliance Report
U.S. EPA, Water Management Division Region III.

GOAL: Halve the 1987 number of dischargers in SNC by the end of 1990.

STATUS: Goal has been achieved and maintained.

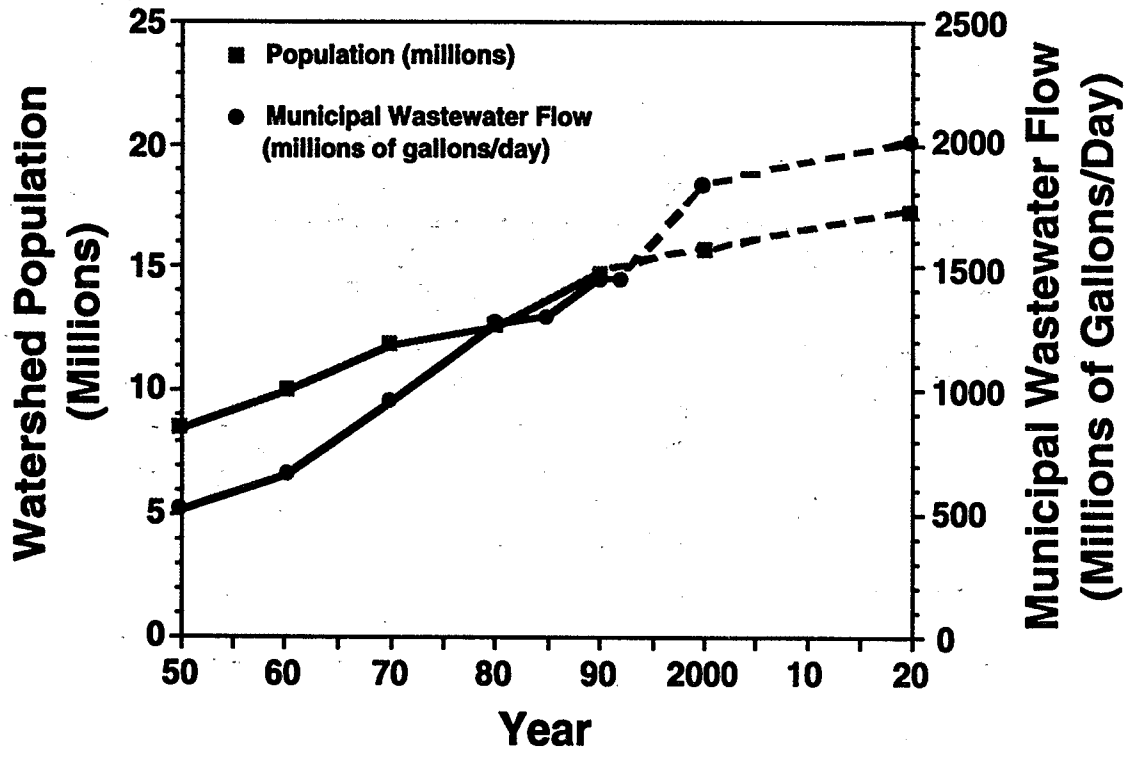
Bay SNC rates are well below the national average.

As of September 1993, only 9 of 319 Chesapeake Bay area facilities were in SNC.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Population and Municipal Wastewater Flow



Source: Chesapeake Bay Program Office.

GOAL: Concentrate development in suitable areas and protect sensitive areas.

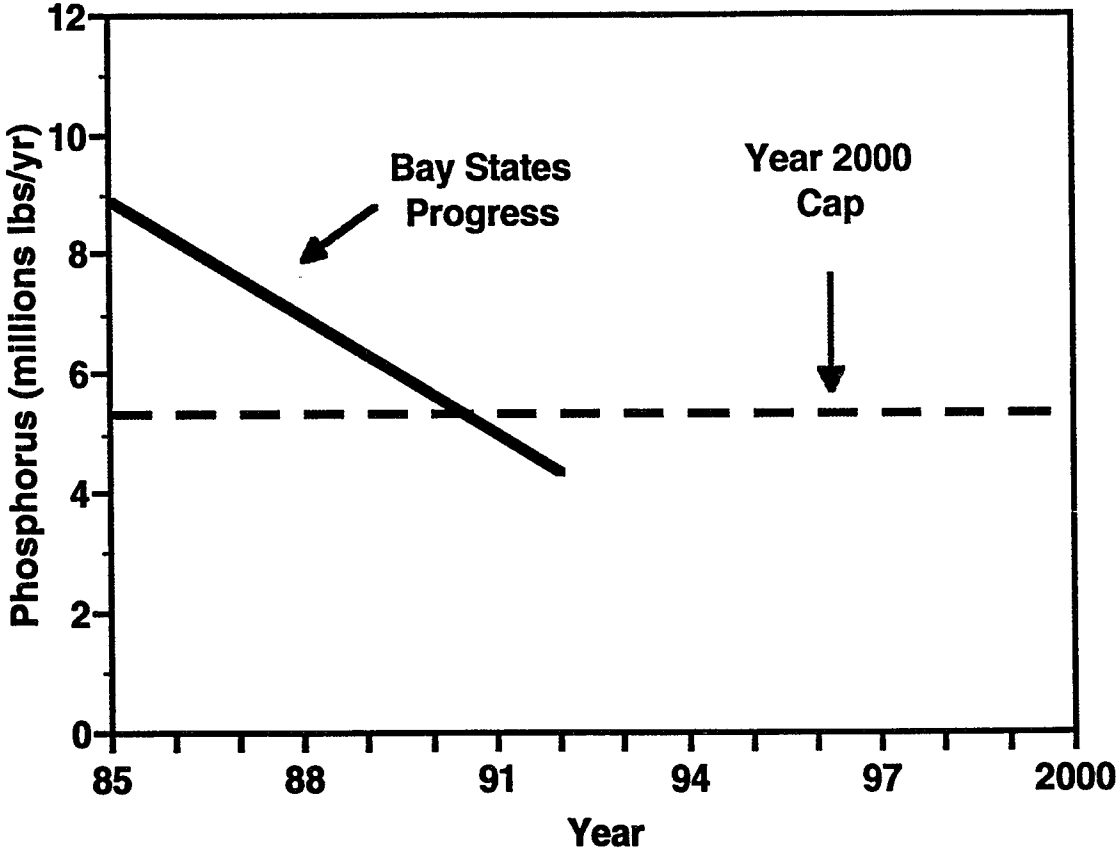
STATUS: Increases in population directly affect the volume of municipal wastewater requiring treatment.

Year 2000 Projections: The volume of municipal wastewater discharged to Bay waters is projected to increase 27% from 1990 levels.

HIERARCHY LEVEL:

1 → 2 → ■ → 4 → 5 → 6

Point Source Phosphorus Loadings



Data includes Chesapeake Bay Agreement States only.
Source: CBP Phase II Watershed Model

GOAL: 40% reduction in the 1985 delivered loads by the year 2000.

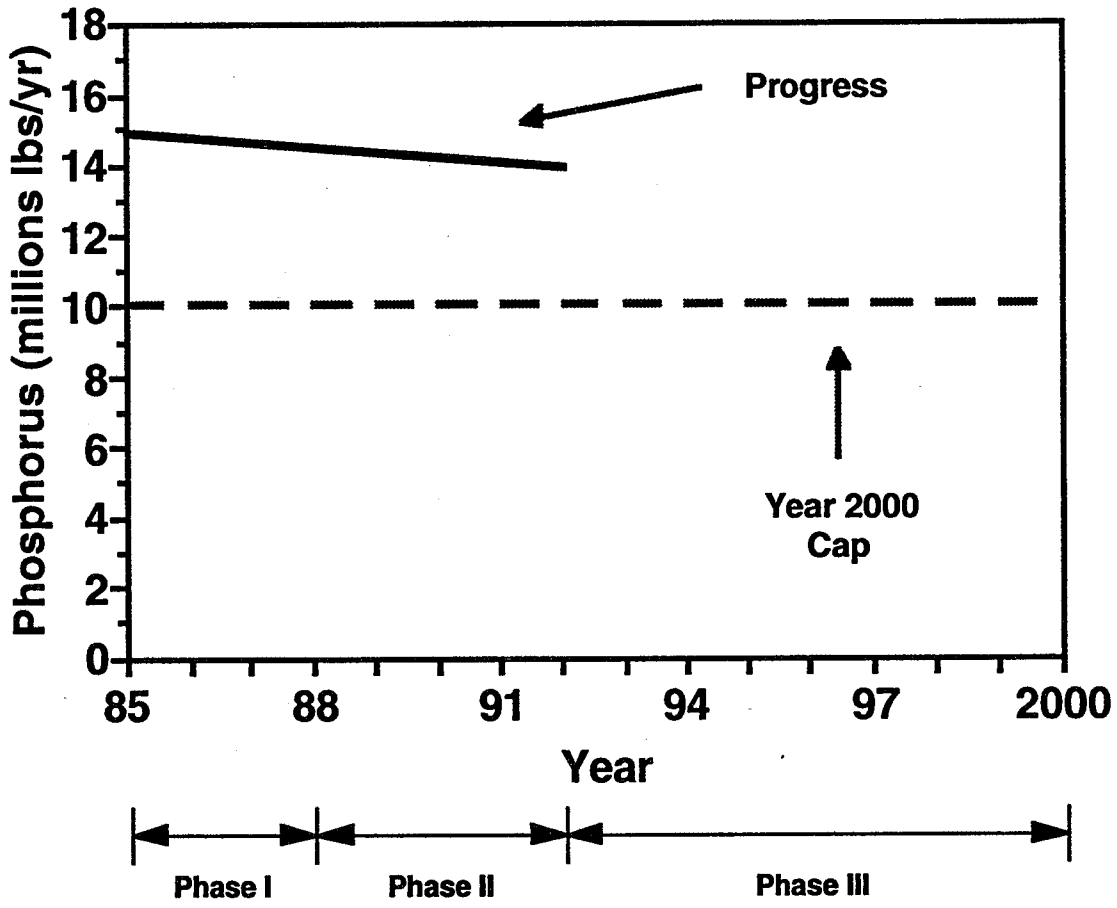
STATUS: Controllable point source phosphorus discharges, delivered to the Bay, have been reduced by over 40%.

More controls will be necessary to hold this level as the population and wastewater flows in the Bay's basin increase.

HIERARCHY LEVEL:

1 → 2 → ■ → 4 → 5 → 6

Nonpoint Source Phosphorus Loadings



Data includes Chesapeake Bay Agreement States only.
Source: CBP Phase II Watershed Model

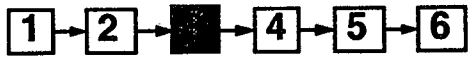
GOAL: 40% reduction by the year 2000.

STATUS: Over 700,000 acres with nutrient management plans (as of 1993).

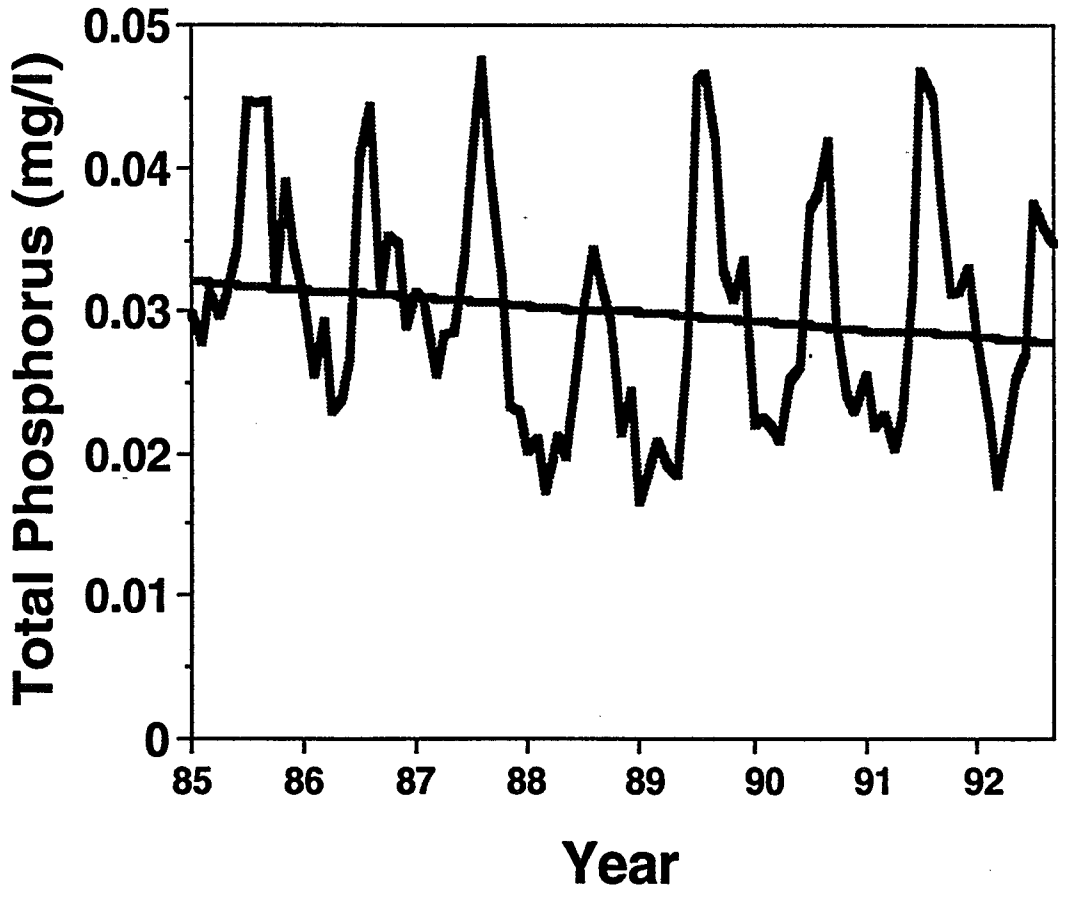
Over 1,700 animal waste storage systems (as of 1991).

Over 17,000 Best Management Practices (BMPs) in place.

HIERARCHY LEVEL:



Phosphorus Concentrations in the Bay



Source: Trends in Phosphorus, Nitrogen, Secchi Depth, and Dissolved Oxygen in the Chesapeake Bay, 1984-1992.

GOAL: To detect trends and measure the impact of load reduction on water quality.

STATUS: Bay phosphorus concentrations down 16% from 1985 to 1992.

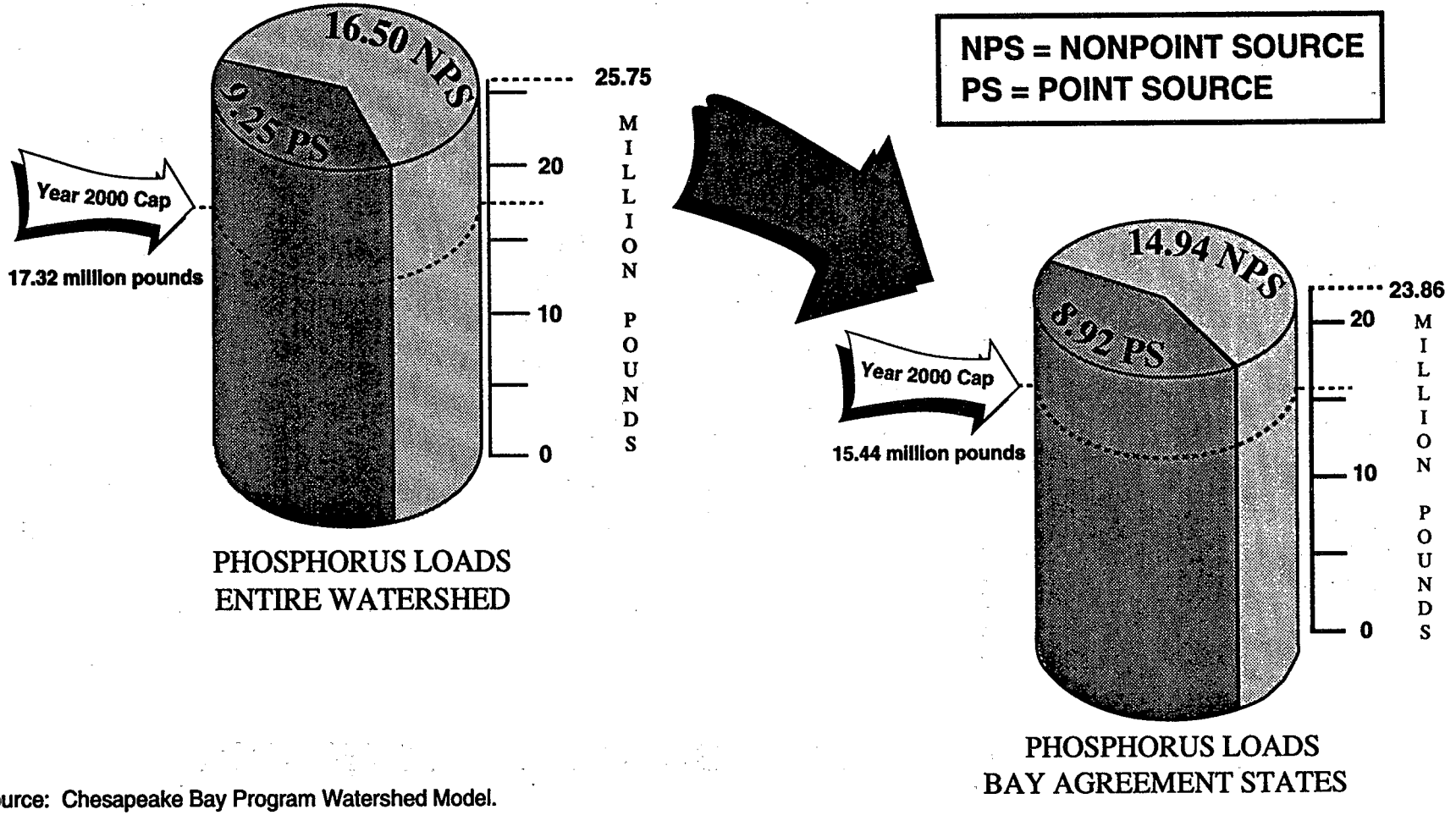
Reductions are due to:

- Phosphate detergent ban,
- Improved municipal treatment, and
- Soil erosion controls and nutrient management.

HIERARCHY LEVEL:

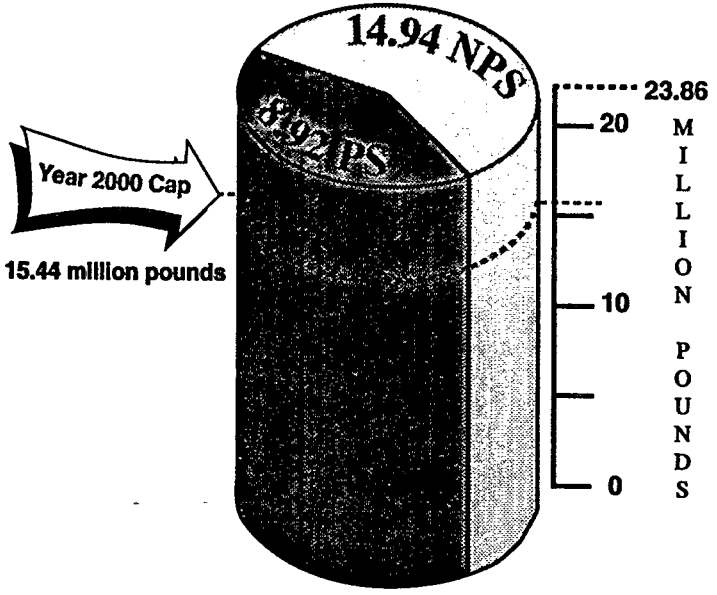
1 → 2 → 3 → ■ → 5 → 6

Annual Phosphorus Load



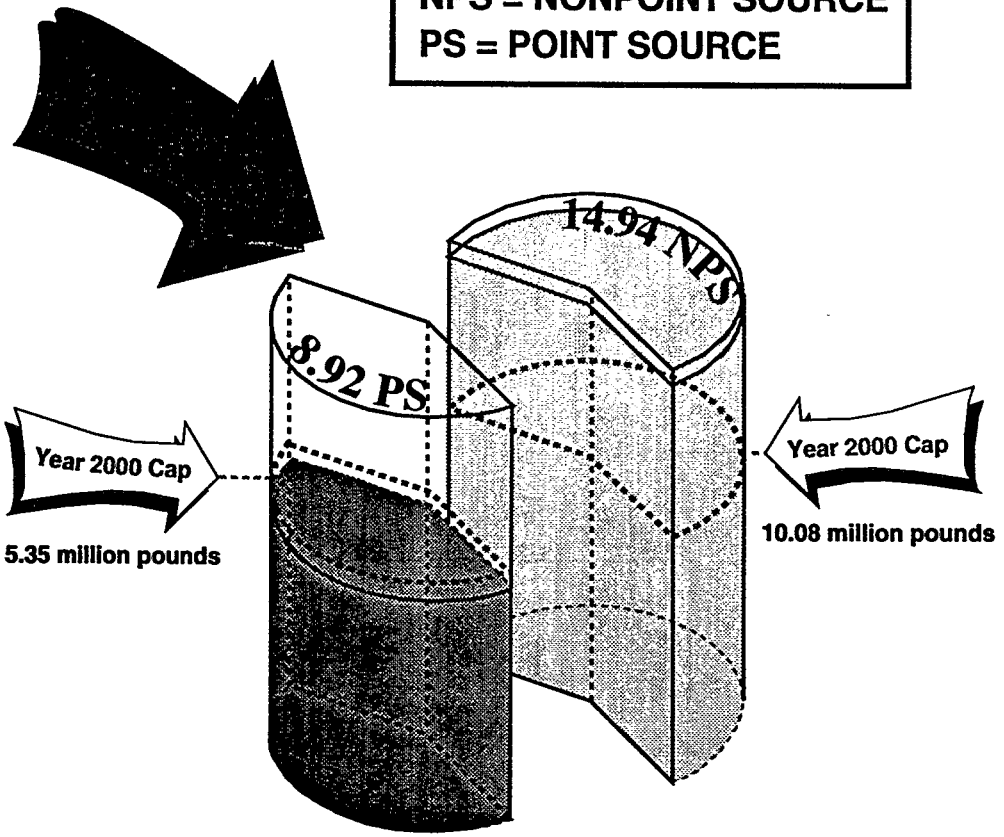
Source: Chesapeake Bay Program Watershed Model.

Annual Phosphorus Load



PHOSPHORUS LOADS
BAY AGREEMENT STATES

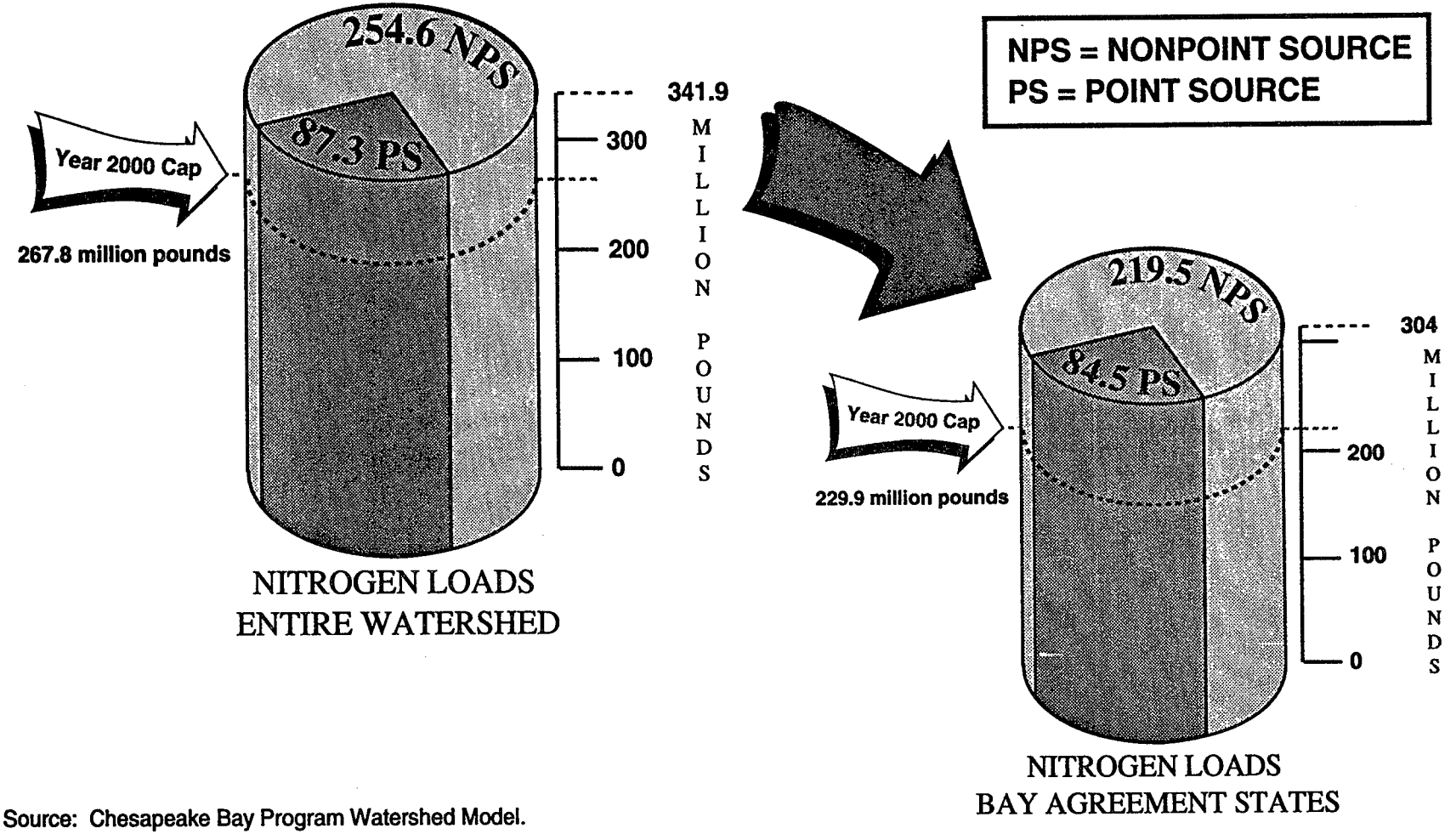
NPS = NONPOINT SOURCE
PS = POINT SOURCE



PHOSPHORUS
1992 PROGRESS

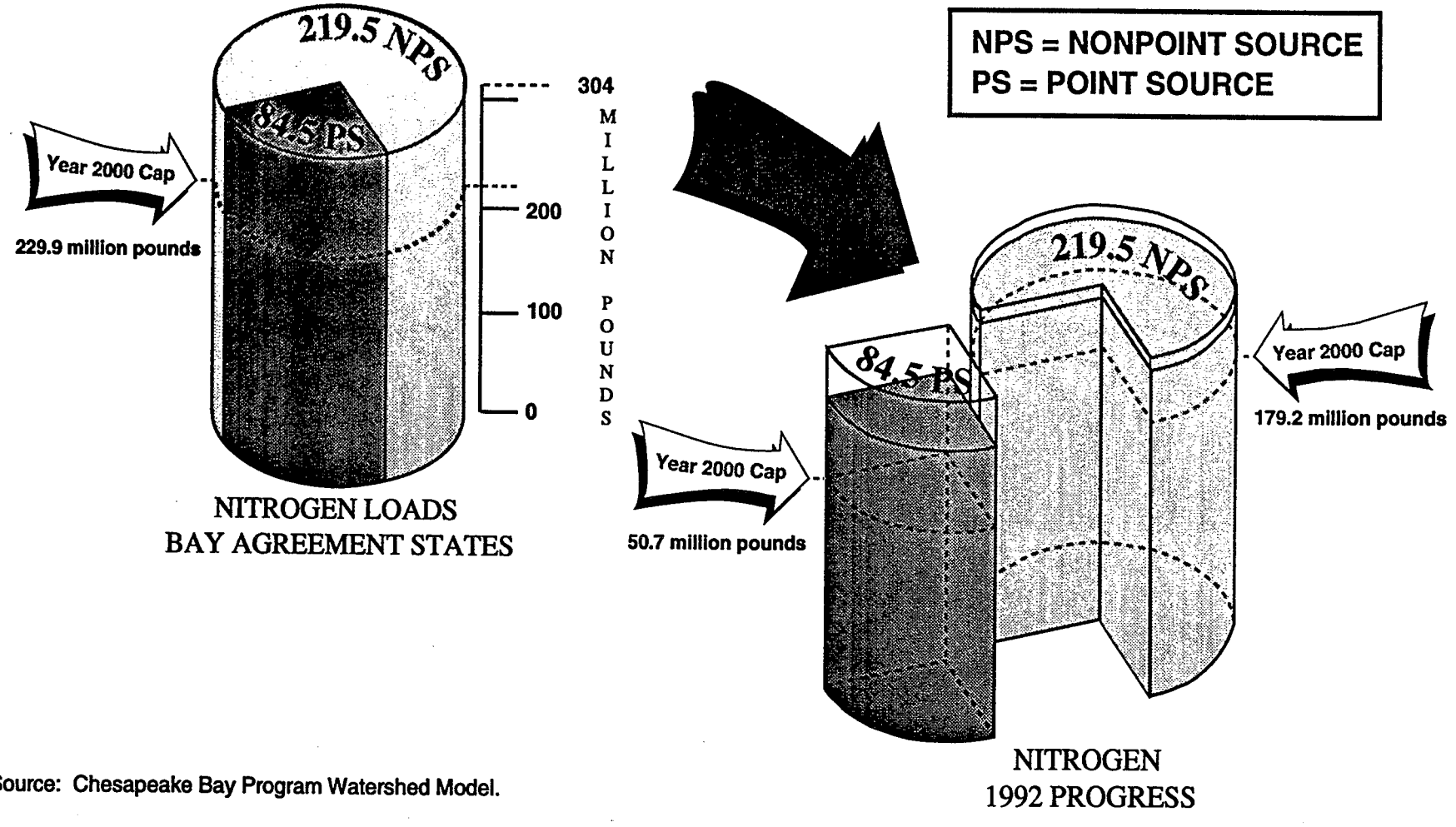
Source: Chesapeake Bay Program Watershed Model.

Annual Nitrogen Load



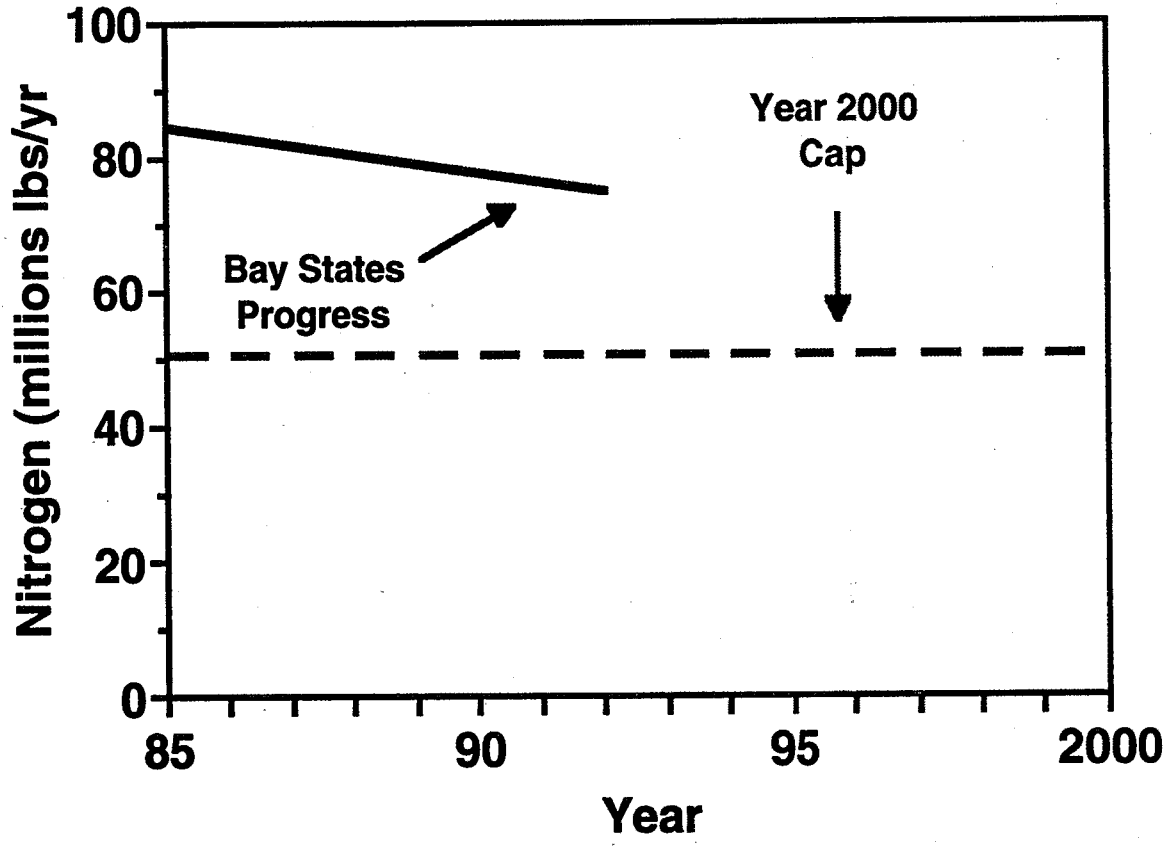
Source: Chesapeake Bay Program Watershed Model.

Annual Nitrogen Load



Source: Chesapeake Bay Program Watershed Model.

Point Source Nitrogen Loadings



Data includes Chesapeake Bay Agreement States only.

Source: CBP Phase II Watershed Model

GOAL: 40% reduction in the 1985 delivered loads by the year 2000.

STATUS: Nitrogen removal is at an early stage.

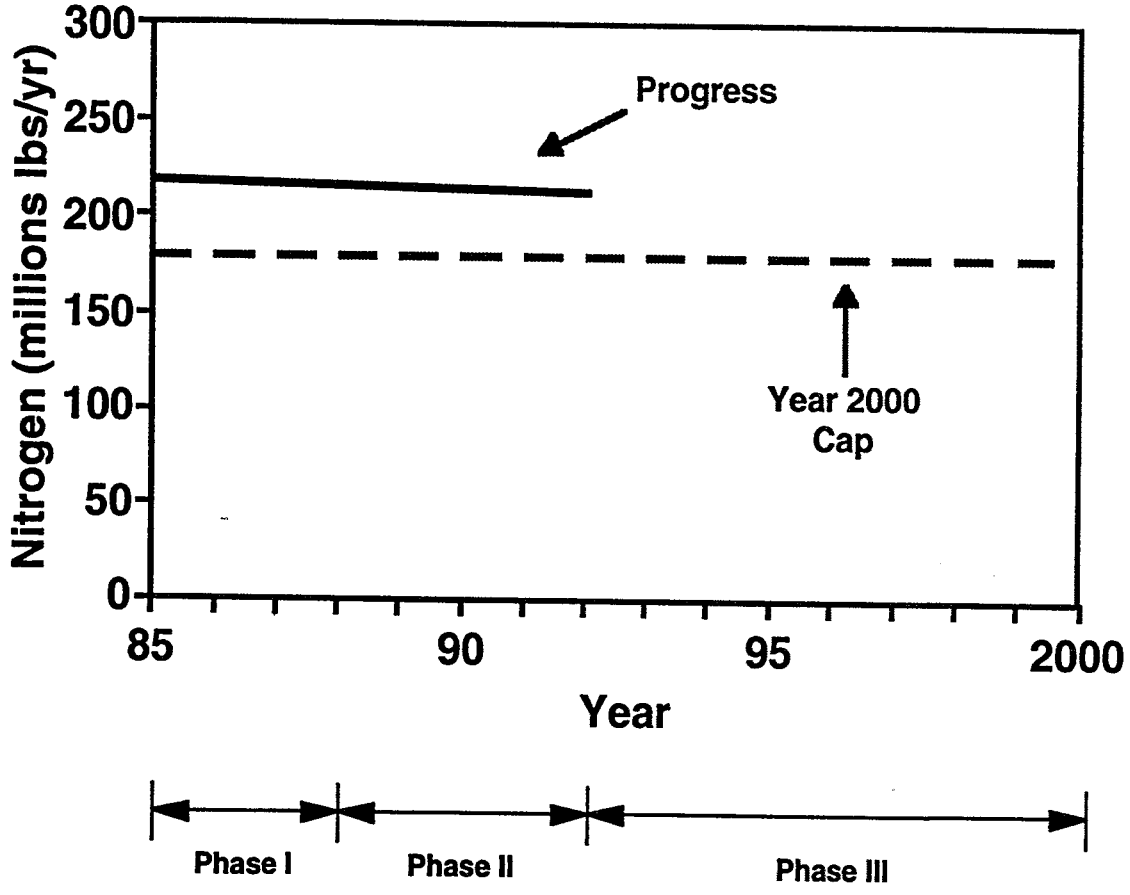
Several large industries have made reductions.

Since the 1987 Agreement, 8 municipalities have begun nitrogen removal and many more have upgrades planned.

HIERARCHY LEVEL:

1 → 2 → ■ → 4 → 5 → 6

Nonpoint Source Nitrogen Loadings



Data includes Chesapeake Bay Agreement States only.
Source: CBP Phase II Watershed Model

GOAL: 40% reduction by the year 2000.

STATUS: Over 700,000 acres with nutrient management plans (as of 1993).

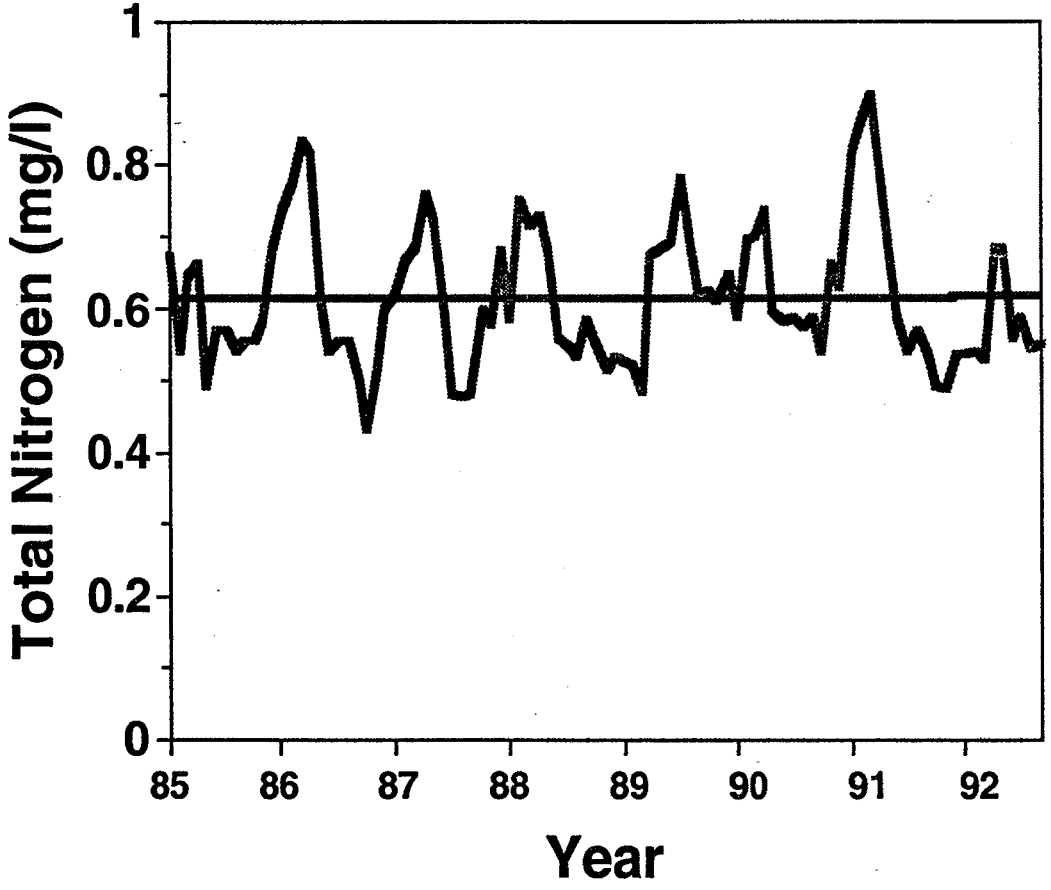
Over 1,700 animal waste storage systems (as of 1991).

Over 17,000 Best Management Practices (BMPs) in place.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Nitrogen Concentrations in the Bay



Source: Trends in Phosphorus, Nitrogen, Secchi Depth, and Dissolved Oxygen in the Chesapeake Bay, 1984-1992.

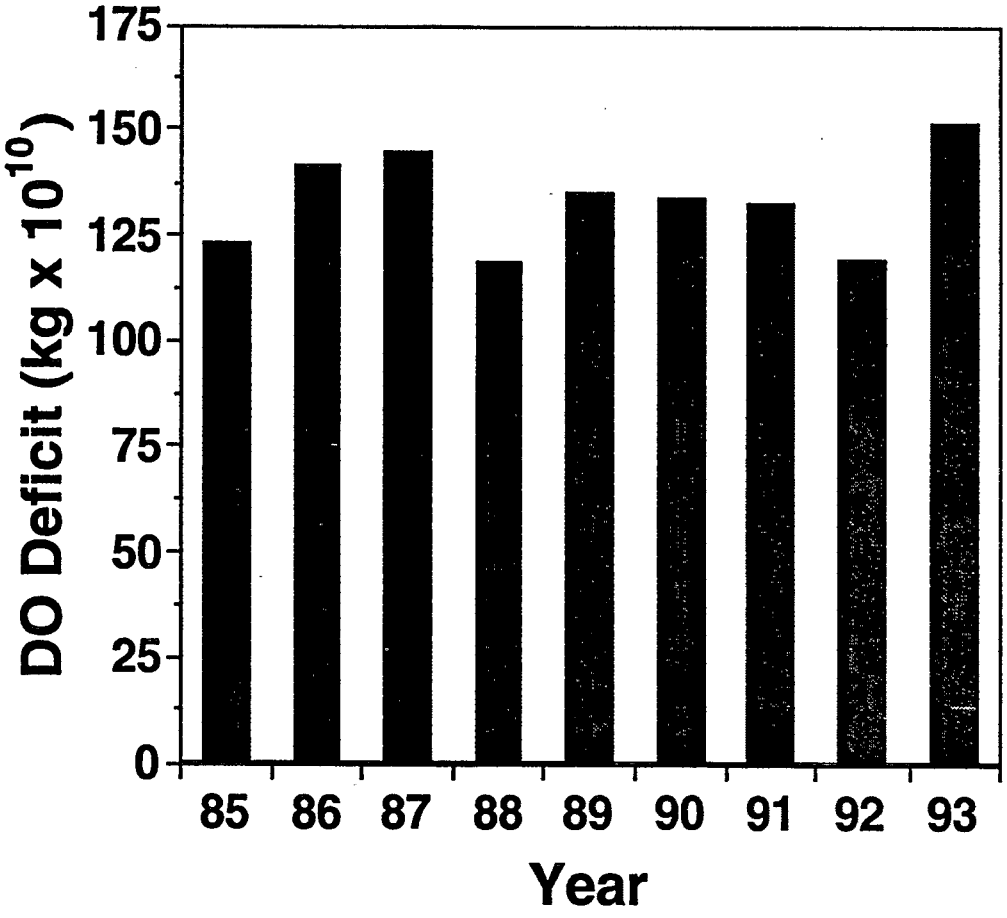
GOAL: To detect trends and to measure the impact of load reduction on water quality.

STATUS: Nitrogen levels have essentially remained unchanged.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Dissolved Oxygen



Source: Chesapeake Bay Program Monitoring Subcommittee

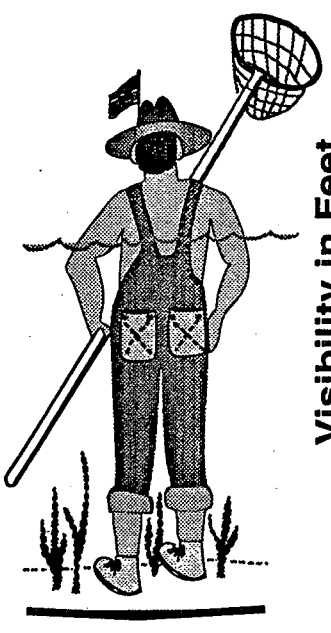
GOAL: Raise dissolved oxygen (DO) to levels that will support the aquatic life of the Bay.

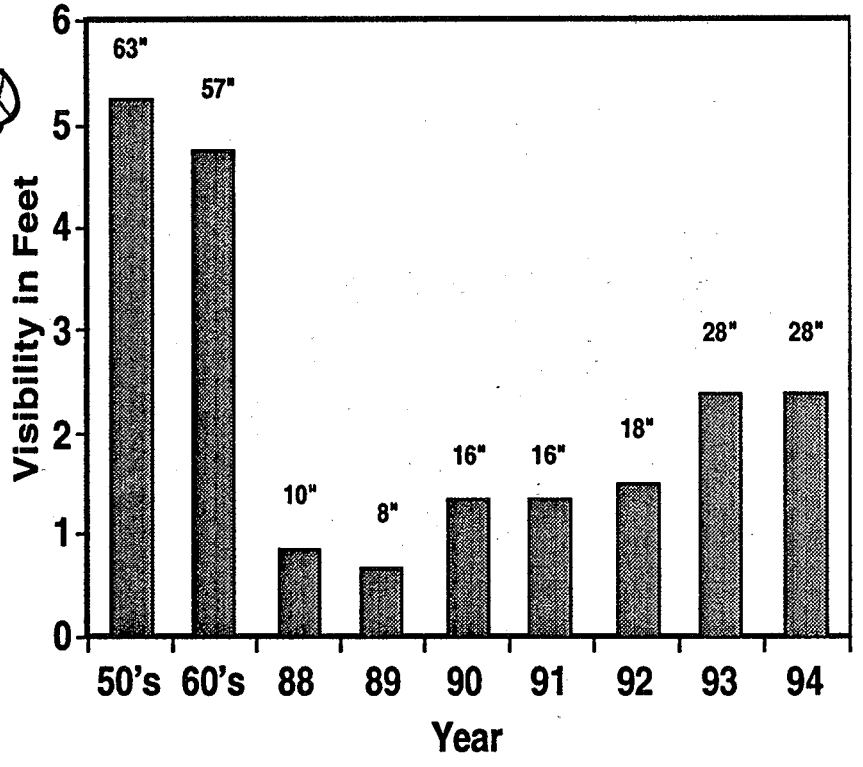
The 3D water quality model predicts that a 40% Nutrient reduction will improve bottom DO 20-25%.

STATUS: DO has not yet responded to management actions.

HIERARCHY LEVEL:

Bernie Fowler's "Sneaker Index"





GOAL: Restore Bernie's sneaker visibility to chest depth (57 to 63 inches).

STATUS: Nutrient-caused plankton blooms, urban and rural sediment runoff block sunlight bay grasses need.

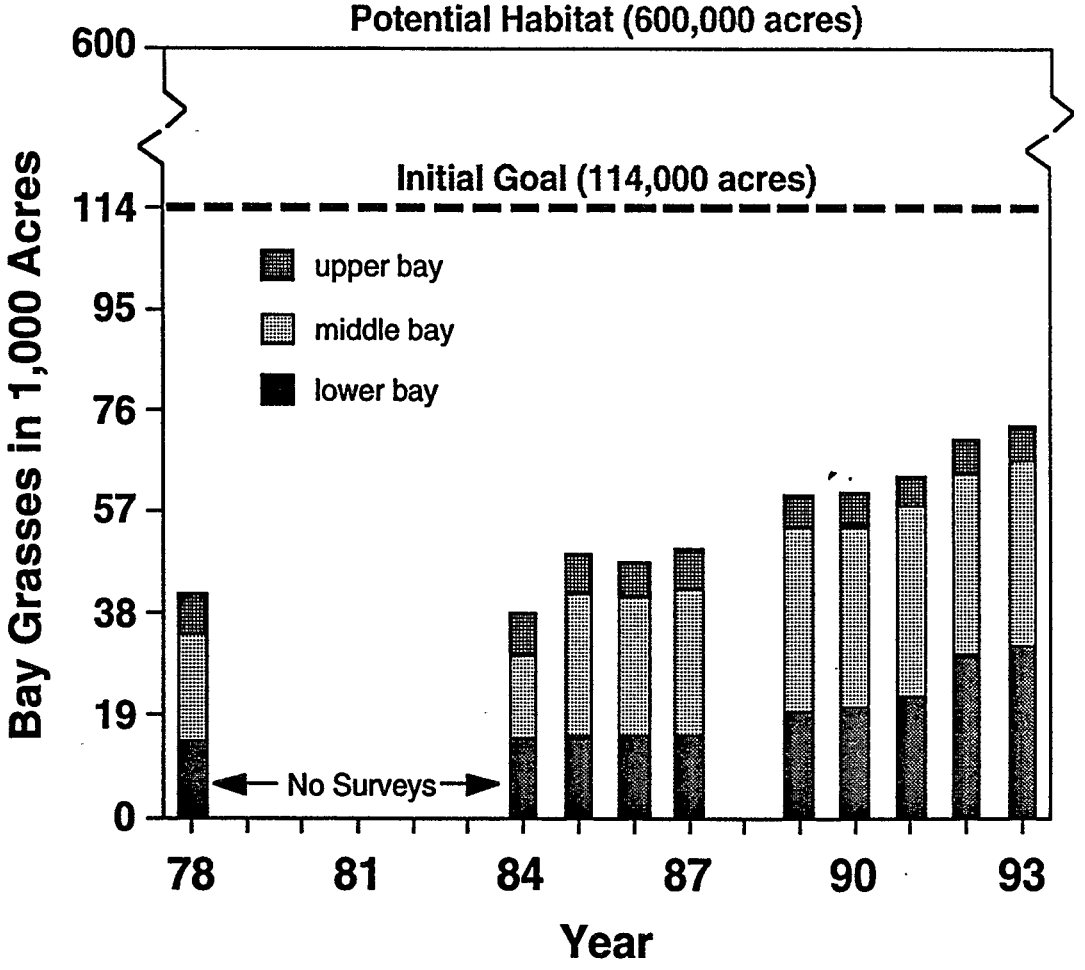
White sneakers have similar visibility to the Secchi disk scientists use to measure water clarity.

HIERARCHY LEVEL:

1 → 2 → 3 → **4** → 5 → 6

Source: Senator C. Bernard Fowler, 1992-1993 Chair of the Chesapeake Bay Commission; Kent Mountford, U.S. EPA Chesapeake Bay Program.

Acres of Bay Grasses



Source: Chesapeake Bay Data Base—Baywide.

GOAL: The initial goal is to restore Bay grasses to all areas where they were observed since 1970.

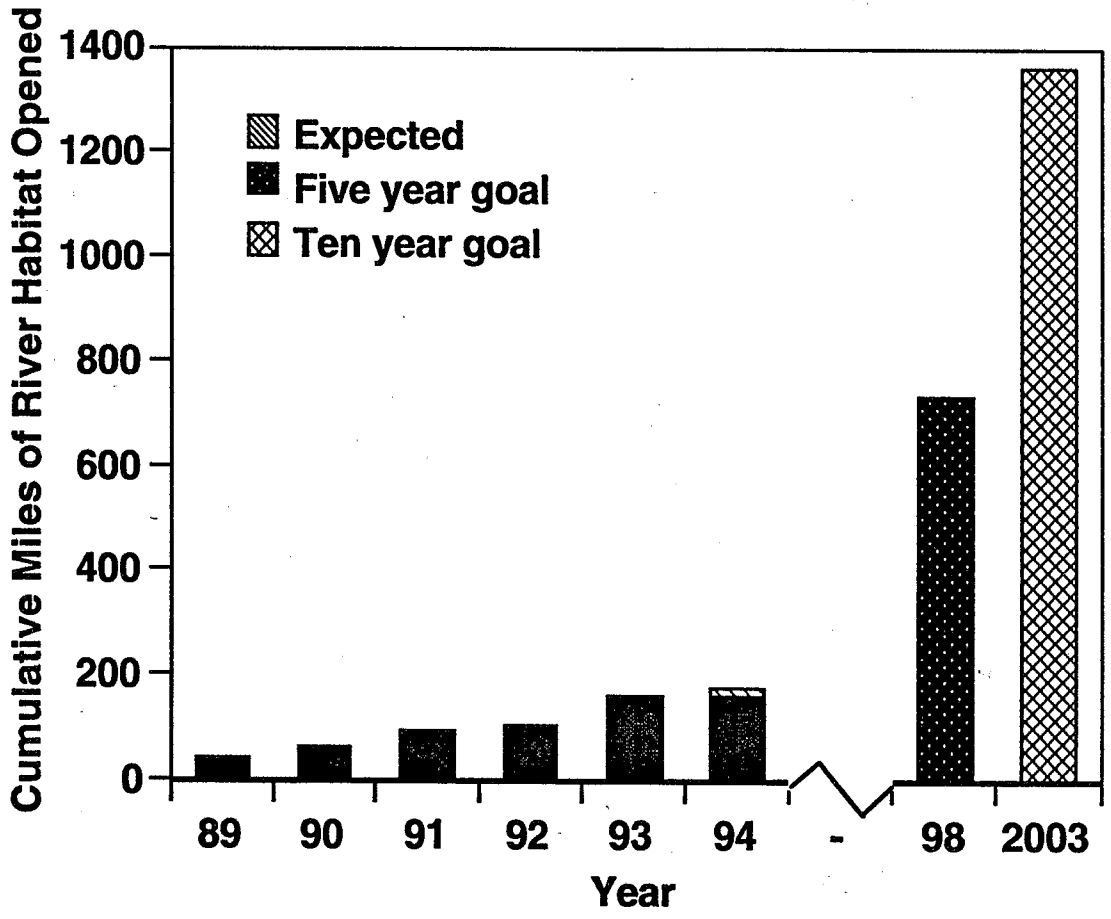
STATUS: Upward trend in the lower and mid-Bay since the mid-1980s.

Continued lack of upward trends in many western shore tributaries.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → ■

Stream Miles Opened for Migratory Fish



Source: Draft Anadromous Fish Habitat Restoration: A Resource Assessment, MD DNR, VGIF.

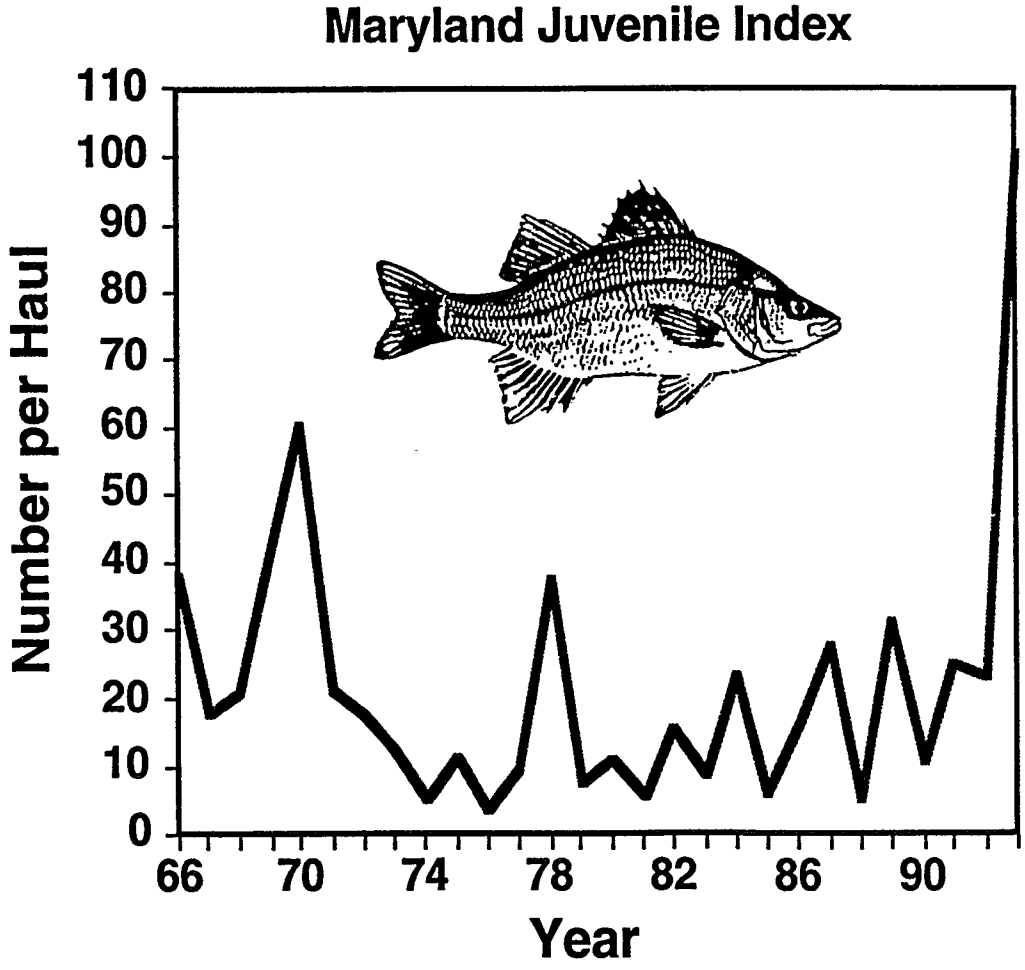
GOAL: To restore access to historical spawning grounds for migratory fish.

STATUS: 159.3 miles made accessible since 1988.

By 1998, 731 miles should be accessible.

HIERARCHY LEVEL:

Trends in Finfish: White Perch



Source: Maryland Chesapeake Bay Estuarine Juvenile Finfish Survey, 1966-1993.

GOAL: Fish population targets are under development.

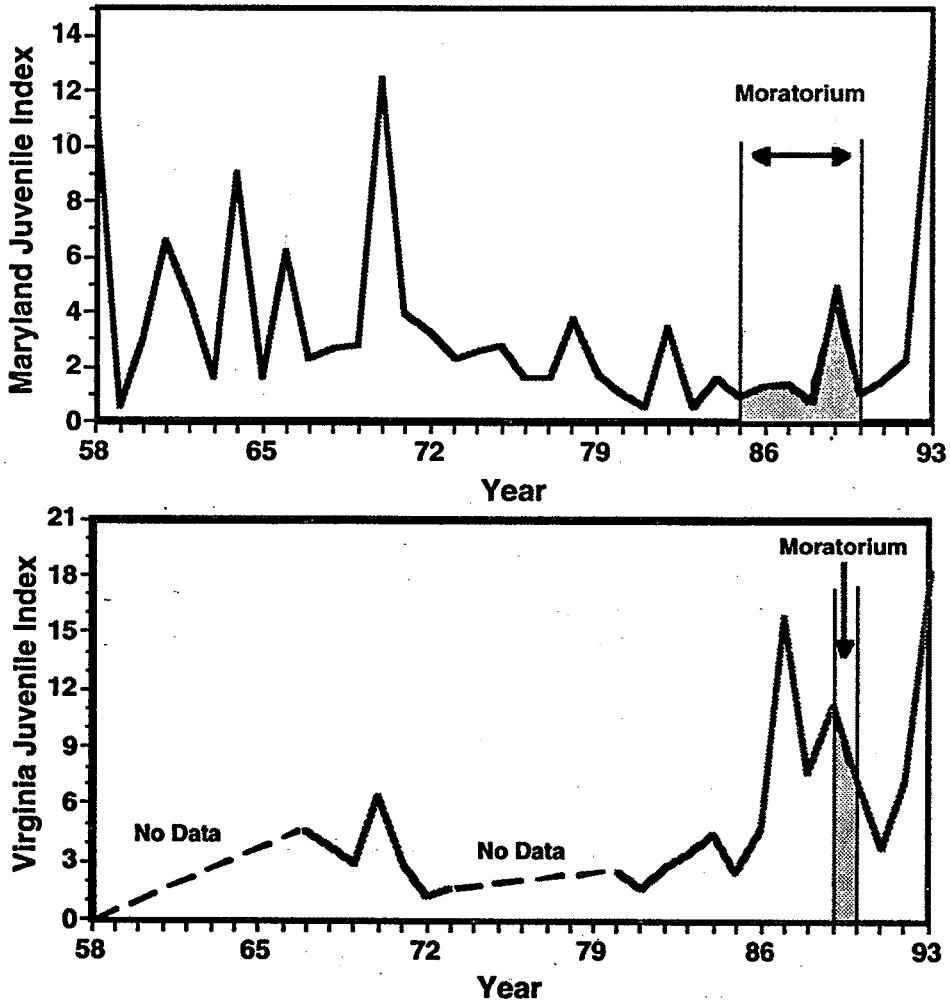
STATUS: White perch juvenile index is an example of living resource trend information being developed.

Juvenile index is based on net samples from many tributaries.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Trends in Finfish: Striped Bass



Source for Maryland index data = Maryland Department of Natural Resources.
Source for Virginia index data = Virginia Institute of Marine Sciences.

GOAL: Sustain the fishery.

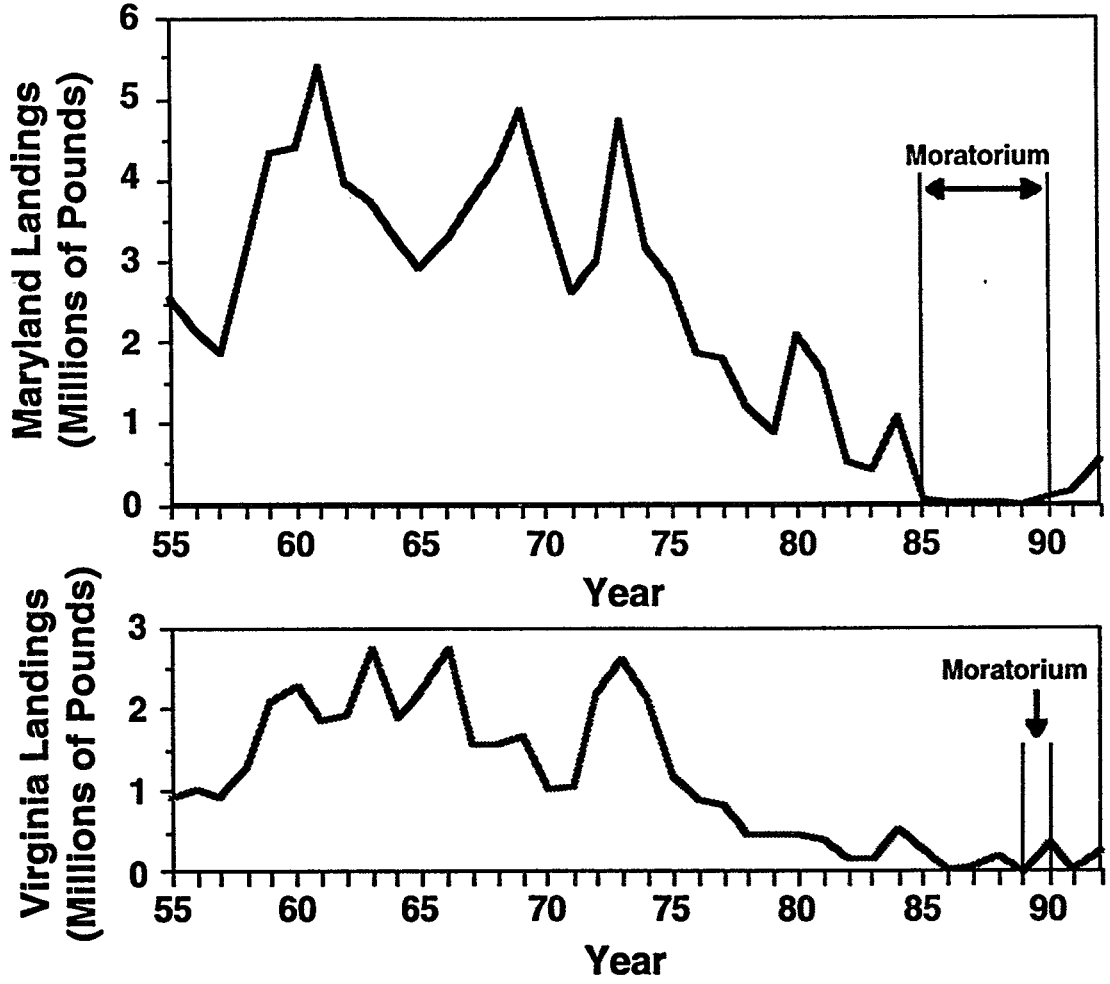
STATUS: Successful management measures first removed, then limited harvest pressure, and as a result, most restrictions have been removed. The fishery has been declared restored by the Atlantic States Marine Fisheries Commission.

Note: Differences in data treatment by MD and VA mean these graphs are not directly comparable.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Trends in Finfish: Striped Bass Landings



Source: National Marine Fisheries Service.

GOAL: Sustain the fishery.

STATUS: Successful management measures led to decreased harvest pressure. The Atlantic States Marine Fisheries Commission has declared the fishery restored.

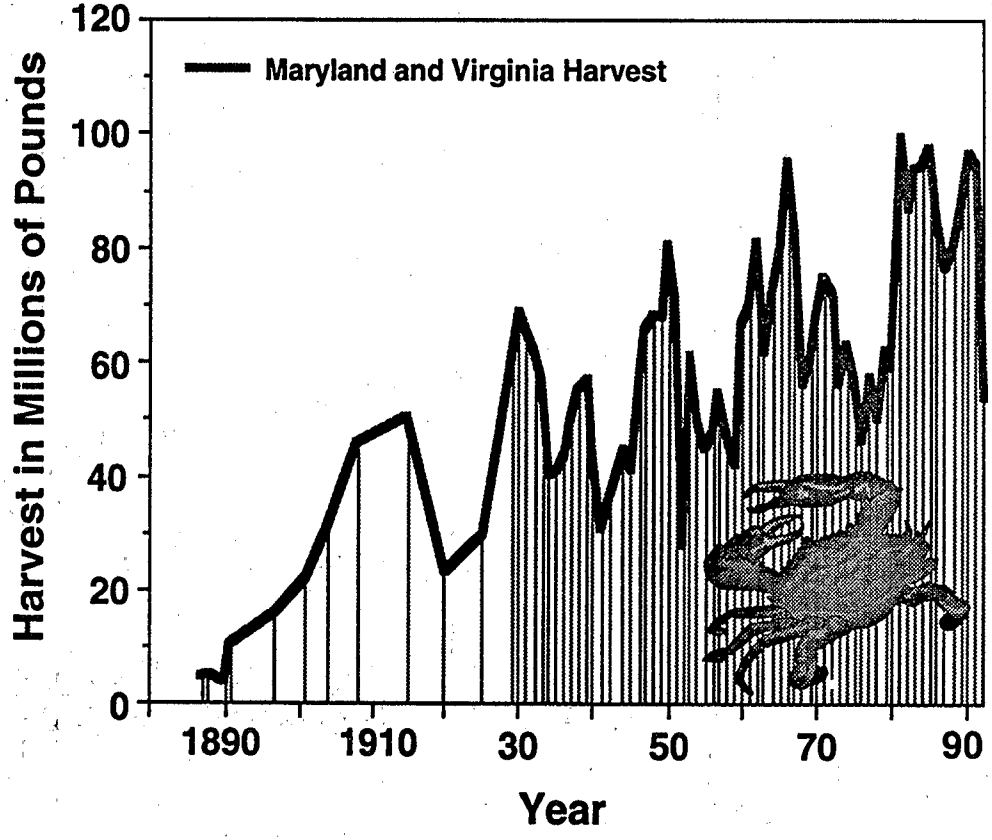
Fishery landings don't reflect how many fish there are; they depend on fishing effort (how many fishermen there are and how many nets are set).

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Long-Term Trends in Shellfish: Blue Crab

Long-Term Harvest Record



Source: National Marine Fisheries Service.

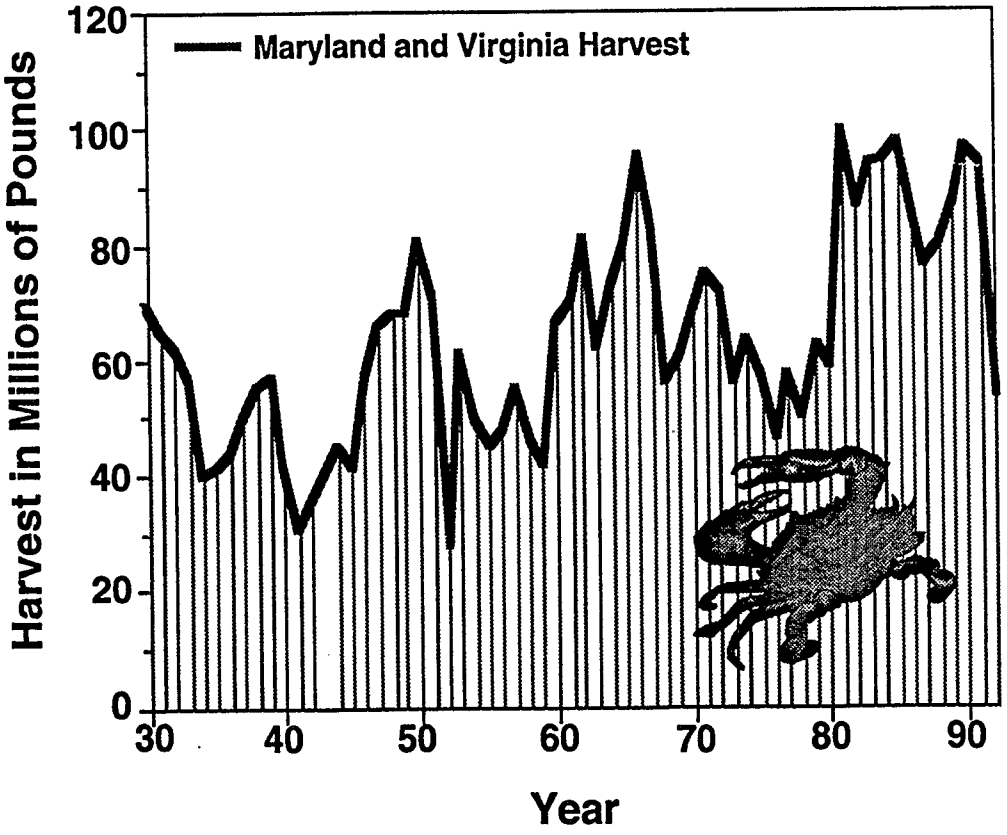
- Early harvest data start in the late 1880s.
- The upward trend reflects both increased interest in crabs and more consistent data (starting around 1930).

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Trends in Shellfish: Blue Crab

From 1930 to Present



Source: National Marine Fisheries Service.

GOAL: Crab population targets are under development.

STATUS: Maryland and Virginia with NOAA's Stock Assessment Committee have begun a baywide winter dredge survey to provide an index of abundance.

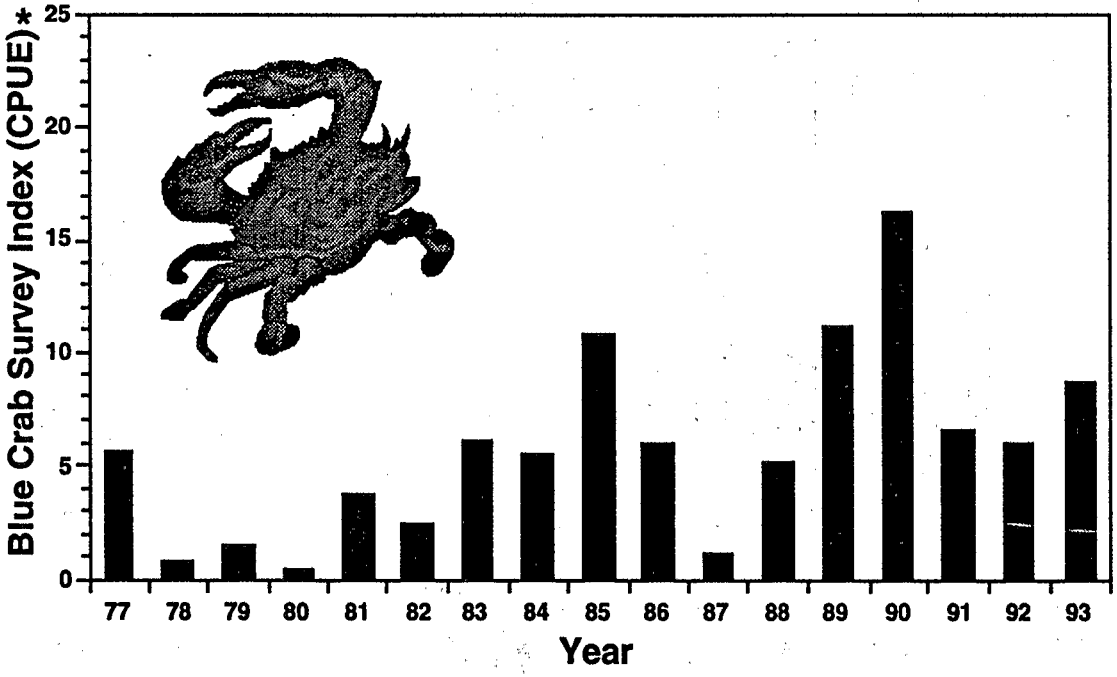
Crab harvests have fluctuated within limits, but scientists feel the population is under heavy pressure.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → ■

Trends in Shellfish: Blue Crab

Maryland Blue Crab Trawl Survey Data



* CPUE: Catch per Unit Effort

Data includes only young crabs less than 2 1/4" .

Source: MD Department of Natural Resources.

GOAL: A strong sustainable yield for the fishery.

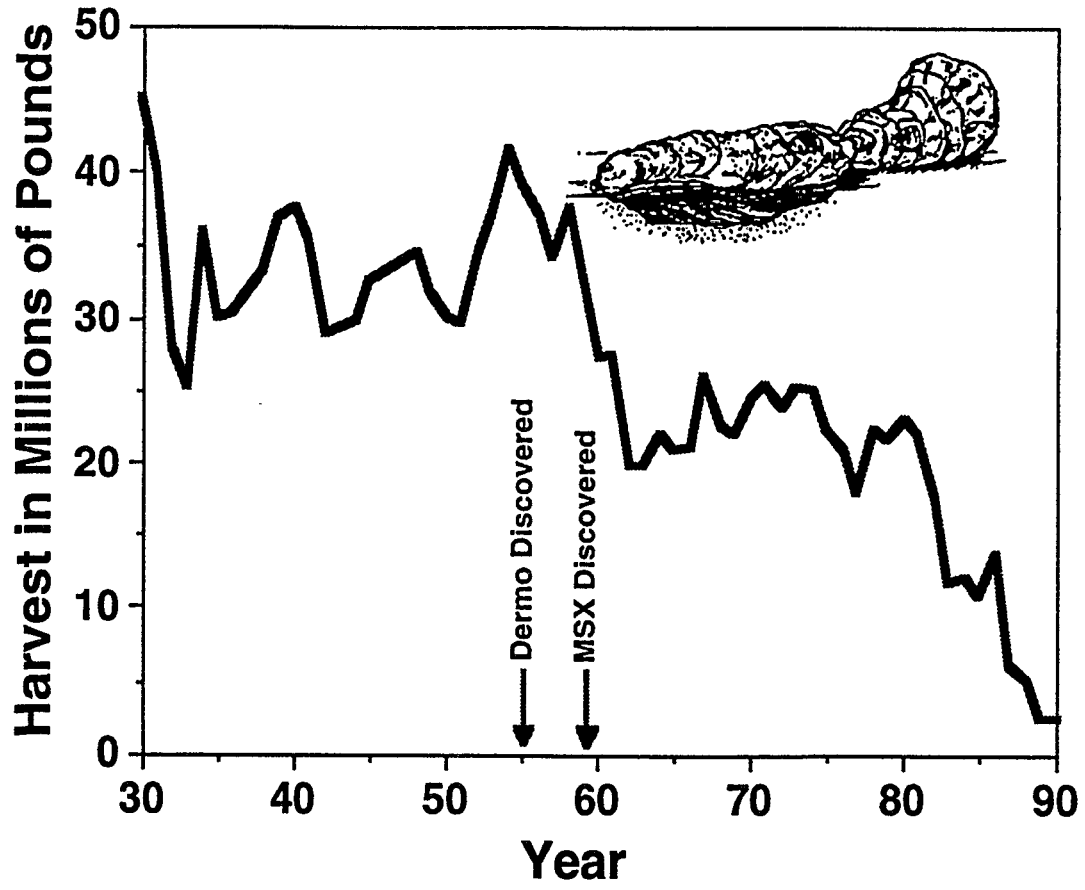
STATUS: While it has been estimated that the fishery removes approximately 75% of the adult stock each year, populations are considered to be healthy.

With the decline of other species in the Bay, increased concern has surrounded the effort placed on the blue crab fishery.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → ■

Trends in Shellfish: Oysters



Source: National Marine Fisheries Service.

GOAL: Oyster population targets are under development.

STATUS: Oyster harvests have declined due to overharvesting, parasites, pollution, and loss of habitat.

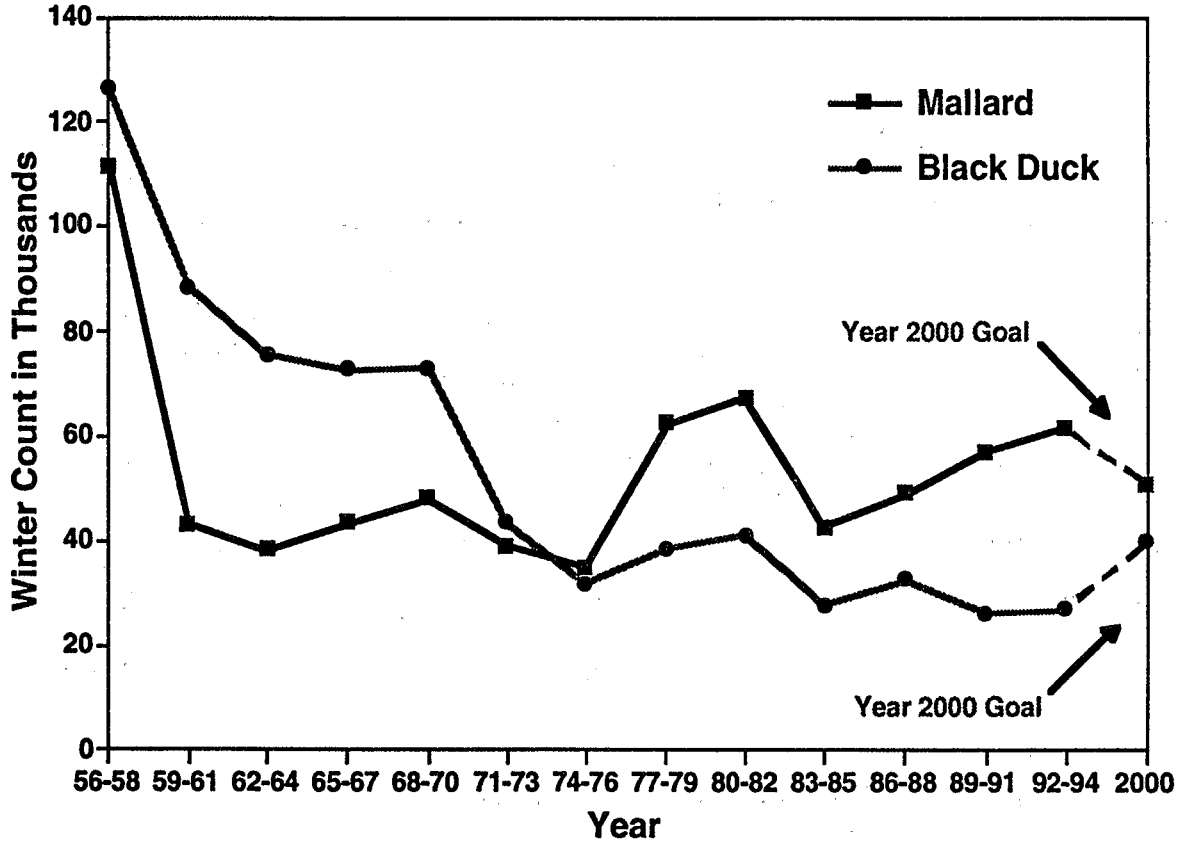
Since the 1950s, the parasites, MSX and Dermo, have been a major cause of the oyster's decline in the Bay.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → ■

Trends in Waterfowl

Black Duck and Mallard



Source: U.S. Fish & Wildlife Service.

GOAL: The goal by species is based on winter bird counts.

STATUS: Bay area waterfowl have declined 10-20% since 1973-1977.

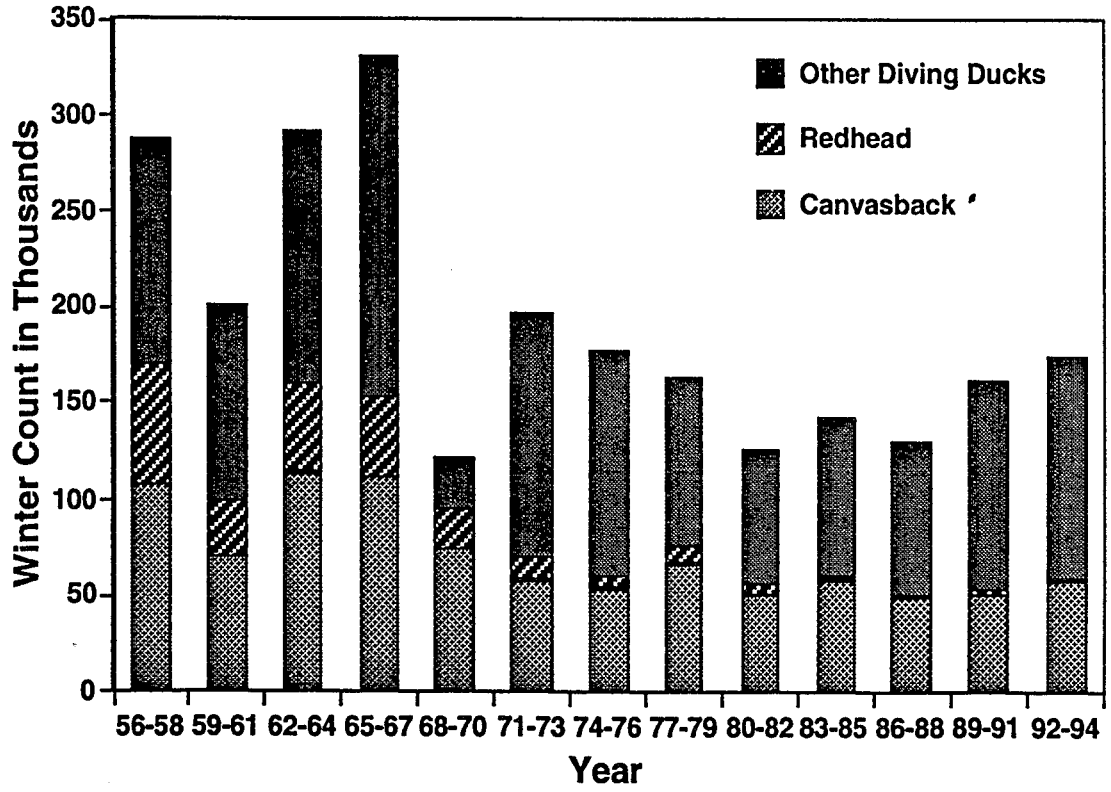
Mute swans and mallards adapt to humans; black and diving ducks need SAV and don't adapt.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → [redacted]

Trends in Waterfowl

Diving Ducks



Source: U.S. Fish & Wildlife Service.

GOAL: Support responsible waterfowl management programs to restore populations and habitats to at least 1970's levels by the year 2000.

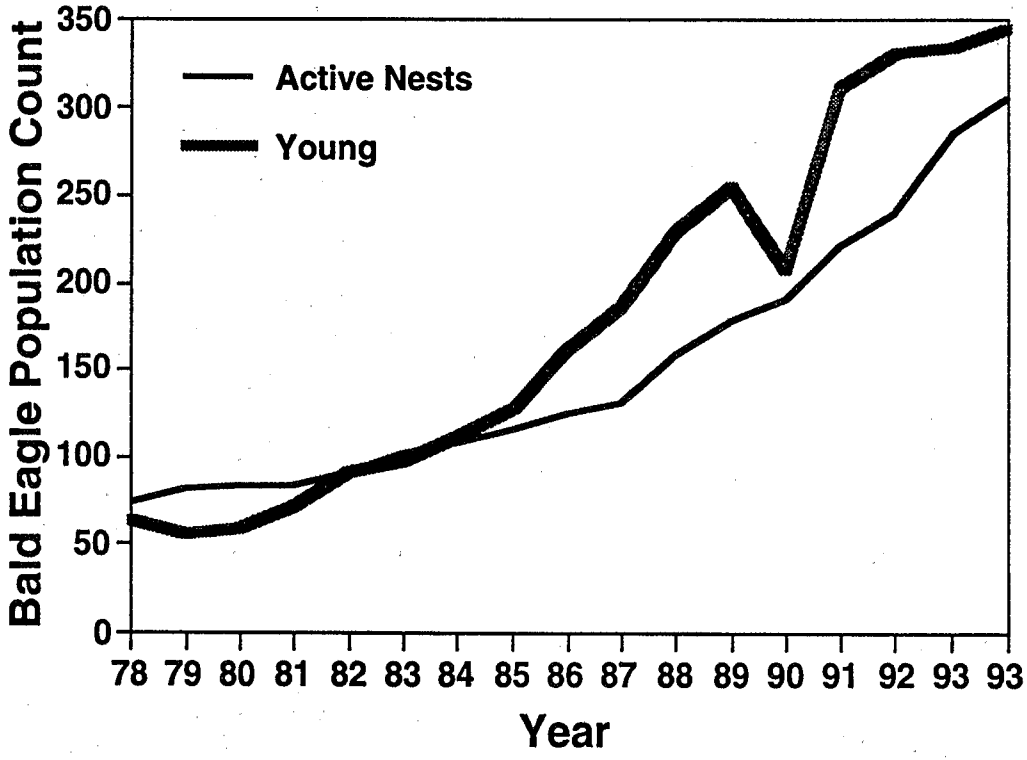
STATUS: The population goal for diving ducks, 162,600, has been reached.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → [redacted]

Bald Eagle Population Count

Chesapeake Bay Basin Population Count



Sources: Maryland Department of Natural Resources, Virginia Department of Game and Inland Fisheries, and Pennsylvania Game Commission.

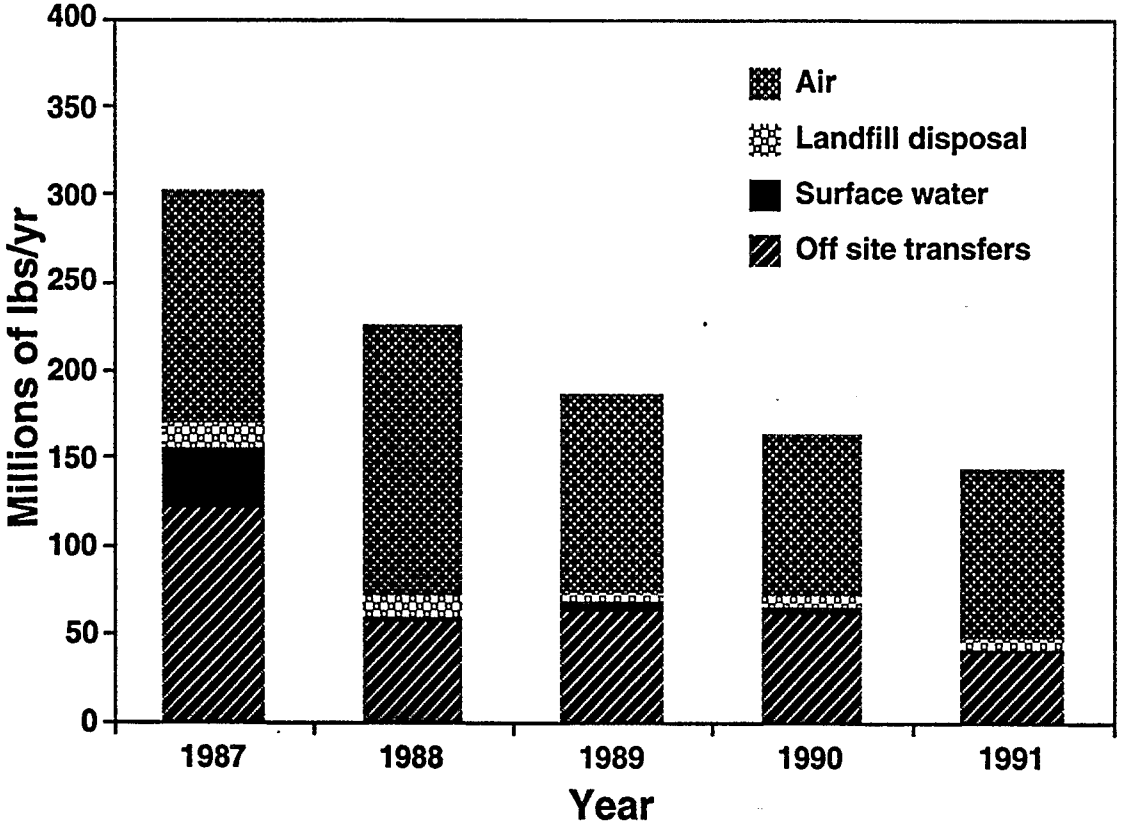
GOAL: Restoration of population levels to non-threatened status.

STATUS: The eagle is no longer classified as an endangered species, however, it is still threatened. Toxic residue effects historically caused declines. Recovery due to these effects has occured. Shoreline development and habitat fragmentation is a present threat to future eagle populations.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → **6**

Industry Reported Releases and Transfers of Chemical Contaminants



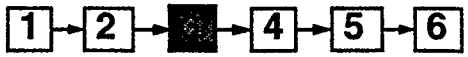
Reported according to SARA Title III Requirements.

GOAL: Toxic loadings/ releases goals are under development.

STATUS: Reported industrial releases of chemical contaminants to the air, water or land, or transfered off site, have declined 52% since 1987.

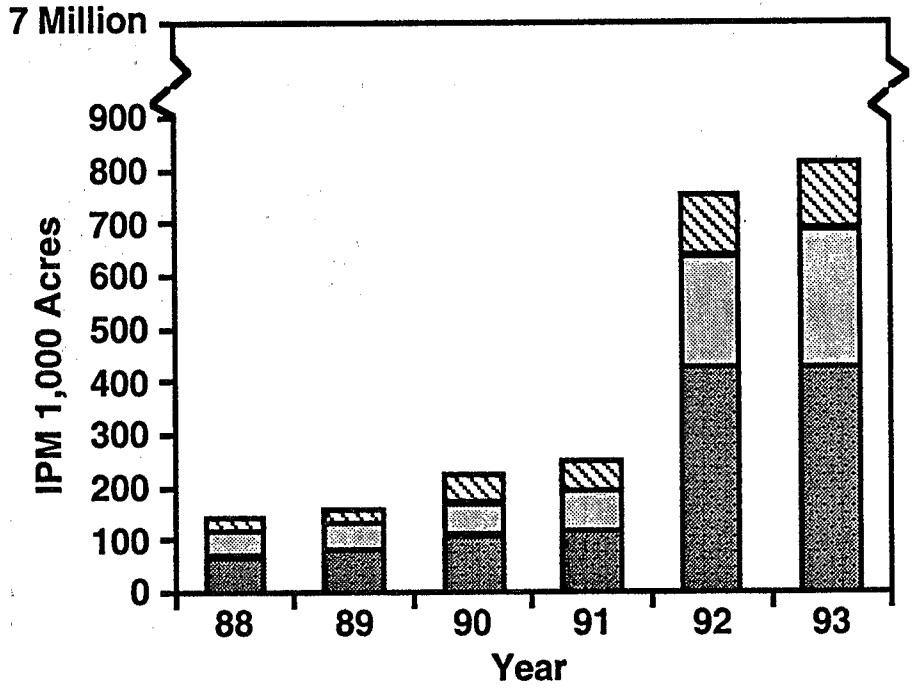
61% of the total releases in 1991 was to the air.

HIERARCHY LEVEL:



Acres Under Integrated Pest Management

Total Basin Croplands = About 7 Million Acres



Source: The states of Maryland, Virginia and Pennsylvania.

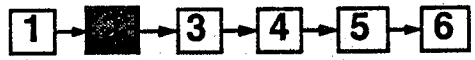
GOAL: Maximize IPM coverage on basin agricultural land.

STATUS: This is a relatively new, yet promising, program.

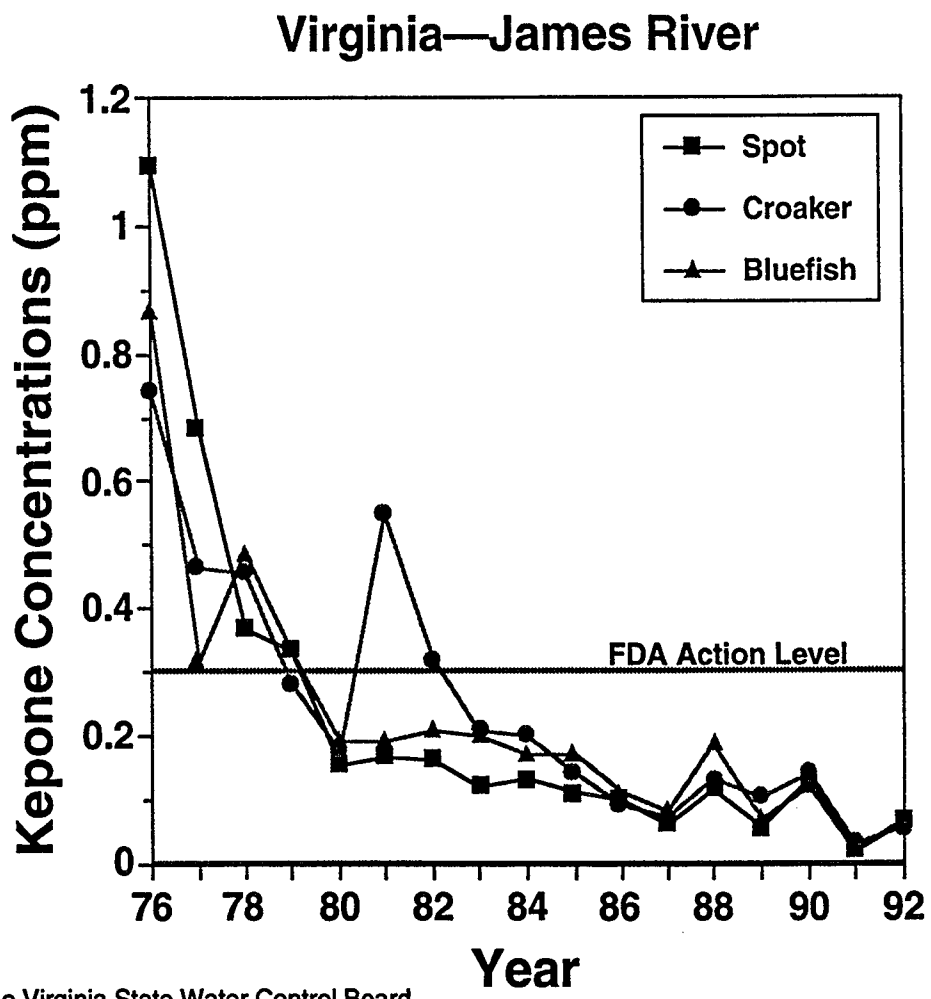
While substantial progress has been made, we have only begun the task.

Appropriateness of IPM will vary depending on the nature of agricultural use.

HIERARCHY LEVEL:



Kepone in Finfish Tissue



Source: the Virginia State Water Control Board.

GOAL: Remove all bans on the harvest and consumption of fish/shellfish due to Kepone contamination.

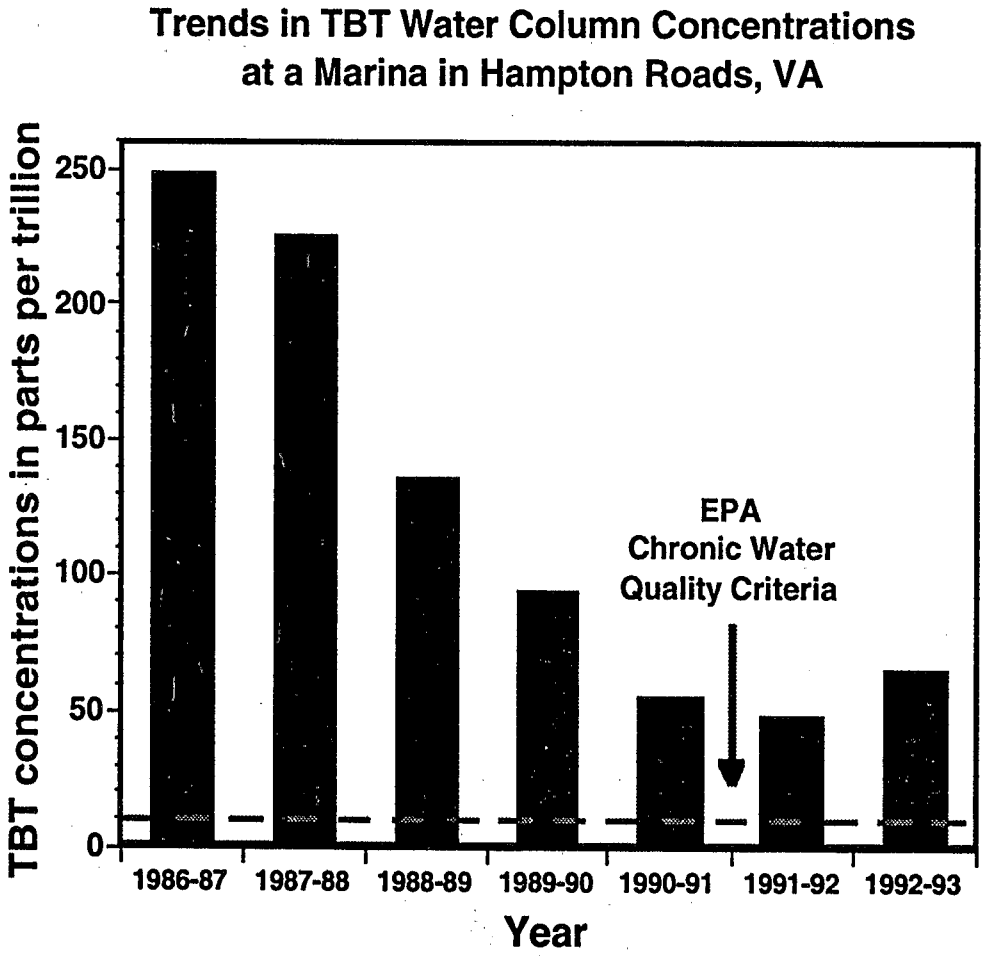
STATUS: From 1966-1975, Kepone was released into the James River at Hopewell, VA.

Kepone levels in finfish tissue have since declined, resulting in the lifting of fishing bans. A consumption advisory, however, still remains.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Tributyltin Concentration Levels



Source: Virginia Institute of Marine Science

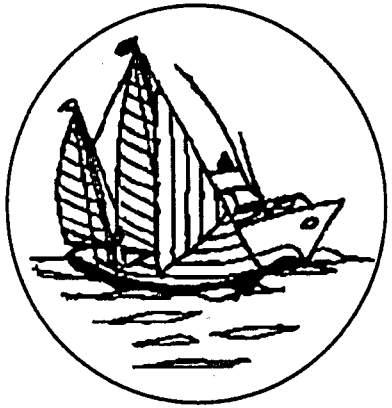
GOAL: Reduce TBT concentrations to below EPA chronic water quality criteria (10 ppt) and state water quality standards (VA=1 ppt).

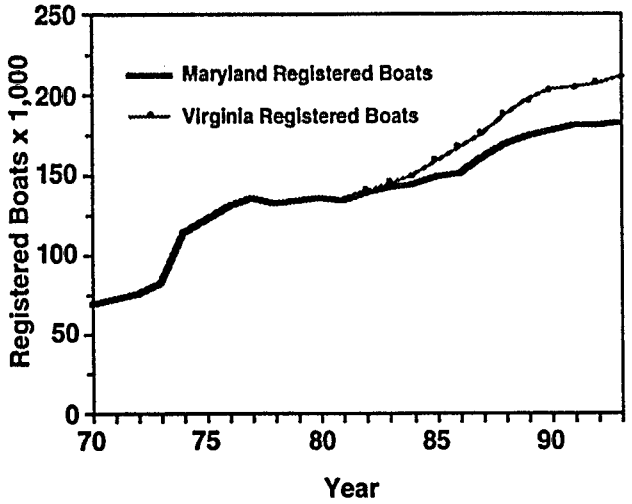
STATUS: Though generally declining, the water column concentrations recorded near marinas are still high enough to pose a risk to certain bay organisms such as plankton and mollusks.

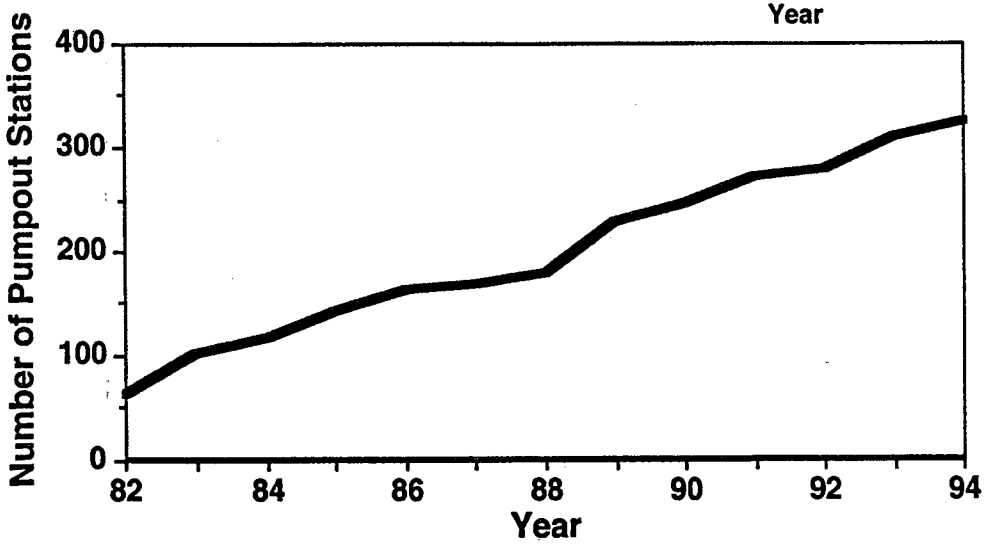
HIERARCHY LEVEL:

1 → 2 → 3 → **4** → 5 → 6

Recreational Boat Wastes







Data sources: Virginia Department of Health and Maryland Boating Administration.

GOAL: Adequate numbers of convenient and inexpensive pump-out facilities to support a future no-discharge policy in the Bay.

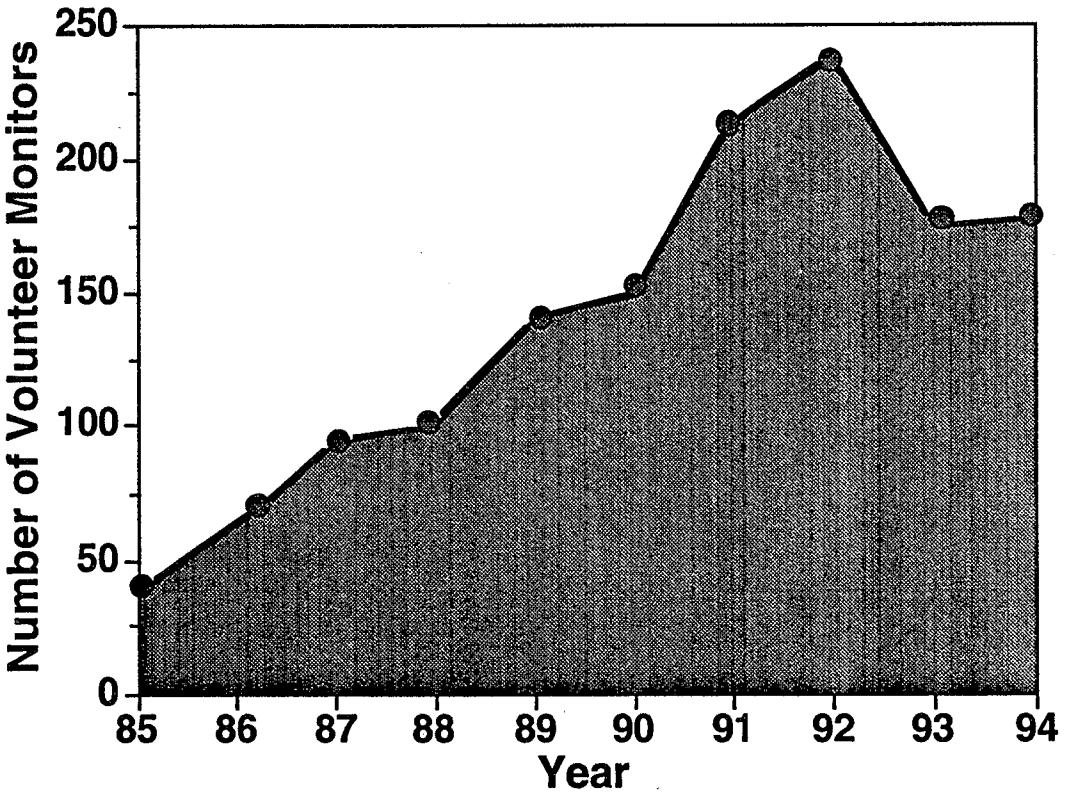
STATUS: Without enough pump-out stations, many boaters dump untreated sewage into the Bay even though it is illegal.

Most boaters will use pump-outs if they are convenient and inexpensive.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Volunteer Monitors



Source: The Alliance for the Chesapeake Bay.

GOAL: To provide data and track changes in shallow water areas of Bay tributaries while promoting public participation.

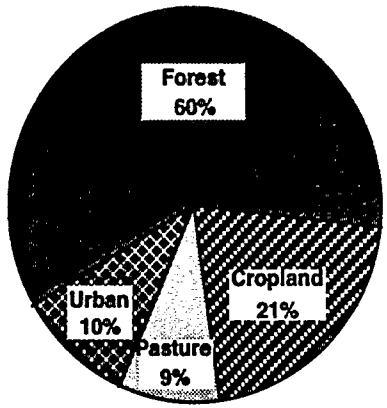
STATUS: Since 1985, hundreds of volunteers have been trained to monitor water quality all over the Chesapeake basin.

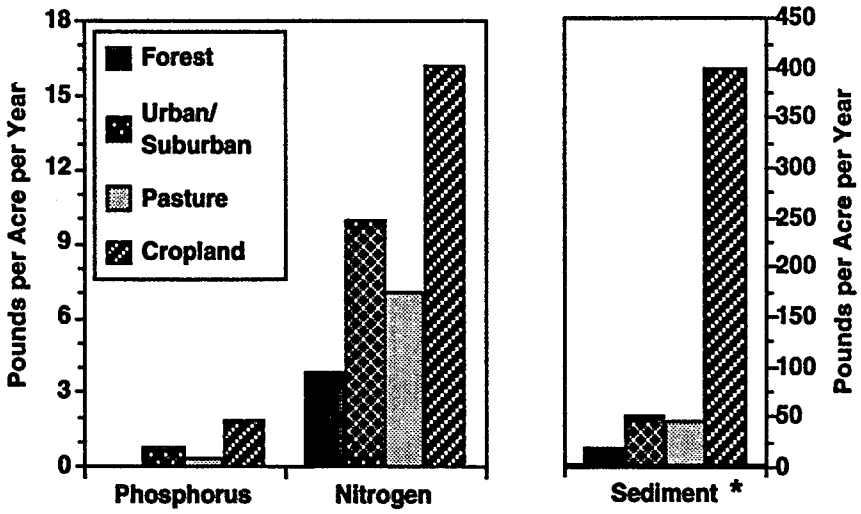
New programs have been taking over from the Alliance work and, basin wide, the number of monitors still increases.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → 5 → 6

Chesapeake Basin Forests and Water Quality





Sources: Chesapeake Bay Program Phase II Watershed Model.
* Values represent sediment transported to the edge of stream.

GOAL: Land use goals may be tributary specific.

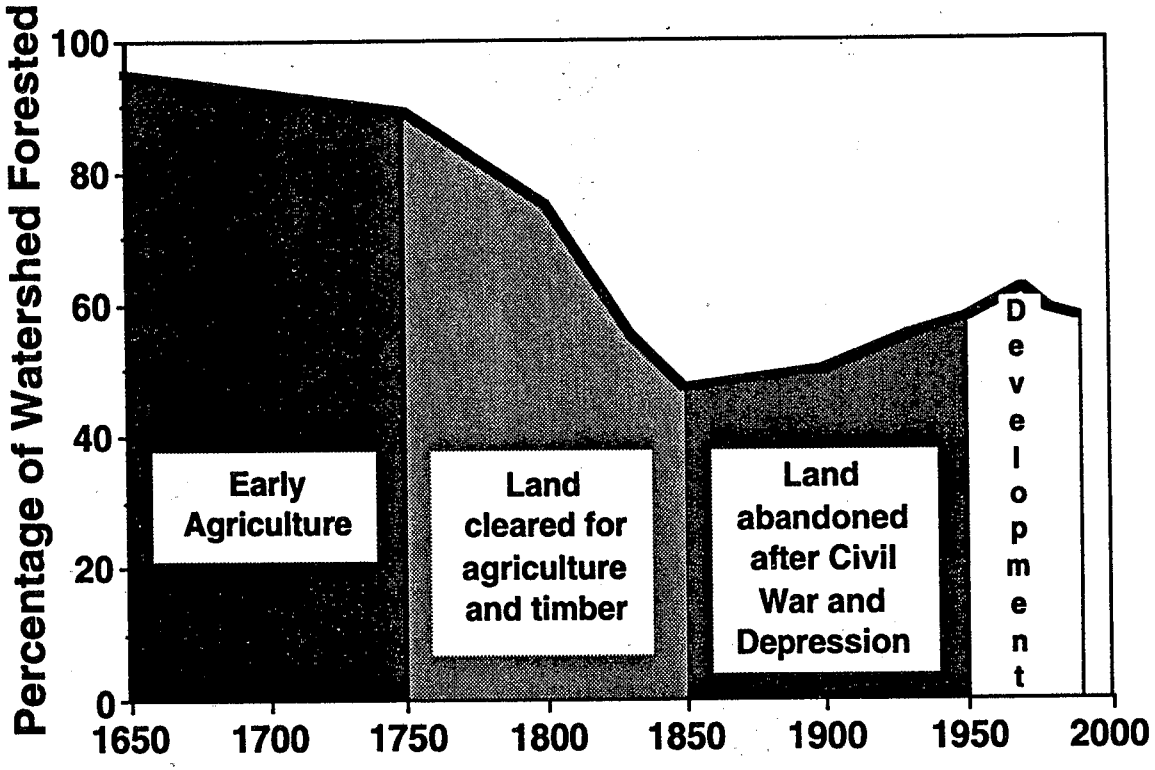
STATUS: In 1650 95% of the basin was forested. In 1990, 59%.

Forests provide a natural filtering system that prevents pollutants and soil from reaching the Chesapeake.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → ■ → 6

Chesapeake Basin Forests



Source: US Forest Service.

GOAL: No goal determined.

STATUS: The forest that regrew from the 19th to the mid-20th centuries is steadily declining.

Current losses represent permanent conversions.

Forest quality may be as important as quantity:

- Proximity to water
- Species diversity
- Ecosystem sustainability
- Habitat fragmentation.

HIERARCHY LEVEL:

1 → 2 → 3 → 4 → ■ → 6

Indicators as Management Tools

✔ **Support Reevaluation Efforts:**
- Nutrients
- Living Resource Strategies
- Toxics

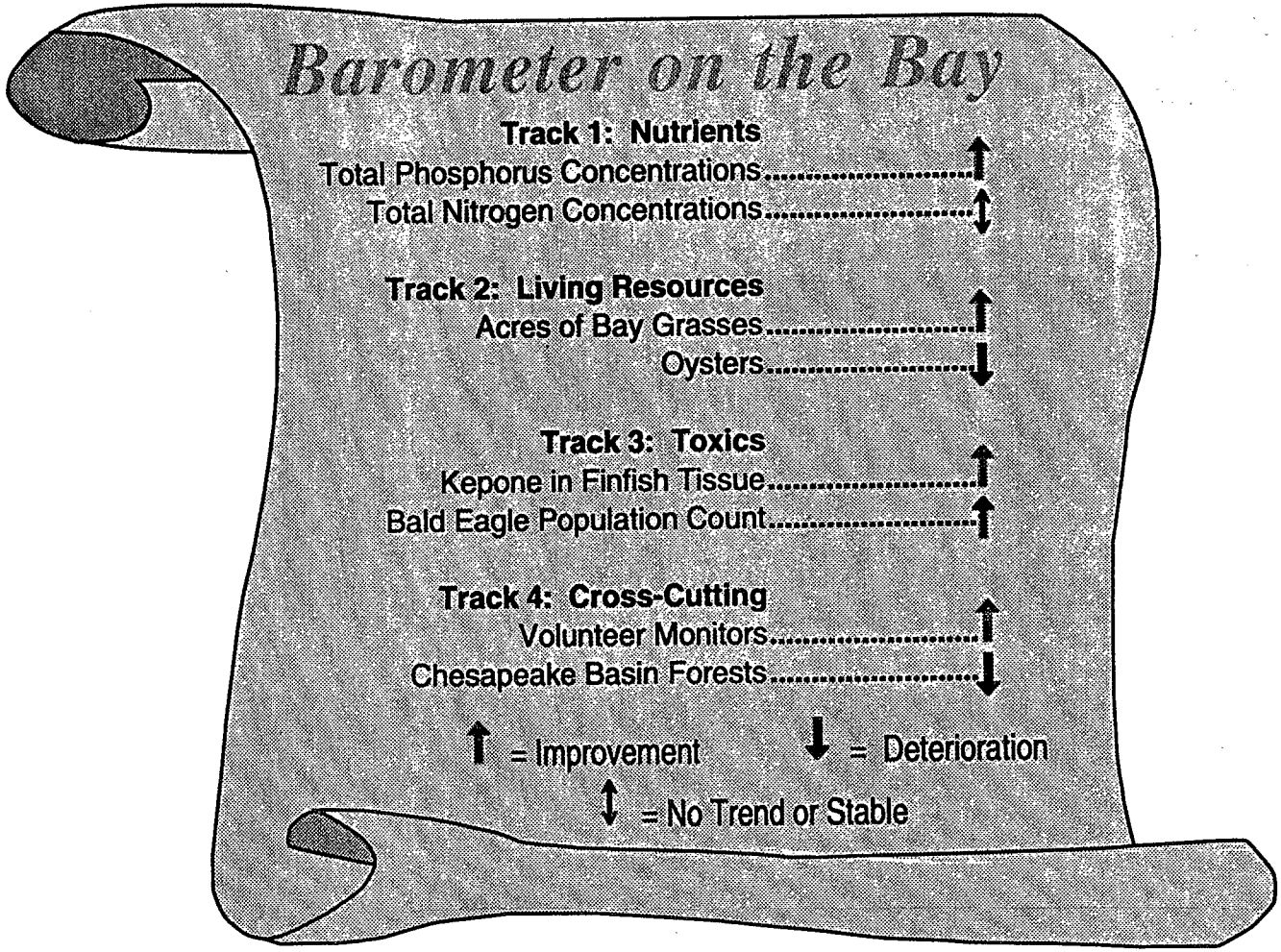
✔ **Communicating a Consistent Public Message**
- Annual Progress Reports
- Bay Barometer
- Bay Journal Centerfold Feature
- State of the Bay Reports
- Poster Presentations

✔ **Program Planning**
- Strategic Directions
- Assessment of Progress
- Budget Formulation

✔ **Customer Feedback on Success Measures**

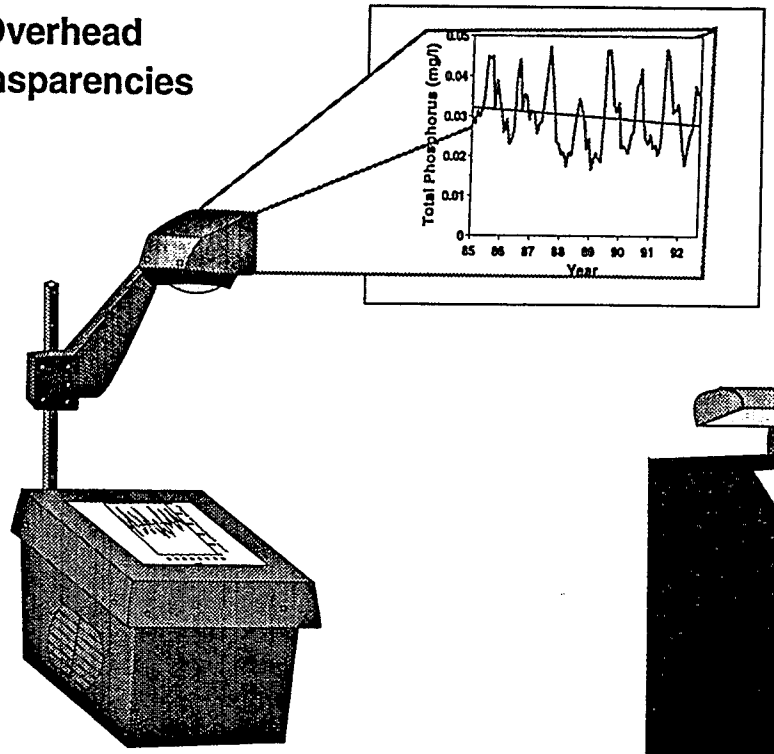
✔ **Targeting of Resources**
- EPA & Other Federal Agencies
- States
- Other Entities

The Chesapeake Bay Barometer

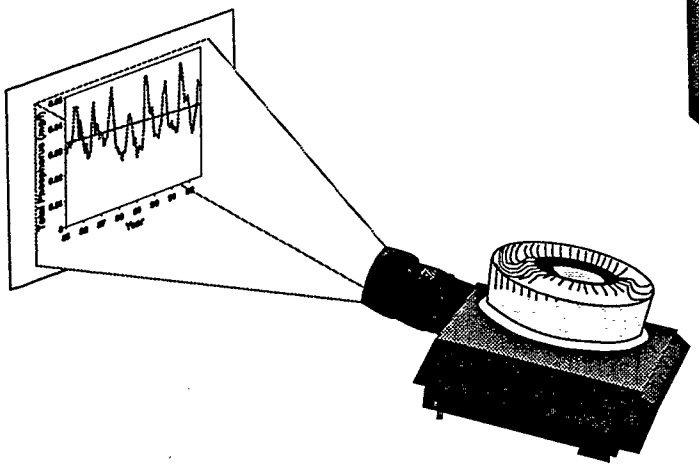


Environmental Indicators User Options

Overhead Transparencies

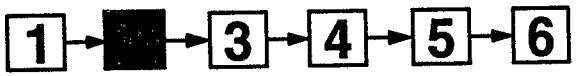
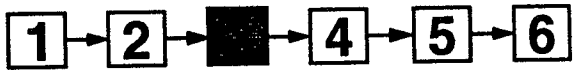
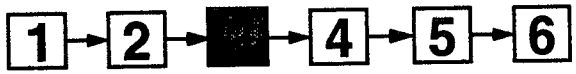


35 mm Slides



Annotated Lecture Notes

Track 1: Nutrient Enrichment Indicators

HIERARCHY LEVEL:	REPORTING STATUS:	INDICATOR:
	●	Dischargers in Significant Noncompliance (SNC)
	●	Population and Municipal Sewage Flow
	●	Point Source Phosphorus Loadings
	●	Nonpoint Source Phosphorus Loadings

Reporting Status Legend:

- ● = Environmental indicators being reported
- ◒ = Environmental indicators under development
- ○ = Environmental indicators under consideration

Track 1: Nutrient Enrichment Indicators

HIERARCHY LEVEL:	REPORTING STATUS:	INDICATOR:
1 → 2 → 3 → ■ → 5 → 6	●	Phosphorus Concentrations in the Bay
1 → 2 → ■ → 4 → 5 → 6	●	Point Source Nitrogen Loadings
1 → 2 → ■ → 4 → 5 → 6	●	Nonpoint Source Nitrogen Loadings
1 → 2 → 3 → ■ → 5 → 6	●	Nitrogen Concentrations in the Bay

Reporting Status Legend:

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- ○ = Environmental indicators under consideration

Track 1: Nutrient Enrichment Indicators

HIERARCHY LEVEL:	REPORTING STATUS:	INDICATOR:
1 → 2 → 3 → ■ → 5 → 6	●	Dissolved Oxygen
1 → 2 → 3 → ■ → 5 → 6	●	Bernie Fowler's "Sneaker Index"

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- ○ = Environmental indicators under consideration

Track 2: Living Resource Indicators

HIERARCHY LEVEL:	REPORTING STATUS:	INDICATOR:
1 → 2 → 3 → 4 → 5 → ■	●	Acres of Bay Grasses
1 → 2 → 3 → ■ → 5 → 6	●	Stream Miles Opened for Migratory Fish
1 → 2 → 3 → 4 → 5 → ■	●	Trends in Finfish: White Perch
1 → 2 → 3 → 4 → 5 → ■	●	Trends in Finfish: Striped Bass

Reporting Status Legend:

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- ○ = Environmental indicators under consideration

Track 2: Living Resource Indicators

HIERARCHY LEVEL:	REPORTING STATUS:	INDICATOR:
1→2→3→4→5→	●	Trends in Shellfish: Blue Crab
1→2→3→4→5→	●	Trends in Shellfish: Oysters
1→2→3→4→5→	●	Trends in Waterfowl: Black Ducks and Mallards
1→2→3→4→5→	●	Trends in Waterfowl: Diving Ducks

Reporting Status Legend:

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- ○ = Environmental indicators under consideration

Track 3: Toxic Indicators

HIERARCHY LEVEL:	REPORTING STATUS:	INDICATOR:
1 → 2 → ■ → 4 → 5 → 6	●	**Industry Reported Releases and Transfers of Toxic Substances**
1 → ■ → 3 → 4 → 5 → 6	●	**Acres Under Integrated Pest Management**
1 → 2 → 3 → 4 → 5 → ■	●	**Kepone in Finfish Tissue**
1 → 2 → 3 → 4 → 5 → ■	●	**Bald Eagle Population Count**

Reporting Status Legend:

- ● = Environmental indicators being reported
- ◒ = Environmental indicators under development
- ○ = Environmental indicators under consideration

Track 3: Toxic Indicators

HIERARCHY LEVEL:	REPORTING STATUS:	INDICATOR:
1 → 2 → 3 → ■ → 5 → 6	●	Tributyltin Concentration Levels

Reporting Status Legend:

- ● = Environmental indicators being reported
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- ○ = Environmental indicators under consideration

Track 4: Cross-Cutting Indicators

HIERARCHY LEVEL:	REPORTING STATUS:	INDICATOR:
1 → ■ → 3 → 4 → 5 → 6	●	Recreational Boat Wastes
1 → ■ → 3 → 4 → 5 → 6	●	Volunteer Monitors
1 → 2 → 3 → 4 → ■ → 6	●	Chesapeake Basin Land Use
1 → 2 → 3 → 4 → ■ → 6	●	Chesapeake Basin Forests

Reporting Status Legend:

- ● = Environmental indicators being reported
- ◒ = Environmental indicators under development
- ○ = Environmental indicators under consideration